



Council of the
European Union

Brussels, 11 June 2019
(OR. en)

10211/19

TELECOM 259
MI 514
IND 193
COMPET 485
PI 98
RECH 325
DIGIT 113
CYBER 203

COVER NOTE

From:	Secretary-General of the European Commission, signed by Mr Jordi AYET PUIGARNAU, Director
date of receipt:	11 June 2019
To:	Mr Jeppe TRANHOLM-MIKKELSEN, Secretary-General of the Council of the European Union
No. Cion doc.:	SWD(2019) 206 final (PART 1/6)
Subject:	COMMISSION STAFF WORKING DOCUMENT Digital Economy and Society Index (DESI) 2019

Delegations will find attached document SWD(2019) 206 final (PART 1/6).

Encl.: SWD(2019) 206 final (PART 1/6)



Brussels, 11.6.2019
SWD(2019) 206 final

PART 1/6

COMMISSION STAFF WORKING DOCUMENT

Digital Economy and Society Index (DESI) 2019



Digital Economy and Society Index (DESI)

2019 Country Reports

About the DESI

The European Commission has been monitoring Member States' digital competitiveness with the Digital Economy and Society Index (DESI) reports since 2015. The set of reports includes both country profiles and thematic chapters.

The DESI country reports combine quantitative evidence from the DESI indicators across the five dimensions of the index with country-specific policy insights and best practices. An in-depth telecoms chapter is annexed to the reports for each Member State.

The thematic chapters present a European-level analysis of broadband connectivity, digital skills, use of the internet, digitisation of businesses, digital public services, the ICT sector and its R&D spending, and Member States' use of Horizon 2020 funds.

To improve the methodology and take account of the latest technological developments, a number of changes have been made to the DESI for 2019. The DESI now covers:

- 5G readiness,
- Above basic digital skills,
- At least basic software skills,
- Female ICT specialists,
- ICT graduates,
- People who never used the internet,
- Professional social networks,
- Doing an online course,
- Online consultations and voting,
- Individuals selling online,
- Big data,
- Medical data exchange and
- e-Prescriptions.

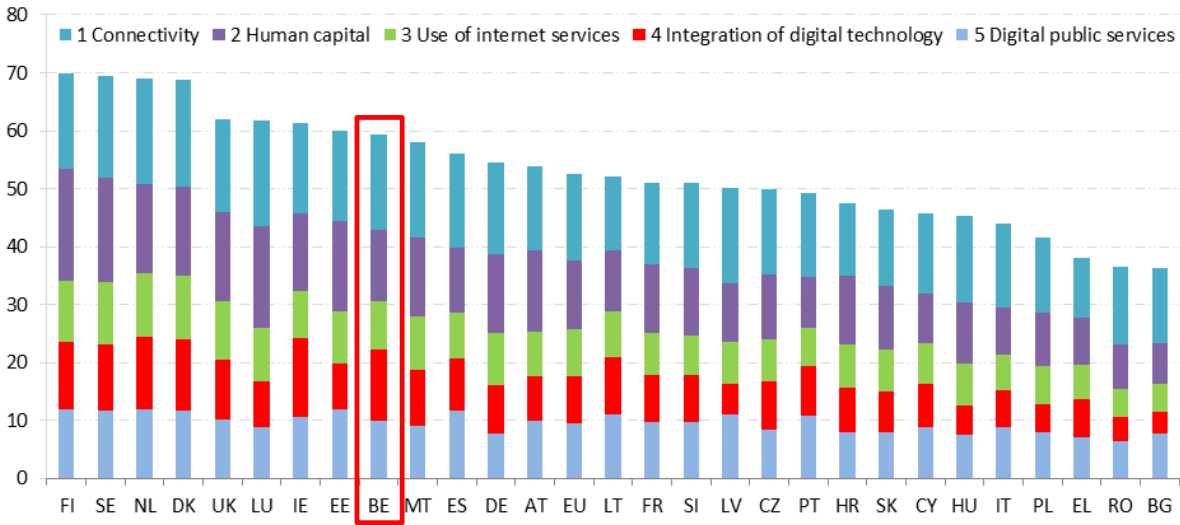
The DESI was re-calculated for all countries for previous years to reflect the above changes in the choice of indicators and corrections to the underlying data. Country scores and rankings may thus have changed compared with previous publications.

For further information, please consult the DESI website: <https://ec.europa.eu/digital-single-market/en/desi>.

Belgium

	Belgium		EU
	rank	score	score
DESI 2019	9	59.4	52.5
DESI 2018	9	56.6	49.8
DESI 2017	7	55.2	46.9

Digital Economy and Society Index (DESI) 2019 ranking



Belgium ranks 9th out of the 28 EU Member States in the European Commission Digital Economy and Society Index (DESI) 2019. Its score increased due to an improved performance in some of the DESI dimensions measured. Belgium performs well in connectivity, thanks to the wide availability of fast and ultrafast fixed and mobile broadband networks and to the growing take-up. The key challenge it still faces in connectivity is the fact that networks are not being upgraded to very high-capacity status all over the country.

Although many innovative projects have been set up to boost digital skills, their impact on human capital is not yet reflected in the statistics. There is a need to motivate more young Belgians to start a career in digital technology and, more generally, to interest more pupils in studying science, technology or mathematics (STEM) subjects. Moreover, investing into the re-skilling of the labour force and reducing the IT gender gap would help Belgium to tap the full potential of the digital economy.

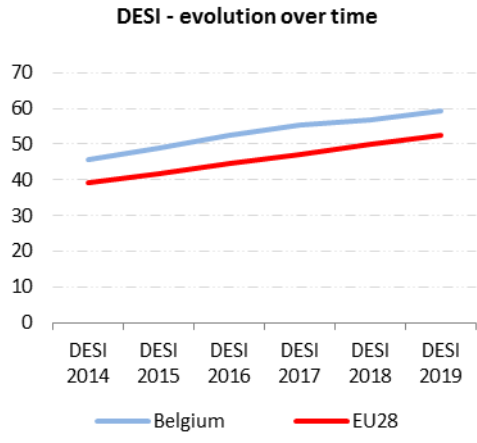
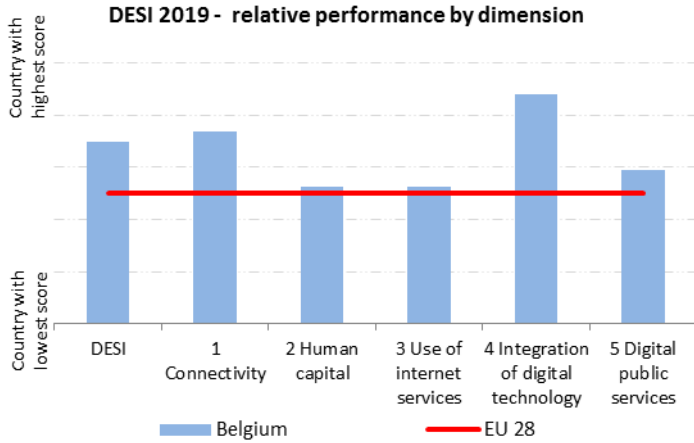
Most people in Belgium are now online and make good use of a variety of web-based services, particularly for banking and social networking.

Belgian enterprises have been successful in adopting digital technology, and there are several complementary strategies in place to digitise Belgian businesses further. However, more investment is needed to boost the digitisation of the Belgian economy, particularly by firms that have been

lagging behind so far (mostly small and medium-sized enterprises and micro-firms), and in the public sector.

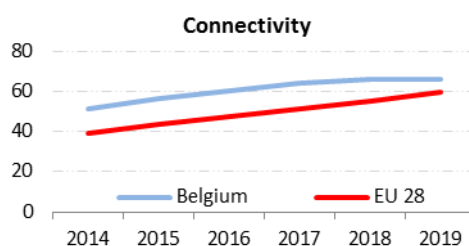
The overall picture as regards digital public services is mixed. Progress over the last year has been slower than in the past.

The Digital Belgium strategy, which dates from 2015, continues to define the country’s long-term digital prospects. There are also regional strategies, such as Digital Wallonia. However, there are no plans for a new overarching national digital strategy at the moment.



1 Connectivity

1 Connectivity	Belgium		EU
	rank	score	score
DESI 2019	6	66.1	59.3
DESI 2018	5	66.1	54.8
DESI 2017	4	64.1	51.2



	DESI 2017	Belgium	DESI 2019		EU
	value	DESI 2018 value	value	rank	DESI 2019 Value
1a1 Fixed broadband coverage % households	>99.5% 2016	>99.5% 2017	>99.5% 2018	7	97% 2018
1a2 Fixed broadband take-up % households	80% 2016	81% 2017	NA¹ 2018		77% 2018
1b1 4G coverage % households (average of operators)	95% 2016	97% 2017	>99.5% 2018	2	94% 2018
1b2 Mobile broadband take-up Subscriptions per 100 people	68 2016	72 2017	76 2018	24	96 2018
1b3 5G readiness Assigned spectrum as a % of total harmonised 5G spectrum	NA	NA	0% 2018	13	14% 2018
1c1 Fast broadband (NGA) coverage % households	98% 2016	98% 2017	99% 2018	3	83% 2018
1c2 Fast broadband take-up % households	65% 2016	67% 2017	67% 2018	3	41% 2018
1d1 Ultrafast broadband coverage % households	NA	92% 2017	96% 2018	3	60% 2018
1d2 Ultrafast broadband take-up % households	30% 2016	42% 2017	40% 2018	5	20% 2017
1e1 Broadband price index Score (0 to 100)	84 2016	82 2017	83 2018	19	87 2017

With an overall connectivity score of 66.1, Belgium remains among the top six performers in 2019. Belgium has universal broadband coverage and the indicators for fixed broadband and next generation access (NGA) coverage remain stable compared with the previous year. Ultra-fast broadband coverage increased by a further 4 percentage points, reaching 96 % of households. However, this figure reflects mainly the wide availability of upgraded legacy networks, as Belgium's fibre-to-the-premises (FTTP) networks cover only 1.4 % of the population (EU 29.6 %).² 4G coverage increased by 3 percentage points to reach almost 100 % of households, bringing the country to the second place among its peers. Belgium scores very well in terms of fast (3rd place) and ultrafast (5th place) broadband take-up. Mobile broadband take-up, however, remains very low at 76 subscriptions per 100 people (compared with the EU average of 96), putting Belgium in 24th place. As regards the broadband price index, Belgium scores relatively low, coming in 19th, 4 points below the EU average.

Belgium is pursuing the implementation of its 2016 white areas action plan, aiming to reach universal NGA coverage by 2020. Operators have already invested more than €32 million to reduce to 18 (from

¹ The data is under revision by the Belgian authorities.

² Source: 2019 digital scoreboard, <https://ec.europa.eu/digital-single-market/en/digital-scoreboard>

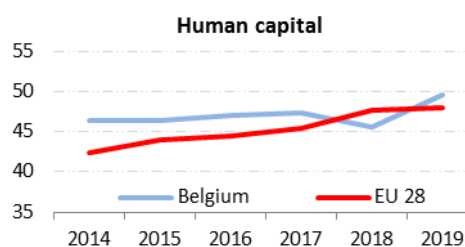
39 in 2016) the number of municipalities in which at least 40 % of the population has no access to connection speeds of 30 Mbps and where there is no full 4G coverage. Aiming higher than the EU gigabit society targets, Belgium wants to ensure that half of the country has access to speeds of 1 Gbps by as early as 2020. The market seems to be following, and the first commercial offers in Belgium at 1 Gbps are expected to be launched in the course of 2019. A large proportion of investments in Belgium are market-driven, with national and EU funding playing only a minor role.

In Belgium, 27 % of the spectrum harmonised at EU level for wireless broadband has been assigned. The outlook for rapid 5G deployment is poor, as the country has not yet assigned any part of the 5G spectrum. On 10 September 2018, the Belgian national regulatory authority for electronic communications (Belgian Institute for Postal Services and Telecommunications, BIPT) adopted a communication on the introduction of 5G in Belgium. The communication mentions the autumn of 2019 as the time when the 5G pioneer bands are to be assigned (apart from the 26 GHz band, scheduled for 2021). However, disagreements on the division of the auction proceeds are likely to cause delays. All operators are looking into 5G use cases and a 5G network launched by Ericsson is active in a technology park in Hasselt, serving as a test environment for companies and researchers. A political agreement was reached in October 2018 to raise the electro-magnetic field exposure limits for mobile communications from 6 to 14.5 V/m in the Brussels Capital region.

Belgium is a top performer as regards coverage of fixed and mobile broadband, including fast, ultra-fast and 4G networks and take-up of ultrafast broadband. FTTP coverage and take-up of mobile broadband continue to be its weak points. The country's rollout of 5G depends on achieving a political agreement between the federal state and the regions, the lack of which is likely to delay the 3.4 - 3.8 GHz spectrum auction until at least 2020. Achieving such agreement fast would be crucial if Belgium is not to lag behind in 5G deployment.

2 Human capital

2 Human capital	Belgium		EU
	rank	score	score
DESI 2019	12	49.6	48.0
DESI 2018	15	45.6	47.6
DESI 2017	11	47.4	45.4



	Belgium		EU	
	DESI 2017	DESI 2018	DESI 2019	DESI 2019
	value	value	value rank	Value
2a1 At least basic digital skills % individuals	61%	61%	61% 9	57%
2a2 Above basic digital skills % individuals	32%	31%	31% 15	31%
2a3 At least basic software skills % individuals	64%	63%	63% 9	60%
2b1 ICT specialists % total employment	4.2%	4.2%	4.6% 7	3.7%
2b2 Female ICT specialists % female employment	1.3%	1.3%	1.8% 7	1.4%
2b3 ICT graduates % graduates	1.8%	1.1%	1.6% 26	3.5%

Belgium ranks 12th among EU countries and slightly above the EU average as regards Human capital. Although increasing numbers of Belgian residents are going online, basic and advanced digital skills levels are progressing only slowly. Only 61 % of individuals between 16 and 74 years have basic digital skills (57 % in the EU).

ICT specialists are a higher proportion of the workforce than the EU average (4.6 % compared with 3.7 % in the EU as a whole). This represents an increase over last year. Female ICT specialists account for 1.8 % of overall female employment, which is above the EU average.

Digitisation represents an upskilling challenge for the Belgian economy. According to a study³ by the employer organisation Agoria, up to 584,000 open vacancies could remain unfilled by 2030 if no decisive action is taken, and 310,000 workers need to be retrained for new jobs.

Although Belgium has no overarching digital skills strategy, components of such a strategy may be found in some of the plans of the communities and regions. All of these entities are developing plans to strengthen STEM and digital competences, such as the recently-adopted Strategy for Digital Education plan for schools in the French-speaking Community and the STEM action plan (2012-2020) in Flanders. Computer programming is not systematically included in school curricula at the moment. As regards the number of ICT and STEM graduates, too, Belgium is still underperforming. There is a shortage of ICT graduates and ICT professionals in all regions of Belgium. Moreover, too few women

³ <https://www.agoria.be/fr/Aucun-secteur-n-echappera-a-l-impact-de-la-digitalisation-bethechange2030>

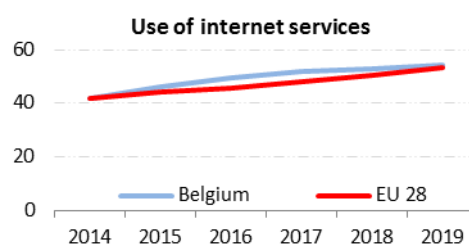
are taking up STEM and ICT careers. However, there are several innovative initiatives tackling the stagnating output of the formal education system and the consequent acute shortage of ICT specialists by providing training for young people and start-ups: they include DigitalChampions.be, BeCentral, the Digital Belgium Skills Fund and WallCode.be. Belgium was quite active in the 2018 Code Week 2018, with 120 events held in the country in October 2018. The Belgian federal government and the Belgian Digital Champion created “Digital Duel”⁴, an interactive assessment tool for citizens.

However, despite these efforts, the shortage of qualified labour limits the capacity of Belgian companies to innovate and to make use of the opportunities offered by digital technologies. Increasing the number of STEM graduates and ICT professionals, investing in re-skilling the labour force and reducing the gender gap in the digital economy would help Belgium to exploit the full potential of the digital economy.

⁴ <https://www.digitalduel.be>

3 Use of internet services

3 Use of internet services	Belgium		EU
	rank	score	score
DESI 2019	10	54.4	53.4
DESI 2018	10	52.9	50.7
DESI 2017	10	51.8	47.8

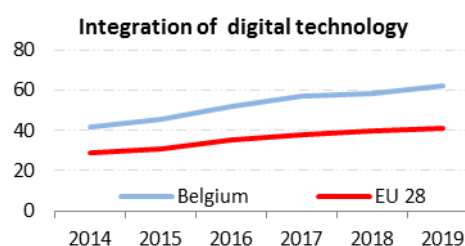


	Belgium		EU	
	DESI 2017 value	DESI 2018 value	DESI 2019 value	DESI 2019 rank
3a1 People who never used the internet	11%	10%	9%	10
% individuals	2016	2017	2018	2018
3a2 Internet users	84%	86%	87%	9
% individuals	2016	2017	2018	2018
3b1 News	65%	64%	64%	26
% internet users	2016	2017	2017	2017
3b2 Music, videos and games	72%	72%	74%	23
% internet users	2016	2016	2018	2018
3b3 Video on demand	12%	12%	24%	14
% internet users	2016	2016	2018	2018
3b4 Video calls	44%	46%	44%	25
% internet users	2016	2017	2018	2018
3b5 Social networks	80%	82%	82%	4
% internet users	2016	2017	2018	2018
3b6 Professional social networks	16%	17%	17%	11
% internet users	2015	2017	2017	2017
3b7 Doing an online course	10%	9%	9%	9
% internet users	2016	2017	2017	2017
3b8 Online consultations and voting	6%	6%	6%	17
% internet users	2015	2017	2017	2017
3c1 Banking	75%	76%	78%	8
% internet users	2016	2017	2018	2018
3c2 Shopping	65%	67%	67%	13
% internet users	2016	2017	2018	2018
3c3 Selling online	24%	23%	21%	14
% internet users	2016	2017	2018	2018

Overall, the use of internet services in Belgium is broadly comparable with the EU average; indeed it is slightly above the average. People are keen to engage in a variety of online activities, the most popular ones being the use of social networks and banking. Residents of Belgium make less use on average of certain possibilities offered by the internet: reading news articles (64 % compared to 72 % in the EU as a whole), online consultations and voting (6 % compared with 10 %), and using video on demand services (24 %, compared with 31 % EU-wide).

4 Integration of digital technology

4 Integration of digital technology	Belgium		EU
	rank	score	score
DESI 2019	3	62.1	41.1
DESI 2018	3	58.2	39.6
DESI 2017	3	57.1	37.6



	DESI 2017	Belgium		EU	
	Value	DESI 2018 value	DESI 2019 value	rank	DESI 2019 value
4a1 Electronic information sharing % enterprises	50% 2015	54% 2017	54% 2017	1	34% 2017
4a2 Social media % enterprises	22% 2016	24% 2017	24% 2017	10	21% 2017
4a3 Big data % enterprises	17% 2016	17% 2016	20% 2018	3	12% 2018
4a4 Cloud % enterprises	20% 2016	NA 2017	31% 2018	6	18% 2018
4b1 SMEs selling online % SMEs	23% 2016	23% 2017	28% 2018	4	17% 2018
4b2 e-Commerce turnover % SME turnover	20% 2016	15% 2017	13% 2018	8	10% 2018
4b3 Selling online cross-border % SMEs	13% 2015	12% 2017	12% 2017	5	8% 2017

As regards the Integration of digital technology into businesses, Belgium ranks third among EU countries, well above the EU average. Belgium has improved or maintained its good scores in most categories, apart from e-commerce as a proportion of SMEs' overall turnover. Belgian enterprises are increasingly taking advantage of the opportunities offered by cloud services: 31 % of firms make use of such services (a long way above the EU average of 18 %), 12 % of SMEs make online sales abroad, and an average of 13 % of their turnover comes from the online segment. Furthermore, more than half of SMEs use electronic information sharing, and one company in four uses social media channels.

The Belgian public authorities have developed a federal strategy for digitisation (Digital Belgium) and regional strategies (Industrie 4.0, Digital Wallonia, beDigital.Brussels). Most projects involving cross-border cooperation are at regional level, often connected to EU programmes. In addition, several industry-led initiatives endorsed by public authorities have been launched to support companies in their digital transformation and to adopt new technologies and boost synergies and innovation. Examples include Made Different, cluster policies including the network of innovation clusters and innovative business networks, the living lab programme, and the Digital Health Valley.

Moreover, there are several initiatives aiming to make the regulatory framework fit for the digital age. While some follow the EU's lead (Digital Act, the open data strategy, cybersecurity measures), "mHealthBELGIUM" is designed to integrate mobile health services into the Belgian healthcare system. Various support mechanisms are available to companies: tax incentives, company vouchers

and investment funds. Most initiatives target the manufacturing sector and key enabling technologies, in line with Belgium's smart specialisation strategy.

Belgium is committed to advancing new digital technologies and to strategically investing in digital technologies, for instance through EU-coordinated programmes. It is a member of the EuroHPC Joint Undertaking and it has signed the Declaration establishing a European Blockchain Partnership and the Declaration on Cooperation on Artificial Intelligence. In March 2019, the country launched AI 4 Belgium, a coalition to boost the use of artificial intelligence and AI readiness in Belgium⁵.

Belgium has requested support from the EU's Structural Reform Support Programme⁶ to improve export and investment promotion in Flanders through digital tools.

To keep up the momentum of the digital transformation of the Belgian economy, it will be crucial to further encourage SMEs, in particular, to use digital technology and online commerce to boost turnover, productivity and profitability. A campaign raising awareness of the benefits of digitisation among SMEs and micro enterprises was launched in April 2019 by the Federal Public Service Economy⁷.

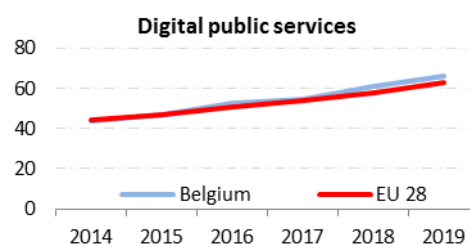
⁵ www.ai4belgium.be

⁶ https://ec.europa.eu/info/funding-tenders/funding-opportunities/funding-programmes/overview-funding-programmes/structural-reform-support-programme-srsp_en

⁷ <https://www.tijdvoordigitaal.be/fr>

5 Digital public services

5 Digital public services	Belgium		EU
	rank	score	score
DESI 2019	13	66.0	62.9
DESI 2018	12	60.8	57.9
DESI 2017	15	54.4	54.0



	Belgium		EU		
	DESI 2017 value	DESI 2018 value	DESI 2019 value	DESI 2019 rank	DESI 2019 Value
5a1 e-Government users % internet users needing to submit forms	48%	50%	51%	23	64%
5a2 Pre-filled forms Score (0 to 100)	59	68	73	11	58
5a3 Online service completion Score (0 to 100)	84	85	86	17	87
5a4 Digital public services for businesses Score (0 to 100) - including domestic and cross-border	79	81	80	20	85
5a5 Open data % of maximum score	NA	NA	65%	15	64%
5b1 e-Health services % individuals	NA	21%	21%	11	18%
5b2 Medical data exchange % of general practitioners	NA	NA	70%	4	43%
5b3 e-Prescription % of general practitioners	NA	NA	79%	10	50%

In Digital public services, Belgium ranks 13th among EU countries and above the overall value for the EU. In 2018, its progress was in line with the EU average. Belgium performs very well in medical data exchange and e-prescription. However, there is room for improvement as regards the level of online interaction between public authorities and citizens. Only 51 % of Belgian residents who use the internet actively engage with e-government services. For e-health services, the country ranks 11th in the EU, with 21 % of Belgian residents having used health and care services provided online. e-Prescription services are used by 79 % of general practitioners and 70 % of them exchange medical data. Overall, Belgium is making progress in digital public services, especially in digital health services and digital authentication, but slow advances in certain areas mean that overall progress has remained in line with the EU average.

The Digital Transformation Office set up by the federal government has already introduced a number of innovative services, for example in the area of digital identification, or Mercurius, a platform for business-to-government transactions. The Belgian federal government monitors and reports on progress in a transparent fashion and estimates cost savings in this field through a digital dashboard⁸. Belgium performs relatively well in digital health services. e-Prescription is widespread and became

⁸ <http://digitaldashboard.belgium.be/>

mandatory (with a few exceptions) on 1 June 2018. A number of parties have also recently launched 'Health Tech Belgium'⁹, an initiative to make Belgium a test country for health tech innovation.

All Belgian citizens and companies are provided with a secure digital mailbox (known as "e-box"¹⁰), which has the potential to become an alternative to physical mail. Not only all government documents, but also all private and business correspondence can be sent and received using this digital mailbox, which also includes a digital signature. The mailbox can also be used to send tenders, purchase orders, contracts, invoices and other documents. Various private service providers¹¹ will offer the front-office for the digital mailbox and help to develop a digital ecosystem. Since January 2018, Belgian residents have been able to identify themselves when using all government applications thanks to itsme[®], a digital identification app. Itsme is already used by 800,000 Belgians. A crucial factor in itsme's success is that it provides access to government and private applications such as medical records, pensions and taxes, home banking and others. Itsme offers the first mobile eIDAS¹² qualified electronic signature and enables the user to sign any document with a smartphone.

Despite these positive developments, numerous administrative procedures, such as those involving building permits, remain largely offline in Brussels and Wallonia, and the digitisation of the judiciary remains a big challenge. By the end of 2018, most courts were equipped with hardware, but only about half had so far migrated to the new case management system and a unified coding system is still missing. However, all these steps must be implemented if reliable court data are to be collected. The same applies to introducing a data-led management of human and financial resources in courts, publishing judgments online and introducing the possibility of electronic communication with court users.

Overall, a better integration of the various federal, regional and local efforts to boost digital public services by all parties involved could lead the way to even more significant improvements in the area of digital public administration.

Highlight 2019: 'Wallonie en poche'

'*Wallonie en poche*' (Wallonia in your pocket) is a mobile app providing access to many aspects of local information for people living in the Walloon region of Belgium. Scalable, innovative and interactive, the application features many micro-services such as public transport timetables, rubbish collection, calendars, local news and events, and the option of paying for parking at a distance. The fundamental principle of '*Wallonie en poche*' is to base all its developments on people's real needs. Feedback from citizens is used directly by the software developers to improve the service, and users get a response to their feedback almost instantly.

⁹ <http://healthtechbelgium.com/>

¹⁰ <https://www.passezaudigital.be/ebox>

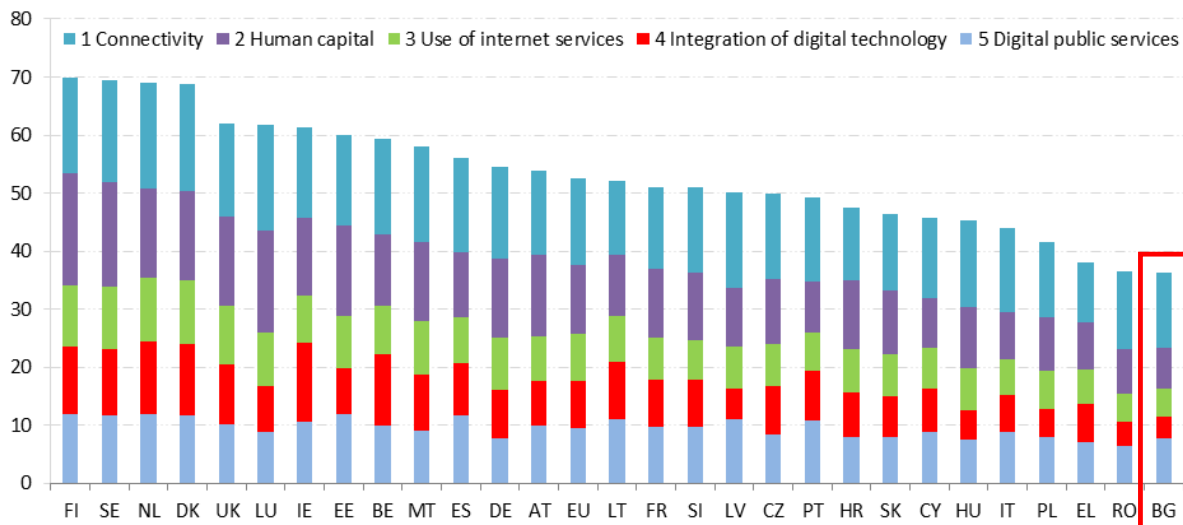
¹¹ Such as <https://doccle.be/en/>

¹² <https://ec.europa.eu/digital-single-market/en/trust-services-and-eid>

Bulgaria

	Bulgaria		EU
	rank	score	score
DESI 2019	28	36.2	52.5
DESI 2018	26	35.5	49.8
DESI 2017	27	32.4	46.9

Digital Economy and Society Index (DESI) 2019 ranking

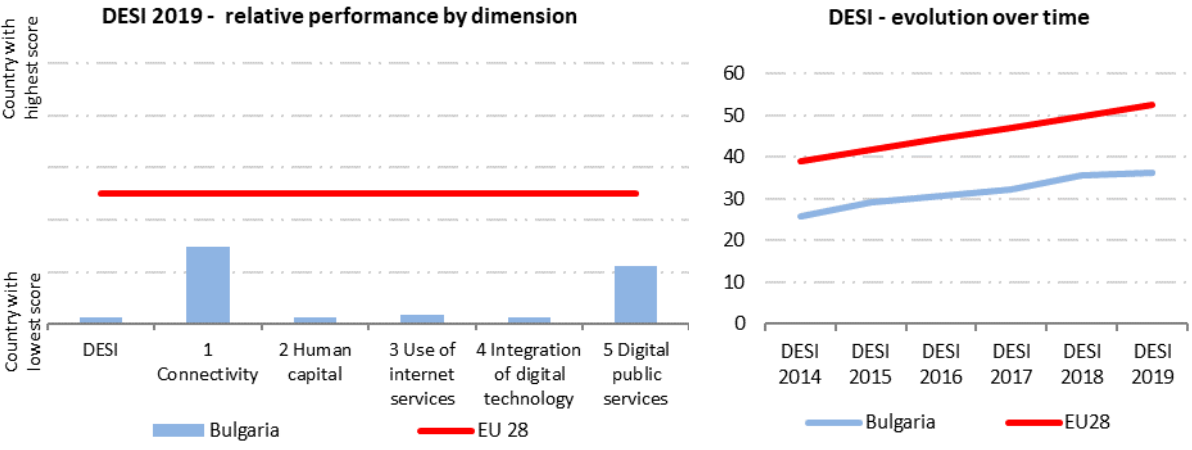


Bulgaria ranks 28th out of the 28 EU Member States in the European Commission Digital Economy and Society Index (DESI) 2019.

Despite an increase in its overall score, its rank decreased due to, on one hand, a limited performance in some of the DESI dimensions measured and, on the other hand, the increased performance of its EU peers in some the DESI indicators.

Bulgaria performs relatively well in connectivity, especially as regards the wide availability of ultrafast and mobile broadband networks. It has also made significant progress with the e-government dimension, with growing number of users and a high score for the provision of digital public services to businesses. However, Bulgaria scores well below the average in Human capital, its overall level of digital skills being among the EU's lowest. People with at least basic digital skills account for 29 % of the total Bulgarian population, against an EU average of 57 %. Only 11 % of people have skills that are above basic, which equals almost one third of the EU average. Bulgaria also performs well below the average in integrating digital technology. Companies are not yet taking full advantage of the possibilities offered by online commerce: 6 % of SMEs sell online (against the 17 % of the EU average), 3 % of total SMEs are selling cross-border and an only 2 % of their turnover comes from the online segment.

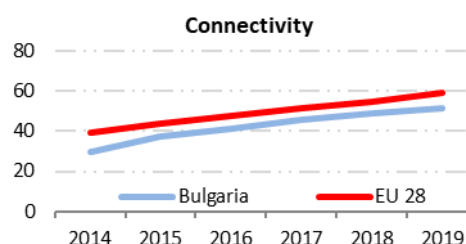
Bulgaria has a National Programme linked to the programming of EU structural funds called "Digital Bulgaria 2025"¹³, which outlines some measures to improve of connectivity, public services and private sector integration of digital technologies. However, this is not an overarching strategy to support digital transformation in Bulgaria. A concept note for the Industry 4.0 strategy was elaborated in 2017 but it is still a draft.



¹³ <https://www.mtitc.government.bg/sites/default/files/uploads/it/putna-karta-15082018.pdf>

1 Connectivity

1 Connectivity	Bulgaria		EU
	rank	score	score
DESI 2019	25	51.6	59.3
DESI 2018	24	48.8	54.8
DESI 2017	21	45.9	51.2



	DESI 2017	Bulgaria		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
1a1 Fixed broadband coverage % households	95%	95%	96%	19	97%
	2016	2017	2018		2018
1a2 Fixed broadband take-up % households	57%	59%	58%	28	77%
	2016	2017	2018		2018
1b1 4G coverage % households (average of operators)	66%	72%	80%	27	94%
	2016	2017	2018		2018
1b2 Mobile broadband take-up Subscriptions per 100 people	82	87	97	11	96
	2016	2017	2018		2018
1b3 5G readiness Assigned spectrum as a % of total harmonised 5G spectrum	NA	NA	0%	13	14%
			2018		2018
1c1 Fast broadband (NGA) coverage % households	74%	75%	75%	23	83%
	2016	2017	2018		2018
1c2 Fast broadband take-up % households	31%	39%	43%	15	41%
	2016	2017	2018		2018
1d1 Ultrafast broadband coverage % households	NA	75%	75%	15	60%
		2017	2018		2018
1d2 Ultrafast broadband take-up % households	5%	7%	10%	23	20%
	2016	2017	2018		2017
1e1 Broadband price index Score (0 to 100)	76	80	81	20	87
	2016	2017	2018		2017

Bulgaria ranks 25th in the Connectivity dimension of DESI 2019 (down one place from last year) despite a small increase in most connectivity indicators. At the end of 2018, the total coverage of fixed broadband networks rose by one percentage point to 96 % of households, slightly below the EU average of 97 %. Broadband take-up stands at 58 %. Despite an increase in 4G coverage by 8 percentage points to 80% of households, Bulgaria still needs to catch up by 14 % with the EU average. Nevertheless, take-up of mobile broadband has risen significantly (by 10 percentage points) to 97 %, slightly above the EU average of 96 %. While Bulgaria is close behind the EU average of 83 % of households covered by 30 Mbps NGA networks, at 75 %¹⁴, it is remarkable that all the networks concerned are ultra-fast, putting the country significantly ahead of the EU average (60 %) in the latter, more future-oriented category. Moreover, take-up of fast broadband has risen considerably to 43 %, slightly exceeding the EU average of 41 %, although there is still a lag in the transition to ultrafast broadband subscriptions (10 % vs an EU average of 20 %), which would take advantage of

¹⁴ NGA (FTTH, FTTB, VDSL, Cable DOCSIS 3.0 and other NGA) subscriptions as a percentage of total fixed broadband subscriptions.

the full capacity of the available networks. The fixed broadband price index¹⁵ is 81, below the EU average of 87, which represents higher prices per person, which might partly explain the low take-up.

Two years before the end of the national funding programmes under the National Broadband Plan (NBP) for 2014-2020, the execution rate reached only 47 %¹⁶. The delays seem to be attributable to the need for additional national financing and for certain legislative changes. Bulgaria plans a state aid notification for the main project to establish broadband access in remote, sparsely populated and rural areas. The sum of €30 million, funded under the EARDF, is earmarked for this project. The NBP's priorities already cover part of the gigabit connectivity goals. To complete the Plan, Bulgaria has started assessing the investment gap to be addressed, so as to fully align its core objectives. Thanks to the extensive dissemination of the WiFi4EU initiative, 246 municipalities (92.8 % of all those in the country) registered on the WiFi4EU portal. Moreover, 215 municipalities applied in response to the first call and 113 obtained a voucher for €15,000 each. The delayed first draft of the secondary legislation needed to ensure the effective implementation of the Broadband Cost Reduction Directive (BB CRD) is finally expected in the first half of 2019, while preparatory work is under way to update the mapping of existing infrastructure and quality of service.

In 2018, a national roadmap was adopted that details the steps needed to meet obligations as regards the use of the 700 MHz pioneer band for 5G. A large part of the 3.6 GHz band in Bulgaria is available and ready to be used for 5G services, but none has yet been assigned under technical conditions suitable for 5G. Operators are carrying out 5G tests, extending and updating their current networks to LTE Advanced. Bulgaria has already identified some potential candidates for 5G-enabled cities. In June 2018, a letter of intent was signed between Bulgaria, Greece and Serbia on preparing and conducting tests for cooperative, connected and automated driving across the three countries for the purposes of 5G deployment. To date, only 14 % of the total 2090 MHz of the EU-harmonised spectrum has been assigned in Bulgaria. This is because of delays in making available crucial spectrum below 1 GHz for electronic communication services, combined with the lack of commercial interest in other frequency bands. Despite some administrative and legislative advances, efforts to release all spectrum in the 800 MHz and 700 MHz bands have not yet yielded any results.

Together with its 5G strategy, which is soon to be incorporated in the National Broadband Plan, Bulgaria would gain by making sure that all EU-harmonised spectrum, including the 5G pioneer bands, is made available in good time to all relevant market players, to achieve the gigabit connectivity goals. An increased focus on deploying broadband in rural areas, combined with more training in digital skills and further development of digital services, would benefit the country's overall connectivity and help to bridge the digital divide, which is particularly challenging in light of factors like the predominantly aging population in rural depopulated areas. Additional measures could help boost demand, realise the NBP's objectives and use the earmarked funds in good time. There is still scope to reduce deployment costs and price levels.

¹⁵ The Broadband Price Index measures the prices of 12 representative broadband baskets as a percentage of household income. The baskets include three speed categories (12-30 Mbps, 30-100 Mbps and at least 100 Mbps) and four types of products (standalone internet, internet + TV, internet + fixed telephony and internet + TV + fixed telephony).

¹⁶ The total value of the planned financing is over €75 million.

Highlight 2019: Second place in the EU by the municipalities covered by the WiFi4EU initiative

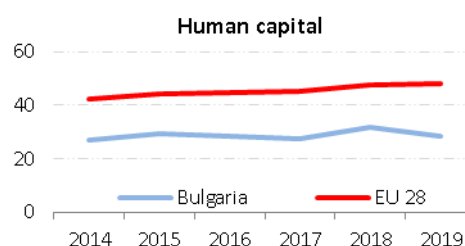
The WiFi4EU initiative promotes free access to Wi-Fi connectivity for citizens in public spaces including parks, squares, public buildings, libraries, health centres and museums in municipalities throughout Europe. With this initiative, municipalities can apply for vouchers to the value EUR 15,000, to be used to install Wi-Fi equipment in public spaces within the municipality that are not already equipped with a free Wi-Fi hotspot.

After the first competition held in November 2018, 43 % of Bulgarian municipalities have won vouchers for building high-speed wireless internet in public places. 215 applications have been submitted from Bulgaria and 113 municipalities have received funding totalling EUR 1,695,000.

The region with the highest percentage of financed municipalities (17 out of 35 municipalities) is the Northeastern, with 49 % of all municipalities receiving the vouchers. Second is the Southwest region with 46 % or 24 out of 52 municipalities funded. The third place is held by the North Central Region where 44 % of municipalities managed to join the initiative, which is 16 out of 36 municipalities. 14 of the district towns are among the top 113 municipalities to build high-speed wireless internet networks in public places.

2 Human capital

2 Human capital	Bulgaria		EU
	rank	score	score
DESI 2019	28	28.5	48.0
DESI 2018	27	31.7	47.6
DESI 2017	27	27.3	45.4



	DESI 2017	Bulgaria		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
2a1 At least basic digital skills % individuals	26% 2016	29% 2017	29% 2017	27	57% 2017
2a2 Above basic digital skills % individuals	10% 2016	11% 2017	11% 2017	27	31% 2017
2a3 At least basic software skills % individuals	28% 2016	31% 2017	31% 2017	28	60% 2017
2b1 ICT specialists % total employment	2.3% 2015	2.7% 2016	2.3% 2017	23	3.7% 2017
2b2 Female ICT specialists % female employment	1.4% 2015	1.7% 2016	1.3% 2017	15	1.4% 2017
2b3 ICT graduates % graduates	2.7% 2014	3.1% 2015	2.9% 2016	22	3.5% 2015

As regards Human Capital, Bulgaria ranks 28th among EU countries, putting it well below the EU average. The overall level of digital skills is among the lowest in the EU: people with at least basic digital skills account for 29 % of the total, against an EU average of 57 %. This trend is confirmed among young people: 54 % of 16-24-year-olds have at least basic digital skills (against an EU average of 81 %). People with more advanced internet user skills (above basic digital skills) account for 11 % of the total, slightly less than a third of the EU average. Finally, the proportion of ICT specialists stood at 2.3 % of total employment in 2017. On a positive note, female ICT specialists are quite well represented, at 1.3 % of total female employment, in line with the EU average.

On the policy side, the education system is currently being reformed at all levels and although measures have not entirely kept pace with the scale of the digital transformation, there is an increased focus on improving levels of digital skills. For example, a revised school curriculum has been implemented and, from the 2018-2019 school year, computer modelling is being introduced in the third grade, while there are now more classes with IT profiles in upper secondary school¹⁷. In addition, extra-curricular activities are pursued in secondary schools (such as the national programme 'Education for IT careers'¹⁸). Performance-based funding will be introduced in vocational education and training (VET) to direct learners to vocational programmes, targeting occupations that are in short supply on the labour market. Financial incentives will be offered to VET schools that provide training for these occupations.

¹⁷https://ec.europa.eu/education/resources-and-tools/document-library/education-and-training-monitor-2018-bulgaria-report_en

¹⁸ Highlight of DESI report (2018)

In the context of the higher-education reform, there are measures to step up cooperation between education institutions and businesses; the European Social Fund supports a project to bring university curricula more into line with labour market needs. The Government provides support for training in certain fields that have good results and also according to labour market needs (including STEM and ICT faculties). The number of students in ICT has risen slightly, though numbers remain low in science, mathematics, and physics.

A range of stakeholders are involved in various activities designed to develop digital skills, such as private companies providing free training in coding for schoolchildren or an online course in *cyberhygiene* developed in collaboration with the State E-government Agency. Another good example is the *Cyberscout* program, within which children educate other children on online safety and internet literacy. The Bulgarian Digital National Alliance¹⁹ continues to organise activities to develop digital skills among different segments of the population. In 2018, a good number of schools and other organisations took part in the EU Code Week²⁰, a grassroots movement to encourage people of all age to code. Almost 600 events were held in Bulgaria, with an estimated number of over 30,000 participants.

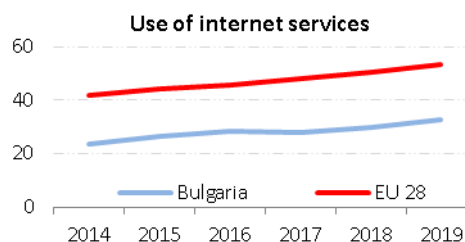
Despite ongoing efforts to tackle the low levels of digital skills, Bulgaria would benefit from an overarching digital skills strategy to address both the education system and the upskilling of the workforce.

¹⁹ <https://www.digitalalliance.bg/>

²⁰ <https://codeweek.eu/>

3 Use of internet services

3 Use of internet services	Bulgaria		EU
	rank	score	score
DESI 2019	27	32.5	53.4
DESI 2018	27	29.9	50.7
DESI 2017	27	28.0	47.8

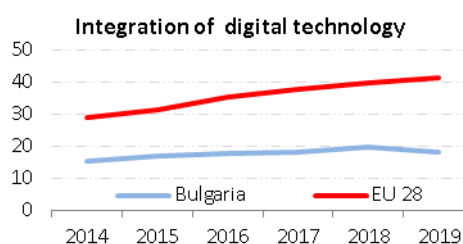


	DESI 2017	Bulgaria		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
		value	value		value
3a1 People who never used the internet	33%	30%	27%	28	11%
% individuals	2016	2017	2018		2018
3a2 Internet users	58%	62%	64%	28	83%
% individuals	2016	2017	2018		2018
3b1 News	68%	74%	74%	20	72%
% internet users	2016	2017	2017		2017
3b2 Music, videos and games	64%	64%	64%	27	81%
% internet users	2016	2016	2018		2018
3b3 Video on demand	8%	8%	9%	27	31%
% internet users	2016	2016	2018		2018
3b4 Video calls	80%	85%	83%	1	49%
% internet users	2016	2017	2018		2018
3b5 Social networks	76%	79%	79%	7	65%
% internet users	2016	2017	2018		2018
3b6 Professional social networks	7%	3%	3%	28	15%
% internet users	2015	2017	2017		2017
3b7 Doing an online course	3%	3%	3%	28	9%
% internet users	2016	2017	2017		2017
3b8 Online consultations and voting	5%	4%	4%	26	10%
% internet users	2015	2017	2017		2017
3c1 Banking	7%	9%	11%	27	64%
% internet users	2016	2017	2018		2018
3c2 Shopping	27%	27%	31%	27	69%
% internet users	2016	2017	2018		2018
3c3 Selling online	11%	8%	13%	21	23%
% internet users	2016	2017	2018		2018

Despite an increase in its score, Bulgaria performs below average in terms of use of internet services: 64 % of people use the internet, against an EU average of 83 %, while 27 % have never used it - the highest value in the EU. Among internet users in the EU, Bulgarians make most video calls, and they are also well above the EU average when it comes to social network activities (79 % vs 65 %). In addition, 74 % of internet users read news online, which is more or less in line with the EU average. On the other hand, Bulgarian internet users are less keen to use other online services, in particular e-banking, which is used by only 11 % of internet users, against an EU average of 64 %. Online shopping, too, is used by only a third of internet users, against an EU average of 69 %.

4 Integration of digital technology

4 Integration of digital technology	Bulgaria		EU
	rank	score	score
DESI 2019	28	18.1	41.1
DESI 2018	28	19.5	39.6
DESI 2017	28	18.0	37.6



	Bulgaria		EU	
	DESI 2017 value	DESI 2018 value	DESI 2019 value	DESI 2019 rank
4a1 Electronic information sharing % enterprises	25%	23%	23%	25
4a2 Social media % enterprises	9%	9%	9%	28
4a3 Big data % enterprises	7%	7%	7%	25
4a4 Cloud % enterprises	5%	6%	6%	28
4b1 SMEs selling online % SMEs	5%	7%	6%	28
4b2 e-Commerce turnover % SME turnover	2%	4%	2%	28
4b3 Selling online cross-border % SMEs	3%	3%	3%	27

As regards integration of digital technology, Bulgaria ranks 28th among EU countries, well below the EU average. Bulgarian companies struggle to take advantage of the opportunities offered by online commerce: 6 % of SMEs sell online (against an EU average of 17 %), 3 % of all SMEs sell across borders, and only 2 % of their turnover comes from the online segment. Although Bulgarians use social media intensively for personal use, only 9 % of companies use it to promote their business, against an EU average of 21 %. Finally, the number of companies with a high-intensity index²¹ account only for 7.81 % of all companies. On a more positive note, 23 % of businesses share information online, against an EU average of 34 %.

Bulgaria has drafted a 'Concept note for the Digital Transformation of Bulgarian Industry (Industry 4.0)', which should form the basis for developing a Strategy 4.0. There is also a National Programme linked to the programming of the measures supported by the EU structural fund 'Digital Bulgaria 2025'²², which outlines some measures to encourage the digitisation of businesses. In this context, EU funds are being used to finance four centres of excellence and nine centres of competences, specialising in disciplines including mechatronics, clean technology and IT. In parallel, another EU-funded project will help set up regional innovation centres, which will encourage cooperation between businesses and research centres. These projects, expected to start in 2019, are designed to

²¹ [Digital Intensity Index](#), number of firms with high intensity rate, i.e. using from 7 to 9 technologies (on 12 technologies), being it from having a website, doing e-sales, sending e-invoices or purchasing cloud computing advanced services, among others (Digital Scoreboard 2019).

²² <https://www.mtitc.government.bg/sites/default/files/uploads/it/putna-karta-15082018.pdf>

facilitate knowledge transfer, help create university spin-offs, and attract capital. These projects' sustainability and performance are vital for future investments, both in terms of infrastructure and soft measures. Meanwhile, the flagship Sofia Tech Park continues to face challenges. The underutilisation of its scientific infrastructure, governance issues and long-term financial sustainability are some of the concerns.

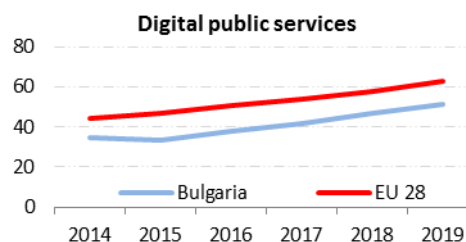
Another project managed by the Bulgarian SME promotion agency, planned to start in 2019, should set up a voucher scheme benefiting up to 450 SMEs in Bulgaria that are willing to acquire digital infrastructure.

Bulgaria is committed to investing strategically in digital technologies through EU-coordinated programmes (such as EuroHPC Joint Undertaking). It also has a National Centre for Supercomputing Applications, whose activities could be stepped up to benefit SMEs. Although Bulgaria is a signatory to the Declaration of Cooperation on Artificial Intelligence, measures to encourage the take-up of artificial intelligence applications in the public and private sector are lagging behind. Bulgaria's cybersecurity strategy, adopted in 2016, aims to combat cyber-crime, engage in international cooperation, establish an incident response capability and raise public awareness of cybersecurity risks. On this last point, cyberhygiene awareness-raising campaigns have been run in 2018 for children and business.

Although some measures are planned to support the take-up of digital technologies by business, the Bulgarian economy would benefit from an overarching strategy addressing digital transformation.

5 Digital public services

5 Digital public services	Bulgaria		EU
	rank	score	score
DESI 2019	25	51.5	62.9
DESI 2018	24	46.9	57.9
DESI 2017	25	41.8	54.0



	DESI 2017	Bulgaria		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
5a1 e-Government users % internet users needing to submit forms	57%	58%	61%	16	64%
	2016	2017	2018		2018
5a2 Pre-filled forms Score (0 to 100)	19	25	26	25	58
	2016	2017	2018		2018
5a3 Online service completion Score (0 to 100)	71	73	75	26	87
	2016	2017	2018		2018
5a4 Digital public services for businesses Score (0 to 100) - including domestic and cross-border	74	89	96	5	85
	2016	2017	2018		2018
5a5 Open data % of maximum score	NA	NA	66%	13	64%
			2018		2018
5b1 e-Health services % individuals	NA	10%	10%	23	18%
		2017	2017		2017
5b2 Medical data exchange % of general practitioners	NA	NA	20%	23	43%
			2018		2018
5b3 e-Prescription % of general practitioners	NA	NA	7%	26	50%
			2018		2018

As regards Digital Public Services, Bulgaria ranks 24th among EU countries, below the EU average. The country performs very well in the provision of digital public services to businesses; it has improved its performance since the previous year and now scores 96 out of 100, well above the EU average of 85. The number of e-government users has also increased since the previous year, with 61 % of internet users submitting forms online, almost in line with the EU average of 64 %. For e-health services, Bulgaria ranks 23rd in the EU, with 10 % of Bulgarians having used health and care services provided online. The e-prescription service is used by 7 % of general practitioners and 20 % of them exchange medical data.

Bulgaria has made significant progress with implementing its Strategy on the Development of e-government. The strategic framework is in place and the State e-Government Agency (SEGA) is operational and plays a key coordinating role. In the second half of 2017, the SEGA started developing an e-government architecture frame. The frame is a necessary and obligatory requirement for implementing the e-government policy, defined by standards, interoperability and network and information security. The Council of Ministers has recently given a mandate to the Chair of the SEGA to develop the general description of the e-government architecture and to ensure that the administrations responsible have access to the system.

Bulgaria's registry information exchange system, RegiX, is now operational, allowing administrations to access data contained in the registers and databases of other public sector services. However, the outdated legal framework remains the major obstacle to its widespread use. The provision of digital

public services for businesses has improved significantly. In 2018, it became compulsory for legal persons to submit their tax declarations online. This will be optional for natural persons (individuals) and will be incentivised via a tax rebate.

Important projects like the introduction of the new identity documents, with electronic identification and electronic signature are significantly delayed and have shown very little progress over the last year.

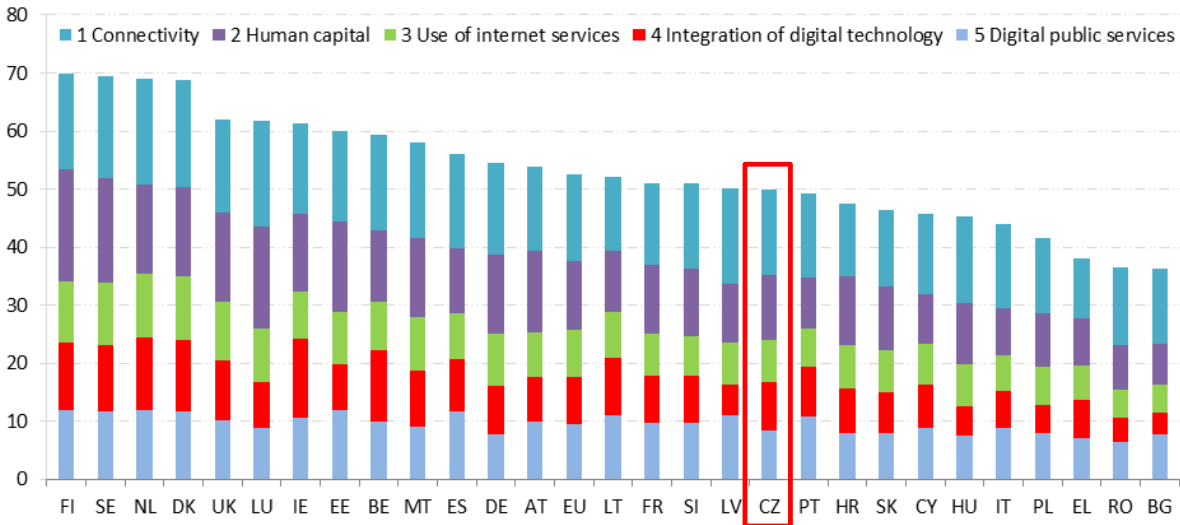
The National Health Strategy for 2014 - 2020 includes the introduction of a single integrated information system by developing electronic and mobile health as one of five main objectives. In this context, EU funds are being used to help complete a National Health Information System (NHSIS). This is designed to improve the quality and efficiency of healthcare, reduce the time needed to provide patients with healthcare, improve the quality of healthcare, and improve diagnosis and treatment through the use of new technologies in e-health. However, this project is also facing some delays in implementation.

Overcoming the delays in the reform process associated with implementing the strategy could contribute to significant improvements in digital public administration.

Czechia

	Czechia		EU
	rank	score	score
DESI 2019	18	50.0	52.5
DESI 2018	17	47.6	49.8
DESI 2017	15	45.3	46.9

Digital Economy and Society Index (DESI) 2019 ranking



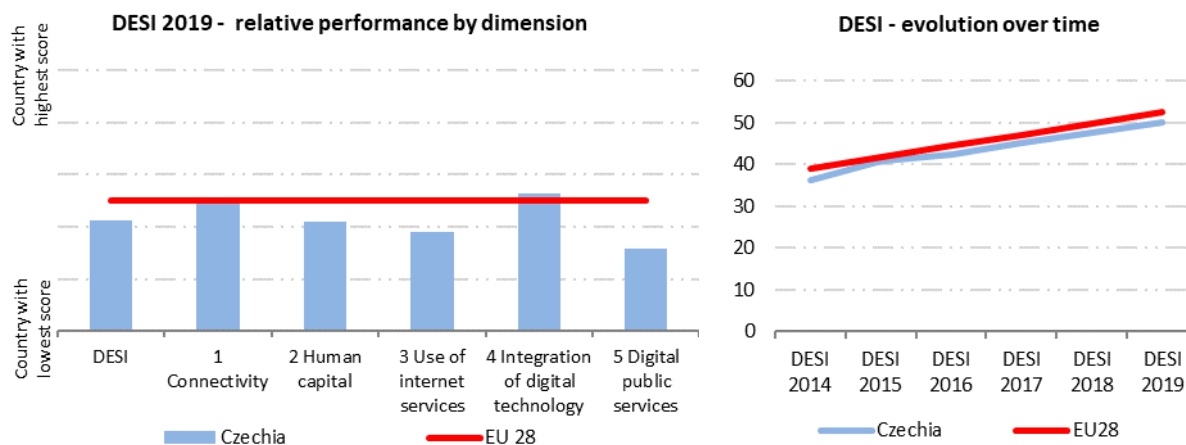
Czechia ranks 18th out of the 28 EU Member States in the European Commission Digital Economy and Society Index (DESI) 2019. Its score increased thanks to an improved performance in some of the DESI dimensions measured but in the overall ranking the country is one position lower than in DESI 2018.

Among all dimensions, Czechia ranks highest in the integration of digital services domain especially thanks to high scores in e-commerce and online shopping. Czechia improved concerning digital public services but still scores below the EU average. More than half of Czech internet users use now e-government services and Czechs are among the EU leaders in reading news online. 4G coverage is one of the best in the EU and Czech SMEs still maintain one of the highest share of turnover from e-commerce in the EU.

However, the not sufficient level of digital skills in the population remains an issue and the digitisation of businesses is not progressing as fast as it could.

Czechia's new digital strategy (*'Digitální Česko'*²³) has been adopted in October 2018 and is divided into 3 chapters: 1/ Digitisation of public services, 2/ Czechia in digital Europe and 3/ Digital economy and society.

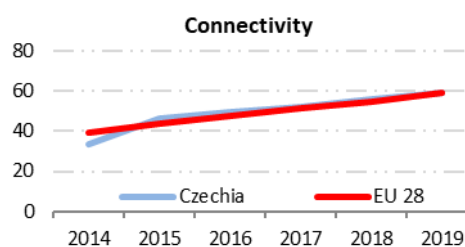
The government has appointed a new Chief Digital Officer for IT and digitisation who is in charge of coordinating actions foreseen in the strategy. For the implementation, he closely collaborates with ministries of industry and trade, interior, employment, education and healthcare.



²³ <https://www.mvcr.cz/clanek/rada-vlady-pro-informacni-spolecnost.aspx?q=Y2hudW09Ng%3D%3D>

1 Connectivity

1 Connectivity	Czechia		EU
	rank	score	score
DESI 2019	15	59.2	59.3
DESI 2018	14	56.2	54.8
DESI 2017	14	51.9	51.2



	DESI 2017	Czechia		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
1a1 Fixed broadband coverage % households	99%	98%	98%	14	97%
1a2 Fixed broadband take-up % households	71%	73%	74%	14	77%
1b1 4G coverage % households (average of operators)	94%	99%	99%	3	94%
1b2 Mobile broadband take-up Subscriptions per 100 people	77	81	82	22	96
1b3 5G readiness Assigned spectrum as a % of total harmonised 5G spectrum	NA	NA	17%	11	14%
1c1 Fast broadband (NGA) coverage % households	75%	89%	90%	12	83%
1c2 Fast broadband take-up % households	26%	32%	37%	18	41%
1d1 Ultrafast broadband coverage % households	NA	60%	63%	17	60%
1d2 Ultrafast broadband take-up % households	14%	16%	18%	16	20%
1e1 Broadband price index Score (0 to 100)	88	87	88	9	87

Overall growth in Connectivity has slowed, falling to just below the EU average. However, Czechia has almost met its target for fixed broadband full coverage, while next generation access (NGA) coverage has expanded to such an extent that it now exceeds the EU average. Reasons for this increase include the deployment of fibre by alternative operators and the incumbent's upgrade of its copper network to very high speed digital subscriber line (VDSL). Subscriptions to fixed broadband have increased mainly in urban areas, which are well developed. They now stand at 74 % of households, which is still below the EU average of 77 %. Czechia's performance as regards ultra-fast broadband coverage is slightly better, at 63%, than the EU average (60 %). However, Czechia's urban-rural digital divide is illustrated by the figures for FTTP coverage; under 8 % of rural areas are covered (half the EU average of 14 %), while overall coverage stands at 38 %, above the EU average of 30 %. Czechia's take-up of fast broadband (37 %) and ultrafast broadband (18 %) is below the EU average (41 % and 20 % respectively), showing a significantly slower pace of growth. The ultrafast broadband take-up is catered for by new entrants, with a marginal deployment on the incumbent's network. 4G coverage of mobile broadband is almost ubiquitous (99 %). Mobile broadband take-up (82 %) increased slightly over the past year, but is well below the EU average of 96 %. The reason for this relatively low take-

up may be that prices for mobile phone users are among the highest in Europe. Mobile broadband prices for handset offers²⁴ (€42.6) are almost double the EU average of €22.3. The fixed broadband price index, however, is very close to the EU average.

The national broadband plan has not yet been updated to reflect the 2025 strategic targets proposed by the Commission. Under the current strategy, deployment in market failure areas will benefit from public support co-financed with European Structural and Investment Funds (ESIF) under the Operational Programme 'Enterprise and Innovations for Competitiveness' (OPEIC). OPEIC support for broadband rollout has been reduced from the €521 million that were initially planned to €281 million, owing to a reduction in the intervention areas with no NGA coverage and lower demand for funding by operators than was initially expected. These funds will support the award of grants under a new call for projects in areas with no NGA coverage, based on a new map prepared by the national regulatory authority (CTU). The Czech authorities are also assessing a new measure to reinforce backhaul networks. The remaining funds will be used to create an infrastructure atlas, to facilitate the reuse of existing infrastructure that can support the deployment of electronic communications networks. The OPEIC is also expected to contribute to setting up a demand support scheme which is currently under preparation and a programme of loans to support SMEs' activities in the provision of electronic communication services.

In Czechia, 42 % of the 2090 MHz of spectrum harmonised at EU level for wireless broadband has been assigned. August 2018 saw further progress towards the proposed auction of the 700 MHz spectrum in Czechia, with the Czech Telecommunication Office (*Cesky telekomunikacni urad*, CTU) issuing its 'framework position' after completing the first stage of its industry consultation. The auction, which is expected to take place in the second half of 2019, will offer those interested the remaining 3.4-3.6 GHz band licence, followed by a refarming on the 3.4-3.8 GHz band by 2020. On 22 November 2018, the national roadmap for the 700 MHz frequency band was published on the website of the Ministry of Industry and Trade²⁵, five months after the legal deadline.

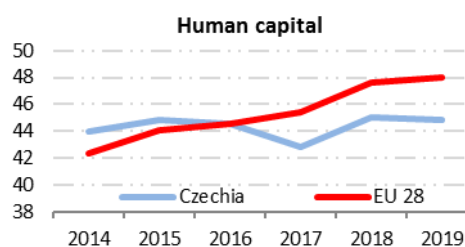
Greater market-led deployment than previously anticipated means that Czechia's direct public investment needs to close the urban-rural divide as regards NGA networks have been reduced. All the remaining measures provided for by the OPEIC should be swiftly implemented. The forthcoming auction of 5G spectrum auction needs to be held soon if 5G is to be deployed in good time.

²⁴ Offers from February 2017 including 1 GB, 300 calls and 225 SMS. Source: Mobile Broadband Price Study (Van Dijk and Empirica). Prices expressed in €/PPP, VAT included. Data: February 2019.

²⁵ Národní plán realizace rozhodnutí Evropského parlamentu a Rady (EU) 899/2017: <https://www.mpo.cz/cz/e-komunikace-a-posta/dvb-t2/narodni-plan-realizace-rozhodnuti-evropskeho-parlamentu-a-rady-eu-899-2017--241553/>

2 Human capital

2 Human capital	Czechia		EU
	rank	score	score
DESI 2019	16	44.8	48.0
DESI 2018	16	45.0	47.6
DESI 2017	16	42.8	45.4



	Czechia		EU	
	DESI 2017 value	DESI 2018 value	DESI 2019 value	DESI 2019 rank
2a1 At least basic digital skills % individuals	54%	60%	60%	11
2a2 Above basic digital skills % individuals	20%	24%	24%	22
2a3 At least basic software skills % individuals	57%	62%	62%	11
2b1 ICT specialists % total employment	3.7%	3.5%	3.6%	15
2b2 Female ICT specialists % female employment	0.8%	0.9%	0.7%	24
2b3 ICT graduates % graduates	4.2%	3.9%	4.0%	13

On Human capital dimension, Czechia ranks 16th and below the EU average. 62 % of Czechs have at least basic software skills. The proportion of ICT specialists (3.6 %) stagnated and dropped below the EU average (3.7 %). Women ICT specialists represent only 0.7 % of total employment, which is the 5th lowest score in the EU. The insufficient supply of ICT graduates could become a bottleneck for the economy: 79 % of enterprises that recruited or tried to recruit ICT specialists in 2017 reported difficulties in filling these vacancies²⁶.

Three national strategic documents aim to improve digital skills. The most recent strategy '*Digitální Česko*'²⁷ (adopted in 2018) focuses primarily on the workforce, labour market and education. Concrete implementation plans with actions and deliverables are expected to be published in 2019. The Strategy for Digital Literacy²⁸ is entering its final phase with approximately half of the foreseen actions progressing. However, there are delays mainly in the introduction of digital technologies to classrooms or digital inclusion of the low-skilled and socially excluded groups. The Strategy for Digital Education²⁹ adopted in 2014 foresees actions to lower the inequalities, support quality teachers, and effectively manage digitisation of education. This strategy faces delays especially in equipping schools with digital infrastructure and providing support materials and training for teachers.

²⁶ https://ec.europa.eu/eurostat/statistics-explained/index.php/ICT_specialists_-_statistics_on_hard-to-fill_vacancies_in_enterprises

²⁷ <https://www.mvcr.cz/clanek/rada-vlady-pro-informacni-spolecnost.aspx?q=Y2hudW09Ng%3D%3D>

²⁸ https://www.mpsv.cz/files/clanky/21499/Strategie_DG.pdf

²⁹ <http://www.msmt.cz/vzdelavani/skolstvi-v-cr/strategie-digitalniho-vzdelavani-do-roku-2020>

Czech students do not have sufficient level of digital media literacy³⁰. Only 43 % of high school students are aware of algorithms that select posts in social media news feeds. They also do not fully understand how search engines work and have difficulties to critically assess articles and media announcements. Low level of digital media literacy makes the population vulnerable to the spread of online disinformation, propaganda and misleading commercial practices. To solve this issue, Czech NGOs and public institutions organise contests for young people in cybersecurity, coding or web design³¹.

In 2018, the Czech Digital Skills and Jobs Coalition³² focused on improving communication with its 134 members. On its new and regularly updated website, the Coalition lists supported projects, key upcoming events and presents success stories. It launched new working groups to prepare a basis for a new think-tank that will improve monitoring and sharing of best practices and support networking.

In 2018, Czechia joined the EU Code Week with 151 events and over 9,000 participants. In December 2018 a Czech project, “Coding Bootcamp Praha”³³ won one of the five European Digital Skills Awards³⁴.

Czechs are not improving their digital skills fast enough. However, public authorities, associations, NGOs and the private sector organise activities to address this issue. Better coordination, strict compliance with the national strategic documents, closer cooperation between initiatives and a more direct contact with the target audiences would make the actions more efficient and help more Czechs to boost their level of digital skills.

³⁰Study by “People in Need”:

<https://docs.google.com/viewerng/viewer?url=https://www.irozhlaz.cz/sites/default/files/documents/64ab57a97c85701abb5652ffc15f117c.pdf&pid=explorer&efh=false&a=v&chrome=false>

³¹ <https://digikoalice.cz/inspirations/>

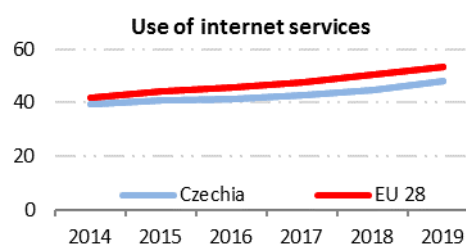
³² <https://digikoalice.cz/>

³³ <https://digikoalice.cz/inspirations/coding-bootcamp-praha/>

³⁴ <https://ec.europa.eu/digital-single-market/en/news/winners-european-digital-skills-awards-2018>

3 Use of internet services

3 Use of internet services	Czechia		EU
	rank	score	score
DESI 2019	19	47.9	53.4
DESI 2018	20	44.7	50.7
DESI 2017	20	42.7	47.8

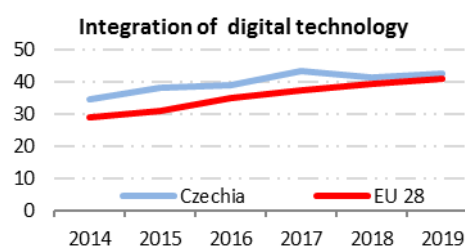


	Czechia		EU	
	DESI 2017 value	DESI 2018 value	DESI 2019 value	DESI 2019 rank
3a1 People who never used the internet % individuals	13%	11%	10%	11
3a2 Internet users % individuals	79%	81%	84%	12
3b1 News % internet users	NA	91%	91%	3
3b2 Music, videos and games % internet users	72%	72%	70%	25
3b3 Video on demand % internet users	4%	4%	5%	28
3b4 Video calls % internet users	40%	42%	49%	18
3b5 Social networks % internet users	55%	57%	64%	23
3b6 Professional social networks % internet users	5%	5%	5%	26
3b7 Doing an online course % internet users	3%	4%	4%	26
3b8 Online consultations and voting % internet users	6%	3%	3%	27
3c1 Banking % internet users	63%	67%	72%	10
3c2 Shopping % internet users	57%	65%	67%	14
3c3 Selling online % internet users	15%	13%	16%	16

The use of internet services in Czechia is growing but remains below the EU average. 84 % of Czechs use the internet at least once a week. Reading news is one of the most popular online activities (3rd highest score in the EU). More and more Czechs (72 % of internet users) also use online banking and in this domain, Czechia is the best performing country of Central Europe. However only 5 % of Czech internet users have a video-on-demand subscription (EU average: 31 %) and only 3 % participate in online consultations and voting (EU average: 10 %) which puts the country at the bottom of the EU ranking. Online shopping grew by 10 percentage points between 2016 and 2018.

4 Integration of digital technology

4 Integration of digital technology	Czechia		EU
	rank	score	score
DESI 2019	12	42.5	41.1
DESI 2018	12	41.3	39.6
DESI 2017	9	43.4	37.6



	Czechia		EU	
	DESI 2017	DESI 2018	DESI 2019	DESI 2019
	value	value	value	rank
4a1 Electronic information sharing	30%	28%	28%	20
% enterprises	2015	2017	2017	2017
4a2 Social media	12%	13%	13%	23
% enterprises	2016	2017	2017	2017
4a3 Big data	9%	9%	8%	21
% enterprises	2016	2016	2018	2018
4a4 Cloud	10%	14%	16%	16
% enterprises	2016	2017	2018	2018
4b1 SMEs selling online	26%	23%	23%	5
% SMEs	2016	2017	2018	2018
4b2 e-Commerce turnover	22%	16%	18%	3
% SME turnover	2016	2017	2018	2018
4b3 Selling online cross-border	12%	12%	12%	4
% SMEs	2015	2017	2017	2017

On the Integration of digital technology by businesses, Czechia ranks 12th among EU countries, slightly above the EU average. Czechia reports top results in SMEs selling online (23 %) and the share of e-Commerce on SME total turnover (18 %). However, both indicators are in a modest decrease since 2016. The use of cloud software increased since 2016 but remains below the EU average. Czech enterprises are among the lowest EU performers in the use of social media.

Czechia is committed to the advancement of new digital technologies and to strategically invest in digital technologies, via EU coordinated programmes (e.g. the country is a member of the EuroHPC Joint Undertaking; it has also signed the Declaration of European Blockchain Partnership as well as the Declaration on cooperation on Artificial Intelligence). The country is home to five digital innovation hubs based in Prague, South Moravia and Ostrava³⁵. In 2019, the government adopted a new innovation strategy³⁶ and is expected to announce a national strategy for Artificial Intelligence.

The national digitisation strategy (*'Digitální Česko'*, adopted in 2018)³⁷ lists 8 priority areas and 58 corresponding actions that aim to create more favourable conditions for digital transformation. The strategy underlines the need to invest in research and innovation, support the adoption of digital

³⁵ <https://europa.eu/!kB94nt>

³⁶ Innovation Strategy of the Czech republic 2019-2030: The country of the future

<https://www.vyzkum.cz/FrontAktualita.aspx?aktualita=867990>

³⁷ <https://www.mpo.cz/cz/podnikani/digitalni-spolecnost/program-digitalni-cesko---243487/>

technologies such as artificial intelligence or big data by businesses, strengthen cybersecurity in private and public sector and ensure appropriate financing.

For an economy dependent on engineering, automotive industry and metallurgy it is vital to help businesses, especially SMEs adapt to the technological change. According to the a study by Czech Chamber of Commerce³⁸, big data is the most popular technology among companies and they expect governmental support in deploying state-of-the-art shared digital infrastructure.

Czech start-ups are in average less than three years old. The government agency CzechInvest offers³⁹ co-financing from the EU regional development funds for young enterprises. However, according to the “Start-up Report 2017/2018”⁴⁰ only one third of start-ups sought public financing. Early stage companies also seek support in regional innovation centres. One of the most successful is the JIC⁴¹ in Brno, which since 2014 has supported 328 enterprises and contributed to the creation of 2160 jobs.

Czechia reports strong results in e-commerce and has an active start-up scene. However, businesses are not adopting digital technologies fast enough. Increasing the number of ICT experts could help bridge the adoption of digital technologies.

Highlight 2019: IT4Innovations – Most powerful Czech supercomputer and a digital innovation hub from Ostrava

In the last decades, this region’s economic power originated from mining, engineering and heavy industry. Digitisation and innovation can represent a new economic and social opportunity. IT4Innovations aims to offer world-class supercomputing infrastructure and increase competitiveness and innovation potential of Czech research and industry. The center’s main device is Salomon:

- 214th most powerful supercomputer in the world
- 76,896 cores
- able to perform 2 petaFLOPS per second

The hub manages the most advanced national HPC infrastructure and represents Czechia in international HPC networks (e.g. EuroHPC). It also conducts its original research in HPC, computer simulations, numerical modeling or artificial intelligence. The hub helps big businesses and SMEs to reap the benefits of HPC and it trains new HPC specialists.

IT4Innovations cooperates with Europe’s main HPC institutions and participates in the key international initiatives such as PRACE or CloudiFacturing. IT4Innovations positively influences the region’s economy. It employs 200 people mainly in the fields of research and supercomputing services. It also collaborates with the Technical University in Ostrava and offers jobs and traineeships for students. In 2018, the center’s budget was CZK 188 million (€4.8 million). In 2020, the centre plans to install a new supercomputer, which should be one of the most powerful in Europe. With the regional innovation centre in Ostrava (MSIC) it aims to create a one-stop-shop digital innovation hub, which will expand the offer of services.

³⁸[https://www.ey.com/Publication/vwLUAssets/Pr%C5%AFmysl_4.0_2018/\\$FILE/Pruzkum_Prumysl_4_0_HK_EY_2018.pdf](https://www.ey.com/Publication/vwLUAssets/Pr%C5%AFmysl_4.0_2018/$FILE/Pruzkum_Prumysl_4_0_HK_EY_2018.pdf)

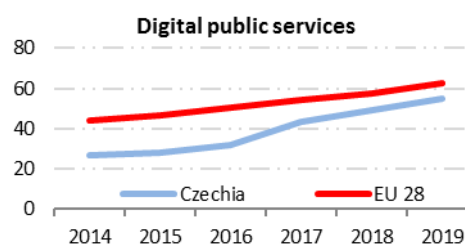
³⁹ CzechStarter, CzechAccelerator, CzechMatch, CzechDemo - <http://www.podporastartupu.cz/projekty/>

⁴⁰ <https://mailchi.mp/1b20a1451ef7/startupreport>

⁴¹ <https://www.jic.cz/en/>

5 Digital public services

5 Digital public services	Czechia		EU
	rank	score	score
DESI 2019	20	55.2	62.9
DESI 2018	21	49.1	57.9
DESI 2017	23	43.5	54.0



	Czechia				EU
	DESI 2017	DESI 2018	DESI 2019	rank	DESI 2019
5a1 e-Government users	35%	33%	52%	22	64%
% internet users needing to submit forms	2016	2017	2018		2018
5a2 Pre-filled forms	43	49	51	18	58
Score (0 to 100)	2016	2017	2018		2018
5a3 Online service completion	77	82	82	21	87
Score (0 to 100)	2016	2017	2018		2018
5a4 Digital public services for businesses	73	81	82	19	85
Score (0 to 100) - including domestic and cross-border	2016	2017	2018		2018
5a5 Open data	NA	NA	62%	21	64%
% of maximum score			2018		2018
5b1 e-Health services	NA	15%	15%	16	18%
% individuals		2017	2017		2017
5b2 Medical data exchange	NA	NA	17%	25	43%
% of general practitioners			2018		2018
5b3 e-Prescription	NA	NA	48%	17	50%
% of general practitioners			2018		2018

On Digital public services, Czechia climbed to the 20th position in the EU. Despite important improvements, the country does not yet reach the EU average in any of the monitored indicators. After a stagnation in 2017, the share of e-government users grew significantly by 19 percentage points to 52 %. There was also a modest improvement in digital public services for businesses (82 with an EU average 85) and pre-filled forms (51 with an EU average 58). Regarding e-health, almost half of general practitioners use e-prescription; however, only 17 % of them exchange medical data, which is the 4th lowest score in the EU.

The new e-government strategy ('*Digitální Česko: Informační koncepce České republiky*') was adopted in 2018⁴². It lists five objectives: 1) more effective and user friendly online services for citizens and businesses; 2) digital friendly legislation; 3) favourable conditions for the use of digital technologies in public services; 4) digital skills for public officials; and 5) central coordination of public services' ICT development. As of July 2018, Czechs can use new e-ID cards with chips and receive certain public services over the internet. 570,000 people owned the new e-ID card at the end of 2018.

⁴² <https://www.mvcr.cz/clanek/rada-vlady-pro-informacni-spolecnost.aspx?q=Y2hudW09Ng%3D%3D>

The related Citizen's Portal (*'Portál občana'*⁴³) currently offers 60 services, inter alia, access to the national citizens' register, extract from the criminal record or the data from the trade licensing register. When fully operational, the portal should offer over 700 services.

As of 2016, Czechia has a National e-Health Strategy⁴⁴. It introduced mandatory e-prescriptions from January 2018. In 2018, Czech doctors issued 58.5 million of them and the Central e-prescription repository registered over 276 million interactions. As of July 2018, patients with the e-ID card can access their drug record online. In 2019 the Ministry of Healthcare plans to launch the National e-Health Contact Point and introduce additional measures to make the use of drugs more efficient and help doctors better follow their patients' medication plans.

In digital public services, Czechia scores below the EU average but the measures that the government is introducing promise progress. In order to increase the number of e-government and e-health users it is also important to make sure people have the right skills and incentives to use public services digitally.

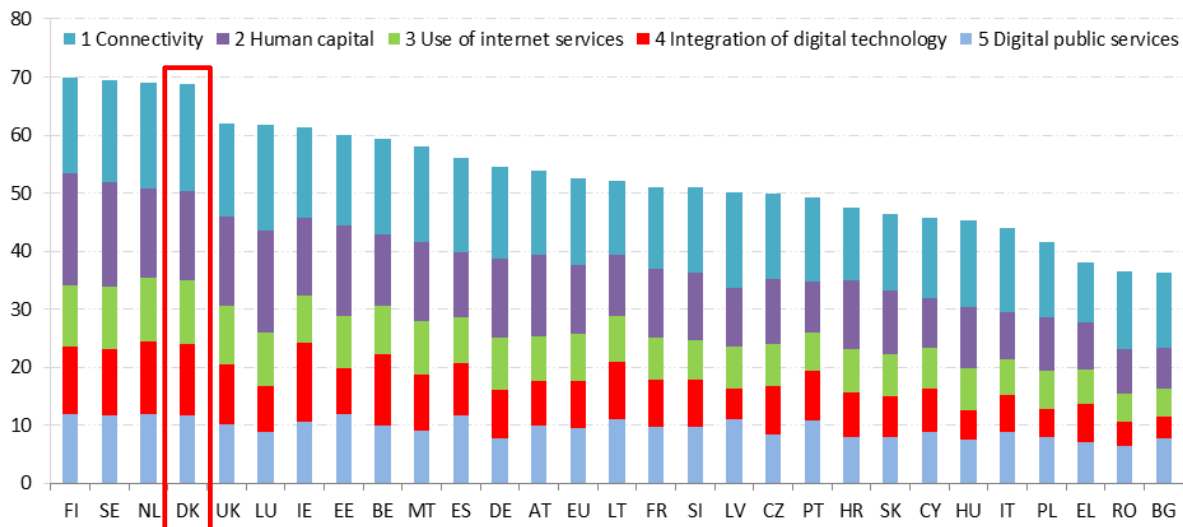
⁴³ <https://obcan.portal.gov.cz/prihlaseni>

⁴⁴ <http://www.nsez.cz/>

Denmark

	Denmark		EU
	rank	score	score
DESI 2019	4	68.8	52.5
DESI 2018	4	66.1	49.8
DESI 2017	1	65.6	46.9

Digital Economy and Society Index (DESI) 2019 ranking



Denmark ranks 4th out of the 28 EU Member States in the European Commission Digital Economy and Society Index (DESI) 2019. Denmark improved its score in all dimensions.

The coverage of fixed broadband, 4G and NGA in particular is approaching 100 %, which is a long way above the EU average. Only 2 % of individuals have never used the Internet and only three out of ten still lack basic digital skills. Danish SMEs are transforming their business and following the digital evolution. This translates into a leading position for SMEs that sell online and a good performance in terms of e-commerce turnover.

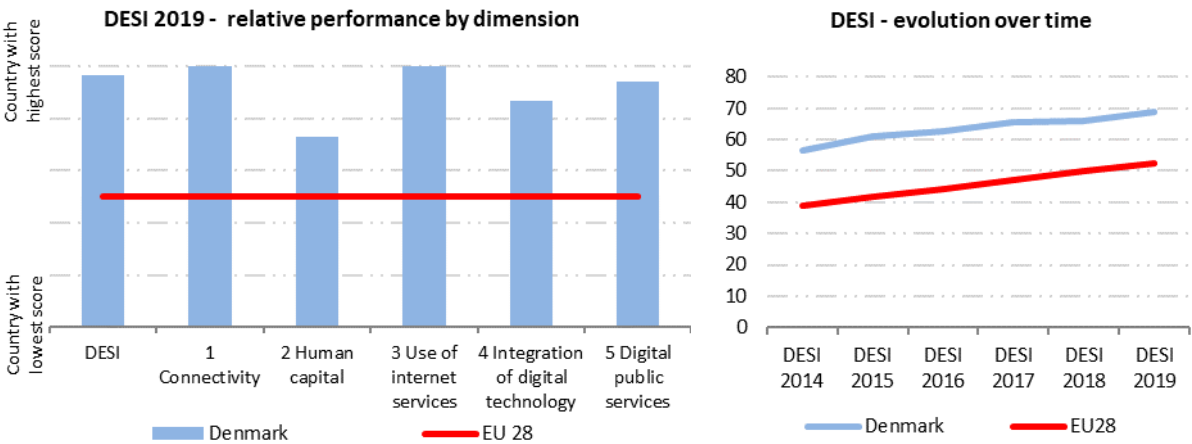
Denmark made most progress in integrating digital technology retaining the same position as last year (4th), while ranked 1st in the Use of internet services.

With the newly launched ‘Digital Strategy for Denmark’s Digital Growth’⁴⁵, the country has a good foundation to remain at the forefront of digital developments. As part of a political agreement, the government has allocated almost DKK 1 billion until 2025 for the implementation of the initiatives making up the strategy. To track the progress of the objectives, the government has set as its main priority the aim of ensuring that all Danes are the most digitally prepared in the EU.

⁴⁵ https://eng.em.dk/media/10566/digital-growth-strategy-report_uk_web-2.pdf

In November 2018, the Danish government decided to prepare a strategy for use of data in the public sector. The strategy aims at creating more coherent and targeted services through data, as well as ensuring a clear framework for use of data. In March 2019, the Danish government launched its National Strategy for Artificial Intelligence⁴⁶. With the strategy, the government aims to provide a common ethical and human centric foundation for AI as well as a set of goals for using AI within the public, private and research sector. Furthermore, the strategy establishes a number of initiatives to further strengthen Denmark’s development and application of AI.

Since 2016, the ‘Digital Strategy 2016-2020’⁴⁷ (e-government strategy) has been setting the course for Danish public sector digitisation efforts and their interaction with businesses and industry. In addition, the government acknowledges the importance of providing confidence in the security of digital solutions to boost the digital development in Denmark. In May 2018, the government published the ‘Danish Cyber and Information Security Strategy 2018-2021’⁴⁸. It plans to launch 25 initiatives and six targeted strategies addressing the most critical sectors’. These initiatives range from efforts to improve cyber and information security to improving the technological resilience of digital infrastructure and to boosting citizens’, businesses’ and authorities’ knowledge and skills with a view to strengthening coordination and cooperation in this area.



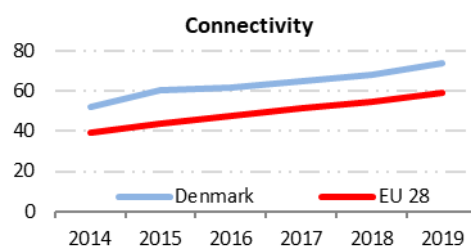
⁴⁶ <https://investindk.com/insights/the-danish-government-presents-national-ai-strategy>

⁴⁷ https://en.digst.dk/media/14143/ds_singlepage_uk_web.pdf

⁴⁸ https://en.digst.dk/media/17189/danish_cyber_and_information_security_strategy_pdf.pdf

1 Connectivity

1 Connectivity	Denmark		EU
	rank	score	score
DESI 2019	1	73.6	59.3
DESI 2018	3	68.1	54.8
DESI 2017	3	65.1	51.2



	DESI 2017	Denmark	DESI 2019	EU
	value	DESI 2018	value rank	DESI 2019
	2016	value	2018	value
1a1 Fixed broadband coverage % households	99%	99.5%	99.5% 10	97%
1a2 Fixed broadband take-up % households	83%	86%	82% 8	77%
1b1 4G coverage % households (average of operators)	97%	97%	99% 5	94%
1b2 Mobile broadband take-up Subscriptions per 100 people	120	128	131 5	96
1b3 5G readiness Assigned spectrum as a % of total harmonised 5G spectrum	NA	NA	33% 3	14%
1c1 Fast broadband (NGA) coverage % households	93%	95%	95% 6	83%
1c2 Fast broadband take-up % households	41%	52%	55% 8	41%
1d1 Ultrafast broadband coverage % households	NA	86%	92% 4	60%
1d2 Ultrafast broadband take-up % households	11%	19%	28% 11	20%
1e1 Broadband price index Score (0 to 100)	89	86	86 13	87

Denmark became the leader in the Connectivity dimension⁴⁹. 4G and next-generation (NGA) coverage are among the best in the EU (99 % and 95 %, respectively). Mobile and fixed broadband take-up have progressed, in particular in ultrafast broadband, where there has been a sharp increase in take-up from 19 % in the previous year to 28 % in 2018. Ultrafast broadband coverage (92 %) is also well above the EU-average (60 %). On rural NGA coverage, the situation has improved, but with 70.6 % coverage these remote areas are still lagging considerably behind total NGA coverage which stands at 95 %.

In May 2018, all political parties in the Danish Parliament agreed on a new political framework for the telecommunications industry. The agreement confirmed the national broadband target that all homes and businesses should be covered by broadband speeds of minimum 100/30 Mbps downlink/uplink by 2020, and they should have good mobile coverage. In 2020 the parties will

⁴⁹ As Denmark is relatively strong in a wide range of connectivity indicators it is fully consistent that its average rank (4) is even above the best ranks (5) achieved in the '4G coverage' and 'Mobile broadband take-up' sub-dimensions.

discuss whether the target would need to be updated. The political agreement confirmed the fundamental principle of the Danish telecom policy, that the roll-out of digital broadband is primarily done by the telecom sector on ordinary market terms. State aid should only be a possibility in local areas with poor prospects for better coverage by the market. The National Broadband Fund, established in 2016 by the Danish government, has been focused further towards lowly populated areas in 2018. There was an amount of DKK 100 million in the fund for 2018⁵⁰. The fund can offer grants to the roll-out of high-speed broadband (minimum 100/30 Mbps downstream/upstream) in underserved areas (which have access to max 10/2 Mbps – ‘white spots’). In November 2018, the Danish Parliament adopted a proposal to amend the Telecommunications Act in order to establish a more concise framework for financial grants from municipalities to support the local roll-out of digital infrastructure.

The spectrum award of the 700 MHz, 900 MHz and 2.3 GHz spectrum bands was planned for the end of February 2019 but did not start yet. The coverage obligations in the 700 MHz and 900 MHz bands require at least 90 % outdoor area coverage. In the 2.3 GHz band, coverage obligations apply to a list of specified addresses and for fixed reception at these addresses. A public consultation on the interest for the 3.6 and 26 GHz bands for 5G use had been under way at the end of 2018. In Denmark, 32 % of the of the total 2090 MHz spectrum harmonised at EU level for wireless broadband has been assigned. In Denmark, mobile operators are already testing 5G; not least in order to clarify technical issues related to the new technology. At the same time, different sectors have begun to look at how 5G could be used in the future. For example, the Danish Agency for the supply of data and the effectiveness of efficiency in collaboration with DTU Space and Aarhus municipality has started a project for a high precision positioning system. This could support i.e. precision agriculture, driverless vehicles and the use of drones. Overall, research and trials of 5G are at a small scale and focus on the health sector, transport, pharmaceuticals, agriculture and broadcasting⁵¹.

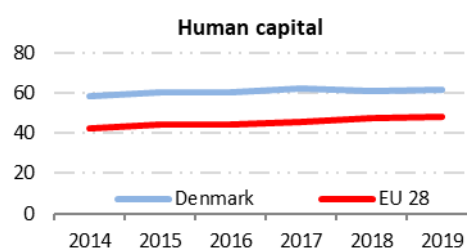
Fixed broadband and mobile network coverage are significantly above the EU average. As Denmark overwhelmingly relies on private investment, more clarity on the issue of prospects for regulated access to fibre networks resulting from the market reviews under preparation could help investors to assess potential benefits and risks more reliably. Bringing down the administrative burden for small localised fixed broadband funding projects in white spots will be another challenge.

⁵⁰ The same amount is expected for 2019 (subject to parliamentary approval).

⁵¹ The Danish 5G action plan has been published on 18 February 2019, see https://ens.dk/sites/ens.dk/files/Tele/5g-handlingsplan_for_danmark.pdf

2 Human capital

2 Human capital	Denmark		EU
	rank	score	score
DESI 2019	7	61.5	48.0
DESI 2018	6	60.6	47.6
DESI 2017	4	62.4	45.4



	Denmark		EU	
	DESI 2017	DESI 2018	DESI 2019	DESI 2019
	value	value	value rank	value
2a1 At least basic digital skills % individuals	78% 2016	71% 2017	71% 5 2017	57% 2017
2a2 Above basic digital skills % individuals	53% 2016	47% 2017	47% 3 2017	31% 2017
2a3 At least basic software skills % individuals	79% 2016	72% 2017	72% 6 2017	60% 2017
2b1 ICT specialists % total employment	3.9% 2015	4.2% 2016	4.4% 8 2017	3.7% 2017
2b2 Female ICT specialists % female employment	1.5% 2015	1.8% 2016	1.8% 6 2017	1.4% 2017
2b3 ICT graduates % graduates	4.4% 2014	4.4% 2015	4.5% 9 2016	3.5% 2015

On Human capital dimension, Denmark ranks 7th among EU countries, which is above the EU average. Denmark performs very well regarding digital skills and of the proportion of ICT specialists is rising. 71 % of Danes reportedly have basic digital skills, while nearly 50 % have above basic skills. Every year the percentage of ICT specialists is increasing (reaching 4.4 % in 2018), which is a larger proportion of the workforce than in EU as a whole (3.7 %), putting Denmark in the 8th place among the Member States. Similarly, the share of female ICT specialist has been improving and is above the EU average of 1.4 %, placing Denmark 6th among EU countries.

‘Digital skills for all’ is one of the six strategic focus areas of the digital growth plan. The ‘Danish Technology Pact’, one of the initiatives included in the national growth plan, provides initiatives designed to improve Danish people’s STEM (Science, Technology, Engineering & Mathematics) skills. Between 2019 and 2022, DKK 20 million (approximately EUR 2.7 million) will be allocated annually to supporting these initiatives. In addition, the government will initiate a project worth DKK 43.4 million (approximately EUR 5.8 million) financed from the national pool of structural funds, to improve the number of STEM graduates. It shall further stimulate actions across the private, public and educational sectors in order to support technological and digital skills.

Also, as part of The Digital Strategy 2016-2020 an initiative has been launched to include and train citizens who lack basic digital competencies in communicating with the public sector.

Denmark has a National Coalition for Digital Skills⁵² established in January 2019. . Denmark also actively participated in the EU Code Week⁵³ in 2018 with 21 events and an estimated 800 teachers and students taking part.

In order to increase basic digital skills The government has also set up a programme to improve understanding of technology in primary and lower secondary education. It is designed to provide schools with appropriate equipment and to back up these efforts by developing teachers' skills. The programme, which runs from 2018 to 2021has assigned DKK 68 million (approximately EUR 9.1 million) so far. 46 schools will be testing the program. In addition, capacity-building programmes will be tested and offered from universities to strengthen businesses, public authorities and individuals.

The Vocational Education and Training (VET) sector creates links with the market and industry in terms of digital skills. The mismatch between the existing and the desired set of digital skills is being tackled by new specialised programmes, which are offered as part of secondary technical and vocational education. The digital 'Technology and Programming' specialisation is one of the programmes. The Centre for the application of IT in teaching in vocational education disseminates experience and new knowledge about the use of IT and technology in teaching for the benefit of students and teachers. It is to work in close collaboration with researchers from Danish universities to create a new knowledge base on IT in teaching.

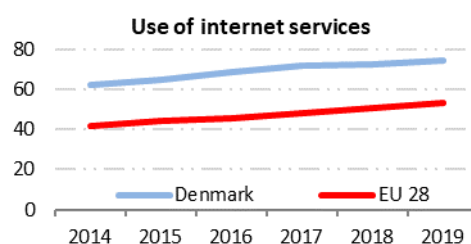
Denmark is progressing in addressing the demand for digital skills in the workforce. In the last ten years, the admission of new students into the higher education STEM degree programs (most in demand on the Danish labour market) has doubled. Furthermore, the government has established an objective to increase the number of tertiary STEM-graduates by 20 percent by 2028 as part of the Danish Technology Pact. To keep pace with the demand for ICT specialists and fill ICT vacancies, it would be beneficial to continue taking similar measures to raise awareness about the need to develop future-proof levels of digital skills. In addition, it is important to boost policies improving the participation of women in ICT.

⁵² <https://dit.dk/dsjc>

⁵³ <https://codeweek.eu/>

3 Use of internet services

3 Use of internet services	Denmark		EU
	rank	score	score
DESI 2019	1	74.1	53.4
DESI 2018	1	72.2	50.7
DESI 2017	1	71.9	47.8

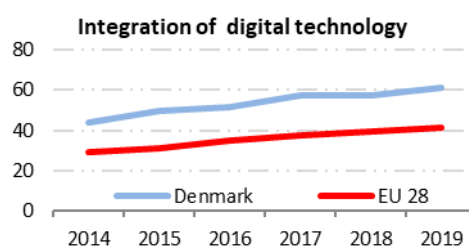


	DESI 2017	Denmark		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
3a1 People who never used the internet % individuals	2% 2016	2% 2017	2% 2018	1	11% 2018
3a2 Internet users % individuals	94% 2016	95% 2017	95% 2018	1	83% 2018
3b1 News % internet users	NA 2016	86% 2017	86% 2017	9	72% 2017
3b2 Music, videos and games % internet users	90% 2016	90% 2016	90% 2018	4	81% 2018
3b3 Video on demand % internet users	49% 2016	49% 2016	56% 2018	3	31% 2018
3b4 Video calls % internet users	60% 2016	62% 2017	69% 2018	5	49% 2018
3b5 Social networks % internet users	77% 2016	78% 2017	81% 2018	6	65% 2018
3b6 Professional social networks % internet users	30% 2015	31% 2017	31% 2017	2	15% 2017
3b7 Doing an online course % internet users	NA 2016	9% 2017	9% 2017	10	9% 2017
3b8 Online consultations and voting % internet users	14% 2015	14% 2017	14% 2017	5	10% 2017
3c1 Banking % internet users	91% 2016	92% 2017	92% 2018	3	64% 2018
3c2 Shopping % internet users	84% 2016	82% 2017	86% 2018	2	69% 2018
3c3 Selling online % internet users	36% 2016	30% 2017	30% 2018	5	23% 2018

Denmark is a leader in the Use of internet services. Almost all Danes (95 %) are regular internet users, which is above the EU average (83 %). People in Denmark are keen to engage in a variety of online activities. Remarkably, only 2 % of Danes have never used internet, while the EU average is 11 %. Dane’s most popular online activities are listening to music, watching videos and playing video games with 90 % of internet users engaging in these activities, while the EU average is slightly lower at 81 %. Banking and shopping online are also very popular among Danes who use internet, and Denmark scores well above the EU average (92 % and 86 % respectively). Doing an online course is the least popular activity among Danes, but it is still above the EU average: almost one in ten Danes takes online courses.

4 Integration of digital technology

4 Integration of digital technology	Denmark		EU
	rank	score	score
DESI 2019	4	61.3	41.1
DESI 2018	4	57.4	39.6
DESI 2017	2	57.2	37.6



	DESI 2017	Denmark	DESI 2019	EU
	value	DESI 2018	value rank	DESI 2019
4a1 Electronic information sharing % enterprises	47% 2015	40% 2017	40% 6 2017	34% 2017
4a2 Social media % enterprises	27% 2016	29% 2017	29% 5 2017	21% 2017
4a3 Big data % enterprises	12% 2016	12% 2016	14% 11 2018	12% 2018
4a4 Cloud % enterprises	30% 2016	38% 2017	41% 4 2018	18% 2018
4b1 SMEs selling online % SMEs	27% 2016	28% 2017	31% 1 2018	17% 2018
4b2 e-Commerce turnover % SME turnover	18% 2016	14% 2017	17% 4 2018	10% 2018
4b3 Selling online cross-border % SMEs	10% 2015	9% 2017	9% 11 2017	8% 2017

In the Integration of digital technology by businesses, Denmark ranks 4th among EU countries, retaining last year's position. 29 % of enterprises use social media, almost one in five SMEs use e-invoicing, and 9 % of SMEs selling services or products cross border. The total number of SMEs selling online rose further to 31 % compared with 28 % in 2017, making Denmark a leader among EU countries. Furthermore, 14 % of enterprises actively analyse big data.

Denmark is committed to the advancement of new digital technologies and it invests in digital technologies through EU-coordinated programmes. Denmark signed the Declaration on cooperation on Artificial Intelligence (AI) in 2018.

In September 2018, the government launched the new 'Danish cyber and information security strategy 2018-2021'. With its 25 initiatives, the new strategy will improve the technological resilience of digital infrastructure, improve knowledge and skills of citizens, businesses and authorities and step up national coordination and cooperation on information security. The Danish government has set three clear benchmarks for becoming more digitally secure as a country over the coming four years: (i) everyday safety for citizens and businesses; (ii) better competences for citizens, authorities and businesses; and (iii) joint efforts and a clear division of roles and responsibilities in the area of cyber and information security for authorities and businesses that fulfil key functions in society.

To promote businesses' use of data, the Government has recently launched a new portal (brugdata.dk) with user-friendly business-oriented information and guidance material on the rules regarding responsibility, ownership and rights on the use of data.

In early 2019, the government presented the report "Prepared for the Future of Work"⁵⁴, follows up on the Danish Disruption Council set up in May 2017. The report sets out a number of conclusions on the Council's discussions and work to date.

Danish industry is flourishing, and governmental policies support SMEs and large enterprises to digitise. However, there is still further scope for SMEs to broaden their markets and reach markets abroad, for all enterprises to incorporate new technologies for creating a competitive advantage (e.g. big data).

Highlight 2019: 'SME: Digital'

Although Denmark leads the EU in the use of digital technologies in business, the government aims to further boost digitisation in SMEs and their use of e-commerce.

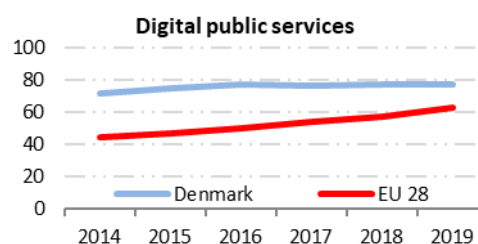
'SMEs: Digital', one of the initiatives included in the growth plan, helps SMEs exploiting the new digital technologies to create growth and jobs in Denmark. Through www.smvdigital.dk, SMEs can get private procurement grants to help them clarify how they can digitise further and to identify economic and business potential. The initiative is also designed to improve SMEs' use of e-commerce by SMEs. 28% of SMEs sell online, while the percentage is almost double that among big companies (54%).

Over the next four years, up to 2,000 SMEs are expected to benefit from what SMEs: Digital has to offer. As part of SMEs: Digital, a small board will be set up to provide input to the Minister for Business on promoting digital conversion in SMEs and ensuring that SMEs:Digital meets business needs. The Board will comprise business representatives, experts and organisations.

⁵⁴ https://www.regeringen.dk/media/6332/regeringen_disruptionraadet_uk_web.pdf

5 Digital public services

5 Digital public services	Denmark		EU
	rank	score	score
DESI 2019	5	77.8	62.9
DESI 2018	3	77.4	57.9
DESI 2017	2	76.7	54.0



	DESI 2017	Denmark	DESI 2019	EU
	value	DESI 2018	value rank	DESI 2019
		value	value rank	value
5a1 e-Government users % internet users needing to submit forms	89% 2016	86% 2017	90% 4 2018	64% 2018
5a2 Pre-filled forms Score (0 to 100)	71 2016	71 2017	69 12 2018	58 2018
5a3 Online service completion Score (0 to 100)	95 2016	95 2017	95 7 2018	87 2018
5a4 Digital public services for businesses Score (0 to 100) - including domestic and cross-border	100 2016	100 2017	100 1 2018	85 2018
5a5 Open data % of maximum score	NA	NA	37% 27 2018	64% 2018
5b1 e-Health services % individuals	NA	42% 2017	42% 3 2017	18% 2017
5b2 Medical data exchange % of general practitioners	NA	NA	98% 1 2018	43% 2018
5b3 e-Prescription % of general practitioners	NA	NA	98% 3 2018	50% 2018

On Digital public services, Denmark ranks 5th among EU countries having fallen 2 positions since 2017. Denmark is leading in medical data exchange, 55 percentage points above the EU average (43 %), while 42 % of Danes used e-health services and almost every practitioner (98 %) exchanged medical data online. Denmark provides top-class digital services for businesses (100 %), which places the country 1st among EU Member States. The online interaction between public authorities and citizens is high (90 %) and well above the EU average (64 %).

The 33 initiatives in the e-government strategy have produced the first results, consolidating Denmark's worldwide leading position on public service digitisation. In March 2019, central and local government took a joint step to enable seamless digital delivery of services across administrations and collaboration in the public service with the new "Digitisation Pact". The overall aim is to accelerate public sector digitisation efforts and contribute to better and more coherent welfare by making sure that more people benefit from new digital possibilities and technology.

The 'e-Government Security Policy' ensures a high common level of network and information security across government information and communication systems. In line with the eIDAS regulation, Denmark has focused on developing an eID gateway that will enable members of the public from within the EU to use their national eID to log into another EU country's digital self-service solutions. In the long term, the objective is for citizens to use the digital solution in any EU country.

Several public authorities in Denmark have been involved in the process and have prepared their own solutions for foreign citizens.

In 2018, Denmark launched the 'Digital Health Strategy 2018-2020'⁵⁵, which has the overall aim of helping the healthcare actors take responsibility for interconnecting patient pathways across individual interactions with the health care sector. Digitisation enables more tasks to be performed close to patients in a personalised and coherent health system, which looks at the person as a whole, not just at the individual diagnosis. The strategy defines five focus areas for achieving the objectives of putting patient needs first and making daily workflows easier for healthcare professionals.

Furthermore, in 2018, the Danish Government launched the health data strategy "Healthcare in the future – responsible use of data for the benefit of patients". The strategy's main principle is that better use of health data for healthcare services, research and quality improvement is a key condition for addressing the challenges that face the healthcare system. The strategy includes goals and initiatives within three focus areas. Firstly, it focuses on transparency about the use of health data, enhanced privacy of citizens' information, and increased cyber and information security. Secondly, it focuses on increased quality and coherence of patient pathways across general practice, hospitals and municipalities through better sharing and use of existing data and good conditions for research and life science. Thirdly, it focuses on updating the legislation to a digital age that supports digital collaboration with and about the patient, and which ensures transparency about the use of data.

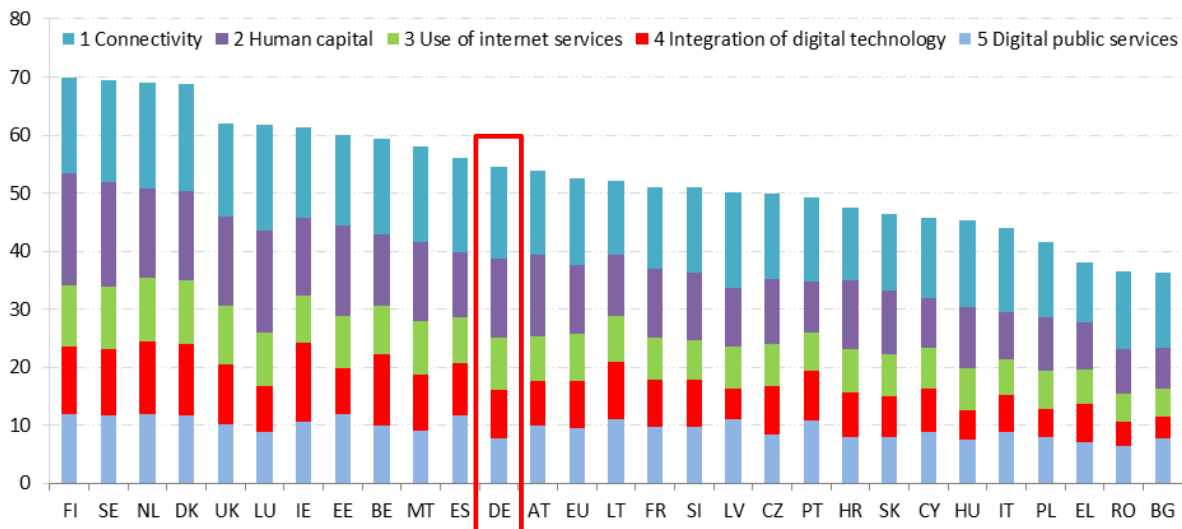
Denmark has a sound foundation on which it can continue digitising public services and health system. It is essential for Denmark to pursue its efforts to further improve the availability and usability of open data, as well as, the amount of data that is pre-filled in public services' online forms.

⁵⁵ https://sundhedsdatastyrelsen.dk/-/media/sds/filer/rammer-og-retningslinjer/strategi-digital-sundhed/digital-health-strategy-2018_2022.pdf

Germany

	Germany		EU
	rank	score	score
DESI 2019	12	54.4	52.5
DESI 2018	13	51.8	49.8
DESI 2017	11	49.4	46.9

Digital Economy and Society Index (DESI) 2019 ranking



Germany ranks 12th out of the 28 EU Member States in the European Commission Digital Economy and Society Index (DESI) 2019.

Germany performs well in most DESI dimensions, thanks to the wide availability and high take-up of basic fixed broadband. The country performs above average in digital skills and has increased its score in the Integration of digital technologies by enterprises. Although it has improved the take-up of fast broadband, it still scores below the EU average as regards the take-up of ultrafast broadband. As regards digital skills, Germany is among the EU's top performers. The share of ICT specialists has also increased since 2017. Among all dimensions, Germany ranks highest (ninth) in the Use of internet services, as Germans are keen to engage in online activities; only 5 % of them have never used the internet.

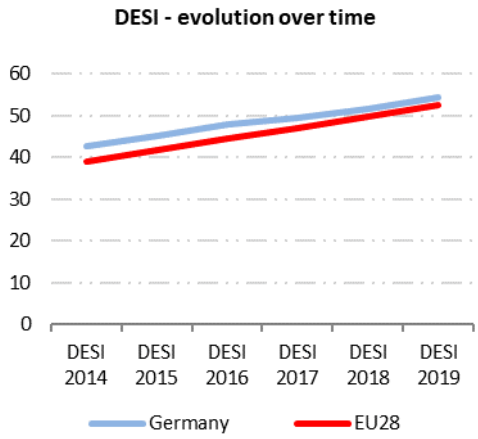
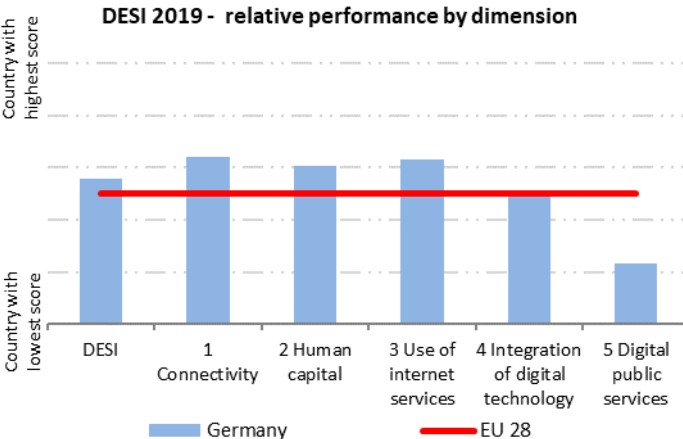
The country's greatest digital challenge is to improve online interaction between public authorities and members of the public. Germany ranks 26th in the use of e-government services, with only 43 % of internet users being e-government users, while a mere 7% of individuals use e-health services.

In 2014, Germany adopted its Digital Agenda 2014-2017⁵⁶ and in March 2016, the Federal Ministry for Economic Affairs and Energy presented the Digital Strategy 2025⁵⁷. A state minister for digital

⁵⁶ <https://www.bmwi.de/Redaktion/EN/Publikationen/digital-aganeda-2014-2017.html>

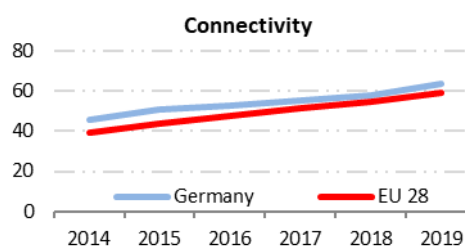
⁵⁷ <https://www.de.digital/DIGITAL/Redaktion/EN/Publikation/digital-strategy-2025.html>

affairs attached to the Chancellor’s Office has become part of the new government established in March 2018.



1 Connectivity

1 Connectivity	Germany		EU
	rank	score	score
DESI 2019	11	63.4	59.3
DESI 2018	9	57.6	54.8
DESI 2017	9	55.2	51.2



	DESI 2017	Germany	DESI 2019		EU
	value	DESI 2018 value	value	rank	DESI 2019 value
1a1 Fixed broadband coverage % households	98%	98%	98%	15	97%
1a2 Fixed broadband take-up % households	86%	88%	87%	4	77%
1b1 4G coverage % households (average of operators)	86%	88%	90%	24	94%
1b2 Mobile broadband take-up Subscriptions per 100 people	73	79	81	23	96
1b3 5G readiness Assigned spectrum as a % of total harmonised 5G spectrum	NA	NA	33%	3	14%
1c1 Fast broadband (NGA) coverage % households	82%	84%	88%	14	83%
1c2 Fast broadband take-up % households	26%	36%	44%	14	41%
1d1 Ultrafast broadband coverage % households	NA	66%	66%	16	60%
1d2 Ultrafast broadband take-up % households	8%	11%	15%	19	20%
1e1 Broadband price index Score (0 to 100)	94	92	93	3	87

In 2018, Germany made progress with most Connectivity indicators. Since other countries were progressing faster, however, it fell from place 9 to place 11. Fixed broadband coverage stands at 98 %. Although rural next-generation access (NGA) coverage has significantly improved since 2017, from 54 % to 66 %, and is above the EU average, the digital divide between urban and rural areas is still obvious (total fixed NGA coverage was 88 % in Germany in 2018). Germany performs particularly well in fixed broadband prices and in fixed broadband take-up. Currently, 87 % of households subscribe to fixed broadband. Ultra-fast broadband coverage is at 66 %, above the EU average of 60 %, but is static year over year, reflecting its reliance on upgraded legacy infrastructure. As regards the Broadband Pricing Index (based on several fixed broadband offers and also income), Germany ranked the third best in the EU. Mobile broadband prices for handset offers⁵⁸ have fallen substantially over the past year (from EUR 19.30 to EUR 15.20), and are even below the EU average (EUR 22.30).

⁵⁸ Offers from February 2018 including 1 GB, 300 calls and 225 SMS.

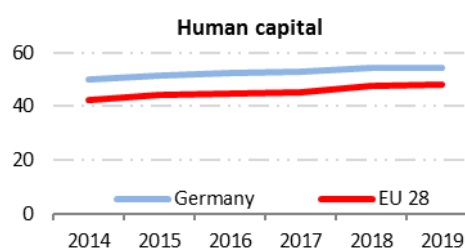
The Federal Ministry of Transport and Digital Infrastructure (*BMVI*) is working on a gigabit strategy including a commitment to full coverage by gigabit-ready networks by 2025. A commercial upgrade of cable networks should contribute about 75 % to achieving this goal. Commercial fibre roll-out is expected to increase, but it is not clear to what extent it will go beyond the areas currently covered by cable networks. It is expected that at least 10 % of households will be connected with fibre by subsidy programmes in white spots. For the remaining 15 % of households, which have at least 30 Mbps available via NGA networks, but with connections which cannot be upgraded to gigabit speeds, the government is working on a programme to subsidise such 'grey areas' and on rolling out of direct fibre connections to socio-economic drivers (schools, hospitals, business parks, etc.) by 2021. Besides, the Government coalition agreement announces a legal 'right to fast Internet' with effect from 1 January 2025.

In Germany, 52 % of the total 2090 MHz spectrum harmonised at EU level for wireless broadband has been assigned. Germany ranks third in the 5G readiness indicator, as by the end of 2018, it had assigned spectrum in the 700 MHz band, and the spectrum is expected to become available for use for 5G by 2020. The spectrum award of the 2 GHz and the 3.6 GHz bands started in the second half of March 2019. The main issues under debate are coverage and access obligations as part of the auction design. It is planned to award the 3.7-3.8 GHz and of the 24.25 GHz to 27.5 GHz bands by the end of 2020, including the option of licensing directly to industrial users with spectrum sharing with other users (such as MNOs) outside industrial sites. 5G is being trialled by MNOs, as DTAG and Vodafone have launched the first 5G sites. Policy envisages stimulating dynamic demand for 5G services by creating lighthouse projects, especially ones involving new collaborations with 'vertical' industrial and service sectors. Various research projects for automated driving (including in urban test fields and on motorways) and for integrating 5G into industrial communications networks are currently running.

Germany continues to face challenges on the fixed and mobile markets. There is an obvious urban-rural digital divide regarding fixed NGA coverage and the share of fibre connections is still very low. While federal broadband funding has been refocussed and applies, de facto, almost exclusively to fibre, and preparations for increased funding over the next four years are on track, the incumbent's focus on vectoring technology (now including super-vectoring) could further delay deployment of gigabit connections. The incumbent's plans for substantial investment in fibre (of the order of two million new connections annually) would not kick in before 2021 and are still said to be contingent on adaptations to the policy and regulatory framework. While policy for encouraging demand for 5G services is progressing, the political debate about coverage and access obligations in the 5G auction was intense and debate on the regulatory implementation of the obligations is expected to continue. The overriding need for sufficient economic incentives to roll out 5G infrastructure in the first place and to sustain infrastructure-based competition will have to be carefully balanced against other objectives such as rural development and quality of service for end-users.

2 Human capital

2 Human capital	Germany		EU
	rank	score	score
DESI 2019	10	54.4	48.0
DESI 2018	10	54.2	47.6
DESI 2017	10	52.8	45.4



	Germany		EU	
	DESI 2017 value	DESI 2018 value	DESI 2019 value	DESI 2019 rank
2a1 At least basic digital skills % individuals	68%	68%	68%	7
2a2 Above basic digital skills % individuals	33%	37%	37%	8
2a3 At least basic software skills % individuals	70%	70%	70%	8
2b1 ICT specialists % total employment	3.7%	3.7%	3.8%	12
2b2 Female ICT specialists % female employment	1.3%	1.3%	1.3%	13
2b3 ICT graduates % graduates	4.4%	4.5%	4.5%	9

As regards the Human capital dimension, Germany ranks 10th among EU countries and well above the EU average. Germans generally have levels of digital skills that are above the EU average. 68 % of individuals between 16 and 74 have at least basic digital skills (57 % in the EU as a whole) and 37 % have above basic digital skills (31 % in the EU). In terms of ICT graduates, Germany ranks ninth among EU countries. However, despite the small increase in the percentage points of ICT specialists since 2017, there is still a lack of ICT specialists in the country. The proportion of female ICT specialists in Germany is slightly below the EU average (1.3 % vs. 1.4 %).

In Germany, digital skills and literacy are considered to be a cross-cutting issue that plays an important role in all relevant strategies: in the Federal Government's implementation strategy 'Designing digitisation'⁵⁹ and in the 'Artificial Intelligence Strategy'⁶⁰, both adopted in November 2018; in the Digital Strategy⁶¹ of the Federal Ministry of Education and Research (BMBF) and in the MINT Action Plan⁶². The last two were presented in early 2019.

⁵⁹ <https://www.bundesregierung.de/resource/blob/975226/1552758/c34e443dbe732e79c9439585b4fbade5/pdf-umsetzungsstrategie-digitalisierung-data.pdf?download=1>

⁶⁰ <https://www.de.digital/DIGITAL/Redaktion/EN/Standardartikel/artificial-intelligence-strategy.html>

⁶¹ https://www.bildung-forschung.digital/files/BMBF_Digitalstrategie_web.pdf

⁶² <https://www.bundesregierung.de/breg-en/news/mint-for-the-future-1580792>

Alongside the *Länder*, the Standing Conference of the Ministers of Education (*Kultusminister Konferenz (KMK)*) has adopted the 'Education in the digital world strategy'.⁶³ This strategy deals with school education (primary and lower secondary education), vocational school education and higher education. The *KMK* strategy sets the following goal: by 2021, every pupil should be able to use a digital learning environment and have access to the internet, wherever that is considered useful in lessons on educational grounds.

The various topics addressed in the Education Offensive for the Digital Knowledge-based Society⁶⁴ will continue to be promoted. This applies in particular to the school cloud and the *DigitalPakt Schule*, and to MINT education activities. The *DigitalPakt Schule* is designed to shape digital transformation in the education system. The Federal Government supports the *Länder* and municipalities in investing in the digital municipal education infrastructure. At the same time, the *Länder* commit to implementing digital education through educational approaches, curriculum adaptation, and by transforming teacher education and training. The aim is to promote nationwide investments for a total of EUR 5 billion over five years (2017-2021).

Germany has not established a National Digital Skills and Jobs Coalition. It played an active part in the EU Code Week⁶⁵ in 2018, with 600 events and an estimated 35,400 participants.

The focus on digital skills in all relevant strategies will bring benefits in the future. Increasing the number of German ICT specialists and closing the gender gap is of the utmost importance for Germany if it is to exploit the full potential of the digital economy.

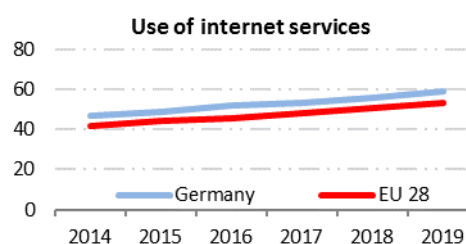
⁶³ https://www.kmk.org/fileadmin/Dateien/pdf/PresseUndAktuelles/2017/KMK-Strategie_Bildung_in_der_digitalen_Welt_Zusammenfassung_en.pdf

⁶⁴ https://www.bmbf.de/files/Bildungsoffensive_fuer_die_digitale_Wissensgesellschaft.pdf

⁶⁵ <https://codeweek.eu/>

3 Use of internet services

3 Use of internet services	Germany		EU
	rank	score	score
DESI 2019	9	58.9	53.4
DESI 2018	9	56.0	50.7
DESI 2017	9	53.1	47.8

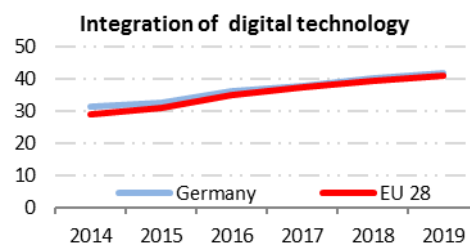


	DESI 2017	Germany		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
3a1 People who never used the internet	8%	7%	5%	7	11%
% individuals	2016	2017	2018		2018
3a2 Internet users	87%	87%	90%	7	83%
% individuals	2016	2017	2018		2018
3b1 News	72%	74%	74%	21	72%
% internet users	2016	2017	2017		2017
3b2 Music, videos and games	78%	78%	82%	15	81%
% internet users	2016	2016	2018		2018
3b3 Video on demand	23%	23%	31%	9	31%
% internet users	2016	2016	2018		2018
3b4 Video calls	31%	54%	57%	12	49%
% internet users	2016	2017	2018		2018
3b5 Social networks	56%	56%	57%	27	65%
% internet users	2016	2017	2018		2018
3b6 Professional social networks	12%	13%	13%	16	15%
% internet users	2015	2017	2017		2017
3b7 Doing an online course	5%	6%	6%	16	9%
% internet users	2016	2017	2017		2017
3b8 Online consultations and voting	15%	13%	13%	8	10%
% internet users	2015	2017	2017		2017
3c1 Banking	59%	62%	64%	15	64%
% internet users	2016	2017	2018		2018
3c2 Shopping	82%	82%	82%	5	69%
% internet users	2016	2017	2018		2018
3c3 Selling online	33%	34%	35%	3	23%
% internet users	2016	2017	2018		2018

Overall, the Use of internet services in Germany is above the EU average. People in Germany are keen to engage in a variety of online activities, in line with the rest of the EU. The most popular online activities are shopping (82 % versus 69 % in the EU as a whole), listening to music, watching videos and playing games (82 % against an EU average of 81 %), and reading news online (74 % versus 72 % EU average). However, professional social networking and doing online courses (13 % and 6 %, respectively) are below the EU average (15 % and 9 %, respectively). Of all internet services, video calls is the one that has increased most in the last two years (up from 31 % in 2016 to 57 % in 2018), followed by video on demand (up from 23 % in 2016 to 31 % in 2018).

4 Integration of digital technology

4 Integration of digital technology	Germany		EU
	rank	score	score
DESI 2019	13	41.9	41.1
DESI 2018	13	40.1	39.6
DESI 2017	13	37.9	37.6



	Germany		EU	
	DESI 2017	DESI 2018	DESI 2019	DESI 2019
	value	value	value	rank
4a1 Electronic information sharing	NA	38%	38%	11
% enterprises	2015	2017	2017	2017
4a2 Social media	18%	16%	16%	20
% enterprises	2016	2017	2017	2017
4a3 Big data	6%	6%	15%	9
% enterprises	2016	2016	2018	2018
4a4 Cloud	9%	NA	12%	21
% enterprises	2016	2017	2018	2018
4b1 SMEs selling online	26%	23%	19%	10
% SMEs	2016	2017	2018	2018
4b2 e-Commerce turnover	7%	11%	9%	18
% SME turnover	2016	2017	2018	2018
4b3 Selling online cross-border	9%	11%	11%	7
% SMEs	2015	2017	2017	2017

As regards the Integration of digital technology by businesses, Germany ranks 13th among EU countries, which is slightly above the EU average. However, Germany has stagnated in the ranking. German enterprises are increasingly taking advantage of the opportunities offered by big data: 6 % of enterprises performed big data analysis in 2016 versus 15 % in 2018 (above the EU average). 11 % of all SMEs sell cross-border (above the EU average). More than a third of enterprises (38 %) share information electronically. However, only 12 % of German enterprises use cloud services (compared to the 18 % EU average). The number of SMEs selling online fell from 26 % in 2016 to 19 % in 2018, but this remains above the EU average.

There are a number of initiatives in Germany for the digitisation of the economy. Many of them target SMEs. These include the *Mittelstand 4.0*⁶⁶ competence centres and the Go-Digital programme.⁶⁷ The common goal of the *Mittelstand 4.0* competence centres is to improve the degree of digitization among medium-sized companies. For 2018, approximately EUR 40 million of federal funds are available for this initiative. The Go-Digital programme promotes consulting and implementation services for SMEs by authorised consulting firms in the area of digitised business processes, digital market development and IT security. There is also an initiative on IT security, designed to increase cybersecurity awareness among SMEs.

⁶⁶ <https://www.mittelstand-digital.de/MD/Navigation/DE/Home/home.html>

⁶⁷ <https://www.bmwi.de/Redaktion/DE/Artikel/Digitale-Welt/foerderprogramm-go-digital.html>

Germany is committed to advancing new digital technologies and making strategic investments in this area through EU-coordinated programmes. It is a member of the EuroHPC Joint Undertaking and it has also signed the Declaration creating the European Blockchain Partnership, and the Declaration on Cooperation on Artificial Intelligence.

Germany continues to pursue its HPC development strategies. The operation of a high-performance research infrastructure is an integral part of the High-Tech Strategy for 2025 - Research and Innovation for People. In the context of 'Supercomputing 2.0'⁶⁸, the Federal Government and the *Länder* agreed in 2016 on a second phase for the gradual expansion of research infrastructure and the further development of computing structures and software technologies. Germany will support projects with a total budget of EUR 450 million.

On 15 November 2018, the Federal Government adopted its Artificial Intelligence (AI) strategy.⁶⁹ The three key goals of the strategy are: (1) for Germany and Europe to become leaders in the development and application of AI technologies, (2) to ensure that the development and use of AI is responsible and pursued for the common good and (3) to firmly anchor AI in society in ethical, legal, cultural and institutional terms.

In the 2019 federal budget, the Federal Government will initially allocate a total of EUR 500 million to the implementation of the AI strategy in 2019 and subsequent years. By the end of 2025, the Federal Government intends to provide up to EUR 3 billion. The leverage effect of this commitment on business, science and the *Länder* is meant to at least double those resources.

Germany is taking important measures to safeguard the digital sovereignty of German industry and the state. Its cybersecurity strategy, in place since 2011, was updated in 2016. In 2018, the Federal Ministry of the Interior founded the Cyber-Alliance in cooperation with the Federation of German Industries e.V.. The Alliance's goal is to promote key technologies for critical business processes, which are essential for safeguarding digital sovereignty. To achieve this, the Federal Ministry of the Interior (*BMI*) is to set up a Project Office for Trustworthy IT (*Projektbüro vertrauenswürdige IT*).

To ensure technological innovation leadership, it was decided in 2018 under the joint leadership of the *BMI* and the Federal Ministry of Defence (*BMVg*) to set up the Agency for Innovation in Cybersecurity, to be founded in 2019. The purpose of the agency is the targeted promotion of ambitious research projects with high innovation potential in the area of cybersecurity and related key technologies, to meet the state's needs in the field of domestic and external security.

To boost the digital transformation of the German economy, it is important to raise awareness of the relevance of digitisation to SMEs and of their cybersecurity needs. This will enable the full range of benefits from the adoption of digital technologies by SMEs to be achieved.

⁶⁸ <https://www.bmbf.de/de/hoechstleistungsrechnen-staerkt-den-forschungsstandort-deutschland-852.html>

⁶⁹ <https://www.ki-strategie-deutschland.de/home.html>

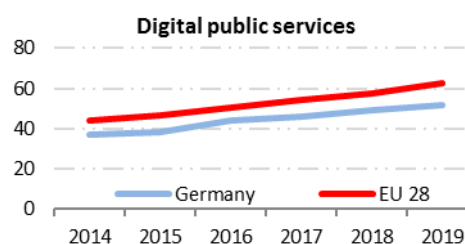
Highlight 2019: The National Cybersecurity Council organises political cooperation on cybersecurity

To ensure cybersecurity, it is essential to identify and eliminate the structural causes of crises at an early stage. The National Cybersecurity Council will coordinate preventive instruments and cybersecurity policy as they apply to the state and the economy. Its work complements the duties of the IT Management Federation (*IT-Steuerung Bund*) and the IT Planning Council (*IT-Planungsrat*) in the area of cybersecurity, at both political and strategic level. So far, its work has focused on protecting critical infrastructure and Germany's cyber foreign policy.

The National Cybersecurity Council has been raising awareness of IT issues since its inception. It has achieved significant developments in the protection of critical infrastructure through the IT Security law. In addition, the activities and interests of the Federal Government, the *Länder* and industry have been brought into line with shared objectives. A coherent cyber foreign policy is also one of the common goals. The National Cybersecurity Council summarises regularly the results of its work in a written report, which is sent to the Federal Cabinet for information.

5 Digital public services

5 Digital public services	Germany		EU
	rank	score	score
DESI 2019	24	51.9	62.9
DESI 2018	20	49.3	57.9
DESI 2017	18	45.8	54.0



	DESI 2017	Germany		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
5a1 e-Government users % internet users needing to submit forms	38%	39%	43%	26	64%
	2016	2017	2018		2018
5a2 Pre-filled forms Score (0 to 100)	38	38	41	20	58
	2016	2017	2018		2018
5a3 Online service completion Score (0 to 100)	83	88	88	14	87
	2016	2017	2018		2018
5a4 Digital public services for businesses Score (0 to 100) - including domestic and cross-border	84	84	80	22	85
	2016	2017	2018		2018
5a5 Open data % of maximum score	NA	NA	64%	17	64%
			2018		2018
5b1 e-Health services % individuals	NA	7%	7%	26	18%
		2017	2017		2017
5b2 Medical data exchange % of general practitioners	NA	NA	26%	17	43%
			2018		2018
5b3 e-Prescription % of general practitioners	NA	NA	19%	22	50%
			2018		2018

As regards Digital public services, Germany ranks 24th among EU countries, well below the EU average. It performs well as regards online service completion. However, there is a low level of online interaction between public authorities and the general public. Only 43 % of German online users engage actively with e-government services (compared with an average of 64 % in the EU as a whole), although Germany performed better in 2018 than in 2017. As regards e-health, only 7 % of Germans have used health and care services provided online. 19 % of general practitioners use e-prescriptions and 26 % of them exchange medical data.

The Online Access Act (*Onlinezugangsgesetz, OZG*) came into force in 2017 and must be implemented by 2022. In the future, administrative services will also be offered electronically via the administrative portals of the Federal Government, *Länder* and municipalities, which should be linked to a portal network (*Portalverbund*). Over the last two years, the focus has been on establishing and further developing the federal digitisation programme, the portal network, the Single Digital Gateway and Federal Information Management.

All federal levels are involved in implementing the Online Access Act. In addition to the state budgets, EUR 500 million are available to digitise the administration, managed centrally by the *BMI*. In 2017, the IT Planning Council adopted the basic principles underpinning the architecture of the future portal network. On this basis, a pilot project for technical infrastructure linking the portals was

set up in 2018⁷⁰. Further expansion will be gradual, with the inclusion of additional administrative services.

After 2015 the e-Health Act significantly accelerated the deployment of e-health infrastructure and brought about important breakthroughs. Efforts to roll out the necessary infrastructure started in late 2017. In 2018, the Federal Ministry of Health made important adjustments to the Appointment Service and Care law, enabling health insurance companies to provide electronic patient records on a nationwide and interoperable basis by 2021. The Electronic Emergency Data Set and the Electronic Medication Plan will be launched in 2019.

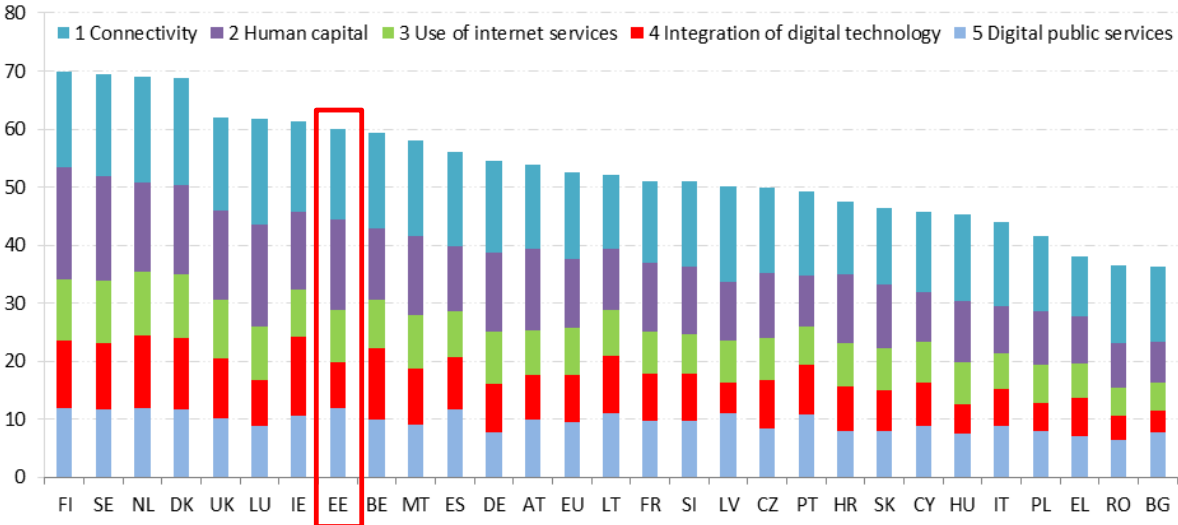
The country's greatest digital challenge is to improve online interaction between public authorities and the general public, as Germans' take-up of e-government services remains low.

⁷⁰ www.beta.bund.de

Estonia

	Estonia		EU
	rank	score	score
DESI 2019	8	60.0	52.5
DESI 2018	7	57.2	49.8
DESI 2017	9	54.9	46.9

Digital Economy and Society Index (DESI) 2019 ranking



Estonia ranks 8th out of the 28 EU Member States in the European Commission Digital Economy and Society Index (DESI) 2019.

Estonia continues to perform well in the Digital public services dimension and the Human capital dimension. Estonia particularly improved in terms of human capital, scoring well above the EU average. Despite Estonia’s relatively low score in previous years in the Integration of digital technology, the 2019 DESI indicates improvement in this dimension. The Use of internet services remains consistently high in Estonia, with the overall 2019 DESI for Estonia showing high performance across the majority of dimensions, alongside significant improvement in others.

However, the key challenge in the Estonian economy is the digitisation of companies. Estonian companies are still not fully exploiting the opportunities offered by digital technology. Fixed broadband coverage is well below the EU average, mainly due to low rural availability, as is the take-up of ultrafast broadband.

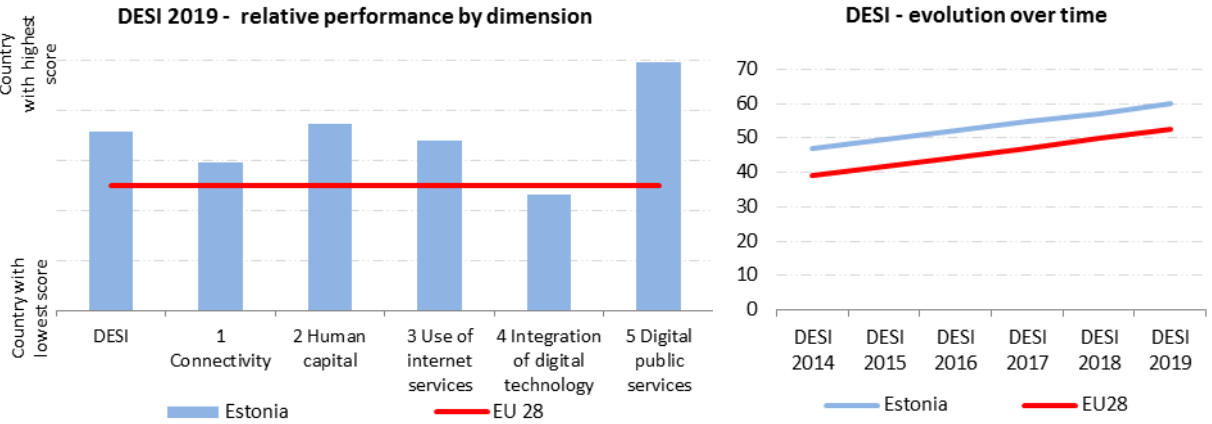
Across all the dimensions measured, Estonia ranks highest in the e-health domain.

The current public sector digital strategy is outlined in the Digital Agenda 2020 for Estonia,⁷¹ which was updated in 2018. The implementation of the strategy in Estonia is steered by the e-Estonia

⁷¹ https://www.mkm.ee/sites/default/files/digitalagenda2020_final.pdf

Council, led by the Prime Minister. This is also complemented by the Estonian Lifelong Learning Strategy 2020⁷² and the Estonian Research and Development and Innovation Strategy 2014-2020 – ‘Knowledge Based Estonia’⁷³.

The Digital Agenda 2020 sets out the general objective to “contribute to achieving higher growth, more jobs and increased welfare by creating an environment supporting the use and development of ICT solutions”⁷⁴.



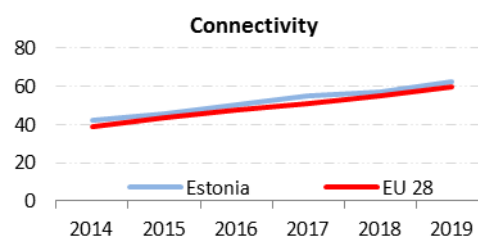
⁷² https://www.hm.ee/sites/default/files/estonian_lifelong_strategy.pdf

⁷³ https://www.hm.ee/sites/default/files/estonian_rdi_strategy_2014-2020.pdf

⁷⁴ Digital Agenda 2020 - https://www.mkm.ee/sites/default/files/digital_agenda_2020_estonia_engf.pdf

1 Connectivity

1 Connectivity	Estonia		EU
	rank	score	score
DESI 2019	13	62.0	59.3
DESI 2018	13	56.9	54.8
DESI 2017	11	54.8	51.2



	DESI 2017	Estonia		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
1a1 Fixed broadband coverage % households	91%	89%	92%	24	97%
1a2 Fixed broadband take-up % households	77%	78%	81%	9	77%
1b1 4G coverage % households (average of operators)	94%	98%	99%	7	94%
1b2 Mobile broadband take-up Subscriptions per 100 people	116	125	144	3	96
1b3 5G readiness Assigned spectrum as a % of total harmonised 5G spectrum	NA	NA	0%	13	14%
1c1 Fast broadband (NGA) coverage % households	79%	80%	83%	19	83%
1c2 Fast broadband take-up % households	24%	29%	34%	21	41%
1d1 Ultrafast broadband coverage % households	NA	71%	83%	9	60%
1d2 Ultrafast broadband take-up % households	7%	9%	11%	22	20%
1e1 Broadband price index Score (0 to 100)	83	85	85	18	87

Estonia's overall connectivity score has risen since 2018, bringing the country to 13. While it has improved both its fixed (92 %) and fast (83 %) broadband coverage by three percentage points compared with 2017, it still ranks under the EU average for the first indicator. The situation is far better with regard to ultrafast broadband, where Estonia ranks ninth with 83 % of its households being covered (all NGA networks are ultra-fast), against an EU average of 60 %. The progress is more important as regards rural ultrafast broadband coverage (from 37.8 of the households in 2017 to 79.7 % against 19.4 % at EU level in 2018). The country performed very well in the take-up of mobile broadband, with 144 subscriptions per 100 people; the EU average is 96 subscriptions per 100 people. Estonia also scores quite well on fixed broadband take-up, reaching 81 %. Estonia's weak spot is the take-up of fast and ultrafast broadband, where, despite the wide availability of ultra-fast networks, it lies well below the EU average; only 11 % of households subscribe to ultrafast broadband. Fixed broadband prices in Estonia are higher but close to the EU average.

While a new broadband strategy is currently under development to align the country's connectivity targets with those of the gigabit society, its short-term targets are to provide all residents with internet access above 30 Mbps and to achieve at least 60 % household subscription rates for speeds above 100 Mbps by 2020. One key measure to achieve the 2020 connectivity targets is the Estonian

Wideband Infrastructure Network (EstWin) project, launched by the Estonian Ministry of Economic Affairs and Communications in 2009 with the target of bringing the EstWin network to not more than 1.5 km away from 98 % of households, businesses and institutions and connecting all existing network nodes with core networks. This is being achieved by intensive fibre backhaul rollout in rural and semi-urban white areas. In 2018, a state aid scheme was established to support the last mile access part in NGA white areas and a single public tender for the whole of Estonia was carried out for €20 million government support. With this state support, Elektrilevi (part of the state-owned energy operator) committed to connect, starting in March 2019, 40,000 addresses in white areas. These should be added to the 60,000 addresses it plans to cover through its own investments.

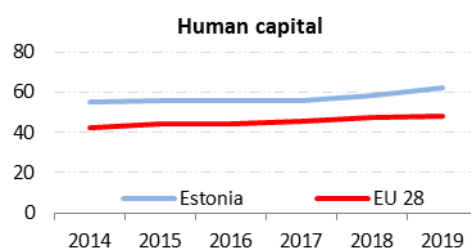
As regards mobile connectivity ambitions, the 700 MHz roadmap was adopted in September 2018 and a broader 5G roadmap was developed by the Ministry and published in February 2019.⁷⁵ The strategy rests on four pillars: 1) a clearer legal environment; 2) infrastructure investments; 3) innovation of services; and 4) frequencies. All operators have 5G test licences and have already performed 5G tests. For instance, Telia and Ericsson have launched a 5G pilot network at the Tallinn University of Technology that can be used by businesses and research institutions. It is anticipated that more specific 5G plans will be known once the 3.4-3.8 GHz auction, planned for the first half of 2019, has been held. To address unresolved spectrum coordination issues with third countries, Estonia requested the assistance of the Commission. In the 700 MHz band, while the target is to hold the auction in the second quarter of 2020, the Interior Ministry's request that part of the spectrum be allocated to PPDR (2 times 10 MHz) may influence the full implementation of mobile broadband in the band in question. 46 % of the spectrum harmonised at EU level for wireless broadband has now been assigned in Estonia.

The smooth implementation of 5G will rely on awarding the 3.4-3.8 GHz and the 700 MHz bands in good time. Coverage with fixed ultra-fast networks in rural areas significantly improved and the successful completion of the EstWin project and the last mile scheme could help further improve it.

⁷⁵ Available only in Estonian at: https://www.mkm.ee/sites/default/files/eesti_5g_teekaart.pdf

2 Human capital

2 Human capital	Estonia		EU
	rank	score	score
DESI 2019	4	62.4	48.0
DESI 2018	7	58.3	47.6
DESI 2017	8	55.9	45.4



	Estonia		Estonia		EU
	DESI 2017	DESI 2018	DESI 2019	rank	DESI 2019
2a1 At least basic digital skills	60%	60%	60%	10	57%
% individuals	2016	2017	2017		2017
2a2 Above basic digital skills	35%	35%	35%	11	31%
% individuals	2016	2017	2017		2017
2a3 At least basic software skills	61%	61%	61%	12	60%
% individuals	2016	2017	2017		2017
2b1 ICT specialists	4,4%	5,3%	5,6%	3	3,7%
% total employment	2015	2016	2017		2017
2b2 Female ICT specialists	1,9%	2,0%	2,2%	3	1,4%
% female employment	2015	2016	2017		2017
2b3 ICT graduates	5,2%	4,9%	6,4%	4	3,5%
% graduates	2014	2015	2016		2015

As regards the Human capital dimension, Estonia ranks fourth among EU countries and well above the EU average. The Estonian Lifelong Learning Strategy aims to ensure that 80 % of the population possess digital competences by 2020.⁷⁶ In 2019, 60 % of the population have at least basic digital skills. The level of basic digital skills among women in Estonia (60 %) is higher than the EU average (55 %).⁷⁷ However, there is still a need for investment in Estonia, as skills shortages and mismatches are among the main obstacles to business investment.⁷⁸ For example, the percentage of people with at least basic digital skills is lower among the unemployed (53.5 %, compared with people in employment: 67.8 %) and in rural areas (56.4 %, against 66 % in urban areas)⁷⁹.

The Estonian Lifelong Learning Strategy 2020 has 'A digital focus on lifelong learning' as one of five priorities. There are several types of action that have been implemented through the strategy, such as the inclusion of standard tests of digital competence in the ninth grade which started in the 2017 / 2018 academic year. Between 2012 and 2017, the public-private initiative ProgeTiger boosted learners' technological literacy and digital skills, through providing programming and robotics resources to participating schools, and providing specialised training for teachers. The programme reached 85 % of Estonian schools and 44 % of Estonian kindergartens, with more than 4100 teachers

⁷⁶ Individuals aged 18-74 with computer skills

⁷⁷ Women in Digital Scoreboard 2019

⁷⁸ EIB 2018

⁷⁹ <https://www.oecdskillsforjobsdatabase.org/#FR/>

having participated in ProgeTiger training sessions.⁸⁰ In 2018, there were 355 activities organised during Code Week, in which there were 11.400 participants.

The percentage of ICT graduates in 2017 was high in comparison with the EU average. Estonia ranks third for ICT specialists as a percentage of total employment, with the percentage of ICT Specialists (5.6 %) higher than the EU average of 3.7 %. Indeed, Estonia has already exceeded the fourth general objective in the Digital Agenda 2020 of increasing the share of ICT professionals in total employment to 4.5 %. The number of female ICT specialists is also above the EU average. However, the proportion of female STEM graduates per 1000 individuals (aged 20-29) is slightly lower in Estonia (12.9) than the EU average (13.1).

Nevertheless, in the third quarter of 2018, nearly 27 % of employers in industry and one third of employers in services indicated that labour shortages limited their production. 85 % of firms cited the lack of skilled staff as a barrier to investment – representing a five-point increase since 2017⁸¹. The unmet demand for labour is particularly high in the information technology and communication (ICT) sector. To ensure that the number of ICT professionals matches the development needs in the ICT sector, Estonia will need a total of 37,000 ICT professionals.⁸² However, the percentage of enterprises providing their employees with training in ICT skills (14 %) is below the EU average (18%).⁸³ In general, SMEs would benefit from additional financial support to train their employees in digital skills⁸⁴.

To address skills shortages in the ICT sector, Estonia has lifted the immigration quota on ICT specialists from countries outside the EU and is in the process of launching support for the recruitment of ICT specialists in industry, including through the proposed Digital Nomad Visa scheme. Furthermore, Estonia proactively promotes work opportunities via Enterprise Estonia - a national foundation to support entrepreneurship. The initiative *Work in Estonia* is to introduce Estonia as an attractive place to work and live to talented specialists worldwide.⁸⁵ The work revolves, inter alia, around simplifying the process for local companies to employ overseas ICT experts and engineers. The 'Select IT' training pilot programme is also offering intensive targeted skills retraining in the ICT sector to selected participants with a Higher Education qualification.⁸⁶

Despite the high percentage of ICT specialists, enterprises provide only limited skills training to meet the needs of the ICT sector in Estonia. Further increasing the number of ICT specialists, by making it easier for ICT specialists from outside of Estonia to work in the country, maintaining a high number of ICT graduates and financing the upskilling of workers in the public and private sectors will enable Estonia to tap into the full potential of the Digital Economy.

⁸⁰ <https://www.hitsa.ee/about-us/news/technology-education-has-reached-majority-of-estonian-schools-by-support-of-the-progetiger-program>

⁸¹ EIB, 'EIB Group Survey on Investment and Investment Finance Country Overview: Estonia', European Investment Bank, 2018.

⁸² http://oska.kutsekoda.ee/wp-content/uploads/2016/05/Key_messages ICT.pdf

⁸³ 2018 SBA Fact Sheet – Estonia p.11

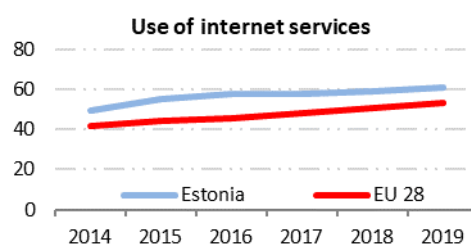
⁸⁴ 2018 SBA Fact Sheet – Estonia p.11

⁸⁵ <https://www.workinestonia.com/>

⁸⁶ <http://vali-it.ee/>

3 Use of internet services

3 Use of internet services	Estonia		EU
	rank	score	score
DESI 2019	7	60.7	53.4
DESI 2018	7	59.1	50.7
DESI 2017	7	57.8	47.8



	DESI 2017	Estonia	DESI 2019	EU
	value	DESI 2018	value rank	DESI 2019
3a1 People who never used the internet	10%	9%	8% 9	11%
% individuals	2016	2017	2018	2018
3a2 Internet users	85%	86%	87% 8	83%
% individuals	2016	2017	2018	2018
3b1 News	89%	90%	90% 5	72%
% internet users	2016	2017	2017	2017
3b2 Music, videos and games	84%	84%	83% 12	81%
% internet users	2016	2016	2018	2018
3b3 Video on demand	24%	24%	27% 11	31%
% internet users	2016	2016	2018	2018
3b4 Video calls	47%	50%	49% 17	49%
% internet users	2016	2017	2018	2018
3b5 Social networks	66%	68%	69% 18	65%
% internet users	2016	2017	2018	2018
3b6 Professional social networks	16%	17%	17% 8	15%
% internet users	2015	2017	2017	2017
3b7 Doing an online course	10%	13%	13% 5	9%
% internet users	2016	2017	2017	2017
3b8 Online consultations and voting	13%	9%	9% ⁸⁷ 13	10%
% internet users	2015	2017	2017	2017
3c1 Banking	90%	90%	90% 5	64%
% internet users	2016	2017	2018	2018
3c2 Shopping	64%	65%	68% 12	69%
% internet users	2016	2017	2018	2018
3c3 Selling online	22%	21%	27% 11	23%
% internet users	2016	2017	2018	2018

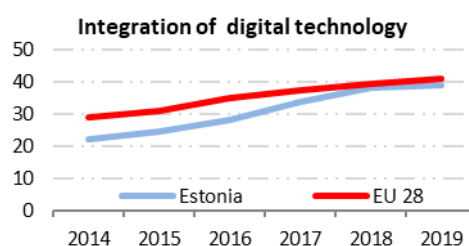
Overall, the use of internet services in Estonia is high (87 % of people). People in Estonia are keen to engage in a variety of online activities, the most popular of which are reading the news and banking. The proportion of people taking an online course is higher in Estonia (13 %), than in the EU as a whole (9 %). *i-Voting* has been possible since 2005, and an estimated 30 % of Estonians used it in the 2015 parliamentary elections⁸⁸. The percentage of Estonians using internet banking has also remained consistent, with Estonia ranking fifth in the EU.

⁸⁷ Data was collected in the first quarter of 2017, so it does not include those having voted on line in the municipal elections in the autumn of 2017.

⁸⁸ See official statistics at: <https://www.valimised.ee/en/archive/statistics-about-internet-voting-estonia>; furthermore: <https://e-estonia.com/solutions/e-governance/i-voting/>

4 Integration of digital technology

4 Integration of digital technology	Estonia		EU
	rank	score	score
DESI 2019	16	39.2	41.1
DESI 2018	17	38.1	39.6
DESI 2017	19	33.7	37.6



	DESI 2017	Estonia		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
4a1 Electronic information sharing % enterprises	22%	28%	28%	21	34%
4a2 Social media % enterprises	12%	13%	13%	24	21%
4a3 Big data % enterprises	13%	13%	11%	15	12%
4a4 Cloud % enterprises	17%	NA	26%	8	18%
4b1 SMEs selling online % SMEs	15%	15%	16%	16	17%
4b2 e-Commerce turnover % SME turnover	11%	11%	12%	9	10%
4b3 Selling online cross-border % SMEs	6%	8%	8%	15	8%

Estonia scores below the EU average in the Integration of digital technology in industry – in which it now ranks 16th - despite some recent progress.

The country has made some progress on certain indicators. The share of Estonian SMEs selling online (16 %) remains slightly below the EU average of 17 %. The percentage of SMEs purchasing online in Estonia (12 %) is around half the EU average of 26 %.⁸⁹ Approximately 8% of SMEs are also selling online cross-border. However, for 17 % of SMEs high delivery costs are the main trade barrier.

On a positive note, Estonia has improved in terms of turnover from e-commerce (12 % versus 11 %). For example, the Ministry of Economic Affairs and Communications has organised information days for entrepreneurs to improve their awareness of EU legislation, and it has developed better cooperation with the e-Commerce Association for mapping the needs and opportunities of entrepreneurs.⁹⁰ 28 % of enterprises use social media (up from 24 % in 2016), while 18 % use cloud services (13 % in 2016). 98 % of companies are established online.⁹¹

⁸⁹ 2018 SBA Fact Sheet – Estonia p.11

⁹⁰ <https://ec.europa.eu/info/sites/info/files/2018-european-semester-national-reform-programme-annex-estonia-en.pdf>

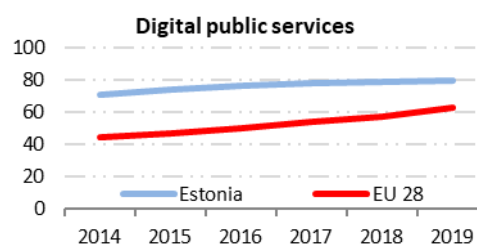
⁹¹ E-Estonia

Estonia is committed to making progress with new digital technologies and to strategically investing in them through EU-coordinated programmes. For instance, the country is a member of the EuroHPC Joint Undertaking; it has also signed the Declaration of European Blockchain Partnership, as well as the Declaration on Cooperation on Artificial Intelligence, the Declaration of cooperation towards access to at least 1 million sequenced genomes in the European Union by 2022 and the Declaration on the Cooperation framework on HPC.

To boost the digital transformation of the Estonian economy, it is important to raise awareness of the relevance of better integration of digital technologies, particularly for SMEs.

5 Digital public services

5 Digital public services	Estonia		EU
	rank	score	score
DESI 2019	2	79.5	62.9
DESI 2018	1	79.4	57.9
DESI 2017	1	78.5	54.0



	DESI 2017	Estonia	DESI 2019	EU
	value	DESI 2018	value rank	DESI 2019
		value	value	value
5a1 e-Government users % internet users needing to submit forms	93%	96%	92% 2	64%
	2016	2017	2018	2018
5a2 Pre-filled forms Score (0 to 100)	89	88	89 2	58
	2016	2017	2018	2018
5a3 Online service completion Score (0 to 100)	97	97	98 3	87
	2016	2017	2018	2018
5a4 Digital public services for businesses Score (0 to 100) - including domestic and cross-border	93	93	93 8	85
	2016	2017	2018	2018
5a5 Open data % of maximum score	NA	NA	44% 25	64%
			2018	2018
5b1 e-Health services % individuals	NA	49%	49% 1	18%
		2017	2017	2017
5b2 Medical data exchange⁹² % of general practitioners	NA	NA	NA	43%
			2018	2018
5b3 e-Prescription % of general practitioners	NA	NA	96% 7	50%
			2018	2018

On digital public services, Estonia ranks second among EU countries - well above the EU average. Estonia has well-developed e-government and e-health systems, with all central government services, as well as municipalities providing services online⁹³. The country is a frontrunner as regards the digital provision of public services and has one of the highest shares (92 %) of e-government users in Europe. Furthermore, X-road, the backbone of e-Estonia, is a digital information infrastructure that securely connects over 900 organisations daily⁹⁴.

There is a 58 % overall satisfaction with e-services. There is therefore a need to make certain services more user-friendly if Estonia is to reach the 'satisfaction with the quality of public services' indicator of 85 % outlined in the Digital Agenda 2020⁹⁵. Estonia is lagging behind with regard to open data. The availability of open data stands at 44 % - well below the EU average. However, in 2018 the renewed Estonian Open Data Portal was launched, which provides access to public sector data and publishes

⁹² Data has been removed due to potential inconsistencies

⁹³ Statistics of e-Government services also available here in the State Services Catalogue: <https://www.mkm.ee/en/service-search>; see also: <http://mkm-itaio.github.io/catalogue/>

⁹⁴ <https://www.x-tee.ee/factsheets/EE/#eng>

⁹⁵ https://ristohinno.shinyapps.io/Riigiteenused_dashboard/

blogs to promote Open Data⁹⁶. Estonia's Fourth Open Government Action Plan for 2018-2020 was implemented in 2018⁹⁷.

It is estimated that Estonian residents save an average of five working days annually, due to the availability of digital document signing⁹⁸. In 2019, Estonia performed marginally better than in 2018 both in terms of users using pre-filled forms (88 in 2018, versus 89 in 2019) and in online service completion. Estonia uses blockchain technology to enforce the integrity of government data and systems⁹⁹. Estonia has also established a high-security data embassy in Luxembourg for hosting critical data and information systems outside Estonia¹⁰⁰.

Moreover, the availability of e-government services for business shows a consistently high performance for Estonia, scoring 93 out of 100, the eighth best in the EU. The high take-up of the electronic identity (eID), electronic authentication and digital signatures has reduced the paper trail of bureaucracy and made business more flexible. For example, the Zero Bureaucracy project has created a task force to implement bureaucracy reduction proposals submitted by businesses¹⁰¹.

For e-health services, Estonia ranks first in the EU, with 49 % of Estonians having used health and care services provided online. e-Prescriptions are used by 96 % of general practitioners (GPs). 56 % of GPs exchange medical data. To date, 99 % of health data is digitised and 99 % of prescriptions are digital. The European e-Health Digital Service Infrastructure also started operating in Estonia in 2018, to facilitate the exchange of patient data. Finnish digital prescriptions are already available in Estonian pharmacies. In 2019, this exchange will be extended to make Estonian digital prescriptions available in Finnish pharmacies.

As a world leader in digital public services, ensuring that the range of online public services are user-friendly and cost effective will enable Estonia to reach the objectives outlined in the Digital Agenda 2020. Promoting the use and the opening up of information gateways, including the expansion of the Estonian Open Data Portal, would also facilitate easy and secure access to data and information.

2019 Highlight: e-Residency

Estonia's e-residency scheme – in place since 2014 - provides online government services to e-Residents worldwide. e-Residents can remotely set up and manage businesses, add digital signatures to contracts, make payments and use a number of private sector e-services to manage cross-border businesses¹⁰². By 2025, Estonia aims to provide a business environment for 10 million e-Residents. As of April 2019, there are 54,500 e-residents, with people from 154 countries worldwide having applied for it. Of these, 67 % cite the 'location of an independent international business' or 'bringing business to Estonia' as their motivation for applying¹⁰³. 6,586 new companies have been established by e-residents.

⁹⁶ <https://opendata.riik.ee/>

⁹⁷ <https://www.riigikantselei.ee/et/valitsuse-toetamine/avatud-valitsemise-partnerlus/tegevuskava-2018-2020>

⁹⁸ <https://e-estonia.com/wp-content/uploads/stories-a4-v02-efficiency-1.pdf>

⁹⁹ <https://e-estonia.com/wp-content/uploads/faq-a4-v03-blockchain-1-1.pdf>

¹⁰⁰ <https://e-estonia.com/estonia-to-open-the-worlds-first-data-embassy-in-luxembourg/>

¹⁰¹ <https://www.mkm.ee/en/zero-bureaucracy-0>

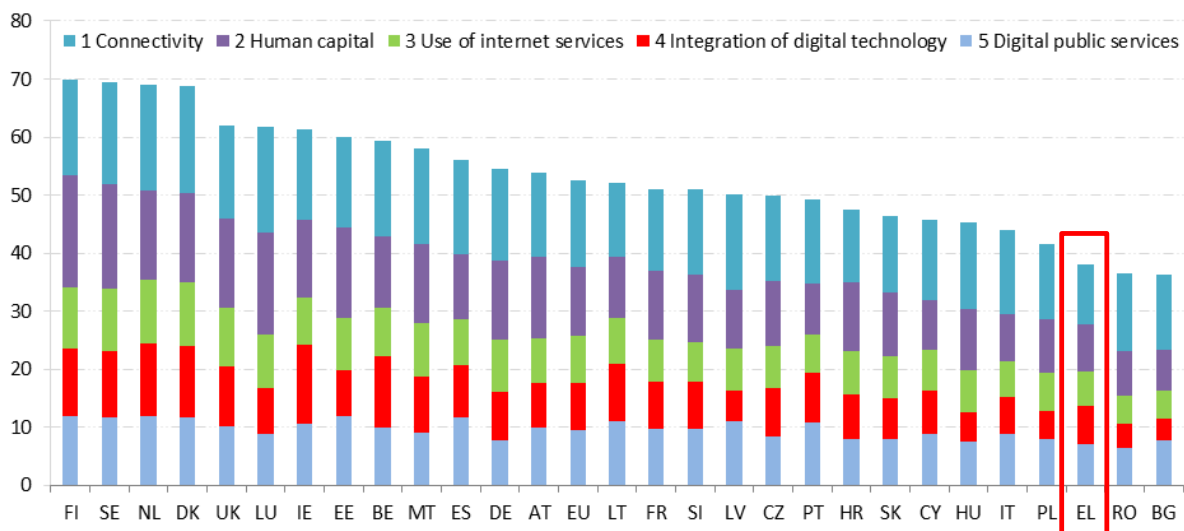
¹⁰² <https://e-estonia.com/wp-content/uploads/stories-a4-v02-efficiency-1.pdf>

¹⁰³ <https://app.cyfe.com/dashboards/195223/5587fe4e52036102283711615553>

Greece

	Greece		EU
	rank	score	score
DESI 2019	26	38.0	52.5
DESI 2018	28	34.9	49.8
DESI 2017	26	33.1	46.9

Digital Economy and Society Index (DESI) 2019 ranking



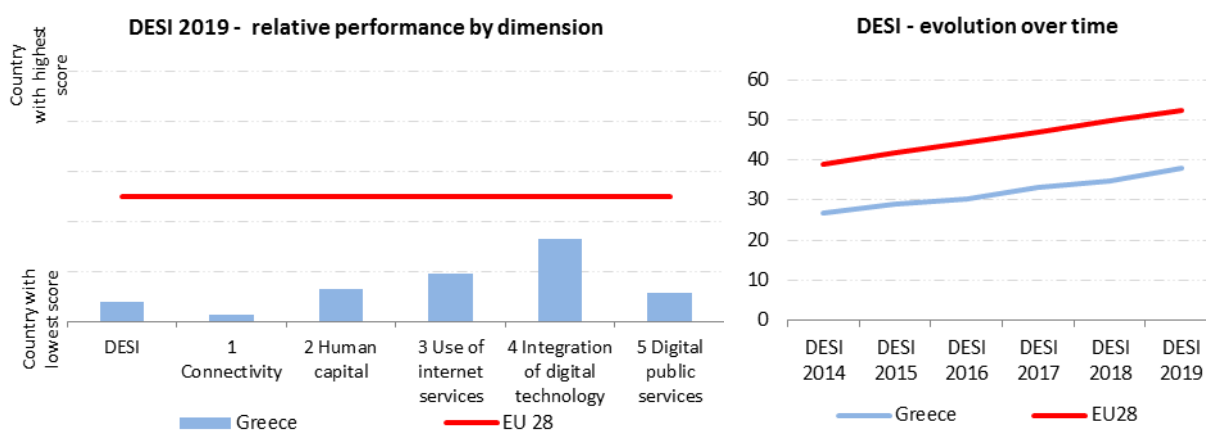
Greece ranks 26th out of the 28 EU Member States in the European Commission Digital Economy and Society Index (DESI) 2019.

Over the last year, Greece progressed slightly more than the EU average increase. The improvement of its score is due to an improved performance in some of the DESI dimensions measured. Greece marginally improved its performance as regards Human capital increasing the percentage of Information and Communication Technology (ICT) specialists in total employment for the third consecutive year, and increasing the number of ICT graduates for the second year running. It also improved the supply side of digital public services. However, the country still scores below the EU average.

In connectivity, the transition to fast and ultrafast broadband is much slower than in the rest of Europe. Although the national broadband plan has been updated, there are still considerable delays in project implementation and the absorption of the funds allocated. Speeding up 5G development will also help improve Greece's digital status. On the positive side, the number of internet users is growing. Greeks are active users of internet services such as video calls and taking online courses. However, progress with integrating digital technology into business has been slow, apart from the use of big data by enterprises, which is higher than the EU average.

Among all dimensions, Greece ranks highest in the integration of digital technology. However, the best progression compared to last year is in the Digital public services dimension where there has been an increase of 7.4 points.

The current Greek National Digital Strategy (NDS)¹⁰⁴ (2016-2021) constitutes the framework for the country's digital transformation. It includes: 1) the deployment of digital infrastructures; 2) boosting digital skills for the public and workers; 3) investment and creating an appropriate legal framework for the digital transformation of economic sectors and businesses; 4) expanding e-government. The NDS was confirmed in July 2018 with the publication of the Growth Strategy for Greece¹⁰⁵, which includes a chapter on the digital economy.

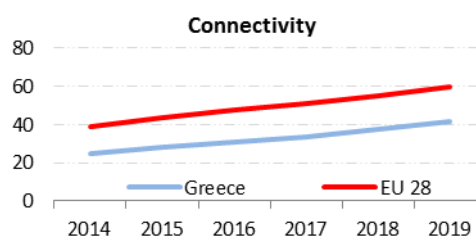


¹⁰⁴ <http://www.mindigital.gr/index.php/κείμενα-στρατηγικής/220-digital-strategy-2016-2021>

¹⁰⁵ <http://www.mindev.gov.gr/greece-a-growth-strategy-for-the-future/>

1 Connectivity

1 Connectivity	Greece		EU
	rank	score	score
DESI 2019	28	41.2	59.3
DESI 2018	28	37.4	54.8
DESI 2017	28	33.5	51.2



	DESI 2017	Greece		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
1a1 Fixed broadband coverage % households	96%	96%	96%	17	97%
1a2 Fixed broadband take-up % households	66%	69%	74%	15	77%
1b1 4G coverage % households (average of operators)	77%	86%	92%	23	94%
1b2 Mobile broadband take-up Subscriptions per 100 people	50	66	74	25	96
1b3 5G readiness Assigned spectrum as a % of total harmonised 5G spectrum	NA	NA	0%	13	14%
1c1 Fast broadband (NGA) coverage % households	48%	53%	66%	26	83%
1c2 Fast broadband take-up % households	5%	7%	11%	28	41%
1d1 Ultrafast broadband coverage % households	NA	0.4%	0.4%	28	60%
1d2 Ultrafast broadband take-up % households	0.01%	0.01%	0.10%	28	20%
1e1 Broadband price index Score (0 to 100)	70	70	65	28	87

With an overall connectivity score of 41.2, Greece ranks last among EU countries; there has been no improvement in rank since 2017. It features wide availability of fixed broadband (96% coverage, slightly lower than the 97 % EU average), but take-up is still progressing slowly, reaching 74 % (below the EU average of 77 %). This could be linked to prices, which remain relatively high compared with the EU average; as Greece now ranks last among EU countries on the broadband price index as well. Despite a progress of 13 percentage points, Greece ranks 26th amongst EU countries in NGA coverage per household, far below the EU average of 83 %. Moreover, the country has almost no ultrafast broadband networks. Despite the 8-point increase in mobile broadband take-up, the current figure is 74 subscriptions per 100 people, well below the EU average of 96 subscriptions per 100 people. While subscriptions to fast broadband have increased by 4 percentage points to 11 %, they remain well below the EU average of 41 %. Greece's 4G performance is better, with coverage reaching 92 %, close to the EU average of 94 %.

In 2018, Greece updated the projects forming part of the National Broadband Plan to meet the Gigabit Society targets. Only future-proof infrastructures providing at least 100 Mbps is now funded

(in most cases, upgradability to one Gbps is a prerequisite). The Superfast Broadband project, approved in December 2018 by the European Commission, is a demand stimulation scheme involving vouchers, which is designed to support Greece's take-up of broadband services with download speeds of at least 100 Mbps. The project's maximum overall budget is estimated at EUR 50 million per year, to be funded from national resources, under the general state budget. The large-scale broadband project Ultrafast Broadband (UFBB) has been approved by the Intergovernmental Project Committee. The project's total budget is EUR 700 million, of which EUR 300 million is a public contribution, the remaining EUR 400 million being from private sources. The UFBB project is designed to cover most areas of the country that will remain NGA white, about 2.5 million people (about 18 % of the active lines) at national level. There is a trend to upgrade the planned VDSL (vectoring) plans with fibre technologies (FTTB/FTTH). Greece is one of the successful Member States in the WiFi4EU¹⁰⁶ first call as it won 117 vouchers (about 40 % of those applied, 268 in total).

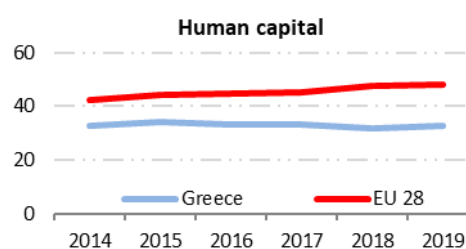
The General Secretariat of Telecommunications and Post has established a special task force to coordinate all issues regarding 5G development in Greece, including the plan to achieve the Gigabit Society targets for 5G. Three Greek cities, namely Trikala, Kalamata and Zografou, have signed memorandums of understanding for the deployment of pilot 5G networks. Moreover, an agreement has been signed with Bulgaria and Serbia to implement a 5G pilot cross-border corridor. In Greece 32 % of the total spectrum harmonised at EU level for wireless broadband has been assigned. The Ministry of Digital Policy Telecommunications and Media published the national roadmap for the release of 700 MHz setting 15 December 2020 as the final date for the start of the use of the band for wireless broadband. The indicative date of granting rights of use for 5G networks in the band 3.4-3.8 GHz is the end of 2019.

Despite the update of the national broadband plan and the progress of the vectoring implementation, remaining sizeable delays in implementing the projects and in the absorption of the funds allocated have meant that Greece has not improved its connectivity score; it still ranked last among EU countries in 2018. Greece hopes to benefit from addressing these delays by creating the right conditions for private investment in order to improve its digital competitiveness. Tackling the significant delays in proceedings for antenna permit granting and promoting 5G development will improve the country's digital status. In addition to this, the Regulator could continue to secure the timely and correct implementation of regulatory decisions. Moreover, it is important that Greece take appropriate measures and address the issues concerning the implementation of the European emergency number 112 without further delay.

¹⁰⁶ <https://ec.europa.eu/digital-single-market/en/policies/wifi4eu-free-wi-fi-europeans>

2 Human capital

2 Human capital	Greece		EU
	rank	score	score
DESI 2019	25	32.7	48.0
DESI 2018	26	31.9	47.6
DESI 2017	25	33.2	45.4



	Greece		EU	
	DESI 2017	DESI 2018	DESI 2019	DESI 2019
	value	value	value	Rank
2a1 At least basic digital skills	46%	46%	46%	25
% individuals	2016	2017	2017	2017
2a2 Above basic digital skills	19%	22%	22%	23
% individuals	2016	2017	2017	2017
2a3 At least basic software skills	53%	52%	52%	21
% individuals	2016	2017	2017	2017
2b1 ICT specialists	1.2%	1.4%	1.6%	28
% total employment	2015	2016	2017	2017
2b2 Female ICT specialists	0.4%	0.4%	0.4%	28
% female employment	2015	2016	2017	2017
2b3 ICT graduates	4.4%	3.0%	3.2%	18
% graduates	2014	2015	2016	2015

In the Human capital dimension, Greece's performance remains well below the EU average, but it is making progress. In 2017, only 46 % of individuals between 16 and 74 had at least basic digital skills (57 % in the EU). Among the 54 % who do not have basic digital skills, 31 % of individuals have no digital skills at all (the EU average being 17 %). In addition, Greece continues to have the lowest share of ICT specialists in total employment in the EU: 1.6 % in 2017, compared with an EU average of 3.7 % But there has been some slight progress in the last three years. Nevertheless, a significant gender gap is also observed with only 10.9 % of employed people in the ICT sector being women. Furthermore, the proportion of ICT specialists in total female employment is also very low, at 0.4 % compared with the EU average (1.4 %), and it has stagnated over the last three years. Referring to the proportion of ICT graduates in the total pool of graduates (3.2 %) means that Greece is performing below the EU average.

Several initiatives aiming at upgrading digital skills and competences among the public, Small and Medium Size Enterprises (SMEs) and civil servants have been initiated in the context of the Greek National Coalition for Digital Skills¹⁰⁷ launched in June 2018. At the end of 2018, the Greek Coalition counted 24 partners, among them key policy makers for digital skills, such as ministries, municipal authorities and enterprises. Coordinated by the innovation unit at the Ministry of Administrative Reconstruction (MAR), the Greek Coalition launched an initiative to encourage enterprises to participate to the Digital Opportunity Traineeships pilot programme through online support and a series of seminars in cooperation with regional chambers of commerce. By the end of 2018, about 100 companies had expressed an interest in offering traineeships.

¹⁰⁷ <http://www.nationalcoalition.gov.gr/>

MAR has established an Action Plan for 2019-2022, its goal being to coordinate actions to develop digital skills taken by major players in the Greek Coalition. It emphasises innovative methods and practices tested by the Coalition's coordinator in 2018, with the aim of reducing potential overlaps, focuses on the economy's need for digital skills, and addresses the need for social inclusion.

In the area of upskilling by the end of 2018, implementation of the training, certification and counselling programme in the field of ICT¹⁰⁸ for young unemployed people aged between 18 and 24 enabled 3000 trainees to take part, and 15000 counselling sessions.

The shortfall of digital skills remains a major obstacle for Greece if it is to achieve its goals in terms of growth opportunities and the digital society and economy. Upscaling existing initiatives will be crucial in this respect. Increasing the number of Greek ICT specialists and closing the gender gap are very important if the country is to benefit fully from the digital economy.

Highlight 2019: EU Code week¹⁰⁹ in Greece, 6-21 October 2018

During EU Code Week, a total of 368 activities were held throughout Greece, covering 37.200 participants whose average age was 11. 44.4 % of participants were girls or women.

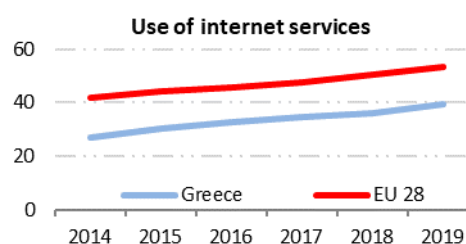
The Ministry of Administrative Reconstruction (MAR) as coordinator of the Greek Coalition for Digital Skills held a national activity to promote the inclusion of coding in school curricula. It was attended by 108 children aged 8-11 and 27 ICT teachers from primary schools all over Greece (with a female participation of approximately 52 %). After this event, the MAR launched a pilot innovation project called 'Code my city', which involved over 250 pupils and lasted until March 2019. The students practised their coding skills in the classroom before presenting a cultural aspect of their city at an event held on 30th of March 2019.

¹⁰⁸ <http://www.sepe.gr/gr/information/training-certification-consulting-unemployed-18-24-ict-skills/>

¹⁰⁹ The EU Code Week is a grass-root initiative which aims to bring coding and digital literacy to everybody in a fun and engaging way. Schools, teachers, libraries, code clubs, businesses, public authorities can organise a #CodeEU event.

3 Use of internet services

3 Use of internet services	Greece		EU
	rank	score	score
DESI 2019	26	39.4	53.4
DESI 2018	26	35.9	50.7
DESI 2017	26	34.5	47.8

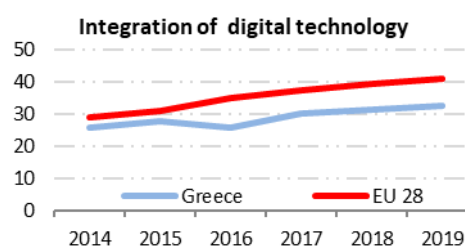


	DESI 2017	Greece		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
3a1 People who never used the internet	28%	28%	25%	27	11%
% individuals	2016	2017	2018	2018	2018
3a2 Internet users	66%	67%	70%	26	83%
% individuals	2016	2017	2018	2018	2018
3b1 News	85%	87%	87%	8	72%
% internet users	2016	2017	2017	2017	2017
3b2 Music, videos and games	77%	77%	79%	18	81%
% internet users	2016	2016	2018	2018	2018
3b3 Video on demand	12%	12%	11%	25	31%
% internet users	2016	2016	2018	2018	2018
3b4 Video calls	46%	48%	61%	7	49%
% internet users	2016	2017	2018	2018	2018
3b5 Social networks	68%	72%	73%	13	65%
% internet users	2016	2017	2018	2018	2018
3b6 Professional social networks	7%	8%	8%	23	15%
% internet users	2015	2017	2017	2017	2017
3b7 Doing an online course	8%	7%	7%	13	9%
% internet users	2016	2017	2017	2017	2017
3b8 Online consultations and voting	8%	5%	5%	21	10%
% internet users	2015	2017	2017	2017	2017
3c1 Banking	28%	36%	38%	26	64%
% internet users	2016	2017	2018	2018	2018
3c2 Shopping	45%	45%	49%	22	69%
% internet users	2016	2017	2018	2018	2018
3c3 Selling online	3%	3%	5%	27	23%
% internet users	2016	2017	2018	2018	2018

Overall, the Use of internet services in Greece is well below the EU average. However, the number of internet users is growing and a large percentage of them - above the EU average - are keen to engage in a variety of online activities. The most popular of these are reading news online, making video calls, using social networks and taking online courses. 87 % of Greek internet users read news online, which is well above the EU average of 72 %. Use of video calls reached 61% in 2018 (48 % in 2017) and is more widespread than in other EU countries (49 % in 2018). However, although the use of online banking is growing for the third year in a row (38 %), the percentage remains far below the EU average of 64 %. The same applies to shopping online, which is progressing with 49% of internet users, but remains below the EU average of 69 %.

4 Integration of digital technology

4 Integration of digital technology	Greece		EU
	rank	score	score
DESI 2019	22	32.8	41.1
DESI 2018	22	31.5	39.6
DESI 2017	22	30.2	37.6



	DESI 2017	Greece		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
4a1 Electronic information sharing % enterprises	37%	37%	37%	12	34%
4a2 Social media % enterprises	20%	21%	21%	12	21%
4a3 Big data % enterprises	11%	11%	13%	13	12%
4a4 Cloud % enterprises	6%	5%	7%	26	18%
4b1 SMEs selling online % SMEs	10%	11%	11%	24	17%
4b2 e-Commerce turnover % SME turnover	6%	3%	4%	26	10%
4b3 Selling online cross-border % SMEs	3%	7%	7%	21	8%

On the Integration of digital technology by businesses, Greece ranks 22th among EU countries, well below the EU average. While the country's ranking has stayed the same, there has been some slight progress with some indicators. The enterprises in Greece are increasingly taking advantage of the opportunities provided by big data: 13 % of them report using big data (above the EU average of 12 %). 21 % of enterprises use social media, as much as the EU average. However, only 7 % of enterprises use cloud computing; while this represents a 2 % increase since last year, it remains below the EU average (18 %). SMEs selling online in 2018 stagnate at 11 %, the same as in 2017. Their e-commerce turnover also remains low at a mere 4% of total turnover.

Access to finance for SMEs and framework conditions for entrepreneurship, innovation and start-ups remains difficult. In 2018, a new fund-of-funds programme - the Equifund¹¹⁰ - was launched to meet start-ups' need for private equity and venture capital especially in the ICT sector and innovative digital technologies. The effort to create Digital Innovation Hubs (DIHs) continued with DIHs covering advanced technologies such as robotics, cloud computing and big data.

At the end of 2018, the Ministry of Digital Policy in collaboration with the Ministry of Rural Development and Food launched a national initiative for the digital transformation of the agricultural sector, based on precision farming technologies to be used by 450,000 farmers.

¹¹⁰ <https://equifund.gr/>

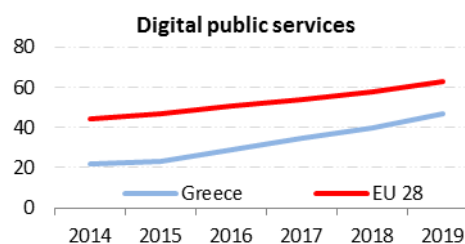
Greece's National Digital Strategy for 2016-2021 plans investment to boost ICT industry. The aim is to develop the ICT ecosystem further, and to promote innovation and entrepreneurial development in ICT sectors and other sectors of the economy. This will give young graduates in STEM fields, opportunities to take part in developing a digital economy.

In 2018, Greece also showed its commitment to advancing new digital technologies - in line with the Digital Europe Programme - and to investing strategically in digital technologies through EU-coordinated programmes. In May, Greece signed the Declaration of European Blockchain Partnership and the Declaration on cooperation on Artificial Intelligence. The country is also a member of the EuroHPC Joint Undertaking.

To boost the digital transformation of the Greek economy and capture the full range of benefits from the adoption of digital technologies, it is important to speed up the implementation of measures relating to the digitisation of the economy for which the National Digital Strategy makes provision.

5 Digital public services

5 Digital public services	Greece		EU
	rank	score	score
DESI 2019	27	46.9	62.9
DESI 2018	28	39.5	57.9
DESI 2017	28	34.5	54.0



	DESI 2017	Greece		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
5a1 e-Government users % internet users needing to submit forms	42%	38%	36%	28	64%
	2016	2017	2018		2018
5a2 Pre-filled forms Score (0 to 100)	5	14	23	26	58
	2016	2017	2018		2018
5a3 Online service completion Score (0 to 100)	63	76	82	22	87
	2016	2017	2018		2018
5a4 Digital public services for businesses Score (0 to 100) - including domestic and cross-border	59	60	65	26	85
	2016	2017	2018		2018
5a5 Open data % of maximum score	NA	NA	74%	8	64%
			2018		2018
5b1 e-Health services % individuals	NA	10%	10%	23	18%
		2017	2017		2017
5b2 Medical data exchange % of general practitioners	NA	NA	25%	18	43%
			2018		2018
5b3 e-Prescription % of general practitioners	NA	NA	NA		50%
			2018		2018

In the Digital public services dimension, Greece ranks 27th among EU countries, well below the EU average, but it is progressing at a rate above the EU average; Greece's score rose by 7.4 points in 2018 while the average EU increase, over the same period, was only 5 points. Greece is performing very well as regards the Open data maturity indicator, with a total of 74 % well above the EU average of 64 %. On the supply side (in the provision of online public services), Greece continued to progress in 2018, with 23/100 pre-filled forms compared with 14/100 in 2017, however, it still scores well below the EU average. Moreover, only 36 % of internet users are active users of e-government services, against an EU-wide average of 64 %. The availability of digital public services for businesses, on the other hand, increased significantly with a score of 65. This compares favourably with the increase between 2016 (59) and 2017 (60). For e-health services, Greece ranks below the EU average; only 10 % of people have used health and care services provided online.

In 2018, Greece continued to implement measures for smart administration based on the 2017-2019 National Strategy for Administrative Reform¹¹¹. In January, the National Citizens Registry¹¹² was set up to reduce the need for members of the public to produce multiple documents for simple administrative procedures, as documents became available to other public agencies. The Greek

¹¹¹ <http://www.minadmin.gov.gr/?p=24473>

¹¹² <https://www.eu-go.gr/sdportal/article.jsp?id=34&lang=EN>

business portal¹¹³ also provided a new e-service for registering a company in the General Electronic Commercial Registry.

Greece has established a National Cyber Security Authority at the Ministry of Digital Policy, Telecommunications and Media, responsible for implementing the National Cybersecurity Strategy¹¹⁴. The strategy is designed to develop a secure cyberspace for both private and public stakeholders by improving capabilities for protection against cyber-attacks and by developing a strong culture of cybersecurity among the general public and private sector stakeholders.

In the field of e-health, Greece has been implementing a national e-prescription system¹¹⁵ since 2013. It covers medication, registration of consultations and the examinations referrals. The system shows a large coverage of users with 53.000 physicians and 11.000 pharmacies, for an estimation of 6 million prescriptions/month and 3 million patients/month. In 2018, the interoperability of 71 hospitals was finalised (project eGov Now¹¹⁶) providing data and web services on functions such as management of pharmacy/logistics, patient care and appointments (e.g. hospital results). A telemedicine programme is being implemented in 100 remote and border municipalities throughout Greece giving residents of remote areas access to basic medical examinations locally and thereby reducing geographical barriers to the prevention of illnesses.

Continuing and speeding-up the implementation of digital solutions to modernise the Greek public sector and offer a comprehensive e-government system that works well, including e-health services, will improve the provision of public service.

¹¹³ <http://www.businessportal.gr/>

¹¹⁴ <https://www.enisa.europa.eu/topics/national-cyber-security-strategies/ncss-map>

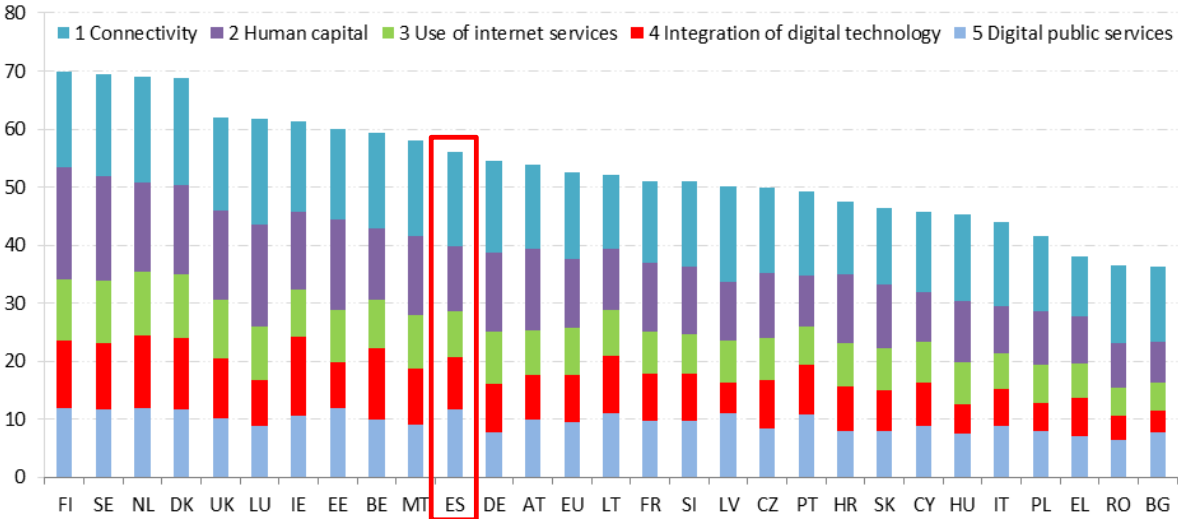
¹¹⁵ <https://www.e-prescription.gr/>

¹¹⁶ <http://www.ktpae.gr/NEA/oloklirosi-diasindesis-bi-ygeias>

Spain

	Spain		EU
	rank	score	score
DESI 2019	11	56.1	52.5
DESI 2018	11	53.2	49.8
DESI 2017	13	49.1	46.9

Digital Economy and Society Index (DESI) 2019 ranking



Spain ranks 11th out of 28 EU Member States in the Digital Economy and Society Index (DESI) 2019.

The improvement is due to a better performance in some of the DESI dimensions measured, namely Connectivity and Digital Public Services. Spain performs well in connectivity, thanks to the wide availability of fast and ultrafast fixed and mobile broadband networks and to the increasing take-up. With regards to Human capital, Spain ranks at the same level as last year, and still scores below the EU average in this dimension.

In particular, around one fifth of people in Spain are not yet online and close to half of them still lack basic digital skills. Despite growing demand on the labour market, the supply of ICT specialists is still below the EU average. Most progress has been made with Connectivity. As regards the Integration of digital technologies, while more Spanish businesses use social media and big data than in previous years, but cloud and e-commerce stagnated compared with last year.

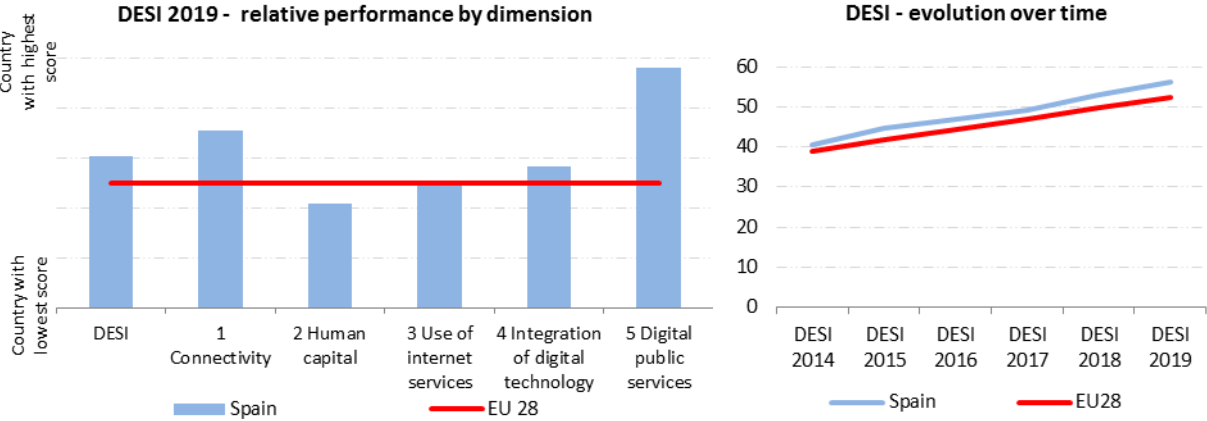
Spain is doing best in the area of digital public services, having implemented its e-government strategy in good time. It ranks fourth in the EU in this area.

The current Spanish Digital Agenda dates back to 2013. The Government is currently working on the 'Spain Start-up Nation' strategy¹¹⁷ as an overarching strategy to embed innovation and digitalisation

¹¹⁷ <http://www.mineco.gob.es/portal/site/mineco/>

in all aspects of the economy and society. This strategy would include the following elements: 1) a new plan for the deployment of digital infrastructure; 2) investment in enabling digital technologies; 3) programs to promote skills and talent, and 4) a national Artificial Intelligence strategy. In addition, new initiatives such as the "Retail modernization plan 2019-2020", included in the "Agenda for Change"¹¹⁸ or the planned "Strategy for sustainable tourism"¹¹⁹ will promote innovation and digitalisation in specific economic sectors. These new policies are expected to be carried out during 2019.

New general elections took place in April 28th 2019.

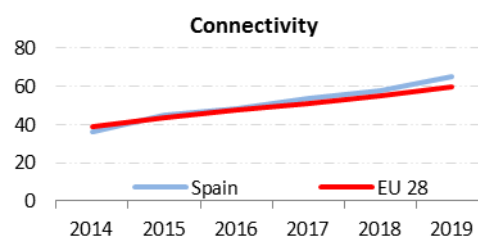


¹¹⁸ <http://www.lamoncloa.gob.es/consejodeministros/referencias/Paginas/2019/refc20190208.aspx>

¹¹⁹ <https://www.agenda2030.gob.es/>

1 Connectivity

1 Connectivity	Spain		EU
	rank	score	score
DESI 2019	9	65.2	59.3
DESI 2018	10	57.3	54.8
DESI 2017	12	53.3	51.2



	Spain		EU	
	DESI 2017 value	DESI 2018 value	DESI 2019 value	DESI 2019 rank
1a1 Fixed broadband coverage % households	95%	96%	96%	18
1a2 Fixed broadband take-up % households	71%	73%	77%	10
1b1 4G coverage % households (average of operators)	86%	92%	94%	21
1b2 Mobile broadband take-up Subscriptions per 100 people	86	92	97	13
1b3 5G readiness Assigned spectrum as a % of total harmonised 5G spectrum	NA	NA	30%	8
1c1 Fast broadband (NGA) coverage % households	81%	85%	88%	13
1c2 Fast broadband take-up % households	35%	43%	54%	11
1d1 Ultrafast broadband coverage % households	NA	84%	87%	7
1d2 Ultrafast broadband take-up % households	15%	18%	30%	9
1e1 Broadband price index Score (0 to 100)	70	75	76	22

Spain's overall connectivity has improved further and now ranks 9th in the DESI. The country performs particularly well in fast and ultrafast coverage. Currently, 88 % of households have access to ultrafast broadband networks, although there are significant differences between urban and rural areas. The deployment of FTTP networks continues to be an important feature of the Spanish digital market, covering 77.4 % of households. Fast and ultrafast broadband take-up rates are two of the main drivers of improvement in the connectivity section of DESI in 2018. 4G coverage reached 94 %, the EU average. Although the fixed broadband price index for Spain shows a slight improvement, the country still ranks 22nd as in year 2017. The context is a market dominated by convergent bundles, including mobile services as well as pay TV services and characterised by increasing internet access speeds (supported by the above-mentioned deployment of FTTP networks) where price increases in the flagship-bundled products of the main operators are generally linked to different improvements. Mobile broadband prices for handset offers¹²⁰ have fallen over the past year (from EUR 20.8 to EUR 20), and are even below the EU average (EUR 22.3).

¹²⁰ 1 GB + 300 calls basket.

The national Programme for the extension of next-generation broadband networks (*'Programa de Extensión de la Banda Ancha de Nueva Generación'*, PEBA-NGA¹²¹), continues to provide financial support for the roll-out of broadband networks in underserved areas. Since 2013, this programme has provided high-speed connectivity to 2.8 million households. In 2018, Spain announced an ambitious plan reinforcing the budget of PEBA-NGA in order to bring 300 Mbps connectivity to all population centres (95 % of the total population) between 2018 and 2021.

Following the publication of the 5G National Plan for 2018-2020, the Ministry of Economy and Business (*Secretaría de Estado para el Avance Digital*, SEAD) guaranteed the use of certain frequency bands for 5G pilots and established the regulatory basis for granting subsidies to 5G technology pilot projects. On that legal basis, the Public Entity *Red.es* issued an invitation to tender for granting subsidies for two 5G pilots¹²². In Spain, 47 % of the spectrum harmonised at EU level for wireless broadband has been assigned. The 700 MHz roadmap, approved in June 2018, will involve the migration of Digital Terrestrial Television (DTT) services between January 2019 and March 2020¹²³. As the roadmap states, the process of releasing the band should be completed by 30 June 2020, but no specific date is given for the auction process. The 3.4-3.8 GHz band was auctioned off in July 2018 and granted to three of the four largest mobile operators (Vodafone: 90 MHz, Orange: 60 MHz and Telefónica: 50 MHz). In the summer of 2018, Masmovil purchased 40 MHz on the secondary market reaching in total 80 MHz. The assignment process has enabled the acquisition of spectrum at reasonable prices (EUR 0.5 pop/MHz) with a view to the forthcoming investment challenge. Spain thus ranks sixth in 5G readiness, with 30 % of 5G pioneer bands assigned; by the end of 2018, it had assigned spectrum in the 3.4-3.8 GHz band in accordance with Commission Decision (EU)2019/235, and the spectrum is expected to become available for use for 5G by 2020. In April 2018, the National Frequency Allocation Table was updated introducing the provisions needed to have the relevant bands including the 26 GHz band available for the provision of 5G services.

Spain is one of the top performers in the roll-out of ultrafast broadband as well as the take-up of ultrafast broadband connections. Deployment is driven by commercial investment made up by several telecom operators, a regulatory framework focused on supporting deployments through effective regulated duct-access and supported by an ambitious national strategy that provides subsidies in sparsely populated and rural areas. The ground for 5G deployment is being prepared, with several pilot projects under way. The assignment of pioneer spectrum is well under way and the 700 MHz auction is expected in early 2020.

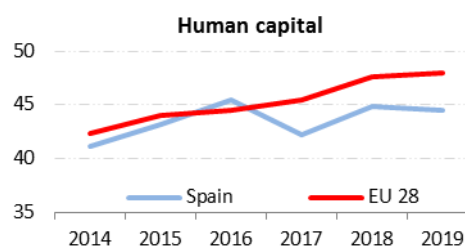
¹²¹ <http://www.mincotur.gob.es/PortalAyudas/banda-ancha/Paginas/Index.aspx>

¹²² <https://sede.red.gob.es/procedimientos/c00718-sp>

¹²³ June 2020 according to the proposed new DTT Technical plan.

2 Human capital

2 Human capital	Spain		EU
	rank	score	score
DESI 2019	17	44.5	48.0
DESI 2018	17	44.9	47.6
DESI 2017	17	42.2	45.4



	DESI 2017	Spain		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
2a1 At least basic digital skills % individuals	53%	55%	55%	17	57%
2a2 Above basic digital skills % individuals	31%	32%	32%	14	31%
2a3 At least basic software skills % individuals	56%	58%	58%	14	60%
2b1 ICT specialists % total employment	2.4%	3.0%	2.9%	18	3.7%
2b2 Female ICT specialists % female employment	0.9%	1.0%	1.0%	18	1.4%
2b3 ICT graduates % graduates	4.0%	4.0%	3.9%	14	3.5%

In the Human capital dimension, Spain ranks 17th out of 28 EU countries and is thus below the EU average. Basic digital skills levels remain below the EU average. Only 55 % of people between 16 and 74 years of age have basic digital skills (the figure is 57 % in the EU as a whole). The proportion of ICT specialists represents a lower percentage of the workforce compared to the EU average (2.9 % compared to 3.7 % in the EU). ICT graduates in Spain account for 3.9 % of the total. Female ICT specialists account for a mere 1 % of total female employment

In 2018, the Ministry of Education and Vocational Training proposed including in all VET programmes at all levels (basic, intermediate and high) a set of specific modules designed to support students in acquiring skills and competencies in Industry 4.0, Big Data, Communication networks 5.0, and other ICT-related skills. The Ministry aims to design new VET programmes or modify existing ones to ensure that the needs of the new digital sectors are covered.

Spain has launched a new project called the 'School of Computational Thinking'¹²⁴. This is designed to help teachers throughout Spain to incorporate computational thinking into their daily practice through programming and robotics. Around 800 teachers and 20,000 students from primary, middle and high school are expected to participate over 2018-2019. In October 2018, Spain also presented the conclusions of the working group on programming, robotics and computational thinking in the

¹²⁴ <https://intef.es/tecnologia-educativa/pensamiento-computacional/>

classroom¹²⁵. This group consisted of 14 Autonomous Communities joining forces with universities, pioneering companies and civil society entities to develop a normative proposal on the teaching of these skills. The Ministry of Education and Vocational Training has also launched an initiative called STEMGirls, consisting of a repository online tool providing an overview of international and national initiatives. This will help and motivate women and girls to choose studies related to STEM, and to overcome the gender gap in technology.

The Spanish National Coalition for Digital Skills and Jobs, run by AMETIC, was established in July 2017¹²⁶. This group of national-level actors engaged in digital skills development, including industry, employer's associations and labour unions and representatives of the education sector. The Coalition awarded the first digital skills awards in June 2018 with several categories (in line with the EU proposal)¹²⁷.

The Ministry of Education is involved in three main areas of the Code Week initiative: 1) by joining the network of Code Week coordinators; 2) by creating a specific website to encourage educators to take part in the initiative¹²⁸; and 3) by offering a nano massive open online course (NOOC) on Code Week for educators¹²⁹. The latter, with over 430 teachers enrolled, aims to help teachers in the organization of activities for Code Week in their schools. Spain ranked fourth in the 2018 Code Week, with more than 1,000 events organised.

A high degree of skills mismatches in companies' workforces limit their capacity to innovate and capitalise from innovation. Increasing the number of Spanish ICT specialists, narrowing the gender gap and re-skilling the labour force are of great importance if Spain is to tap into the full potential of the Digital Economy.

Highlight 2019: Call for the training of workers and unemployed people in Digital and Technological Skills

The Government (through the Ministry of Employment) has set up a training plan in digital and technological competencies¹³⁰. Its budget is EUR 60 million.

This plan will focus on 12 areas considered to be priorities in 23 sectors of the economy: 1) broadband communications; 2) cybersecurity; 3) management and maintenance of 3D printers; 4) artificial intelligence; 5) robotics; 6) drones; 7) automotive with electric motor or autonomous driving; 8) cloud computing; 9) Internet of things; 10) advanced analytics; 11) cognitive computing; and 12) location services.

The Priority groups identified are women, people with disabilities, low-skilled workers and workers aged above 45.

¹²⁵ <https://www.educacionyfp.gob.es/prensa-mecd/actualidad/2018/10/20181022-escuelacomputacional.html>

¹²⁶ <http://ametic.es/es/proyectos/digital-skills-jobs-coalition>

¹²⁷ <https://ametic.es/en/prensa/pedro-duque-senala-que-las-companias-espanolas-necesitan-un-entorno-mejor-para-poder-crecer>

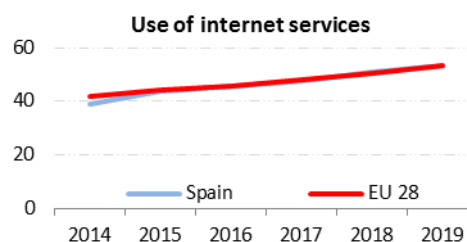
¹²⁸ <http://code.intef.es/codeweek/>

¹²⁹ http://enlinea.intef.es/courses/course-v1:INTEF+SomosCodeEU+2018_ED1/about

¹³⁰ <https://www.sepe.es/contenidos/comunicacion/noticias/aprobado-programa-competencias-digitales.html>

3 Use of internet services

3 Use of internet services	Spain		EU
	rank	score	score
DESI 2019	11	53.4	53.4
DESI 2018	11	50.8	50.7
DESI 2017	11	47.7	47.8

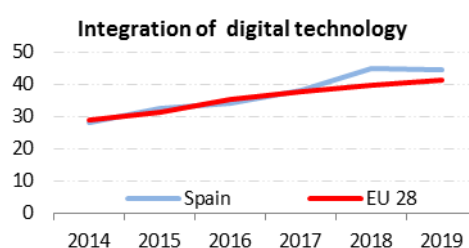


	Spain		EU		
	DESI 2017	DESI 2018	DESI 2019	DESI 2019	
	value	value	value rank	value	
3a1 People who never used the internet	17%	14%	13%	13	11%
% individuals	2016	2017	2018		2018
3a2 Internet users	76%	80%	83%	14	83%
% individuals	2016	2017	2018		2018
3b1 News	78%	77%	77%	17	72%
% internet users	2016	2017	2017		2017
3b2 Music, videos and games	83%	83%	86%	9	81%
% internet users	2016	2016	2018		2018
3b3 Video on demand	27%	27%	39%	8	31%
% internet users	2016	2016	2018		2018
3b4 Video calls	31%	35%	38%	27	49%
% internet users	2016	2017	2018		2018
3b5 Social networks	67%	68%	67%	20	65%
% internet users	2016	2017	2018		2018
3b6 Professional social networks	16%	16%	16%	12	15%
% internet users	2015	2017	2017		2017
3b7 Doing an online course	13%	15%	15%	3	9%
% internet users	2016	2017	2017		2017
3b8 Online consultations and voting	12%	13%	13%	9	10%
% internet users	2015	2017	2017		2017
3c1 Banking	54%	55%	57%	19	64%
% internet users	2016	2017	2018		2018
3c2 Shopping	54%	59%	62%	17	69%
% internet users	2016	2017	2018		2018
3c3 Selling online	15%	15%	13%	20	23%
% internet users	2016	2017	2018		2018

Overall, the use of internet services in Spain is broadly comparable with the EU average. People in Spain are keen to engage in a variety of online activities in line with the rest of the EU. Compared to the EU, the higher ranked activities are watching videos on demand and taking online courses. 77 % of Spanish internet users read news online (72 % in the EU). 38 % of Spaniards use video calls, well below the EU average, but online consultations and e-voting are above the EU average. The online consumption of music, videos and games online is also more widespread than in other EU countries, with 86 % of internet users engaging in these activities.

4 Integration of digital technology

4 Integration of digital technology	Spain		EU
	rank	score	score
DESI 2019	10	44.6	41.1
DESI 2018	9	44.7	39.6
DESI 2017	12	38.2	37.6



	DESI 2017	Spain		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
4a1 Electronic information sharing % enterprises	35%	46%	46%	4	34%
4a2 Social media % enterprises	24%	28%	28%	7	21%
4a3 Big data % enterprises	8%	8%	11%	16	12%
4a4 Cloud % enterprises	13%	18%	16%	13	18%
4b1 SMEs selling online % SMEs	19%	20%	18%	11	17%
4b2 e-Commerce turnover % SME turnover	9%	10%	10%	16	10%
4b3 Selling online cross-border % SMEs	6%	7%	7%	20	8%

As regards the integration of digital technology in businesses' activities Spain ranks 10th among EU countries. Compared with last year, Spain has gone down one step in the ranking. Spanish enterprises are taking advantage of the opportunities presented by online commerce: 18 % of SMEs sell online (slightly above the EU average of 17 %); 7 % of all SMEs are selling cross-border and 10 % of turnover comes from the online segment. 28 % of enterprises use social media (up from 24 % in 2016), 16 % use cloud services and 11 % of them access big data services.

Spain is committed to the advancement of new digital technologies and to investing strategically in digital technologies through EU-coordinated programmes (e.g. the country is a member of the EuroHPC Joint Undertaking; it has also signed the Declaration on European Blockchain Partnership, as well as the Declaration on cooperation on Artificial Intelligence).

The Spanish Secretary General for Industry and SMEs (SGIPYME), through its Industry 4.0. Strategy¹³¹, has proposed several measures to boost digitisation in companies. The HADA platform¹³², a free online application that allows companies to obtain an assessment of their digital maturity, is particularly noteworthy. There are over 2,000 companies in its registry so far (25 % of them from the food and beverage industry). Other measures include a new Master in Industry 4.0, designed by

¹³¹ <http://www.industriaconectada40.gob.es/>

¹³² <https://hada.industriaconectada40.gob.es/hada/register>

'Escuela de Organización Industrial (EOI)' in collaboration with the Connected Industry Plan 4.0¹³³. This master programme is designed to train generalist experts in emerging technologies in the productive processes of connected factories 4.0, and in the design of new connected products.

The proposal announced to foster the Spanish start-up ecosystem¹³⁴ has three main goals:

- 1) to boost tax incentives for investment in R&D&I;
- 2) to reinforce networks of accelerators and incubators' networks by improving their connectivity and number; and
- 3) to host more international forums so as to strengthen the contacts with investors for talent.

The National Security Strategy¹³⁵, set up in 2017, has a section on cybersecurity that is designed to guarantee a safe and reliable digital environment. This section focuses on strengthening the ability to prevent, detect and respond to cyber-attacks, and on boosting and adopting specific measures to help promote a secure and reliable cyberspace. The public and business sectors are included, as well as civil society.

To boost the digital transformation of the Spanish economy, it is important to raise awareness on the relevance of digitisation of SMEs and their needs. This will enable SMEs to reap the full range of rewards from adopting digital technologies.

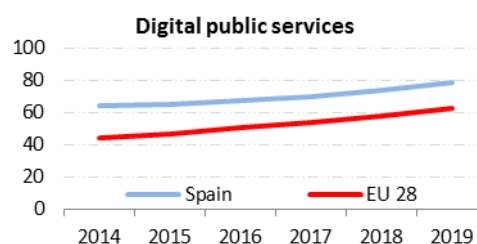
¹³³ <https://www.eoi.es/es/cursos/26560/master-executive-en-industria-40-madrid>

¹³⁴ <http://www.lamoncloa.gob.es/presidente/actividades/Paginas/2018/051018sanchez-summit.aspx>

¹³⁵ <https://www.dsn.gob.es/es/2017-spanish-national-security-strategy>

5 Digital public services

5 Digital public services	Spain		EU
	rank	score	score
DESI 2019	4	78.4	62.9
DESI 2018	6	73.7	57.9
DESI 2017	6	69.3	54.0



	DESI 2017	Spain		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
5a1 e-Government users % internet users needing to submit forms	66% 2016	67% 2017	76% 2018	10	64% 2018
5a2 Pre-filled forms Score (0 to 100)	67 2016	72 2017	74 2018	10	58 2018
5a3 Online service completion Score (0 to 100)	89 2016	95 2017	95 2018	8	87 2018
5a4 Digital public services for businesses Score (0 to 100) - including domestic and cross-border	88 2016	95 2017	93 2018	7	85 2018
5a5 Open data % of maximum score	NA	NA	87% 2018	2	64% 2018
5b1 e-Health services % individuals	NA	29% 2017	29% 2017	5	18% 2017
5b2 Medical data exchange % of general practitioners	NA	NA	68% 2018	6	43% 2018
5b3 e-Prescription % of general practitioners	NA	NA	74% 2018	12	50% 2018

In Digital public services, Spain ranks 4th among EU countries, well above the EU average. This is the dimension in which it performs best. The country performs very well in the open data indicator on which it is ranked 2nd. There is a high level of online interaction between public authorities and members of the public. 76 % of Spanish internet users actively engage with e-government services. In 2018, Spain performed better than the previous year for pre-filled forms. However, the availability of e-government services for businesses performed slightly worse, although positioning Spain as the seventh best performer in the EU with a score of 93 out of 100. For e-health services, Spain ranks 5th in the EU.

The country's investment in the area of open government data is particularly noteworthy. Most of the digital-by-default strategy – the ICT Strategic plan for 2015-2020¹³⁶ - is already in place. This implies that almost all services are already available for members of the public to use in a fully digitised public administration environment. However, the adaptation of administrative procedures to this new paradigm and to the design of optimal management processes needs investments to ensure all technological and legal requirements are in place. A consensus was reached between the

¹³⁶ http://administracionelectronica.gob.es/pae_Home/pae_Estrategias/Estrategia-TIC-AGE.html#.Vuklmf4UV9A

different layers of the competent public authorities (general, regional and local bodies) which required an extension of the deadline for the integration of certain services¹³⁷.

In the area of e-health, the measures taken by the Autonomous Communities include the creation of comprehensive health web portals. Several Autonomous Communities have already implemented e-health mobile applications that allow patients access to information concerning them through their smartphones¹³⁸. The Andalusian and Catalan health systems, in particular, have created apps, called '*App Salud Responde*' and '*AppSalut*', respectively, with very positive results. The Ministry of Health, Consumer and Social Welfare classes e-health information systems as medium-security. Every two years, the Ministry must undergo an audit to verify it fulfils the requirements set up in the National Security Scheme.

Full implementation of the Digital Transformation plan, by all public actors involved - central, regional and local government and other bodies - could lead the way to even more significant improvements in the area of digital public administration. Additional measures to facilitate the use of e-health mobile services by all members of the public, regardless of their geographical location, could help improve take-up further.

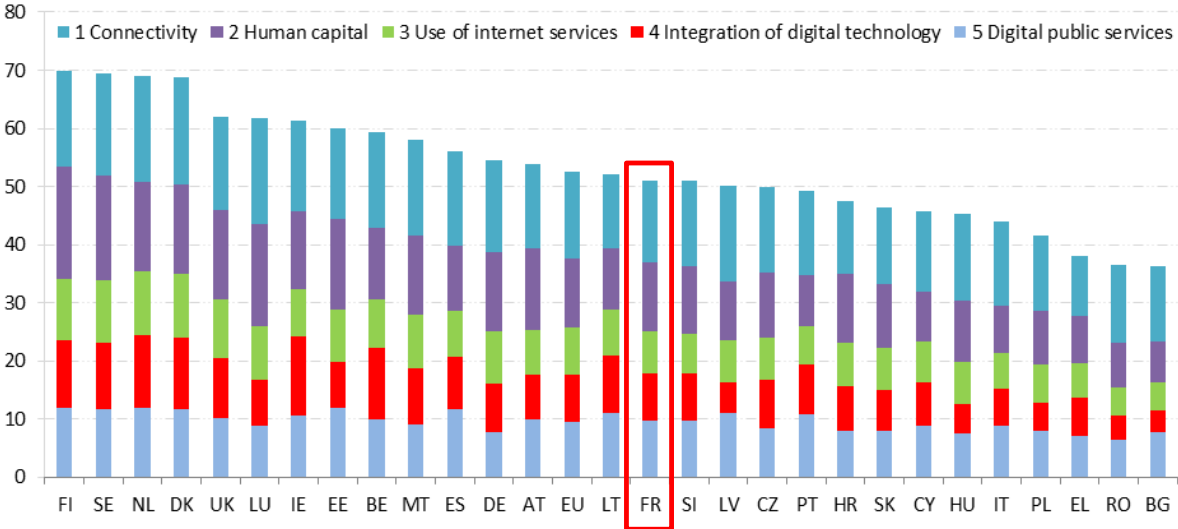
¹³⁷ Real Decreto-ley 11/2018

¹³⁸ For example, Extremadura, Galicia, La Rioja, Navarra and the Basque Country.

France

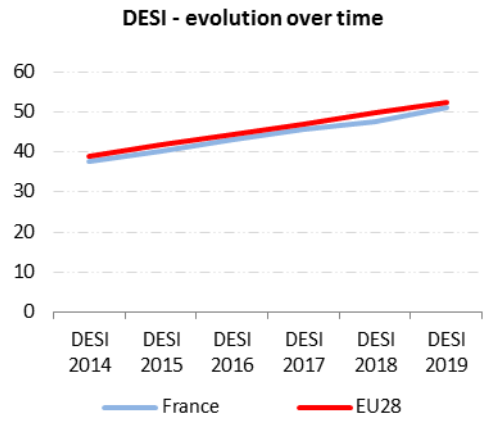
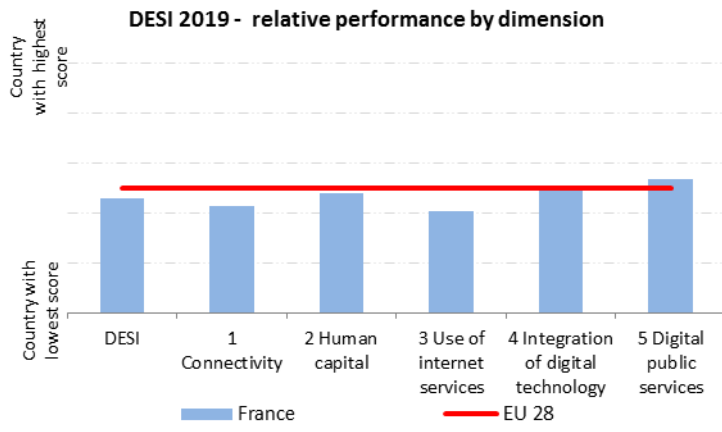
	France		EU
	rank	score	score
DESI 2019	15	51.0	52.5
DESI 2018	16	47.7	49.8
DESI 2017	14	45.6	46.9

Digital Economy and Society Index (DESI) 2019 ranking



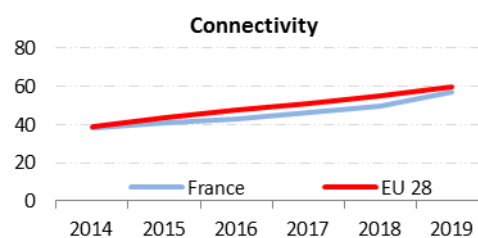
France ranks 15th out of the 28 EU Member States in the European Commission's Digital Economy and Society Index (DESI) 2019. Compared with last year, the country scored better overall as well as in four of the five dimensions considered, thus moving up one place in the overall ranking. It remains, however, at a considerable distance from the EU's top performers. The largest improvement corresponds to the Connectivity dimension (although this remains France's main weakness due to limited fast and ultrafast broadband coverage), followed by the Digital public services dimension, thanks to a strong performance as regards uptake of e-government services, availability of online services for business and open data. The country's highest rankings are in the dimensions covering Human capital (driven by relatively high shares of female ICT specialists and digital skills levels in line with the EU average), and Integration of digital technology (as a relatively high proportion of French companies share information electronically or make use of big data analysis).

Over the past year, France has adopted a number of important initiatives that address digital-related challenges. These include several measures announced under the country's plan to fight digital exclusion (*'Plan National pour un Numérique Inclusif'*), funding commitments for digital-related training under its dedicated investment plan (*'Plan d'investissement dans les compétences'*), a new national initiative for the digital transformation of SMEs and microenterprises (*'France Num'*), a national strategy for artificial intelligence, and several projects to modernise public services through digitisation.



1 Connectivity

1 Connectivity	France		EU
	rank	score	score
DESI 2019	20	56.6	59.3
DESI 2018	20	49.5	54.8
DESI 2017	19	46.3	51.2



	DESI 2017	France		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
1a1 Fixed broadband coverage % households	>99.5%	>99.5%	>99.5%	6	97%
1a2 Fixed broadband take-up % households	72%	71%	73%	18	77%
1b1 4G coverage % households (average of operators)	78%	89%	95%	18	94%
1b2 Mobile broadband take-up Subscriptions per 100 people	81	86	91	15	96
1b3 5G readiness Assigned spectrum as a % of total harmonised 5G spectrum	NA	NA	33%	3	14%
1c1 Fast broadband (NGA) coverage % households	47%	52%	58%	28	83%
1c2 Fast broadband take-up % households	13%	16%	20%	25	41%
1d1 Ultrafast broadband coverage % households	NA	42%	49%	25	60%
1d2 Ultrafast broadband take-up % households	8%	10%	14%	20	20%
1e1 Broadband price index Score (0 to 100)	94	95	94	2	87

With an overall connectivity score of 56.6, France ranks 20th among EU Member States. French households are almost fully covered by fixed broadband (almost 100% coverage, above the EU average of 97 %) and 73 % subscribe to fixed broadband, slightly below the EU average of 77 %. The situation as regards higher performance networks is more complex: only 58 % of French households have NGA coverage (Next Generation Access or fast broadband networks providing at least 30 Mbps); and only 20 % of French households actually make use of fast broadband. These figures are significantly lower than the EU averages of 83 % for NGA coverage and 41 % for subscription to fast broadband respectively. On the other hand, a very significant share of overall NGA lines are ultra-fast, and progress year-on-year is substantial (growth rate >15 %), while ultra-fast subscriptions have almost doubled in two years. Take-up of mobile broadband has improved from 86 to 91 subscriptions per 100 people within a year, although it is still slightly below the EU average of 96.

The Plan for Ultra-Fast Broadband in France ('*Plan France Très Haut Débit*') is designed to cover all French territories by broadband speeds of 30 Mbps or more by 2022. Additionally, in July 2017, President Macron declared that he wanted to offer good high-speed internet at or above 8 Mbps to all by 2020. The plan provides for an investment worth EUR 20 billion over a 10-year period. Overall,

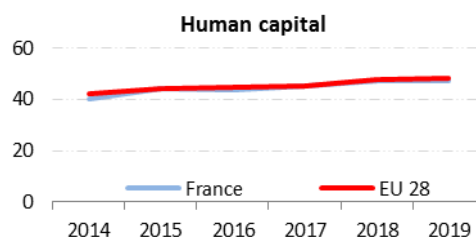
the investment costs will be split between the state, regional authorities and operators. It is estimated that up to EUR 14 billion should be generated by the revenues stemming from the public networks rolled out by the relevant public bodies and their co-financing. The remaining part of the investment (about EUR 6.5 billion) will come from public subsidies, including state subsidies worth EUR 3.3 billion. As of July 2018, the Government had allocated EUR 3.1 billion to supporting the national broadband plan. In order to further improve its high-speed connectivity coverage throughout the country, France aims to speed up the roll-out of fibre network and has also considered alternative means to fibre in remote areas, e.g. fixed 4G, as a transitory complement. In 2018, two market players made legally binding commitments to have fibre to the home technology rolled out to 13.65 million units by 2020 (namely 37 % of the total housing units in France). As far as 4G is concerned, as a result of the 'new deal for mobile' agreement reached in January 2018 between the state and a number of market players, new coverage obligations have been incorporated into the current and future licences of the winning applicants, with a view to reducing white zones (areas not covered by a network). In particular, the agreement provides for a RAN sharing obligation in given areas where operators do not already offer satisfactory coverage for voice and SMS services. In other instances, there is a passive infrastructure-sharing obligation with operators who have been asked to roll out infrastructure in given areas.

The French Government has adopted a 5G roadmap which refers to the following four timeframes: while there was already some 5G testing in various cities in 2018, the frequency bands needed for 5G use should be freed in 2019 and the first 5G-compatible terminals should go on sale. In 2020, the relevant frequency bands should be assigned and 5G should be commercially available in at least one major city. Finally, in 2025, the main routes should be covered by 5G. The current plan is to allocate a large part of the 3.4 – 3.8 GHz band and at least 1 GHz of the 26 GHz in an assignment procedure expected to be held in the second half of 2019. The 700 MHz band was already assigned in 2015 in Metropolitan France, ahead of the European timetable. France thus ranks third on the 5G readiness indicator, as by the end of 2018 the country had assigned spectrum in the 700 Mhz band and the spectrum should be available for 5G use by 2019. Overall, 33 % of the entire 2090 MHz spectrum harmonised at EU level for wireless broadband has been assigned. The roadmap is designed to promote transparency and dialogue around 5G rollout. Working groups on 5G have been set up. These will take the necessary action under the supervision of the relevant public authorities.

To offer better nationwide connectivity in terms of speed and coverage, and to remedy its low NGA coverage, France is continuing to implement its national broadband plan and has also chosen to promote the use of 4G. The 4G coverage objectives appear to be high and will require substantial investment by the operators concerned, which will have to build a considerable number of dedicated sites. As far as 5G is concerned, it should nevertheless be noted that a number of spectrum bands have not been assigned yet.

2 Human capital

2 Human capital	France		EU
	rank	score	score
DESI 2019	14	47.0	48.0
DESI 2018	12	47.1	47.6
DESI 2017	14	45.0	45.4



	DESI 2017	France	DESI 2019	EU
	value	DESI 2018	value rank	DESI 2019
2a1 At least basic digital skills % individuals	56% 2016	57% 2017	57% 13 2017	57% 2017
2a2 Above basic digital skills % individuals	28% 2016	29% 2017	29% 18 2017	31% 2017
2a3 At least basic software skills % individuals	59% 2016	60% 2017	60% 13 2017	60% 2017
2b1 ICT specialists % total employment	3.6% 2015	3.8% 2016	3.7% 14 2017	3.7% 2017
2b2 Female ICT specialists % female employment	1.2% 2015	1.4% 2016	1.5% 9 2017	1.4% 2017
2b3 ICT graduates % graduates	NA 2014	3.1% 2015	3.0% 21 2016	3.5% 2015

France is in the middle range of the ranking for DESI's Human capital dimension. Its population's digital skills levels are on par with the EU average: about 57 % of those aged 16-74 have at least basic digital skills (2017). France is also on par with the EU average in terms of the proportion of ICT specialists in total employment (3.7 % in 2017), although it still lags far behind the EU leaders in this respect. About 17 % of French companies¹³⁹ employed ICT specialists in 2018 (EU average 19.6 %), with large disparities between SMEs (15 %) and large enterprises (75 %). Moreover, 54 % of companies having tried to recruit ICT specialists reported difficulties in filling job vacancies in 2018 compared with 42 % a year earlier. In the same vein, a 2017 report from the Employment Orientation Council estimated that unfilled ICT vacancies could reach 80,000 in 2020. Although the share of ICT graduates in the overall graduate pool in France is relatively low by European standards, the country's share of female ICT specialists in total female employment is, at 1.5 %, slightly above the EU average (1.4 %).

In 2018, several relevant measures to fight digital exclusion and enable effective access to digital services were announced under the '*Plan National pour un Numérique Inclusif*¹⁴⁰', which has the goal of training at least 5 million people. These measures include an online voucher ('*pass numérique*') system (with a budget of EUR 10 million for 2019, which is expected to leverage up to EUR 40 million) giving access to advisory and capacity building services; platforms and certification mechanisms to

¹³⁹ All data refer to companies with more than 10 employees and excluding the financial sector.

¹⁴⁰ <https://societenumerique.gouv.fr/plannational/>

promote digital inclusion, assessment tools (e.g. Pix, an online tool to assess and develop digital skills) and the development of digital "intermediation" services ('*mediation numérique*', '*Hubs France Connectée*')¹⁴¹ that will receive EUR 5 million over the period 2019-2020, whereas matching funding from other sources is expected to help reach EUR 75-100 million in total¹⁴². Moreover, in the context of the '*Plan d'investissement dans les compétences*', the sum of EUR 77 million has been committed to digital-related training actions (10 KNUM), notably via the '*Grande école du numérique*'. The French Digital Skills & Jobs Coalition¹⁴³, which was launched in September 2017 and is structured around four main components (*employees, education, professionals and skills*) has already involved more than 50 organisations including private sector companies and associations, public entities and trade unions. It is to present the results from its work so far at the next annual general assembly. In 2018, a good number of schools and other organisations took part in the EU Code Week, a¹⁴⁴ grassroots movement to encourage people of all ages to code. More than 500 events were held in France gathering over 23,000 participants.

While France's efforts in this area go in the right direction, ensuring that these and other relevant initiatives successfully address the country's needs in terms of advanced digital skills will be important. One key challenge in this respect has to do with the availability of skilled professionals to deploy high capacity networks timely throughout the country (see section 1 for more details).

¹⁴¹ Secrétariat d'Etat au Numérique. *Pour une France connectée. Plan national pour un numérique inclusif*. Dossier de presse, 13/10/2018.

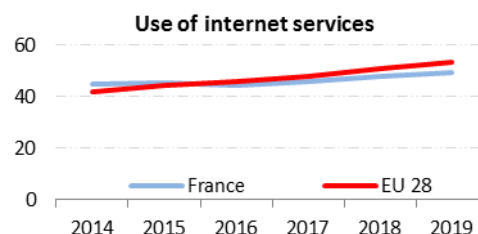
¹⁴² <https://secretariat-etat.numerique.gouv.fr/presentation-plan-national-numerique-inclusif-lancement-numerique-communs>

¹⁴³ <http://www.french-digital-coalition.fr/>

¹⁴⁴ <https://codeweek.eu/>

3 Use of internet services

3 Use of internet services	France		EU
	rank	score	score
DESI 2019	16	49.2	53.4
DESI 2018	14	48.0	50.7
DESI 2017	13	46.1	47.8

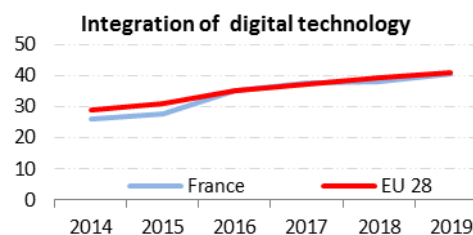


	DESI 2017	France		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
3a1 People who never used the internet % individuals	10%	10%	8%	8	11%
3a2 Internet users % individuals	82%	83%	85%	11	83%
3b1 News % internet users	56%	61%	61%	27	72%
3b2 Music, videos and games % internet users	75%	75%	74%	22	81%
3b3 Video on demand % internet users	12%	12%	23%	16	31%
3b4 Video calls % internet users	34%	33%	35%	28	49%
3b5 Social networks % internet users	47%	49%	48%	28	65%
3b6 Professional social networks % internet users	9%	10%	10%	20	15%
3b7 Doing an online course % internet users	6%	7%	7%	15	9%
3b8 Online consultations and voting % internet users	7%	9%	9%	14	10%
3c1 Banking % internet users	69%	72%	72%	11	64%
3c2 Shopping % internet users	75%	76%	75%	6	69%
3c3 Selling online % internet users	28%	29%	25%	12	23%

France's overall score in this dimension increased slightly from a year earlier, although to a lesser extent than in the EU as a whole. Therefore, the country slipped down in the ranking and is now 16th out of 28 Member States. Although most of the indicators considered have remained stable, a large increase was recorded in the share of video on demand users, which, compared with 2016, nearly doubled to reach 23 %. The share of the internet-using French population (France's main strength in this dimension) remains high by European standards, as does the proportion of internet users engaging in online banking, buying or selling online. Conversely, the shares of French internet users participating in social networks and making video calls over the internet (48 % and 35 % respectively) are the lowest in the EU. There are also relatively few French internet users participating in online votes and consultations, using professional social networks or taking online courses.

4 Integration of digital technology

4 Integration of digital technology	France		EU
	rank	score	score
DESI 2019	14	40.7	41.1
DESI 2018	16	38.2	39.6
DESI 2017	14	37.7	37.6



	DESI 2017	France	DESI 2019	EU
	value	DESI 2018	value rank	DESI 2019
		value	value rank	value
4a1 Electronic information sharing % enterprises	39%	38%	38% 10	34%
	2015	2017	2017	2017
4a2 Social media % enterprises	14%	16%	16% 21	21%
	2016	2017	2017	2017
4a3 Big data % enterprises	11%	11%	16% 8	12%
	2016	2016	2018	2018
4a4 Cloud % enterprises	12%	NA	15% 17	18%
	2016	2017	2018	2018
4b1 SMEs selling online % SMEs	16%	16%	15% 17	17%
	2016	2017	2018	2018
4b2 e-Commerce turnover % SME turnover	10%	11%	11% 12	10%
	2016	2017	2018	2018
4b3 Selling online cross-border % SMEs	8%	7%	7% 19	8%
	2015	2017	2017	2017

Thanks to progress accomplished over the past year in DESI's dimension covering the integration of digital technology by businesses¹⁴⁵, France moved up to the 14th place in the ranking. Its overall score is in line with the European average. Between 2016 and 2018, the proportion of French companies using electronic invoicing and cloud computing increased from 11 % to 16 % and from 12 % to 15 % respectively. The share of companies using electronic information sharing solutions is higher than for the EU as a whole (2017). However, relatively fewer companies are active on social media. In the same vein, e-commerce uptake levels by French enterprises are still below the EU average and vary significantly with company size: only 15 % of small and medium-sized enterprises sell online compared to nearly 44 % of large enterprises

In October 2018, France launched '*France Num*', a national initiative for the digital transformation of small and medium-sized enterprises and microenterprises (see 'Highlight' below). French start-ups in the digital sector are becoming increasingly attractive to foreign investors yet often encounter difficulties to grow; e.g. there are, despite recent increases, relatively few deals worth EUR 50 million or more, and the number of French "unicorns" (i.e. private companies valued at USD 1 billion or more) remains limited. Fund-of-funds initiatives have been renewed under the Investment for the future ('*Investissements d'avenir*') programme, and a new fund (French Tech Seed Fund, endowed

¹⁴⁵ Unless otherwise stated, figures exclude companies in the financial sector as well as those with fewer than 10 employees.

with EUR 400 million) has been created to support tech start-ups at their early stages of development, especially deep tech start-ups and those younger than three years old. Major private initiatives include Station F, founded in June 2017 and currently the largest business incubator in the world (see last year's Highlight).

France is likewise committed to the development of innovative digital technologies including by means of strategic investments coordinated at EU level: it is a member of the EuroHPC Joint Undertaking and has signed the European Blockchain Partnership Declaration¹⁴⁶ as well as the Declaration of Cooperation on Artificial Intelligence. In addition, drawing on the findings of the 2018 Villani Report, a national strategy for artificial intelligence (AI for humanity) has been designed and foresees EUR 1.5 billion in public investments until 2022 (including EUR 400 million for innovation). Priority areas include mobility, environment, security and health, notably the creation of a Health Data Hub. The Innovation and Industry Fund ('*Fonds pour l'innovation et l'industrie*') has also started funding two major undertakings ('*grands défis*') selected by the National Innovation Council in the field of artificial intelligence.

Timely development of enabling technologies, such as the Internet of Things, 5G networks, high performance computing and, more generally, the data economy, will be one of the keys to the success of the above-mentioned initiatives. It will also be crucial to continue to make sure that companies of all sizes and across sectors are able to benefit from digitisation.

Highlight 2019: France Num

*France Num*¹⁴⁷, launched in October 2018, aims to further promote the digital transformation of businesses. It notably encompasses a dedicated guarantee scheme (initial contribution from the French State of EUR 30 million) that partly draws on EU funding and seeks to unlock EUR 1 billion worth of loans to small and medium-sized enterprises and microenterprises to be provided via commercial banks over the course of 2019.

Other noteworthy features of this initiative include the development of a national platform centralising relevant resources and information (e.g. assessment tools, sources of funding, good practices, relevant events nearby...) and connecting businesses with a network of public and private advisers (*activateurs*, over 1,500 of whom already at work throughout the country at the time of writing) as well as service providers to help them succeed in their digital transformation. Awareness-raising campaigns are another important component. *France Num*, which is based on a collaborative approach (over 30 institutional partners registered so far), focuses strongly on the provision of tailored advice to business, the implementation of which is to be monitored over time.

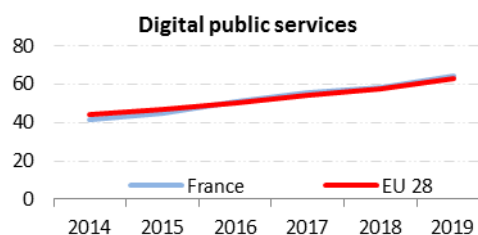
France Num's main strategic objective is to enable all companies within the target population (about 3.7 million) to use the services provided through the national platform by 2021.

¹⁴⁶ [In addition, France announced its national strategy on blockchain in April 2019.](#)

¹⁴⁷ <https://www.entreprises.gouv.fr/numerique/france-num>

5 Digital public services

5 Digital public services	France		EU
	rank	score	score
DESI 2019	15	64.1	62.9
DESI 2018	15	58.4	57.9
DESI 2017	14	55.3	54.0



	DESI 2017	France	DESI 2019		EU
	value	DESI 2018	value	rank	DESI 2019
5a1 e-Government users % internet users needing to submit forms	62%	67%	71%	13	64%
	2016	2017	2018		2018
5a2 Pre-filled forms Score (0 to 100)	27	32	36	21	58
	2016	2017	2018		2018
5a3 Online service completion Score (0 to 100)	86	89	90	13	87
	2016	2017	2018		2018
5a4 Digital public services for businesses Score (0 to 100) - including domestic and cross-border	84	85	89	12	85
	2016	2017	2018		2018
5a5 Open data % of maximum score	NA	NA	83%	3	64%
			2018		2018
5b1 e-Health services % individuals	NA	12%	12%	20	18%
		2017	2017		2017
5b2 Medical data exchange % of general practitioners	NA	NA	51%	11	43%
			2018		2018
5b3 e-Prescription % of general practitioners	NA	NA	34%	19	50%
			2018		2018

France ranks 15th out of 28 Member States in the Digital public services dimension of DESI. Its score has improved over the past year and is now slightly higher than the EU average. The country performs strongly in open data use: it is the third best performer in the EU according to the Euro Data Portal composite indicator. It also scores above the EU average in terms of interaction between internet users and public authorities, online service completion (measured as the share of administrative steps related to major life events that can be dealt with online) and availability of digital public services for businesses. France's performance is significantly weaker, however, regarding the amount of pre-filled data in public services' online forms. About 12 % of the population used e-health services such as online consultations in 2017, compared with an EU average of 18 %. 34 % of general practitioners, in turn, declared to be using e-prescriptions in 2018 compared with 50 % for the EU as a whole (which may have to do with the fact that this service has not been fully implemented in France yet) and 51 % of them exchanged medical data online (EU average 43 %).

A number of projects were launched in 2018 to implement 'FranceConnect', the digital transformation component of the country's public service modernisation programme ('Action Publique 2022'), which was launched in October 2017 and notably aims at digitising all public services by 2022. Public investment in this area totalled EUR 176 million in 2018 and served to fund several projects, such as development of AI solutions to improve public employment services; use of AI and

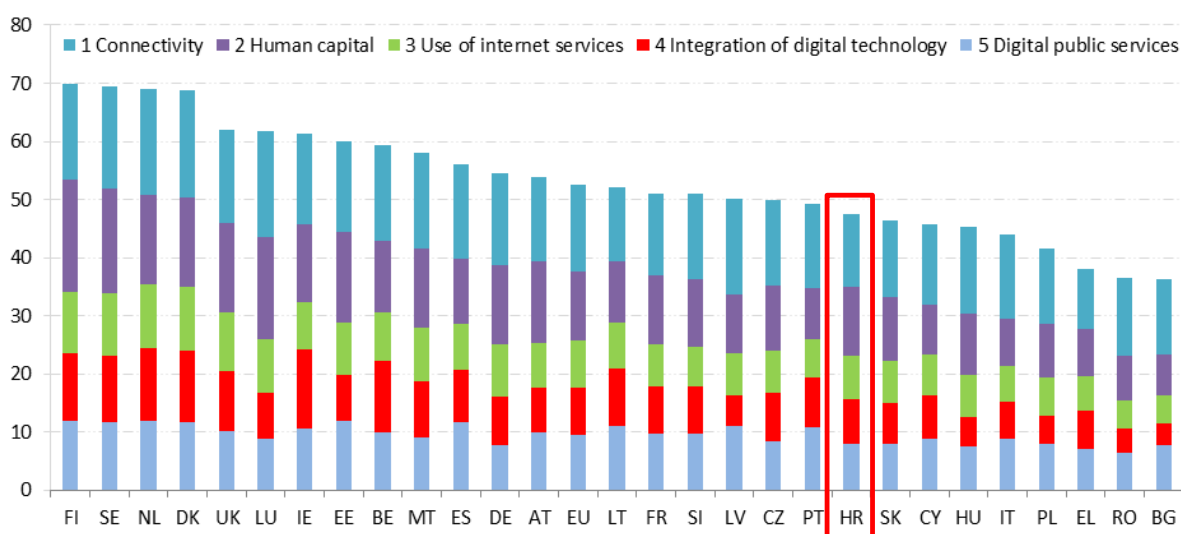
data mining to increase tax control efficiency; digitisation of administrative procedures linked to the Ministry of Culture, and the creation of an online labour law repository. Several measures to enhance access to digital services have also been undertaken as part of the '*Plan National pour un Numérique Inclusif*' (see section 2, Human capital, for more details). In the area of e-health, telemedical consultations are already reimbursed by the national health insurance system for primary care, and a personalised digital space for patients is expected to be operational by 2022. In addition, an AI-based Health Data Hub is under development (see section 3).

France has taken steps to position itself at the forefront of digitally-enabled public service modernisation. Full implementation of the country's strategy in this area, including through additional efforts to improve access to e-Health services and increase the amount of pre-filled data in online forms, is likely to bring further improvements in terms of availability and uptake by people and businesses alike.

Croatia

	Croatia		EU
	rank	score	score
DESI 2019	20	47.4	52.5
DESI 2018	21	43.8	49.8
DESI 2017	20	41.4	46.9

Digital Economy and Society Index (DESI) 2019 ranking



Croatia ranks 20th out of the 28 EU Member States in the European Commission Digital Economy and Society Index (DESI) 2019.

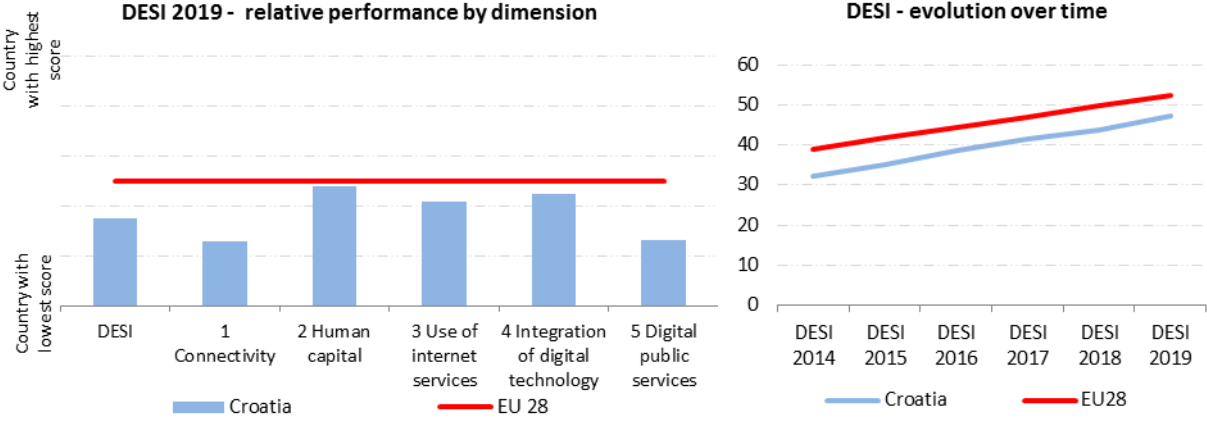
Its score increased thanks to an improved performance in some of the DESI dimensions measured. Croatia performs well in fixed broadband coverage and improved 4G and NGA coverages but is still performing low in Connectivity.

Croatia made progress on internet use and digital public services dimensions. Croats are among the EU's keenest readers of online news, and Croatian businesses use social media, big data and e-commerce. Still, one fifth of Croatians are not yet online. Despite growing demand on the labour market, the supply of ICT specialists is below the EU average. Among all dimensions, Croatia ranks highest in the Human capital, with the eight highest share of ICT graduates.

Croatia has no overarching digital skills strategy but currently addresses the issue through various strategic documents. It is preparing the 'National Development Strategy Croatia 2030¹⁴⁸', which will become the country's main strategic document. This will be developed in three phases in the course of 2019, and implementation is expected by 2021, once the document has been adopted by the Croatian Parliament.

¹⁴⁸ <https://www.hrvatska2030.hr/>

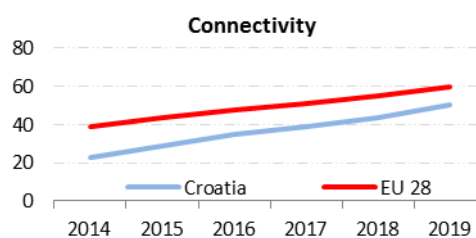
During the course of 2018 and 2019, Croatia has launched over 40 different digital projects that will further shape the digitisation of the Croatian public administration¹⁴⁹.



¹⁴⁹ The projects are valued at around 1 billion HRK (€134,000,000). Due to their longer nature (2-3 years), the full impact will be further studied in the next editions of DESI country report.

1 Connectivity

1 Connectivity	Croatia		EU
	rank	score	score
DESI 2019	27	50.1	59.3
DESI 2018	27	43.5	54.8
DESI 2017	27	39.0	51.2



	Croatia				EU
	DESI 2017	DESI 2018	DESI 2019		DESI 2019
	value	value	value	rank	value
1a1 Fixed broadband coverage	97%	99%	>99.5%	8	97%
% households	2016	2017	2018		2018
1a2 Fixed broadband take-up	70%	70%	72%	19	77%
% households	2016	2017	2018		2018
1b1 4G coverage	67%	73%	94%	19	94%
% households (average of operators)	2016	2017	2018		2018
1b2 Mobile broadband take-up	78	82	84	21	96
Subscriptions per 100 people	2016	2017	2018		2018
1b3 5G readiness	NA	NA	0%	13	14%
Assigned spectrum as a % of total harmonised 5G spectrum			2018		2018
1c1 Fast broadband (NGA) coverage	60%	68%	83%	20	83%
% households	2016	2017	2018		2018
1c2 Fast broadband take-up	7%	14%	19%	26	41%
% households	2016	2017	2018		2018
1d1 Ultrafast broadband coverage	NA	35%	39%	26	60%
% households		2017	2018		2018
1d2 Ultrafast broadband take-up	0%	1%	5%	26	20%
% households	2016	2017	2018		2017
1e1 Broadband price index	56	63	72	26	87
Score (0 to 100)	2016	2017	2018		2017

Despite some progress, Croatia has made no significant improvements in Connectivity overall compared with 2018, and remained at the bottom of the ranking. Fixed coverage, at nearly 100 %, is above the EU average of 97 %. Croatia has increased the take-up of fixed broadband by two percentage points, but remains below the EU average. Mobile broadband take-up has improved slightly, but also remains below the EU average. Croatia has improved its fast broadband (NGA) coverage to 83 %, which is now the EU average level. On ultrafast (100 Mbps and above) broadband, Croatia is lagging behind significantly, with only 39 %, compared with an EU average of 60 %. The rate of fast broadband subscriptions increased markedly last year (up from 7 % in 2017 to 19 %), but remains very low.

The current National Broadband Access Development Strategy is not aligned with the gigabit society objectives, but preparatory work for this alignment has already started, as has the development of the draft National Development Strategy for 2030. The goals set for 2020 as regards NGA coverage are hard to achieve, despite the existence of two national EU-co-financed NGN schemes with a budget of €224.4 million (of which €209.2 million comes from the ERDF). Both programmes focus on areas where high-speed connectivity is neither available nor planned due to the lack of commercial

interest. While the funding is available, the implementation of both programmes is seriously delayed and the milestones are being postponed, putting at risk the absorption of the available funds. The incumbent has slowed down its FTTH rollout, but continued reconstructing its copper network by building street cabinets and new nodes. It has also started testing G.fast technology on FTTB networks, in the expectation of commercial deployment in 2019.

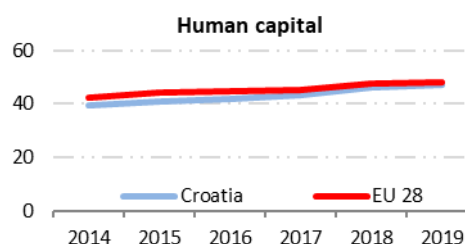
The limited 5G trials which began in 2017 have continued, and the first 5G commercial networks are expected to start operating in 2020. In 2018, Croatia introduced additional measures to increase the investment potential of operators, especially for the deployment of 5G networks and services¹⁵⁰. In June 2018, the country abolished the one-off fees for the use of radio spectrum for public mobile networks, €2 million per mobile network operator, for each new frequency band. In November 2018, the annual fee for the use of the radio frequency spectrum was further reduced for all three operators by 50 %. This could help to explain the improvement in the Broadband Price Index (on which Croatia scores 26, compared with 28 last year). However, Croatia has not adopted a national roadmap including detailed steps to enable the 700 MHz frequency band to be used for mobile broadband by 30 June 2020. No spectrum has been assigned in the 700 MHz band or in the 2.6 GHz band. While Croatia has assigned some spectrum in the 3.4 - 3.8 GHz band, there is no indication as to when the rest of the band will be auctioned. As the existing rights of use in the lower part of the band run beyond 31 December 2020, refarming will be necessary to ensure that the entire band is available countrywide by the deadline. Croatia has assigned 440 MHz (which is 21 % of the spectrum harmonised at EU level) for wireless broadband. This is below the EU average of 39 %.

Some progress was made in 2018. However, it was slow and insufficient to increase the DESI ranking. Croatia could speed up the rollout of the approved EU-funded access and backhaul networks to avoid the risk of losing EU funds. While the reduction of fees for the use of radio-spectrum is a positive development, Croatia still lacks a dedicated comprehensive strategy for 5G deployment and a roadmap for the timely assignment of the pioneer bands which could improve its prospects for improving its wireless connectivity.

¹⁵⁰ In December 2017, Croatia cut the annual fee for the use of the radio frequency spectrum for all three operators by a third.

2 Human capital

2 Human capital	Croatia		EU
	rank	score	score
DESI 2019	13	47.1	48.0
DESI 2018	13	46.1	47.6
DESI 2017	15	43.2	45.4



	DESI 2017	Croatia	DESI 2019	EU
	value	DESI 2018 value	value rank	DESI 2019 value
2a1 At least basic digital skills % individuals	55%	NA	NA	57%
2a2 Above basic digital skills % individuals	33%	NA	NA	31%
2a3 At least basic software skills % individuals	58%	NA	NA	60%
2b1 ICT specialists % total employment	2.7%	3.3%	3.3% 17	3.7%
2b2 Female ICT specialists % female employment	1.0%	0.9%	0.9% 21	1.4%
2b3 ICT graduates % graduates	3.3%	4.1%	4.7% 8	3.5%

In the Human capital¹⁵¹ dimension, Croatia ranks 13th out of EU countries, slightly below the EU average. Increasing number of Croats are going online and digital skills oscillate around the EU averages. Croatian SMEs lack sufficient ICT specialists, since at least 57 % of those that need such specialists in 2018 report difficulties in filling vacancies¹⁵². The number of ICT graduates continues to grow. Female ICT specialists represent very small proportion of total female employment - only 0.9 % of employed women.

The National Development Strategy, Croatia 2030, will address digital skills vertically through 'Digital Society' priority and through cross-cutting policies, 'Education and Human Resource Development' and 'Industrial Development and Entrepreneurship'.

A reformed curriculum has been introduced in 151 schools as part of a pilot project: eSchool: Establishment of the Digital Maturity Schools Development Programme. This has brought digital content and technology to the primary and secondary school systems. The national rollout of remaining schools was launched, once the pilot project has been completed in 2018.

The obligatory ICT classes were introduced in the fifth and sixth grade of primary school in 2018. Sixth graders have also benefited through the ProMikro, which has project that entered its second phase. ProMikro, introduced by the Croatian Academic and Research Network (CARNET), is designed to educate teachers in new ways of using microcomputers in teaching. With the 22,000 state

¹⁵¹ Some data points have been removed because of potential break in series.

¹⁵² Digital Scoreboard 2019

scholarships for Science, Technology, Engineering and Mathematics (STEM) studies, Croatia aims to increase interest and graduation rate in the STEM studies.

The Algebra University College has launched the programme called IT Education for a safer tomorrow that targets unemployed adults with low qualifications or none at all. It offers qualifications for web designers, computer operators, system and network administrators, and computer programmers. The 'Digital Citizen' project, launched in 2018 with the support of Google, is designed to bring digital skills to local communities through public libraries transformed into digital innovation centres.

Croatia has launched a National Digital Skills and Jobs Coalition¹⁵³. The goal is full cooperation with business, educational institutions and the public and private sectors, and to encourage young people to pursue their careers in ICT. Croatia actively participated in EU Code Week¹⁵⁴ in 2018. There were 439 activities organised around the country, with 22,400 participants, including almost 10,000 girls and women.

The ICT Supergirls¹⁵⁵ initiative encourages young women and girls to pursue careers in ICT through annual events and a mentoring programme 'You can do IT'. Women Techmakers, Google's brand and global programme for women in technology, promotes an inclusive environment for women in technology and celebrates women who play leading roles in the industry through various events and panels in Croatia.

Nurturing digital skills is the biggest priority, and it is key to improve labour market access in Croatia. With its growing supply of highly-skilled employees, Croatia is tackling existing skills mismatches in companies' workforces. Increasing the number of ICT specialists and focusing strongly on re-skilling and up-skilling is important if Croatia is to tap the full potential offered by the digital economy.

Highlight 2019: Achievements in International Competitions

Croatia is very active and well represented in international competitions

- In 2018, Croatian primary and secondary school students: were among the top groups competing in the fifth International Robotics Competition, 'RoboFinist'. Croatian robotics won several top spots in the competition.
- Croatia's best young computer scientists competed in the 30th International Olympiad in Informatics, in Tsukuba, Japan. Students from Zagreb's Mathematics School won two silver medals and a bronze medal.
- During the World Robotics Championship in Montreal in 2018, competitors representing Croatia won two gold medals.
- The Croatian robotics team from the Josip Antun Čolčić primary school in Đakovo got through to the final round of the MakeX competition in China, among sixteen of the best teams in the world.

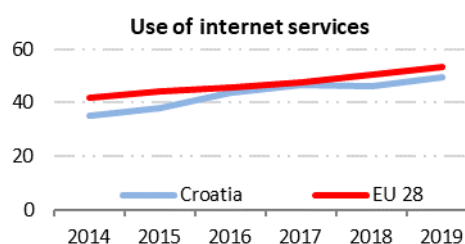
¹⁵³ <https://digitalnakoalicija.hup.hr/koalicija>

¹⁵⁴ EU Code Week is a grassroots initiative designed to bring coding and digital literacy to everybody in a fun and engaging way. For more on EU Code Week, see: <https://codeweek.eu/>

¹⁵⁵ <https://ictsupergirls.lemax.net/about-us/>

3 Use of internet services

3 Use of internet services	Croatia		EU
	rank	score	score
DESI 2019	15	49.7	53.4
DESI 2018	18	46.1	50.7
DESI 2017	12	46.7	47.8



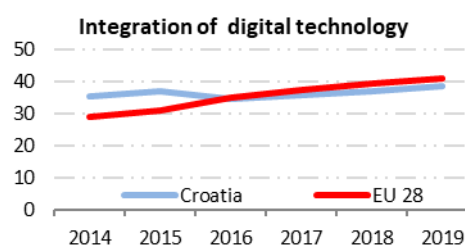
	Croatia				EU
	DESI 2017	DESI 2018	DESI 2019		DESI 2019
	value	value	value	rank	value
3a1 People who never used the internet	23%	28%	21%	25	11%
% individuals	2016	2017	2018		2018
3a2 Internet users	71%	NA	73%	23	83%
% individuals	2016	2017	2018		2018
3b1 News	91%	91%	91%	2	72%
% internet users	2016	2017	2017		2017
3b2 Music, videos and games	85%	85%	88%	6	81%
% internet users	2016	2016	2018		2018
3b3 Video on demand	17%	17%	26%	12	31%
% internet users	2016	2016	2018		2018
3b4 Video calls	45%	63%	69%	4	49%
% internet users	2016	2017	2018		2018
3b5 Social networks	69%	70%	72%	16	65%
% internet users	2016	2017	2018		2018
3b6 Professional social networks	8%	9%	9%	22	15%
% internet users	2015	2017	2017		2017
3b7 Doing an online course	7%	4%	4%	27	9%
% internet users	2016	2017	2017		2017
3b8 Online consultations and voting	12%	11%	11%	11	10%
% internet users	2015	2017	2017		2017
3c1 Banking	53%	50%	54%	21	64%
% internet users	2016	2017	2018		2018
3c2 Shopping	45%	NA	47%	24	69%
% internet users	2016	2017	2018		2018
3c3 Selling online	38%	37%	33%	4	23%
% internet users	2016	2017	2018		2018

Overall, the Use of internet services¹⁵⁶ in Croatia is broadly comparable with the EU average. Like people in the rest of the EU, Croatians are keen to engage in a variety of online activities such as reading news items, listening to music, watching videos, playing games and using social networks. As many as 91 % of Croatian internet users read news online (compared with 72 % in the rest of the EU). Yet one fifth of Croatian citizens are not yet online, and doing an online course is not popular among internet users. However, video on demand is growing in popularity; it has increased significantly over the last year (up from 17 % in 2017 to 26 % in 2018), putting Croatia in 12th place, slightly below the EU average of 31 %.

¹⁵⁶ Some data points have been removed because of potential break in series.

4 Integration of digital technology

4 Integration of digital technology	Croatia		EU
	rank	score	score
DESI 2019	18	38.6	41.1
DESI 2018	18	36.9	39.6
DESI 2017	17	35.9	37.6



	DESI 2017	Croatia		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
4a1 Electronic information sharing	29%	26%	26%	23	34%
% enterprises	2015	2017	2017		2017
4a2 Social media	15%	16%	16%	18	21%
% enterprises	2016	2017	2017		2017
4a3 Big data	9%	9%	10%	17	12%
% enterprises	2016	2016	2018		2018
4a4 Cloud	16%	22%	22%	10	18%
% enterprises	2016	2017	2018		2018
4b1 SMEs selling online	18%	17%	18%	13	17%
% SMEs	2016	2017	2018		2018
4b2 e-Commerce turnover	8%	9%	11%	11	10%
% SME turnover	2016	2017	2018		2018
4b3 Selling online cross-border	9%	8%	8%	14	8%
% SMEs	2015	2017	2017		2017

On the Integration of digital technology within businesses, Croatia ranks 18th among EU countries. Croatian enterprises are slowly integrating digital technologies into their business practices. With 15.5 % of enterprises at a high and very high level of digital intensity, Croatia lags behind the EU average of 18 %¹⁵⁷.

However, Croatian enterprises are increasingly taking advantage of the opportunities offered by online commerce: 18 % of SMEs sell online (above the EU average of 17 %), which represents an average of 11 % of their turnover and 8 % of all SMEs sell online cross-border. Moreover, social media are used by 16 % of enterprises (21 % in the EU as a whole), cloud by 22 % (18 % in EU), and one in four enterprises (26 %) use electronic information sharing. Big data is analysed only in every tenth enterprise in Croatia.

Croatia is committed to the advancement of new digital technologies and it invests in digital technologies, through EU-coordinated programmes. It is a member of the EuroHPC Joint Undertaking and has signed the Declaration on cooperation on Artificial Intelligence (AI) in 2018.

The National Platform for Digitalisation of the Industry of the Republic of Croatia is under preparation. The goals of the platform are to provide supporting conditions for the creation of networking opportunities, increase digital connectivity, prepare for Industry 4.0, further digitise public administration and develop technical standards and security of systems and data.

¹⁵⁷ Digital Scoreboard 2019

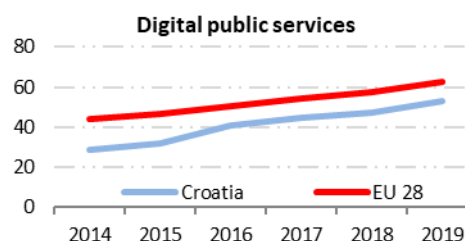
Innovation clusters continue to boost Croatia's innovation capacity. With flagship projects: Algebra LAB - Open Innovation Lab, CroTechHub, CROBOHUB, and HUB 385-Centre for Knowledge, Creativity and Innovation, Croatia encourages the use of advanced technologies such as robotics, cloud, Internet of Things (IoT), cybersecurity, big data, 3D printing and AI.

Croatia has adopted the Directive on Security of Network and Information Systems (NIS Directive) into its national law. The Act on cybernetic security of key service providers and digital service providers was adopted to strengthen the security of key network and information systems. Croatia also participated in a major national Cyber Shield exercise in 2018 to raise awareness of cyber threats, emphasising the importance of the management and coordination of the public sector, academic community and economic subjects.

To boost the digital transformation of the Croatian economy, it is important to raise awareness of the relevance of the digitisation of SMEs. In particular, attention should be paid to providing support for further digitisation of SMEs, business in disadvantaged regions, and female digital entrepreneurs. That way the full range of benefits from SMEs' the adoption of digital technologies can be captured.

5 Digital public services

5 Digital public services	Croatia		EU
	rank	score	score
DESI 2019	22	53.0	62.9
DESI 2018	23	47.3	57.9
DESI 2017	21	44.5	54.0



	Croatia		EU	
	DESI 2017	DESI 2018	DESI 2019	DESI 2019
	value	value	value	rank
5a1 e-Government users % internet users needing to submit forms	66%	66%	75%	11
	2016	2017	2018	2018
5a2 Pre-filled forms Score (0 to 100)	20	20	30	24
	2016	2017	2018	2018
5a3 Online service completion Score (0 to 100)	61	62	64	28
	2016	2017	2018	2018
5a4 Digital public services for businesses Score (0 to 100) - including domestic and cross-border	61	61	63	27
	2016	2017	2018	2018
5a5 Open data % of maximum score	NA	NA	62%	19
			2018	2018
5b1 e-Health services % individuals	NA	22%	22%	10
		2017	2017	2017
5b2 Medical data exchange % of general practitioners	NA	NA	51%	11
			2018	2018
5b3 e-Prescription % of general practitioners	NA	NA	97%	6
			2018	2018

On Digital public services, Croatia ranks 22nd out of EU countries, below the EU average. Croatia performs very well in e-prescriptions, and there is a high level of online interaction between public authorities and members of the public. 75 % of online users actively embrace e-government services. In 2018, Croatia performed better than the previous year as regards pre-filled forms. Furthermore, the availability of e-government services for business is on the rise. Croatia performs well the provision of e-health services and it ranks 10th in the EU as regards online users (22 % of online users). 97 % of general practitioners use e-prescriptions and 51 % of them exchange medical data.

The Croatian Government adopted several legislative proposals during the period in question. The Open Data Policy was adopted in 2018, representing the strategic direction in which public administration openness and transparency policy are set to develop. The legislative proposal for bringing Croatia's laws into line the directive of the European Parliament and of the Council on the accessibility of public sector bodies' websites was adopted in February 2019. The country is in the process of making all the governmental websites more readily accessible and moving them to a single platform, which is to be completed by the end of 2019.

Croatia has launched the development of an electronic process to link all the data of registering companies and start-ups by developing an electronic one-stop-shop through the e-Citizen system. This platform offers services to SMEs including an e-business service for accessing documents to do with taxation, health insurance or pension matters), while e-fees enable administrative fees and charges to be paid by electronic means. e-Citizen enables easier communication between members

of the public and the public sector and makes public sector services more transparent. It holds 54 e-services, while 76 are available outside the main platform. In 2018 it was modernised, additional functionalities were added and 10 e-services were incorporated (including e-baby, e-request for e-passport, e-exchange and e-submission for students). In 2019 Croatia is launching the Shared Service Centre (SSC), the e-government cloud solution, to further speed up development of public digital services.

Croatia's National Health Care Strategy for 2012–2020¹⁵⁸ sets the context, vision, priorities, goals and key measures in health care. The New Health Data and Information Act, adopted in January 2019, improves the scope of personal data protection in healthcare by amending regulations and laying down rules on the use and protection of data from patient medical records in Croatia's Central Health Care Information System in Croatia (CEZIH). The Act regulates prescribing, managing, storing, collecting and disposing of patient medical records in CEZIH and lays down principles for managing the professional documentation of healthcare workers and healthcare associates.

Investments in e-health services are relevant, and Croatia offers services such as e-referrals and an e-Medical Prescription System. Users can check prescribed medications and doctors can electronically prescribe medications to be collected directly from a pharmacy. There are also plans to establish, in the course of 2019, cross-border services involving e-prescription and access to patient data by physicians in the EU countries. Croatian pharmacists will be able to issue medicinal products to the EU citizens based on e-prescriptions issued in other EU countries.

Croatia has launched preparatory work on linking up hospitals to a central calendar to manage waiting lists more effectively, and to integrate the National Transfusion Programme (e-Delphyn) with the Hospital Information Systems (HIS). The Ministry of Health has drawn up a proposal for a Structural Reform Support Programme (SRSP) in 2019. The plan includes the preparation, development and adoption of a new 'Croatian eHealth Strategic Development Plan for 2020-2025'.

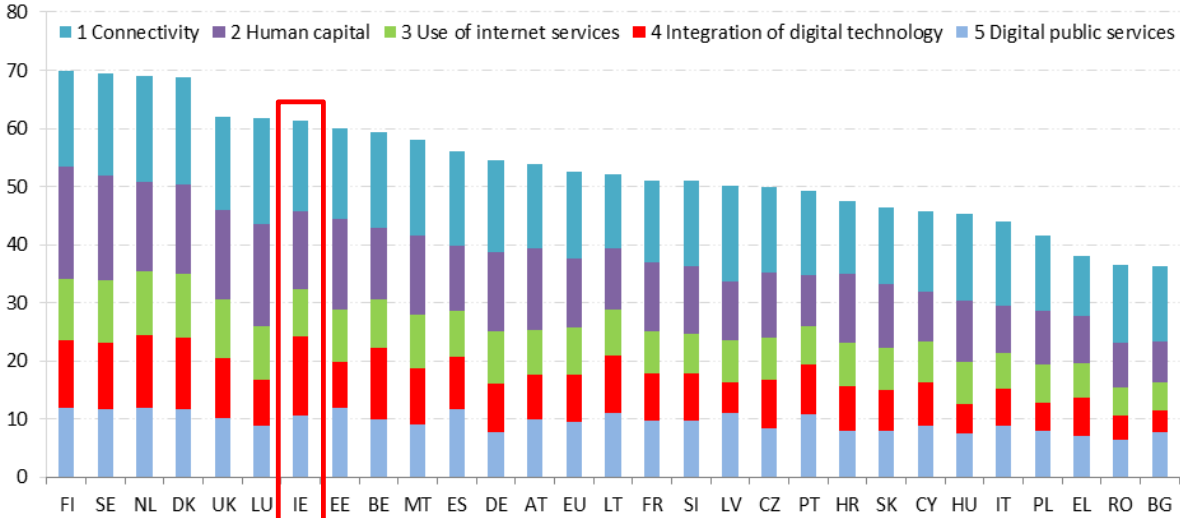
Further digital integration by all public actors could lead the way to even more significant improvements in digital public administration. Additional measures to make e-health mobile services available to all, regardless of their geographical location, could boost take-up of even further.

¹⁵⁸ <https://ec.europa.eu/migrant-integration/librarydoc/national-health-care-strategy-2012---2020>

Ireland

	Ireland		EU
	rank	score	score
DESI 2019	7	61.4	52.5
DESI 2018	8	57.0	49.8
DESI 2017	10	52.8	46.9

Digital Economy and Society Index (DESI) 2019 ranking



Ireland ranks 7th out of the 28 EU Member States in the European Commission Digital Economy and Society Index (DESI) 2019.

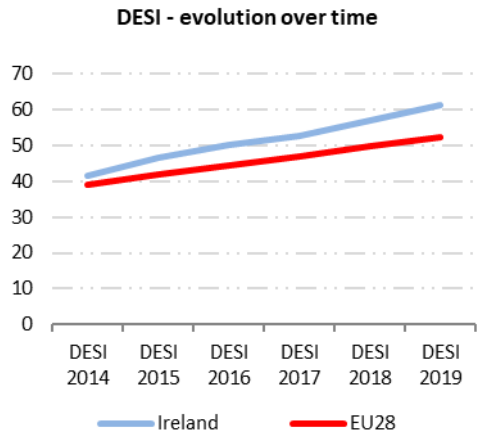
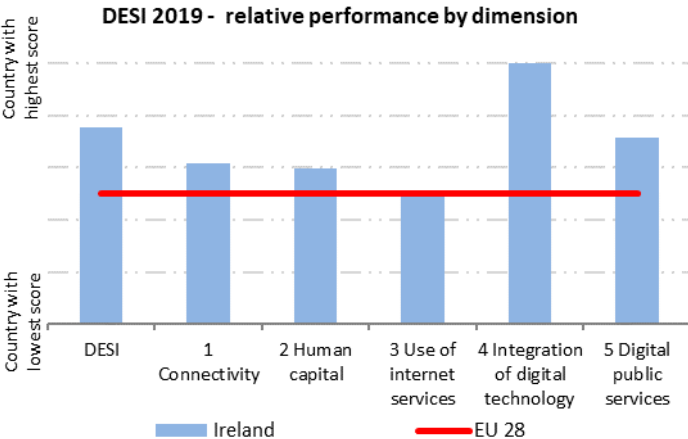
Its overall score increased due to an improved performance in all DESI dimensions measured. Ireland is number 1 in the EU in the Integration of digital technology dimension, particularly because Irish SMEs excel in the use of e-Commerce. Ireland records the highest growth in Digital public services with top ranking in open data and second place in services for business users.

While Ireland has improved its scores for Connectivity and Human capital, it ranks outside the top 10 in both of these dimensions, as well as for the Use of internet services by people. In particular, ultrafast broadband coverage is below the EU average and broadband in general is still relatively expensive. While Ireland performs above the EU average in high-level digital skills, the average digital skills of people are low: only 48 % have at least basic digital skills, well below the EU average of 57 %. It is therefore not surprising that the proportion of internet users is also below the EU average.

The Irish Digital Agenda¹⁵⁹ dates from 2013. It is currently under review and a new strategy is being developed. A public consultation took place in late 2018. It was also foreseen that the new strategy would cover a broad range of societal and economic areas including infrastructure and security; data,

¹⁵⁹ <https://www.dccae.gov.ie/en-ie/communications/topics/Digital-Strategy/Pages/default.aspx>

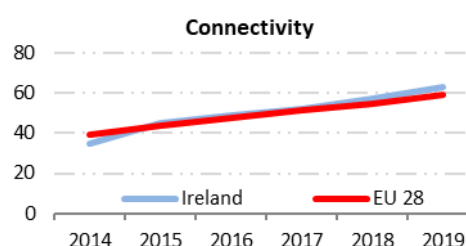
privacy and regulation; education and skills; trust, wellbeing and inclusion; digital public services, and innovation, the digital economy, and labour market changes¹⁶⁰.



¹⁶⁰ <https://www.gov.ie/en/news/69baa0-government-seeks-views-on-irelands-digital-strategy/>

1 Connectivity

1 Connectivity	Ireland		EU
	rank	score	score
DESI 2019	12	62.6	59.3
DESI 2018	12	57.2	54.8
DESI 2017	13	52.3	51.2



	Ireland		EU	
	DESI 2017 value	DESI 2018 value	DESI 2019 value	DESI 2019 rank
1a1 Fixed broadband coverage % households	96%	97%	98%	13
1a2 Fixed broadband take-up % households	69%	74%	73%	17
1b1 4G coverage % households (average of operators)	92%	92%	96%	17
1b2 Mobile broadband take-up Subscriptions per 100 people	94	101	102	9
1b3 5G readiness Assigned spectrum as a % of total harmonised 5G spectrum	NA	NA	30%	8
1c1 Fast broadband (NGA) coverage % households	82%	93%	96%	5
1c2 Fast broadband take-up % households	41%	51%	54%	10
1d1 Ultrafast broadband coverage % households	NA	53%	56%	21
1d2 Ultrafast broadband take-up % households	14%	18%	20%	15
1e1 Broadband price index Score (0 to 100)	72	72	75	24

Ireland maintains its ranking (12th) among EU countries, slightly outscoring the EU average (62.6 compared with 59.3). Its best performance comes in fast broadband, where in just 5 years it has turned from being a laggard to being a leader. Specifically, Ireland ranks 5th in fast broadband coverage with 96 %, compared with an EU average of 83 %; and 10th in fast broadband take-up, with 54 %, compared with an EU average of 41 %. Ireland outperforms the EU in most connectivity indicators. However, it lags behind in fixed broadband take-up (coming 17th with 73 %, compared with 77 %, the EU average) and in ultrafast broadband coverage (21st with 56 % compared with an EU average of 60 %). It is also one of the EU's most expensive countries in terms of fixed broadband (coming 24th, with a broadband price index of 75, compared with an EU average of 87).

The 2015 National Broadband Plan (NBP) Intervention Strategy provides for a minimum download of 30 Mbps and a minimum upload of 6 Mbps, to be provided to all premises through a mix of private and public intervention. According to the national authorities, commercial operators in the Irish market have invested over €2.75 billion in upgrading and modernising their networks over the past 5 years, with further investments planned, covering the majority of premises. The public intervention addresses the remaining 540,000 premises. Through a procurement process, Ireland is selecting the

body that will build, maintain and operate over a 25-year term a state-funded network and offer wholesale services on an open-access basis. The remaining bidding consortium is proposing an ambitious solution based on deploying a predominantly fibre-to-the-home (FTTH) network. On 7 May 2019, the Irish Government announced the approval of the appointment of a preferred bidder to the National Broadband Plan. According to this announcement, the contract will be awarded, following confirmation of State Aid Approval by the European Commission.

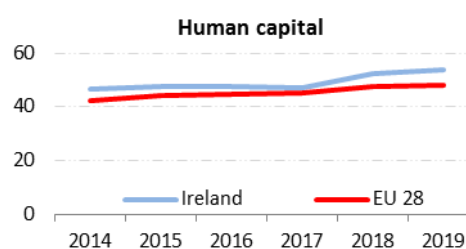
Ireland expresses its awareness of the importance of 5G infrastructure but still lacks a 5G connectivity strategy and a clear timetable for assigning the 700 MHz band. 5G trials are facilitated with the use of ComReg's Test and Trial Licensing scheme¹⁶¹. Ireland ranks eight on the 5G readiness indicator, as it had assigned spectrum in the 3.4-3.8 GHz band by the end of 2018, in accordance with Commission Decision (EU)2019/235, and the spectrum is expected to become available for use for 5G by 2020. The assignment process has therefore enabled large blocks of spectrum to be acquired, facilitating the provision of gigabit 5G services at reasonable prices (4.86 euro cent/MHz/pop). Transition licences allow legacy users to continue using the band, although their licences have already expired. Ireland has assigned a total of 760 MHz, which is 36 % of the spectrum harmonised at EU level for wireless broadband.

The implementation of the publicly supported broadband intervention in rural areas is essential to bridge the geographical divide and ensure that ultrafast broadband networks reach all Irish households, in line with the gigabit society targets for 2025. Persistent delays, specifically in laying down rules on the penalties for breaching the net neutrality rules and on transposing Article 8 of the Broadband Cost Reduction Directive for 2014/61, as well as the absence of dissuasive, direct sanctioning power of ComReg as regards market monitoring and regulation, might also undermine legal certainty and the further development of the electronic communications sector.

¹⁶¹ www.testandtrial.ie

2 Human capital

2 Human capital	Ireland		EU
	rank	score	score
DESI 2019	11	53.8	48.0
DESI 2018	11	52.2	47.6
DESI 2017	12	47.0	45.4



	DESI 2017	Ireland	DESI 2019	EU
	value	DESI 2018	value rank	DESI 2019
2a1 At least basic digital skills % individuals	44% 2016	48% 2017	48% 23 2017	57% 2017
2a2 Above basic digital skills % individuals	25% 2016	28% 2017	28% 19 2017	31% 2017
2a3 At least basic software skills % individuals	46% 2016	49% 2017	49% 23 2017	60% 2017
2b1 ICT specialists % total employment	4.0% 2015	4.3% 2016	4.4% 8 2017	3.7% 2017
2b2 Female ICT specialists % female employment	1.7% 2015	1.9% 2016	2.0% 4 2017	1.4% 2017
2b3 ICT graduates % graduates	5.4% 2014	6.5% 2015	7.0% 2 2016	3.5% 2015

Ireland ranks 11th in the Human capital dimension, scoring above the EU average. It performs well when it comes to high level ICT skills: it has the 2nd largest share of ICT graduates and the share of ICT specialists in the workforce (4.4 %) is also above the EU average (3.7 %). Yet there is a significant shortage of ICT specialists.¹⁶² The 2 % share of ICT specialists in total female employment is the 4th highest in the EU. However, Ireland performs rather poorly when it comes to the average digital skills of the wider adult population, including the workforce. Less than half of the adult population has at least basic digital skills, well below the EU average (57 %). Only 28 % of people have digital skills above a basic level, below the EU average of 31 %. This general gap in digital skills is also confirmed by the OECD PIAAC survey of adult learning.

The need to step up upskilling initiatives to respond to digital transformation is also recognised in two policy analysis papers published by the Irish authorities in 2018¹⁶³. This does not only concern high-level or specialised ICT skills (addressed under the Springboard+ upskilling programme or the apprenticeship schemes), but also general, non-specialist digital skills which are increasingly needed for all types of jobs across different sectors and qualifications.

¹⁶² National Skills Bulletin 2018, SOLAS, The Further Education and Training Authority

¹⁶³ Progress Review of the Further Education and Training Strategy 2014 – 2019, SOLAS The Further Education and Training Authority/Department for Education and Skills, June 2018]; ‘Digital Transformation: Assessing the Impact of Digitalisation on Ireland’s Workforce’ Expert Group on Future Skills Needs, 7 December 2018.

The most relevant policy initiative to address high level ICT skills shortages was the adoption of Technology Skills 2022, the third ICT skills action plan¹⁶⁴. Since the adoption of the first action plan in 2012, the number of ICT graduates has increased by 70 %. As of 2018 57 % of demand for high level ICT specialists is expected to be met from 'home-grown' ICT graduates. This still falls short of previous targets (74 % for 2018), and is even below the starting point for the previous ICT skills action plan (60 %). This is because the demand for high level ICT skills has substantially exceeded the forecasts used as a basis for setting previous targets. The new action plan therefore assumes very high growth for demand for high level ICT skills and sets the ambitious target of increasing the number of graduates from Ireland's own education and training system by 65% by 2022. This represents an additional 5,000 graduates per year over existing numbers, allowing Ireland to meet up to 70 % of annual expected demand from its own education and training system. While most of this will come from the 'standard' tertiary education path, reskilling will also play an important role. To fill the demand gap, the new action plan also contains measures to keep attracting ICT specialists from abroad.

Ireland has continued implementing previous initiatives on education (in particular the 2018 Action Plan on Education), which included concrete actions on digital skills. Notably, in September 2018, Leaving Certificate courses in Computer Science were launched for the first time in selected schools. Students from 40 secondary schools are expected to sit, for the first time, for Leaving Certificate exams in computer science in 2020.

Ireland has also taken steps to improve the general (non-specialist) digital skills of adults. In 2018, Ireland put forward a new policy framework¹⁶⁵ to promote the upskilling of the workforce (including digital, but also other skills), focusing especially on employees needing it the most. A new pilot upskilling programme, EXPLORE, was also launched to improve, in particular, the digital skills of over 35s working in the manufacturing sector. As in previous years (since 2008), funding continued to be made available for introductory courses to bring people online who would not otherwise use the Internet.

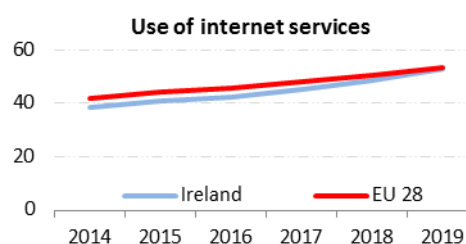
In conclusion, Ireland continues to work towards specific targets when it comes to digital skills education in schools and universities, in particular high-level and specialist ICT skills. It is also taking steps to improve upskilling and participation in adult learning in general, which may include digital skills. Basic online literacy training sessions are available for the least digitally literate adults. Ireland therefore has a number of strategies and initiatives in place which are relevant for digital skills. However, there is no coordinated and targeted strategy specifically for digital skills, which would cover all the different levels of skills and different stages of life, and which would provide a specific roadmap to close the digital skills gap with the rest of the EU.

¹⁶⁴ <https://www.education.ie/en/Publications/Policy-Reports/technology-skills-2022.pdf>

¹⁶⁵ "Supporting Working Lives and Enterprise Growth in Ireland"

3 Use of internet services

3 Use of internet services	Ireland		EU
	rank	score	score
DESI 2019	12	53.1	53.4
DESI 2018	13	48.6	50.7
DESI 2017	15	45.3	47.8

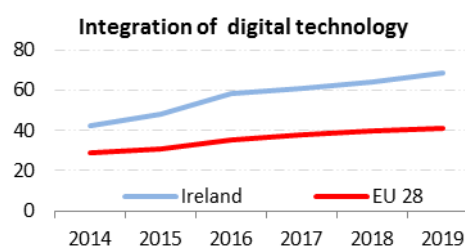


	DESI 2017	Ireland		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
3a1 People who never used the internet % individuals	15%	16%	16%	17	11%
3a2 Internet users % individuals	79%	79%	80%	17	83%
3b1 News % internet users	49%	65%	65%	25	72%
3b2 Music, videos and games % internet users	73%	73%	80%	16	81%
3b3 Video on demand % internet users	24%	24%	48%	6	31%
3b4 Video calls % internet users	42%	48%	46%	23	49%
3b5 Social networks % internet users	70%	72%	73%	14	65%
3b6 Professional social networks % internet users	17%	17%	17%	10	15%
3b7 Doing an online course % internet users	6%	5%	5%	19	9%
3b8 Online consultations and voting % internet users	4%	6%	6%	19	10%
3c1 Banking % internet users	64%	71%	70%	12	64%
3c2 Shopping % internet users	71%	64%	70%	10	69%
3c3 Selling online % internet users	13%	22%	29%	7	23%

Ireland ranks 12th in the Use of internet services dimension, one place up from DESI 2018. Its overall score is just below the EU average. The share of internet users in Ireland is below the EU average without any significant improvement. People who use the internet are keen to engage in a variety of online activities, in line with the rest of the EU. The most popular online activities are entertainment (music, videos and games), social networks, shopping and banking. People in Ireland are less likely to read news online or to take an online course than people in the rest of the EU. However, they are more likely to watch video on demand or use social networks for example.

4 Integration of digital technology

4 Integration of digital technology	Ireland		EU
	rank	score	score
DESI 2019	1	68.7	41.1
DESI 2018	1	64.0	39.6
DESI 2017	1	61.2	37.6



	DESI 2017	Ireland		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
4a1 Electronic information sharing % enterprises	25%	28%	28%	19	34%
4a2 Social media % enterprises	36%	36%	36%	4	21%
4a3 Big data % enterprises	NA	NA	20%	4	12%
4a4 Cloud % enterprises	24%	NA	33%	5	18%
4b1 SMEs selling online % SMEs	30%	30%	30%	2	17%
4b2 e-Commerce turnover % SME turnover	22%	23%	26%	1	10%
4b3 Selling online cross-border % SMEs	16%	17%	17%	1	8%

In the Integration of digital technology dimension Ireland retains its top ranking among EU countries. Irish SMEs continue to excel in the use of e-commerce. 30 % sell online and 17 % sell cross border, well above the EU average of 17 % and 8 % respectively. 26 % of the total turnover generated by SMEs comes from online sales, more than double the EU average of 10 %. Irish companies also rank relatively high on the use of big data (20 %), cloud services (33 %) and social media (36 %).

In addition to the relatively long-running scheme to help SMEs trade online (Trading Online Voucher Scheme), a new pilot (pilot Online Retail Scheme) was launched to help retail SMEs specifically to boost their online sales. More generally, the digitisation of SMEs has been singled out as the priority for the first programmes to be launched by the European Investment Advisory Hub. It was agreed that EIB experts together with the Irish authorities would identify the knowledge and funding gaps preventing the digitisation of Irish SMEs and would develop funding mechanisms to address these gaps¹⁶⁶. The Government also committed to implementing a strategic approach to maximise the benefits from digitisation and incentivising SMEs to invest in new technologies¹⁶⁷.

Irish ICT start-ups continue to feature prominently among the beneficiaries of Ireland's start-up support schemes. Deeptech and Fintech in particular are priority areas for start-up funding. The first

¹⁶⁶ The EIB subsequently delivered its respective report in March 2019 (<https://www.eib.org/en/infocentre/publications/all/the-digitalisation-of-smes-in-ireland.htm>)

¹⁶⁷ Government of Ireland, *Future Jobs 2019 – Preparing now for tomorrow's economy* (<https://dbei.gov.ie/en/Publications/Future-Jobs-Ireland-2019.htm>)

calls under the EUR 500 million Disruptive Technologies Innovation Fund ran in 2018. More than 10 out of the first 27 approved projects related to ICT. Ireland ranks 7th (6th in the EU) in Startup Europe's ranking of European scale-up ecosystems¹⁶⁸.

Ireland is committed to advancing new digital technologies and to investing strategically in digital technologies through EU-coordinated programmes. For example, Ireland is signatory to the Declaration of Cooperation on Artificial Intelligence and to the Declaration on European Blockchain Partnership. However, it has not yet joined other key EU initiatives relating to high-performance computing and sequenced genomes.

As for domestic initiatives, there are now four ICT-related Technology Centres (advanced manufacturing, AI/machine learning and microelectronics). These centres provide a bridge between research and business by allowing Irish companies and multinationals to work together on market-focussed strategic R&D projects in collaboration with research institutions. Both the AI and advanced manufacturing technology centres have in the region of 100 research partners. The AI centre "CeADAR" was approved for a second five-year cycle of funding. Based on innovative research, it offers concrete tools and solutions that companies can integrate and use in their operations. Five of Ireland's 15 Technology Gateways (based in the Institutes of Technology) also formed an Applied Internet of Things Cluster, through which industry can avail of full-time researchers and engineering professionals in the relevant areas. Science Foundation Ireland research centres also link scientists and engineers in partnerships across 19 research bodies, including all seven universities, and over 325 companies across Ireland. Their areas of focus include Big Data Analytics, Nanotechnology Materials, Software, and Digital Content.

These initiatives are likely to be boosted by Ireland's strategy to secure high-level and specialist ICT talent and its increasing focus on digital skills in schools. This notwithstanding, it is also important to improve the wider ecosystem for the integration of digital technologies by ensuring sufficient, future-proof connectivity and by improving the average digital skills of the current workforce.

Highlight 2019: Knowledge Transfer Ireland

Knowledge Transfer Ireland (KTI) aims to help business to connect and engage with Ireland's research base (universities, institutes of technologies and research centres). The KTI web portal¹⁶⁹ provides an overview of Ireland's research landscape and allows users to obtain a detailed picture of the research capabilities of the country's research base. KTI's mission is *"to support business and the research base to maximise innovation from State funded research by getting technology, ideas and expertise into the hands of business, swiftly and easily for the benefit of the public and the economy"*¹⁷⁰. KTI's web portal also provides practical help and technical advice to its users, for example when it comes to intellectual property and licencing arrangements.

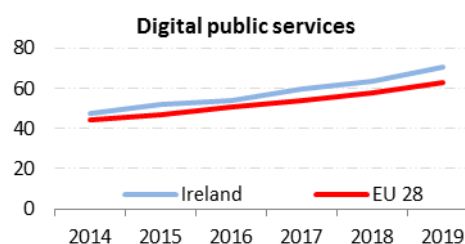
¹⁶⁸ *Tech Scaleup Europe 2018 Report*, Startup Europe Partnership, 2018

¹⁶⁹ <https://www.knowledgetransferireland.com/>

¹⁷⁰ <https://www.enterprise-ireland.com/en/Research-Innovation/Companies/Collaborate-with-companies-research-institutes/Knowledge-Transfer-Ireland/>

5 Digital public services

5 Digital public services	Ireland		EU
	rank	score	score
DESI 2019	10	70.2	62.9
DESI 2018	10	63.5	57.9
DESI 2017	11	59.4	54.0



	DESI 2017	Ireland		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
5a1 e-Government users % internet users needing to submit forms	71%	77%	72%	12	64%
	2016	2017	2018		2018
5a2 Pre-filled forms Score (0 to 100)	35	39	67	13	58
	2016	2017	2018		2018
5a3 Online service completion Score (0 to 100)	89	89	88	15	87
	2016	2017	2018		2018
5a4 Digital public services for businesses Score (0 to 100) - including domestic and cross-border	97	99	99	2	85
	2016	2017	2018		2018
5a5 Open data % of maximum score	NA	NA	88%	1	64%
			2018		2018
5b1 e-Health services % individuals	NA	11%	11%	21	18%
		2017	2017		2017
5b2 Medical data exchange % of general practitioners	NA	NA	63%	8	43%
			2018		2018
5b3 e-Prescription % of general practitioners	NA	NA	8%	25	50%
			2018		2018

Ireland ranks 10th among EU countries in the Digital public services dimension, above the EU average. Ireland ranks 1st in Open data and 2nd in Digital public services for businesses. While above the EU average, the indicators which include private users are less impressive (e-government users, pre-filled forms, online service completion). However, the lowest rankings are in e-health. While 63 % of general practitioners exchange medical data (well above the EU average of 43 %), only 8 % of them use e-prescription (well below the EU average of 50 %). When it comes to use of e-health services, Ireland ranks only 21st (11 %, below the EU average of 18 %).

In line with the objectives of the e-Government strategy 2017-2020¹⁷¹, the Public Service Data Strategy 2019-2023¹⁷², published in December 2018, introduces a number of privacy, security and data protection measures. These relate to the data provided both by private and business users. The strategy aims to provide more transparency and more control to citizens over the use of their data. At the same time, it will also promote the reuse of data, where possible, so that citizens and businesses do not have to provide the same information over and over again (if successfully implemented, these measures should therefore help Ireland improve its position in the relevant DESI indicator on pre-filled forms).

¹⁷¹ <https://egovstrategy.gov.ie/>

¹⁷² <https://www.per.gov.ie/en/minister-of-state-odonovan-launches-the-public-service-data-strategy-2019-2023/>

An interesting initiative to secure ICT specialists for the public sector is a new ICT apprenticeship scheme. During the two year programme successful candidates will be trained as ICT specialists at different public bodies.

e-Health is considered a critical element of healthcare reform Following the recommendation of the 2017 cross-party report on healthcare reform (the "Sláintecare Report"), the '*Sláintecare*' Implementation Strategy and the National Development Plan 2018-2020¹⁷³ committed to provide the necessary investment for e-health. This will focus particularly on the nationwide rollout of the Electronic Health Records system (the foundation for a successful eHealth ecosystem) in the next 10 years, also with the help of EUR 225 million funding from the EIB.

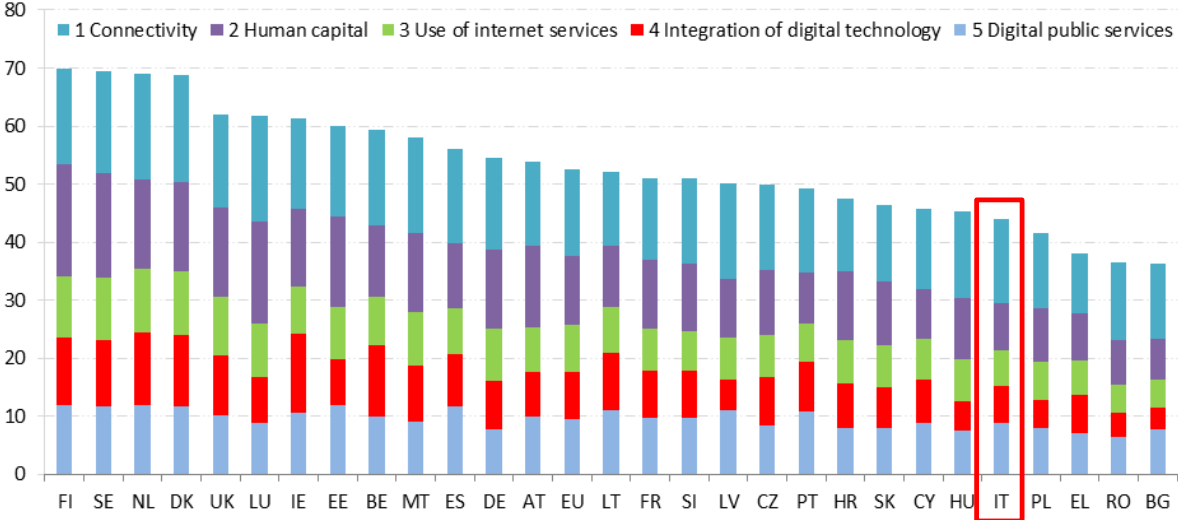
Addressing the digital skill gaps and ensuring an adequate, future-proof nationwide broadband connectivity are both of course prerequisites for effective digital public services and a successful e-health system.

¹⁷³ <https://www.per.gov.ie/en/national-development-plan-2018-2027/>

Italy

	Italy		EU
	rank	score	score
DESI 2019	24	43.9	52.5
DESI 2018	24	38.9	49.8
DESI 2017	24	36.5	46.9

Digital Economy and Society Index (DESI) 2019 ranking

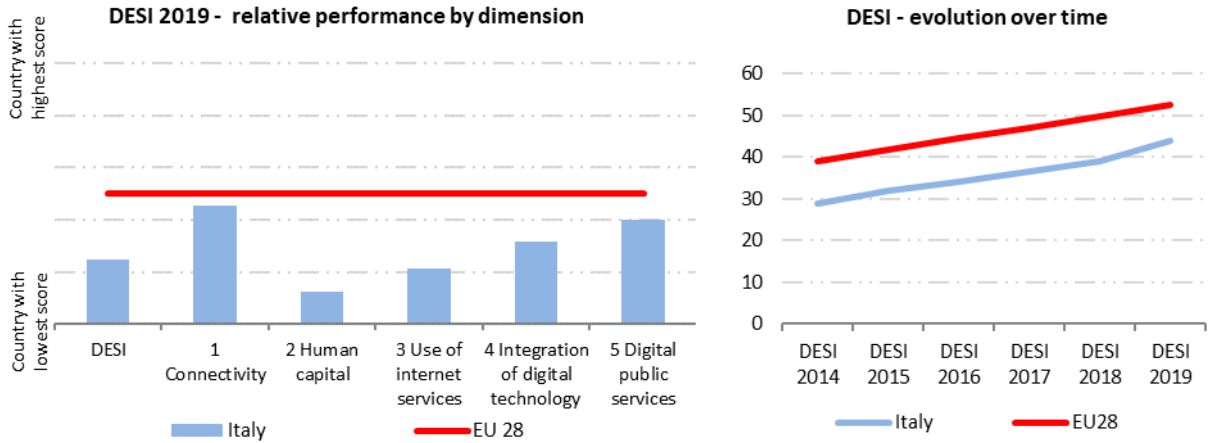


Italy ranks 24th out of the 28 EU Member States in the European Commission Digital Economy and Society Index (DESI) 2019.

Italy performs relatively well, although still below the EU average, as regards Connectivity and Digital public services. Online public services and open data are readily available, and take-up of e-health services is good. Fast broadband coverage and take-up are progressing well (although the latter remains below average), while ultrafast connectivity is progressing far more slowly. Italy is advanced in the assignments of 5G spectrum.

However, three out of ten people are not regular internet users yet, and more than half of the population still lacks basic digital skills. This shortfall in digital skills is also reflected in low use of online services, with which little progress has been made. Low demand also affects supply, with fewer Italian SMEs selling online than their EU peers. However, Italian enterprises score better on the use of electronic information-sharing software and social media.

Italy adopted the national Digital Agenda Strategy 2014-2020¹⁷⁴ and the National ultra-broadband Strategy in March 2015¹⁷⁵. In September 2016, Italy developed its Industry 4.0 Strategy, renamed 'Impresa 4.0'¹⁷⁶ in 2017 to emphasise its broader scope, as it includes service sector enterprises as well as industry. The current government has confirmed that the Industry 4.0 Strategy will be continued (with some and/or modified measures). It is also providing renewed support for the Digital Agenda Strategy through a more active political steering.



174

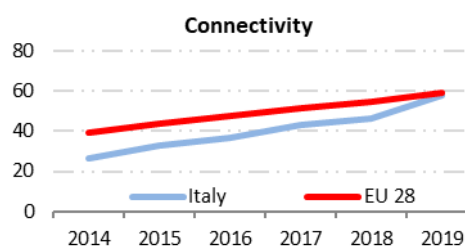
https://www.agid.gov.it/sites/default/files/repository_files/documentazione/strategia_crescita_digitale_ver_d ef_21062016.pdf

175 <http://bandaultralarga.italia.it/piano-bul/strategia/>

176 <https://www.mise.gov.it/index.php/it/industria40>

1 Connectivity

1 Connectivity	Italy		EU
	rank	score	score
DESI 2019	19	57.6	59.3
DESI 2018	26	46.5	54.8
DESI 2017	26	43.4	51.2



	DESI 2017	Italy		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
1a1 Fixed broadband coverage % households	99%	99%	>99.5%	9	97%
1a2 Fixed broadband take-up % households	55%	57%	60%	24	77%
1b1 4G coverage % households (average of operators)	86%	91%	97%	13	94%
1b2 Mobile broadband take-up Subscriptions per 100 people	85	86	89	17	96
1b3 5G readiness Assigned spectrum as a % of total harmonised 5G spectrum	NA	NA	60%	2	14%
1c1 Fast broadband (NGA) coverage % households	72%	87%	90%	10	83%
1c2 Fast broadband take-up % households	7%	12%	24%	23	41%
1d1 Ultrafast broadband coverage % households	NA	22%	24%	27	60%
1d2 Ultrafast broadband take-up % households	1%	5%	9%	24	20%
1e1 Broadband price index Score (0 to 100)	90	88	91	6	87

With an overall Connectivity score of 57.6, Italy ranks 19th among EU countries; it has moved up seven positions in the ranking by comparison with last year's DESI ranking. Fixed broadband coverage increased slightly to over 99.5 %. Italy continued to significantly increase its fast broadband (NGA) coverage, reaching 90 % of households and thereby outstripping the EU average (83 %). As regards ultrafast (100 Mbps and above) broadband coverage, Italy is still lagging behind (only 24 %, compared with the EU average of 60 %) and ranks near the bottom (27th) with a still moderate growth rate. While fixed broadband take-up has increased slightly, Italy still lags behind the EU average and ranks 24th among EU countries. Mobile broadband take-up (89 subscriptions per 100 people) remains below the EU average (96 subscriptions per 100 people). Take-up of fast broadband has improved significantly but remains low in absolute and comparative terms, with Italy still ranking 23rd in the EU. Both ultrafast broadband coverage and take-up are far below the EU averages. However, broadband prices in Italy are lower than the EU average.

With the official award in December 2018 of the third and last public tender, valued at EUR 103 million, to roll out high-speed broadband in white areas of Calabria, Apulia and Sardinia, Open Fiber has been awarded all three tenders launched by Infratel in the context of the national

ultra-broadband (UBB) plan. The objective of this plan is to provide connectivity with at least 100 Mbps to 85 % of the Italian population, guaranteeing coverage of at least 30 Mbps download speed to all members of the public by 2020.

While Open Fiber has finished working on 40 out of the 950 construction sites, active and passive service trials have been launched in only 4 municipalities¹⁷⁷. In commercially viable areas, 3.3 million households were passed by Open Fiber by September 2018. Flashfiber, the joint venture between TIM and Fastweb launched in July 2016, is currently deploying an FTTH network in 29 major cities. By 30 June 2018, 650,000 addresses were reported to be connected with fibre¹⁷⁸. In April 2018, the new Investment Plan in grey areas (originally planned for about EUR 2.1 billion) was published and submitted to public consultation. The Italian authorities are currently assessing and choosing the necessary intervention model, of which the European Commission will be notified in due course. A second investment plan including measures to support demand is also being planned and is expected to be notified to the European Commission, which will assess whether it complies with EU state aid rules.

Following a public call for projects launched by the Ministry of Economic Development (MISE) in 2017, pre-commercial 5G trials are being carried out in three geographical areas, with several use cases being tested¹⁷⁹. Other 5G trials, based on voluntary agreements between operators and municipalities, are being conducted in Rome, Turin, Naples and . 94 % of the spectrum harmonised at EU level for wireless broadband has been assigned in Italy. The auction for the assignment of spectrum in the 5G pioneer bands (700 MHz, 3.6 GHz and 26 GHz) was held in 2018. While the 3.6 GHz and 26 GHz bands had to be made available by 1 December 2018, the 700 MHz band is expected to be made available only by July 2022. This explains why Italy scores only 60 % in the 5G readiness indicator, but still ranks 2nd. The 3.6 GHz spectrum, in which 5G services are first expected to be deployed, was assigned at high prices relative to the investment needs, i.e. at an average price of EUR 36 cents/pop/MHz, which is the highest arising from assignments in Europe so far. Italy has asked the European Commission to help address unresolved spectrum coordination issues with non-EU countries.

The rising trend in infrastructure-based competition has resulted in a constantly improving level of rollout of fibre-based next generation access (NGA), thereby significantly improving Italy's position as regards connectivity. Some progress, albeit slow, was registered with implementing the national UBB plan. The complexity and fragmentation of the procedure for granting local permits may have adversely affected the initial phase of the UBB strategy in white areas. Improving the effectiveness of initiatives by the Italian authorities in this respect could result in better outcomes for the national broadband strategy.

¹⁷⁷ <https://openfiber.it/it/fibra-ottica/comunicati/open-fiber-collegati-primi-clienti-della-rete-interamente-fibra-ottica-nelle-aree-dei-bandi-infratel>

¹⁷⁸ <https://www.flashfiber.it/copertura/>

¹⁷⁹ Milan metropolitan area, the cities of Prato and L'Aquila, and the cities of Bari and Matera. The ongoing 5G trials started at the end of 2017 and may continue until June 2020.

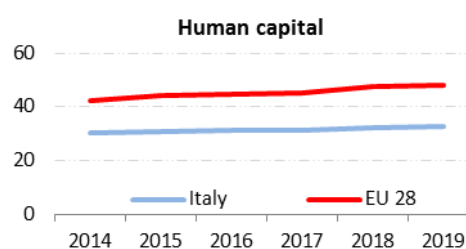
Highlight 2019: WiFi°Italia°it

In 2017, the "WiFi°Italia°it" project was launched to enable users to connect easily to a free of charge and widespread WiFi network throughout the country through the use of an application for mobile devices that provides access to federated WiFi networks.

The Interministerial Committee for Economic Programming, CIPE, decided to assign about EUR 100 million to developing WiFi and new technologies (such as Artificial Intelligence, the Internet of Things and blockchain). Of this sum, EUR 5 million have been earmarked for phase II of the wifi.italia.it project, which will extend the footprint of the WiFi network, with a focus on the areas hit by the violent earthquake of 2016 and on further developing the wifi.italia.it app.

2 Human capital

2 Human capital	Italy		EU
	rank	score	score
DESI 2019	26	32.6	48.0
DESI 2018	25	32.2	47.6
DESI 2017	26	31.1	45.4



	DESI 2017	Italy		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
2a1 At least basic digital skills % individuals	44%	NA	NA		57%
2a2 Above basic digital skills % individuals	19%	NA	NA		31%
2a3 At least basic software skills % individuals	48%	NA	NA		60%
2b1 ICT specialists % total employment	2.5%	2.6%	2.6%	22	3.7%
2b2 Female ICT specialists % female employment	0.8%	0.9%	1.0%	20	1.4%
2b3 ICT graduates % graduates	0.9%	NA	1.0%	28	3.5%

In the Human capital dimension, Italy ranks 26th among EU countries and is thus below the EU average. The basic and advanced digital skills levels of Italians are below the EU average. Only 44 % of people aged 16-74 years have basic digital skills (57 % in the EU as a whole). The percentage of ICT specialists has remained stable. ICT specialists still account for a lower proportion of the workforce compared with the EU as a whole (2.6 % compared with an EU average of 3.7 %). When it comes to graduates holding an ICT degree, Italy performs well below the EU average with only 1 % of ICT graduates. Only 1 % of female workers are ICT specialists.

As regards digital skills, the National Plan for Digital School that was launched in 2015 has had only modest results so far. For instance, only 20 % of teachers have ever taken any training in digital literacy and 24 % of schools still lack coding courses. As part of Italy's Industry 4.0 Strategy, the government earmarked resources for an annual 700 PhD slots¹⁸⁰ in Industry 4.0 subjects. However, by the end of 2017 (last available year), only 41 of such PhD courses were active (out of a total of 815), with a total of 400 places available.

The forthcoming changes in the rules defined by the Ministry of Education, University and Research should, however, make such courses more widely available in the future. Italy's participation in EU Code Week (a grassroots initiative to promote coding and digital literacy) has been the highest in the EU, with more than 20,000 events held in 2018 and 750,000 people attending. Italy has no national

¹⁸⁰ Industrial Ph.D. courses are courses whose contents are defined in collaboration with enterprises or private research institutions and the latter usually participate in financing part of their costs.

digital skills and jobs coalition¹⁸¹, but a wide range of private enterprises, NGOs and public organisations have made 56 pledges¹⁸² for specific measures such as training digital experts, re-skilling and up-skilling the labour force, and equipping people with the digital skills they need for their lives. Tax credits for expenditure on training in '*Impresa 4.0*' topics, initially introduced for 2018 only, have been extended to cover 2019 as well.

Only 92 % of 16-24-year-olds are regular internet users, which puts Italy last in the EU28 (the EU28 average being 97 % of people in this age group).¹⁸³ These data show the urgency of investing more resources in the National Plan for Digital Schools, especially in primary and secondary education, to tackle the lack of digital skills among young people. In post-secondary and tertiary education, the effectiveness of such investment will also depend on the success of the Industry 4.0 strategy in creating the necessary demand for ICT professionals. Italy has no comprehensive digital skills strategy apart from the National Plan for Digital Schools, which means that groups at risk of social exclusion, such as the elderly and people out of work, are also at risk of a widening digital divide.

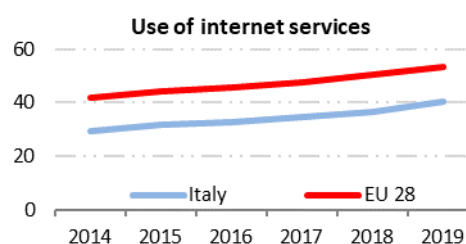
¹⁸¹ The Digital Skills and Jobs Coalition is one of the 10 key actions under the New Skills Agenda for Europe. It has been operational since 2016 and brings together Member States and stakeholders from the private and public sectors to develop a large digital talent pool and ensure that Europe's citizens and labour force are equipped with adequate digital skills.

¹⁸² <http://pledgeviewer.eu/pledges/?offset=50&country=17>

¹⁸³ Source: Digital scoreboard, <https://ec.europa.eu/digital-single-market/en/digital-scoreboard>

3 Use of internet services

3 Use of internet services	Italy		EU
	rank	score	score
DESI 2019	25	40.4	53.4
DESI 2018	25	36.6	50.7
DESI 2017	25	34.8	47.8

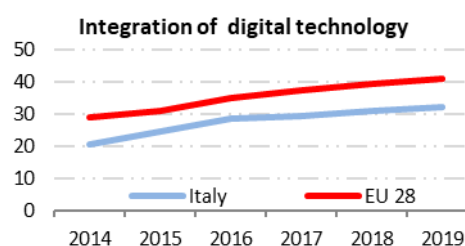


	DESI 2017 value	Italy		EU	
		DESI 2018 value	DESI 2019 value	DESI 2019 rank	DESI 2019 value
3a1 People who never used the internet % individuals	25%	22%	19%	23	11%
3a2 Internet users % individuals	67%	69%	72%	24	83%
3b1 News % internet users	60%	56%	56%	28	72%
3b2 Music, videos and games % internet users	79%	79%	79%	19	81%
3b3 Video on demand % internet users	15%	15%	23%	15	31%
3b4 Video calls % internet users	34%	39%	47%	20	49%
3b5 Social networks % internet users	60%	61%	63%	24	65%
3b6 Professional social networks % internet users	12%	12%	12%	17	15%
3b7 Doing an online course % internet users	7%	8%	8%	11	9%
3b8 Online consultations and voting % internet users	9%	9%	9%	15	10%
3c1 Banking % internet users	42%	43%	46%	24	64%
3c2 Shopping % internet users	41%	44%	47%	25	69%
3c3 Selling online % internet users	9%	11%	11%	23	23%

Overall, the Use of internet services remains well below the EU average. 19 % of people living in Italy, almost double the EU average, have still never used the internet. None of the online activities monitored here score above the EU average. The most popular online activities are listening to or downloading music, watching videos and playing games, followed by using social networks and reading news (although this activity ranks last in the EU28). Doing a course online is the least popular activity (although it is more popular than in other EU countries). Using video on demand services (23 %, against 31 % in the EU as a whole) is the online activity, which has increased most (8 percentage points) over the past year.

4 Integration of digital technology

4 Integration of digital technology	Italy		EU
	rank	score	score
DESI 2019	23	32.3	41.1
DESI 2018	23	31.2	39.6
DESI 2017	23	29.6	37.6



	DESI 2017	Italy		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
4a1 Electronic information sharing	36%	37%	37%	13	34%
% enterprises	2015	2017	2017		2017
4a2 Social media	16%	17%	17%	16	21%
% enterprises	2016	2017	2017		2017
4a3 Big data	9%	9%	7%	24	12%
% enterprises	2016	2016	2018		2018
4a4 Cloud	12%	NA	15%	18	18%
% enterprises	2016	2017	2018		2018
4b1 SMEs selling online	7%	8%	10%	26	17%
% SMEs	2016	2017	2018		2018
4b2 e-Commerce turnover	6%	6%	8%	19	10%
% SME turnover	2016	2017	2018		2018
4b3 Selling online cross-border	5%	6%	6%	22	8%
% SMEs	2015	2017	2017		2017

As regards the Integration of digital technology by businesses, Italy ranks 23rd among EU countries, well below the EU average; it ranks the same as in DESI 2018. There has been some progress in the use of cloud services and e-commerce. However, Italian enterprises continue to lag behind in taking advantage of the opportunities offered by online commerce. Only 10 % of SMEs sell online (well below the EU average of 17 %), 6 % sell cross border, and an average of 8 % of their turnover comes from online sales. Over 37 % of enterprises share information electronically across business departments (above the EU average of 34 %).

Italy is committed to advancing new digital technologies and investing strategically in digital technologies through EU-coordinated programmes. It is a member of the EuroHPC Joint Undertaking; it has also signed the Declaration establishing a European Blockchain Partnership and the Declaration on Cooperation on Artificial Intelligence. Italy has had an Industry 4.0 strategy since 2016, which the current government has confirmed as a priority, though with some changes. Tax deductions for Industry 4.0-related investment have been extended to 2019, though at altered rates, focusing on SMEs. Instead of a 150 % flat extra deduction, the rate now falls with the size of investments, and there is a cap on deductible investments¹⁸⁴. An additional measure has been introduced to help SMEs in their digital transformation - a EUR 40,000 voucher to hire an innovation manager. As part of the Industry 4.0 strategy, 22 Digital Innovation Hubs are already active, providing Italian SMEs with

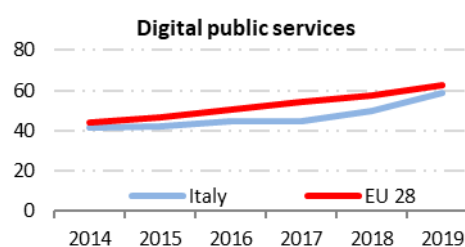
¹⁸⁴ 170 % for investments up to EUR 2.5 million, 100 % from EUR 2.5 million to EUR 10 million and 50 % between EUR 10 million and EUR 20 million.

services to facilitate their digital transformation and networking in larger digital value chains. Additional instruments, such as the *Punti Impresa Digitale* (89 so far), promote digitisation, mostly of service sector enterprises. The final component of the Industry 4.0 strategy is the competence centres, designed to provide technological advice, to enable SMEs to experiment with new technologies and related ICT training. These centres are finally starting to operate after delays caused by lengthy administrative procedures and court appeals on the tendering for their public funding. Almost all had started work by early 2019.

To boost the digital transformation of the Italian economy, it is important to raise awareness of the relevance of digitisation in SMEs. Refocusing some incentives on SMEs is a step in the right direction, but further systemic efforts are needed to raise their level of digitisation towards that of Italian enterprises' main competitors.

5 Digital public services

5 Digital public services	Italy		EU
	rank	score	score
DESI 2019	18	58.7	62.9
DESI 2018	19	49.9	57.9
DESI 2017	20	45.0	54.0



	DESI 2017	Italy		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
5a1 e-Government users % internet users needing to submit forms	NA	30%	37%	27	64%
	2016	2017	2018		2018
5a2 Pre-filled forms Score (0 to 100)	33	33	48	19	58
	2016	2017	2018		2018
5a3 Online service completion Score (0 to 100)	84	89	91	12	87
	2016	2017	2018		2018
5a4 Digital public services for businesses Score (0 to 100) - including domestic and cross-border	81	81	85	17	85
	2016	2017	2018		2018
5a5 Open data % of maximum score	NA	NA	80%	4	64%
			2018		2018
5b1 e-Health services % individuals	NA	24%	24%	8	18%
		2017	2017		2017
5b2 Medical data exchange % of general practitioners	NA	NA	30%	13	43%
			2018		2018
5b3 e-Prescription % of general practitioners	NA	NA	32%	20	50%
			2018		2018

As regards Digital public services, Italy ranks 18th among EU Member States. The country performs very well in open data and e-health services. However, there is a low level of online interaction between public authorities and the public: only 37 % of Italian internet users needing to send forms did so online. In 2018, Italy performed better than in 2017 as regards services involving pre-filled forms, e-government users and digital public services for businesses. It is the EU's fourth best performer on open data, with a score of 80 %. Italy ranks eighth in the EU in e-health services; 24 % of Italians have used health and care services provided online. 32 % of general practitioners use e-prescription.

The Digital Italy Agency (AgID) and the Digital Transformation Team are coordinating the digitisation of public services. Results in those local public administrations that are rapidly digitising their services have been good. However, the degree of autonomy enjoyed by local public administrations means that these agencies have been much less successful in coordinating the less cooperative local public administrations. Thus, although some major e-government projects have improved their rate of adoption, concerns remain about the digitisation of the last quintile of local public administrations. The eIDAS compliant e-identity system (*Sistema Pubblico di Identità Digitale*) has reached 3.4 million subscribers and 4,000 active public administrations. The centralisation of digital population registries (*Anagrafe Nazionale Popolazione Residente*) speeded up in 2018, but it covers only 21 % of Italian municipalities. In an effort to increase the take-up of online public services, the government is

developing a smartphone app to make public services easily accessible through mobile devices. The success of the app will depend on how many services it can make available.

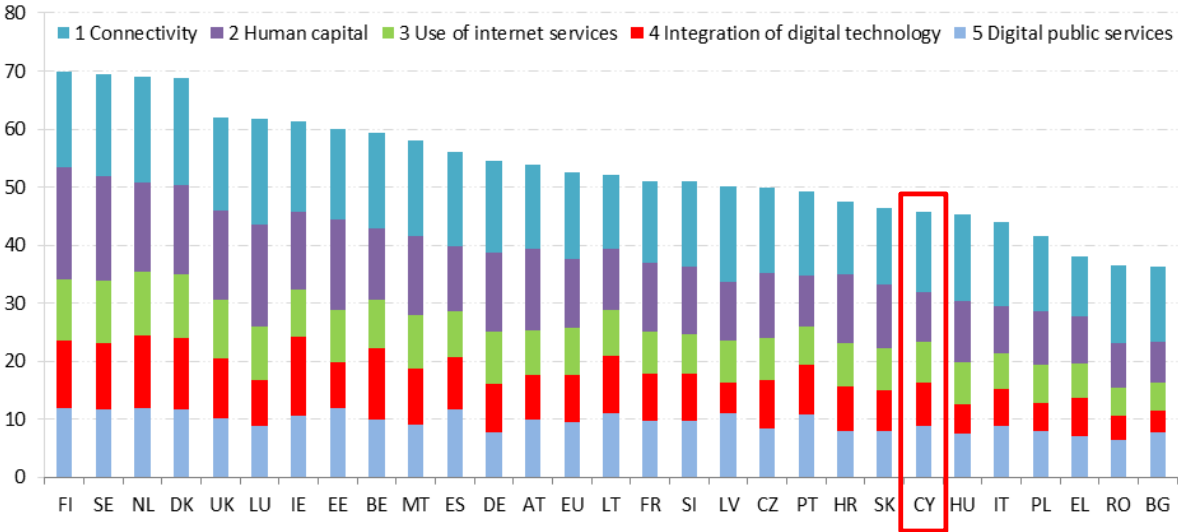
13 of 20 Italian regions have now adopted the electronic health record, which can make patient health records available to both patient and doctors (including information on hospitalisations, medicines prescribed and clinical examinations) in electronic format (although only a minority of such records cover all health services). 11 regions have adopted interoperable health records which can dialogue with each other.

Under a new law, some of the powers of the ad-hoc commissioner for the implementation of digital agenda policies have been transferred to the Prime Minister (or delegated Minister). The commissioner's powers are extensive, as he or she can take action where non-compliant administrations fail to do so. The fact that the government wants to take over these powers, previously held by the Director of the Digital Transformation Team, could indicate that digitisation is a higher priority for the new government. However, it could make things more difficult during the transition from the Digital Transformation Team to the new structure.

Cyprus

	Cyprus		EU
	rank	score	score
DESI 2019	22	45.8	52.5
DESI 2018	22	43.2	49.8
DESI 2017	22	40.5	46.9

Digital Economy and Society Index (DESI) 2019 ranking



Cyprus ranks 22nd out of the 28 EU Member States in the European Commission’s Digital Economy and Society Index (DESI) 2019.

Cyprus has improved in the areas of Connectivity, Use of internet services, Integration of digital technology and Digital public services, although it still scores below the EU average. However, Cyprus performed less well in the Human capital during the period concerned.

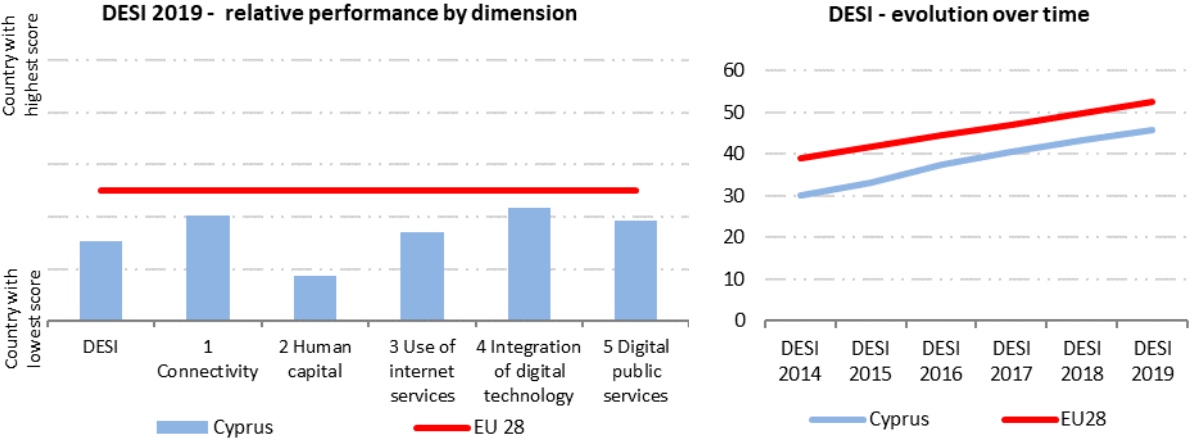
In mobile broadband take-up, Cyprus is above the EU average. However, it is well below the EU average in the take-up of fast broadband. Almost a sixth of Cypriots have never used the Internet, and half lack basic digital skills. Despite growing demand in the labour market, the supply of ICT specialists is still below the EU average.

Cyprus has made most progress with Connectivity, in which it also ranks higher than in 2017.

The current ‘Digital Strategy for Cyprus¹⁸⁵’, which started in 2012 and updated in 2015 and in 2018, is in line with the objectives and measures proposed in the Digital Agenda for Europe, and will contribute substantially to economic growth and productivity. The Ministry of Education and Culture

¹⁸⁵[http://www.mcw.gov.cy/mcw/dec/digital_cyprus/ict.nsf/3700071379D1C658C2257A6F00376A80/\\$file/Digital%20Strategy%20for%20Cyprus-Executive%20summary.pdf](http://www.mcw.gov.cy/mcw/dec/digital_cyprus/ict.nsf/3700071379D1C658C2257A6F00376A80/$file/Digital%20Strategy%20for%20Cyprus-Executive%20summary.pdf)

(MoEC¹⁸⁶) places particular emphasis on developing measures that can contribute to the acquisition of the necessary digital skills at all levels of education. The ‘Cyprus national reform programme¹⁸⁷’, published in 2015 and updated in April 2018, is in line with the Commission’s Annual Growth Survey. Additionally, the current plans of the Ministry of Transport, Communications and Work (MoTCW¹⁸⁸) include the emerging technologies (i.e. Artificial Intelligence, high performance computing and blockchain) in the updated Digital Strategy. The MoTCW is also in the process of drafting the new National Digital Strategy.



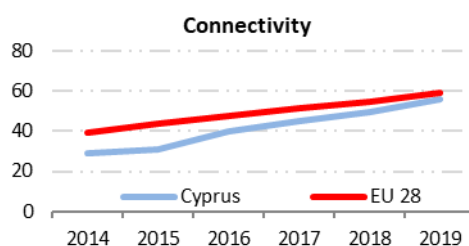
¹⁸⁶ <http://www.moec.gov.cy/en/index.html>

¹⁸⁷ <https://ec.europa.eu/info/sites/info/files/2018-european-semester-national-reform-programme-cyprus-en.pdf>

¹⁸⁸ http://www.mcw.gov.cy/mcw/mcw.nsf/index_en/index_en?OpenDocument

1 Connectivity

1 Connectivity	Cyprus		EU
	rank	score	score
DESI 2019	21	55.7	59.3
DESI 2018	21	49.4	54.8
DESI 2017	22	45.3	51.2



	DESI 2017 value	Cyprus DESI 2018 value	DESI 2019 value	rank	EU DESI 2019 value
1a1 Fixed broadband coverage % households	>99.5% 2016	>99.5% 2017	100% 2018	1	97% 2018
1a2 Fixed broadband take-up % households	72% 2016	76% 2017	85% 2018	6	77% 2018
1b1 4G coverage % households (average of operators)	64% 2016	77% 2017	94% 2018	20	94% 2018
1b2 Mobile broadband take-up Subscriptions per 100 people	89 2016	100 2017	112 2018	8	96 2018
1b3 5G readiness Assigned spectrum as a % of total harmonised 5G spectrum	NA	NA	0% 2018	13	14% 2018
1c1 Fast broadband (NGA) coverage % households	88% 2016	88% 2017	90% 2018	11	83% 2018
1c2 Fast broadband take-up % households	3% 2016	9% 2017	15% 2018	27	41% 2018
1d1 Ultrafast broadband coverage % households	NA	45% 2017	53% 2018	23	60% 2018
1d2 Ultrafast broadband take-up % households	0.1% 2016	0.2% 2017	2% 2018	27	20% 2017
1e1 Broadband price index Score (0 to 100)	62 2016	65 2017	66 2018	27	87 2017

Cyprus ranks 21st in Connectivity, scoring 55.7. It lags behind the EU average (59.3), but is gradually closing the gap. It performs well in fixed broadband coverage (100 %) and fast broadband coverage (90 %, 11th). The same is true of fixed broadband take-up (85 %, 6th) and mobile broadband take-up (112, 8th). In these categories, Cyprus is above the EU average and its scores are improving. On the other hand, it still lags behind in ultrafast broadband coverage, fast and ultrafast broadband uptake and the broadband price index. In all these categories, it ranks among the lowest in the EU (23rd for ultrafast broadband coverage and 27th for the other three indicators). Cyprus has closed the gap with the EU average for 4G coverage, but it is continuing to lose ground with fast and ultrafast broadband uptake. Given the widespread coverage of fast broadband networks and the reasonable coverage of ultrafast ones, this slow uptake may be partly attributable to retail offers, which remain unattractive.

The updated Cyprus Broadband Plan¹⁸⁹ applied for the period 2019-2020, sets targets in line with the Digital Agenda for Europe. While it makes reference to the European gigabit society¹⁹⁰ and the 5G

¹⁸⁹ 'Αναθεωρημένο ευρυζωνικό πλάνο της Κύπρου 2016-2020', published on 18/1/2019

Action Plan¹⁹¹, it does not include any concrete actions, since operators are currently in the process of updating their investment plans; in addition, a relevant detailed mapping is currently being drafted. The plan does not provide for any supply side measures, in view of operators' plans for investment in fast and ultrafast broadband networks. However, it acknowledges the difficulties of commercial deployment in remote rural areas and considers the possibility of public interventions to bridge the geographical divide. Measures focus on stimulating demand, through such means as awareness campaigns, e-government projects and subsidies for new or upgraded subscriptions to ultra-fast speeds. Moreover, 19 local authorities (out of 105 applicants) were selected in the first bid under the WiFi4EU programme. The implementation of several e-government actions has been delayed, mainly as a result of court cases, which frequently accompany public procurement. The Ministry of Transport, Communications and Work is developing a new National Broadband Plan that will apply for 2021-2025.

There is a growing market interest in 5G, and all three mobile operators have asked for pilot rights of use in the 3.5 GHz band. Cyprus has issued these rights, which will apply until the auction of the 5G spectrum gets under way, which is currently expected to take place in Q4 2019. Cyprus is working hard to resolve outstanding problems to do with the 700MHz band and to include it in the auction of 5G spectrum and has requested EU assistance for cross-border coordination with third countries since 22 August 2017., 505 MHz or 23 % of the spectrum harmonised at EU level for wireless broadband has been assigned in Cyprus.

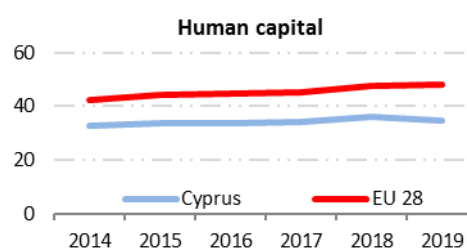
Fixed network coverage is among the factors boosting Cyprus' ability to benefit from the digital economy. The main challenge remains to encourage take-up of high-speed broadband, which is influenced by factors such as pricing, a lack of compelling content and low digital literacy. Market players seem keen to invest in new networks and launch 5G services. A new broadband strategy and plan, setting concrete targets and measures in line with the European gigabit society and the 5G action plan, may help catalyse such action. Another important enabler is the timely award of spectrum. Unwillingness of local authorities to grant permits for antenna masts and delays in the relevant procedures could obstruct and deter the deployment of such networks.

¹⁹⁰ Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Connectivity for a Competitive Digital Single Market — Towards a European Gigabit Society (COM (2016) 587 final)

¹⁹¹ Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions — 5G for Europe: An action plan (COM (2016) 588 final)

2 Human capital

2 Human capital	Cyprus		EU
	rank	score	score
DESI 2019	24	34.6	48.0
DESI 2018	22	36.2	47.6
DESI 2017	24	34.2	45.4



	Cyprus		EU	
	DESI 2017	DESI 2018	DESI 2019	DESI 2019
	value	value	value	rank
2a1 At least basic digital skills % individuals	43% 2016	50% 2017	50% 2017	19
2a2 Above basic digital skills % individuals	20% 2016	19% 2017	19% 2017	26
2a3 At least basic software skills % individuals	46% 2016	54% 2017	54% 2017	20
2b1 ICT specialists % total employment	2.2% 2015	2.2% 2016	2.3% 2017	23
2b2 Female ICT specialists % female employment	0.7% 2015	0.9% 2016	0.7% 2017	25
2b3 ICT graduates % graduates	3.5% 2014	3.0% 2015	2.4% 2016	23
				3.7% 2017
				3.1% 2017
				60% 2017
				1.4% 2017
				3.5% 2015

In the Human capital dimension, Cyprus ranks 24th among EU countries and is below the EU average. Although Cypriots increasingly going online, basic and advanced digital skills levels remain below the EU average. Only 50 % of individuals aged between 16 and 74 have basic digital skills, almost 40 % of these also have above basic digital skills. Despite the small increase since 2017 (2.3 %), ICT specialists are still a lower proportion of the workforce than in the EU as a whole (3.7 %). Cyprus ranks 23rd out of all Member States in terms of ICT specialists. The number of female ICT specialists, expressed as a share of total female employment, has not improved since DESI 2018, indeed the percentage has fallen by 0.2 percentage points to 0.7 %, far below the EU average of 1.4 %.

The national reform programme focuses on digital entrepreneurship, digital skills, women in digital and the national plan for the Coalition. The National Coalition aims to improve the dissemination and the improvement of digital skills, to tackle the mismatch between the small number of ICT professionals and the higher number of vacancies. The National Coalition has been issuing European Computer Driving Licence (ECDL) certificates secondary school pupils and to the unemployed. Its underlying goal is to acquire robots and robotic trucks for organising competitions in schools. From 2019 to 2020, 205 robots and robotic trucks will be placed in 205 schools all over Cyprus, to train IT teachers in robotics and hold competitions in this field. In the 2018-2019 school year, robotics has been introduced as a new module in the computer science in the second year of upper secondary school.

As part of the newly established National Youth Strategy¹⁹², Cyprus' Youth Board (ONEK)¹⁹³ is implementing programmes to promote Science, Technology, Engineering, and Mathematics (STEM) in education. In 2017, the 'STEAMers', a programme which seeks to combine Science and Technology with the Arts, was introduced on a small scale. It includes after-school workshops for young people on topics such as robotics, programming, music, photography, painting, theatre and creative writing. The programme provides comprehensive cross-curricular programmes for children and teenagers aged 6-16, covering STEM in an integrated way.

The Digital Skills and Jobs Coalition¹⁹⁴, designed to improve overall digital skills is actively tackling the digital skills gap in Cyprus. Cyprus also participated in EU Code Week¹⁹⁵, organising more than 30 events. It is also vital for women to play more active role in ICT. Measures for promoting women's participation will be included in the forthcoming 'Strategic Action Plan on Gender Equality'. The Office of the Commissioner of Gender Equality and the National Mechanism for Women's Rights held a workshop¹⁹⁶ on the major social and economic benefits for women and the overall economy, of having more women in ICT. Their aim is to promote female employment and entrepreneurship and reduce inequalities in the labour market.

To match the demand for ICT specialists and fill existing vacancies, it would be beneficial for Cyprus to continue promoting digital skills initiatives to improve skills in this area. In addition, it is important to promote measures for encouraging the participation of women in ICT and in STEM studies.

Highlight 2019: Use of tablets at primary and secondary schools

Cyprus started distributing tablets in primary and secondary schools during the period under consideration. The pilot programme launched in February 2019 will run for 18 months. The main aim is to step up the digital transition in schools. 125 tablets have been distributed to primary schools and 125 to secondary schools. The ultimate aim is to replace pupils' textbooks and exercise books by tablets and to use them in the classroom. Pupils will also be able to use tablets to do their homework.

¹⁹² http://onek.org.cy/wp-content/uploads/ONEK_brochure.pdf

¹⁹³ <http://onek.org.cy/en/>

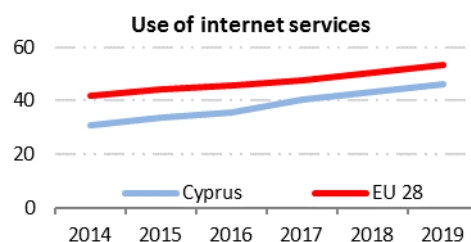
¹⁹⁴ <http://www.digitaljobs.cyprus-digitalchampion.gov.cy/el/page/home>

¹⁹⁵ <https://codeweek.eu/>

¹⁹⁶ <https://in-cyprus.com/women-are-still-under-represented-in-ict-sector-workshop-highlights/>

3 Use of internet services

3 Use of internet services	Cyprus		EU
	rank	score	score
DESI 2019	22	46.1	53.4
DESI 2018	22	43.5	50.7
DESI 2017	21	40.2	47.8

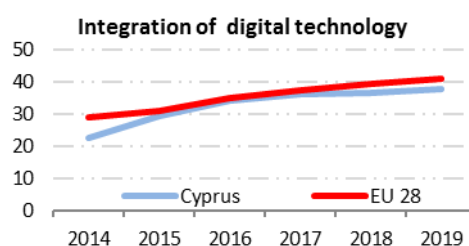


	DESI 2017	Cyprus		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
3a1 People who never used the internet % individuals	23%	18%	15%	16	11%
	2016	2017	2018		2018
3a2 Internet users % individuals	74%	79%	84%	13	83%
	2016	2017	2018		2018
3b1 News % internet users	73%	80%	80%	14	72%
	2016	2017	2017		2017
3b2 Music, videos and games % internet users	86%	86%	87%	8	81%
	2016	2016	2018		2018
3b3 Video on demand % internet users	12%	12%	11%	24	31%
	2016	2016	2018		2018
3b4 Video calls % internet users	72%	70%	74%	2	49%
	2016	2017	2018		2018
3b5 Social networks % internet users	79%	78%	82%	5	65%
	2016	2017	2018		2018
3b6 Professional social networks % internet users	8%	11%	11%	18	15%
	2015	2017	2017		2017
3b7 Doing an online course % internet users	4%	6%	6%	18	9%
	2016	2017	2017		2017
3b8 Online consultations and voting % internet users	3%	3%	3%	28	10%
	2015	2017	2017		2017
3c1 Banking % internet users	37%	34%	39%	25	64%
	2016	2017	2018		2018
3c2 Shopping % internet users	38%	39%	38%	26	69%
	2016	2017	2018		2018
3c3 Selling online % internet users	6%	5%	3%	28	23%
	2016	2017	2018		2018

Overall, the Use of internet services in Cyprus is below the EU average. Cypriots are keen to engage in a variety of online activities as it is the case elsewhere in the EU. The most popular activities are listening to music, watching videos and playing games (87 %). 80 % of Cypriot internet users read news online, in comparison with 72 % in the EU. Cypriots are active internet users, but participation in online consultations and voting (3 %), and online shopping (38 %) are far below the EU average. Furthermore, the number of users selling online is less widespread than in other EU countries. However, Cypriots are active users of the social media, with 82 % social network users, putting Cyprus in fifth place among EU countries.

4 Integration of digital technology

4 Integration of digital technology	Cyprus		EU
	rank	score	score
DESI 2019	20	38.0	41.1
DESI 2018	20	36.6	39.6
DESI 2017	16	36.2	37.6



	DESI 2017	Cyprus		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
4a1 Electronic information sharing % enterprises	43% 2015	35% 2017	35% 2017	14	34% 2017
4a2 Social media % enterprises	35% 2016	37% 2017	37% 2017	3	21% 2017
4a3 Big data % enterprises	3% 2016	3% 2016	5% 2018	28	12% 2018
4a4 Cloud % enterprises	9% 2016	12% 2017	14% 2018	19	18% 2018
4b1 SMEs selling online % SMEs	12% 2016	11% 2017	12% 2018	22	17% 2018
4b2 e-Commerce turnover % SME turnover	5% 2016	6% 2017	6% 2018	23	10% 2018
4b3 Selling online cross-border % SMEs	8% 2015	9% 2017	9% 2017	13	8% 2017

On the Integration of digital technology in businesses, Cyprus ranks 20th among EU countries, the same place as in 2017. 37 % of enterprises use social media, almost one in ten SMEs use e-invoicing and 9 % of SMEs are selling online services or products cross-border to other EU countries. The total number of SMEs selling online increased slightly to 12 % from 11 % in 2017, but remains below the EU average. 5 % of enterprises analyse big data for their business purposes.

Cyprus underperforms on e-commerce, ranking below the EU average. However, the attitude towards e-commerce has gradually changed, and customers are becoming more familiar with online transactions. The main obstacle identified to developing e-commerce in Cyprus is the lack of confidence in the security of online transactions. The Ministry of Energy, Commerce, Industry and Tourism is currently taking specific measures, such as amending existing legislation on e-commerce to safeguard the security of online transactions. A scheme, which the Ministry is expected to launch, will involve creating e-shops and e-platforms in Cyprus. A call for tenders is expected to be held in the course of 2019, with a budget of EUR 4.5 million.

The Department of Electronic Communications of the MoTCW has taken on the role of policy coordinator on technologies associated with Artificial Intelligence and high performance computing. Also, the Ministry of Finance took on the role of policy coordinator on technologies related to blockchain. These technologies will be part of Cyprus' updated Digital Strategy, which is currently being drawn up. The Department has held several meetings with stakeholders of the Cyprus research ecosystem to gather information about these technologies. With their help, will be able to promote initiatives and measures to benefit both research community and Cypriot society.

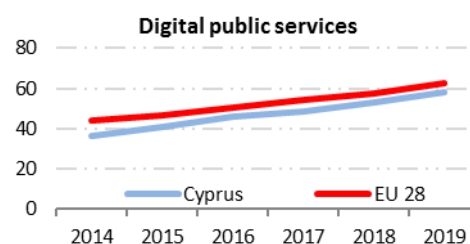
Cyprus is committed to making progress on new digital technologies and investing in digital technologies, through EU-coordinated programmes. Cyprus is a member of the EuroHPC Joint Undertaking. The country has also signed the Declaration on the Cooperation Framework on HPC, Declaration of European Blockchain Partnership, and the Declaration on cooperation on Artificial Intelligence (AI).

The national Cybersecurity Strategy that was published in 2013 takes a holistic approach and covers a number of specific strategic measures. Having been revised in 2018, the strategy is now more structured in its approach, includes specific targets for capacity maturity at national level across a number of dimensions (e.g. cybercrime), coordinated by the new Digital Security Authority. In 2019, a national cybersecurity competence centre will be established in cooperation with the Digital Security Authority, the Ministry of Education and other competent authorities.

Raising awareness of the relevance and potential of the digitisation of SMEs will boost the digital transformation of Cypriot SMEs. The 'Cyprus Industrial Strategy Policy' was launched in the spring of 2018. It aims to gradually raise industry's contribution to GDP from 8%, (the figure for 2017), to 15 % by 2030. Smart manufacturing and digitisation are two of the seven pillars underpinning the strategy.

5 Digital public services

5 Digital public services	Cyprus		EU
	rank	score	score
DESI 2019	19	58.1	62.9
DESI 2018	17	53.2	57.9
DESI 2017	17	48.7	54.0



	DESI 2017	Cyprus		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
5a1 e-Government users % internet users needing to submit forms	48%	49%	53%	21	64%
	2016	2017	2018		2018
5a2 Pre-filled forms Score (0 to 100)	52	58	58	15	58
	2016	2017	2018		2018
5a3 Online service completion Score (0 to 100)	73	77	78	25	87
	2016	2017	2018		2018
5a4 Digital public services for businesses Score (0 to 100) - including domestic and cross-border	91	91	90	11	85
	2016	2017	2018		2018
5a5 Open data % of maximum score	NA	NA	80%	5	64%
			2018		2018
5b1 e-Health services % individuals	NA	9%	9%	25	18%
		2017	2017		2017
5b2 Medical data exchange % of general practitioners	NA	NA	14%	27	43%
			2018		2018
5b3 e-Prescription % of general practitioners	NA	NA	28%	21	50%
			2018		2018

In the Digital public services domain, Cyprus ranks 19th among EU countries. This is below the EU average and shows a decline since 2017. Cyprus performs very well in open data, with 16 percentage points above the EU average of 64 %. However, online interaction between the public authorities and citizens is still limited, with only 50 % of Cypriots interacting online. Only 53 % of individuals send pre-filled forms to public administrations, which is still significantly below the EU average (64 %). Regarding the interaction of businesses with the public authorities, Cyprus performs well, despite a small decrease since 2017. The country ranks 25th as regards e-health services. Only 9 % of Cypriots used online health and care services during the period of question. General practitioners (GPs) did not make extensive use of e-prescriptions (only 28 % of GPs), while only 14 % of GPs exchanged medical data online.

The Digital Strategy and the reform programme include measures to advance e-government and e-health, enhance the capacity of public sector by delivering more e-services and facilitate cross-border collaboration.

The government has taken steps to enable seamless digital service provision across administrations and collaboration in the public service. It has also begun to use social media channels such as Facebook and Twitter to communicate with the citizens. The Department of Information Technology Services prepared the 'Getting Started with Social Media' document with information and

recommendations to help government organisations to make efficient use of social media platforms. Regarding the use of eID, the e-government Board has decided to purchase it from the private sector instead of developing government public key infrastructure (PKI). Qualified certificates for e-signatures and e-identification are designed to establish a high assurance level based on the eIDAS Regulation and national legislation. Some time ago, the government signed an agreement with Estonia's e-Government Academy. This agreement enabled Cyprus to draw on Estonian expertise to draft its policy and Action Plan for the eID (e-signature and e-identification) project, which were completed in May 2017.

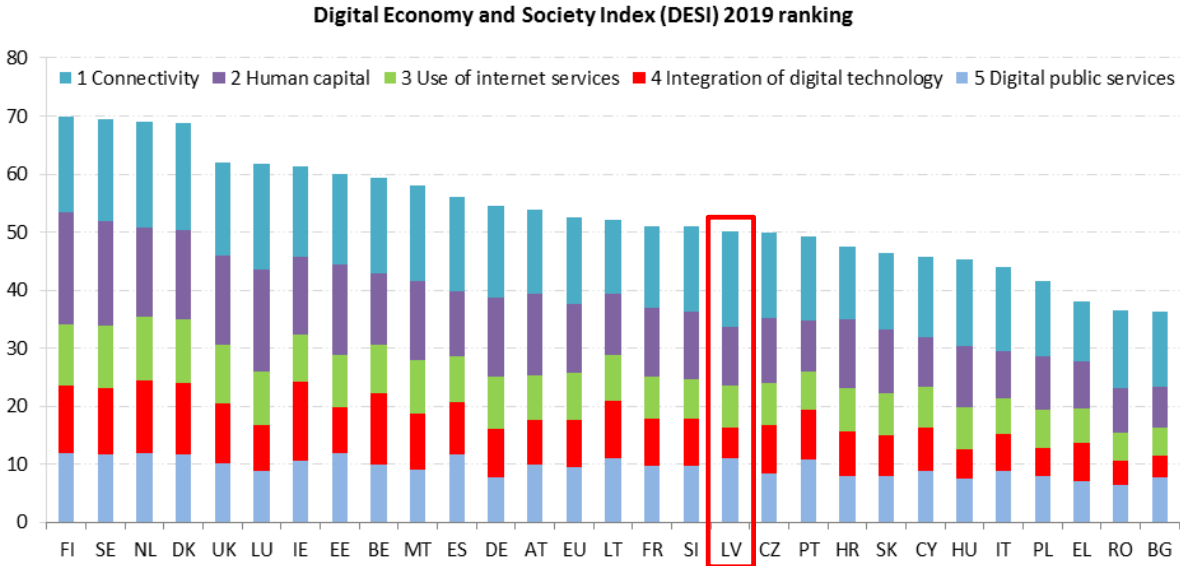
The main barriers to deploy e-health shown to be issues of interoperability between systems, data security, lack of awareness and knowledge among health professionals and patients, resistance to change and lack of trust. The Ministry of Health and the eHealth Lab of the University of Cyprus are participating in the Connecting Europe Facility (CEF¹⁹⁷) initiative for achieving cross-border interoperability. e-Health law is under discussion in Parliament, and once a new law has been approved, it will introduce the uniform Electronic Health Record (EHR) for all citizens. Through EHR, all the interoperability preconditions will be satisfied at national and cross-border levels and all public hospitals and health centres will be fully interoperable. The e-health law will also regulate all private health institutions.

Full implementation of the national reform programme could result in more significant improvements in digital public administration. In addition, the EHR for all citizens will facilitate the use of e-health systems by citizens and improve Cyprus' provision of such services. In addition, the implementation of e-government actions on time, under the supervision of the e-government Board, can be a catalyst in this direction.

¹⁹⁷ <https://ec.europa.eu/inea/en/connecting-europe-facility>

Latvia

	Latvia		EU
	rank	score	score
DESI 2019	17	50.0	52.5
DESI 2018	18	46.9	49.8
DESI 2017	19	43.1	46.9

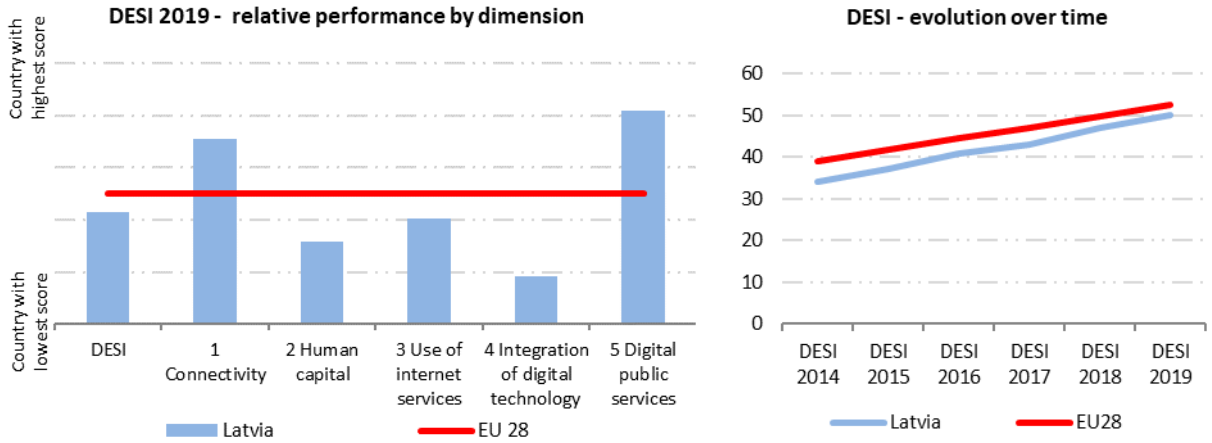


Latvia ranks 17th out of the 28 EU Member States in the European Commission Digital Economy and Society Index (DESI) 2019.

Its score increased due to a slightly improved performance in some of the DESI dimensions. Latvia performs well in Digital public services and Connectivity thanks to the wide availability of fast and ultrafast fixed and mobile broadband networks and the increased take-up of e-government services. However, the Latvian business sector still scores below the EU average on the Integration of digital technology and also on the Human capital dimension. Nearly half the population still lacks basic digital skills and the supply of ICT specialists has not kept pace with growing demand in the labour market. Latvia has made most progress with Digital public services. However it is a long way behind as regards the Use of digital technologies by businesses, with Latvian enterprises failing to make use of the opportunities offered by e-commerce. They are also far below the EU average in their use of social media.

Among all dimensions, Latvia scores best in e-government. Progress is driven by the growing number of Latvians who actively use e-government services and by the increased availability of pre-filled forms and open data.

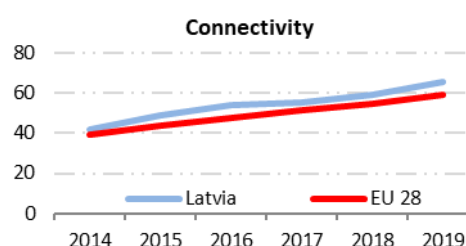
The current Latvian Digital Agenda Strategy dates from 2013, when the Latvian government approved the Information Society Development Guidelines for 2014-2020¹⁹⁸, which cover: ICT education and skills; internet access; modern and efficient public administration; e-services and digital content for society; cross-border cooperation for the digital single market; ICT research and innovation; and trust and security. Further measures are also included in the Education Development Guidelines 2014–2020¹⁹⁹; in the Latvia’s Cyber Security Strategy²⁰⁰ - which should be updated as of 2019-; in the National Industry Policy guidelines for 2014-2020²⁰¹; and, finally, in the Science, Technology Development and Innovation Framework for 2014-2020²⁰².



¹⁹⁸ <http://polsis.mk.gov.lv/documents/4518>
¹⁹⁹ <https://likumi.lv/doc.php?id=266406>
²⁰⁰ <http://polsis.mk.gov.lv/documents/4642>
²⁰¹ <http://polsis.mk.gov.lv/documents/4391>
²⁰² <http://polsis.mk.gov.lv/documents/4608>

1 Connectivity

1 Connectivity	Latvia		EU
	rank	score	score
DESI 2019	8	65.3	59.3
DESI 2018	8	58.8	54.8
DESI 2017	10	55.1	51.2



	DESI 2017	Latvia		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
1a1 Fixed broadband coverage % households	93%	93%	94%	22	97%
	2016	2017	2018		2018
1a2 Fixed broadband take-up % households	61%	64%	60%	25	77%
	2016	2017	2018		2018
1b1 4G coverage % households (average of operators)	91%	98%	98%	9	94%
	2016	2017	2018		2018
1b2 Mobile broadband take-up Subscriptions per 100 people	78	92	123	6	96
	2016	2017	2018		2018
1b3 5G readiness Assigned spectrum as a % of total harmonised 5G spectrum	NA	NA	33%	3	14%
			2018		2018
1c1 Fast broadband (NGA) coverage % households	91%	92%	93%	8	83%
	2016	2017	2018		2018
1c2 Fast broadband take-up % households	38%	42%	40%	16	41%
	2016	2017	2018		2018
1d1 Ultrafast broadband coverage % households	NA	88%	90%	6	60%
		2017	2018		2018
1d2 Ultrafast broadband take-up % households	29%	35%	32%	8	20%
	2016	2017	2018		2017
1e1 Broadband price index Score (0 to 100)	86	87	87	10	87
	2016	2017	2018		2017

Latvia performs above the EU average on the overall connectivity indicator and has maintained a comparable pace of progress in line with the EU average over the last few years. The country's main strengths are the extremely advanced coverage of ultrafast broadband (with 90 % of households covered, against 60 % in the EU as a whole), coupled with the relatively good take-up of such connections (32 % of households, against 20 % in the EU as a whole). 4G in Latvia covers nearly 100 % of households. Mobile broadband take-up is substantially above the EU average and it further improved considerably in 2018, reaching 123 subscriptions per 100 people. In contrast, Latvia is tailing the EU in fixed broadband coverage (94 % of households, against 97 % at EU level) and its related take-up (60 %, against 77 % at EU level), owing to a persistent gap in some rural areas. Broadband prices in Latvia are in line with the EU average.

Latvia's national broadband plan for 2013-2020 includes the same broadband targets as the rest of the EU. The gigabit society objectives have been integrated into the 2018-2020 national policy plan for the electronic communications sector and will be integrated into the next broadband policy document covering the post-2020 period. The country is among the EU's front runners as regards the deployment of very high-speed infrastructure. Total fibre-to-the-premises (FTTP) coverage stood at

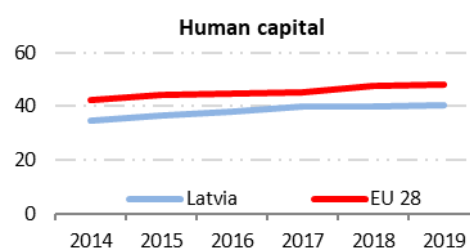
88 % of Latvian households in 2018, against 30 % in the EU as a whole. Closing the digital divide between urban and rural areas has been the objective of the 'middle mile' project deploying fibre (in particular backhaul infrastructures) up to the last mile in white areas. Latvia now has the highest fibre-to-the-premises (FTTP) coverage in the EU in rural areas (73.6 %, against 14 % for the EU as a whole). However, deploying the last mile in a number of white areas remains a challenge. In 2018, 16 % of rural households completely lacked fixed broadband infrastructure (against fewer than 13 % of rural households in the EU as a whole). Mobile operators are clearly important market players for deploying wirelessly the last mile and home connections over 4G technology.

Latvian authorities are working on a national 5G roadmap. First 5G trials in the 26 GHz band were presented at the 5G regional conference (5G Techritory), hosted in Riga in September 2018. Mobile operators will start deploying 5G in 2019 in the 3.4-3.8 GHz band, which is now fully assigned on technical conditions suitable for 5G. The assignment process has enabled the acquisition of large blocks of spectrum, facilitating the provision of gigabit 5G services at reasonable prices (the maximum price paid is EUR 0.65/pop.MHz). This has enabled Latvia to do well as regards the 5G readiness indicator (with 33 % of the 5G spectrum assigned, against an EU average of 11 %). The first use of 5G in 2019 is likely to be home or office wireless internet. In September 2018, Estonia, Latvia and Lithuania signed a memorandum of understanding and intentions, in which they agreed to make efforts to gradually deploy the 4G+, 4G ++ and finally 5G network along the section of the Via Baltica (E67) that links Tallinn (EE) with Riga (LV), Kaunas (LT), and the Lithuanian-Polish border. There are plans to auction the 700 MHz band in early 2021 and it will be used for 5G from 1 January 2022. The reason for the two-year delay is that that band is currently being used for TV broadcasting and frequency coordination with Russia. It is planned that the sub-700 MHz band will be used for digital-terrestrial-transmission (DTT) operations. 47 % of the spectrum harmonised at EU level for wireless broadband has been assigned so far in Latvia.

Latvia is well equipped with very high-speed fixed network infrastructure, has near-complete 4G coverage of households, and is prepared for early 5G deployment in the 3.4-3.8 GHz band. However, deploying the last mile in a number of remaining white areas remains a challenge. In the medium to long term, access to and the renting of property in order to install the many base stations required for 5G might hinder 5G deployment.

2 Human capital

2 Human capital	Latvia		EU
	rank	score	score
DESI 2019	21	40.4	48.0
DESI 2018	21	40.0	47.6
DESI 2017	20	40.1	45.4



	DESI 2017	Latvia		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
2a1 At least basic digital skills % individuals	50% 2016	48% 2017	48% 2017	22	57% 2017
2a2 Above basic digital skills % individuals	27% 2016	27% 2017	27% 2017	20	31% 2017
2a3 At least basic software skills % individuals	52% 2016	49% 2017	49% 2017	25	60% 2017
2b1 ICT specialists % total employment	2.2% 2015	2.2% 2016	2.3% 2017	23	3.7% 2017
2b2 Female ICT specialists % female employment	1.1% 2015	1.1% 2016	1.0% 2017	19	1.4% 2017
2b3 ICT graduates % graduates	4.0% 2014	4.4% 2015	4.8% 2016	7	3.5% 2015

As regards Human capital, Latvia ranks 21st among EU countries and below the EU average, with indicators showing no relevant progress in the last few years. Although increasing numbers of Latvians are going online, basic and advanced digital skills levels remain well below the EU average. Only 48 % of people have basic digital skills (57 % in the EU as a whole) and the gap between Latvia and other EU countries is even wider for advanced skills. Despite the slight increase in the percentage of ICT specialists since 2017, they account for a smaller proportion of the workforce than in the rest of the EU (2.3 % against 3.7 % in the EU as a whole). However, Latvia is successful in producing ICT graduates: there has been a constant increase, well above the EU average (to 4.8 % of all graduates, compared to 3.5 % in the EU). Female ICT specialists, however, account for a mere 1 % of female employment, below the EU average of 1.4 %.

Latvia's digital skills policies are not part of an independent strategy, rather, they fall under a set of different strategies that include aspects of digital skills. The main measures fall under the following: 1) the Information Society Development Guidelines for 2014-2020, which include ICT Education and E-Skills; 2) the Education Development Guidelines for 2014-2020 including numerous measures to promote and update digital skills and STEM studies, the use of ICT in the learning process and the development of teachers' digital skills; 3) Latvia's Cyber Security Strategy for 2014 – 2018, with a separate section of the Action Plan promoting digital skills and research in cybersecurity, including the development of bachelor academic study programmes on cybersecurity.

The 2018 E-Skills Week²⁰³, an annual awareness raising campaign reached a total of 128,000 people across Latvia, with 3,028 events held and 300 partners involved across the country. 2018 also saw 100 Code Week events across Latvia involving 5,000 participants and 47 participating schools.

ICT programmes in Latvia are an integral part of active labour market policies to support unemployed people. They play an essential role in reducing ICT skills gaps for older workers, unemployed and job seekers. In 2018, the state employment agency provided courses on digital skills for approximately 3,800 unemployed people. Other measures target specific industrial sectors. Support for technology training was provided to 10 industry associations to promote training of employees with a view to facilitating the adoption of digital technologies and innovation by businesses in the manufacturing, ICT and tourism industries. Another example is the Latvian Information and Communication Technology Association (LIKTA²⁰⁴) which implemented a high-level ICT course in the latest technology for over 1,600 ICT specialists. LIKTA is also the coordinator of the Latvian Digital Skills and Jobs Coalition, whose partners, including several government ministries, signed a new memorandum of cooperation in 2017 defining the coalition's priorities for 2017-2020²⁰⁵.

Despite the rising numbers of ICT graduates and the associated policy efforts, such as the activities supported by the Digital Skills and Jobs Coalition, Latvia would benefit from further sustaining motivation for life-long learning, raising awareness of the relevance of digital skills in the labour market and encouraging enterprises to invest in these skills. Higher levels of digital skills among the general public will make the country's labour market more inclusive while also boosting business productivity.

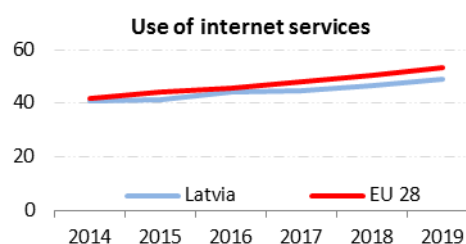
²⁰³ <http://www.e-prasmes.lv/>

²⁰⁴ <https://likta.lv/en/home-en>

²⁰⁵ <http://eprasmes.lv/wp-content/uploads/2017/03/Memorands-27.03.2017-PUBLIC.pdf>

3 Use of internet services

3 Use of internet services	Latvia		EU
	rank	score	score
DESI 2019	17	49.1	53.4
DESI 2018	16	46.7	50.7
DESI 2017	17	44.9	47.8

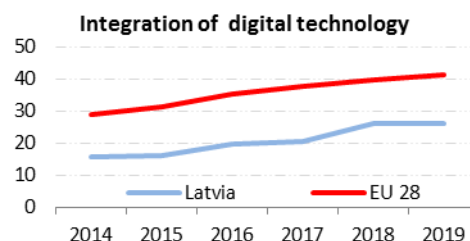


	DESI 2017	Latvia		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
3a1 People who never used the internet % individuals	17%	16%	13%	14	11%
3a2 Internet users % individuals	77%	78%	81%	15	83%
3b1 News % internet users	84%	84%	84%	11	72%
3b2 Music, videos and games % internet users	77%	77%	76%	20	81%
3b3 Video on demand % internet users	15%	15%	15%	20	31%
3b4 Video calls % internet users	51%	51%	62%	6	49%
3b5 Social networks % internet users	71%	74%	74%	12	65%
3b6 Professional social networks % internet users	5%	7%	7%	24	15%
3b7 Doing an online course % internet users	5%	5%	5%	24	9%
3b8 Online consultations and voting % internet users	4%	6%	6%	18	10%
3c1 Banking % internet users	78%	75%	79%	6	64%
3c2 Shopping % internet users	55%	55%	53%	20	69%
3c3 Selling online % internet users	7%	10%	11%	22	23%

Overall, the Use of internet services in Latvia is slightly below the EU average. People in Latvia are keen to engage in some online activities, just as in the rest of the EU. The most popular online activities are: reading the news and banking; 84 % of Latvian internet users read news online, compared with 72 % in the EU as a whole. Although Latvians have recourse to online banking more than the EU average (79 % bank online), shopping and selling online are less widespread than in other EU countries. Use of professional social networks (7 %) and online courses (5 %), are also below the EU average. The highest growth has been in video calls, with an increase of 11 percentage points to 62 % of Latvian internet users. This figure is well above the average in other EU countries.

4 Integration of digital technology

4 Integration of digital technology	Latvia		EU
	rank	score	score
DESI 2019	24	25.9	41.1
DESI 2018	25	26.1	39.6
DESI 2017	26	20.6	37.6



	DESI 2017	Latvia	DESI 2019		EU
	value	DESI 2018	value	rank	DESI 2019
4a1 Electronic information sharing % enterprises	16% 2015	25% 2017	25% 2017	24	34% 2017
4a2 Social media % enterprises	11% 2016	13% 2017	13% 2017	25	21% 2017
4a3 Big data % enterprises	NA 2016	NA 2016	8% 2018	23	12% 2018
4a4 Cloud % enterprises	6% 2016	9% 2017	11% 2018	24	18% 2018
4b1 SMEs selling online % SMEs	8% 2016	11% 2017	10% 2018	25	17% 2018
4b2 e-Commerce turnover % SME turnover	8% 2016	9% 2017	5% 2018	24	10% 2018
4b3 Selling online cross-border % SMEs	4% 2015	5% 2017	5% 2017	25	8% 2017

On Integration of digital technology by businesses, Latvia ranks 24th among EU countries, well below the EU average. Latvia succeeded in advancing one rank compared to last year, but has not made any significant progress, with the exception of the slight increase in the proportion of Latvian enterprises taking advantage of the opportunities offered by cloud computing (11 % of enterprises use cloud services, compared with 18 % in the EU). Latvian enterprises continue to significantly underexploit the potential of online selling of goods and services, remaining considerably below the EU average in e-commerce among SMEs and related levels of turnover. Only 10 % of SMEs sell online, slightly less than in 2017 and below the EU average of 17 %. The percentage of SMEs selling cross-border remains below the EU average (only 5 % of total SMEs, against 8 % in the EU as a whole) and only an average of 5 % of SMEs turnover comes from the online segment. Only 13 % of enterprises use social media, while 8 % use big data.

Latvia is committed to making progress with new digital technologies and to investing strategically in digital technologies through EU-coordinated programmes. For instance, the country is a member of the EuroHPC Joint Undertaking; it has also signed the Declaration on European Blockchain Partnership, and the Declaration on Cooperation on Artificial Intelligence. An artificial intelligence strategy is being developed and a revision of the cyber strategy is planned in 2019.

Initiatives to boost digital innovations and promote use of digital technologies include developing Competence Centres and a strategic project to develop the Smart City Ecosystem. The existing 8 Competence Centres, established in the areas of the Latvia's smart specialization strategy for an

overall investment of EUR 67 million, cover 175 projects and 138 enterprises, financed through EU funding. They promote innovation in Latvia through joint development of products and processes by companies and scientific institutions. Latvia also established a Single Technology Transfer centre, as part of the Investment and Development Agency of Latvia, to foster industry-science cooperation and commercialisation of public research.

Further improvements in the integration of digital services by businesses might also be limited by the shortage of skilled professionals and a persistently low proportion of ICT specialists. 56 % of enterprises that recruited or tried to recruit ICT specialists reported find it hard to fill their vacancies²⁰⁶. Additionally, only 11 % of enterprises provide staff with training to develop and upgrade their ICT skills, a figure that is significantly below the EU average of 23 %.

To address entrepreneurs' reluctance to use ICT solutions, the Interreg SKILLS +project²⁰⁷ is expected to provide entrepreneurs with new training modules to encourage SMEs to develop digital strategies and improve productivity and competitiveness. Additional measures also focus on ICT skills among SMEs in rural areas, promoting the development of Industry 4.0, providing support through innovation vouchers and speeding up industry digitisation through cooperation in the Baltic Sea region.

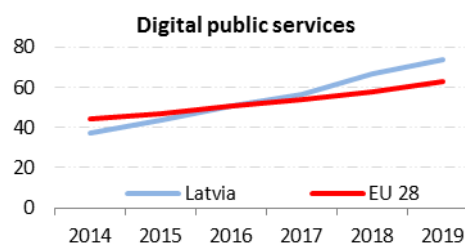
To boost the digital transformation of the Latvian economy, it is important to further raise awareness of the importance of digitisation in SMEs and to step up existing efforts, to enable the full range of benefits to be reaped from the adoption of digital technologies by businesses.

²⁰⁶ Digital Scoreboard, 2019

²⁰⁷ <https://www.interregeurope.eu/skillsplus/>

5 Digital public services

5 Digital public services	Latvia		EU
	rank	score	score
DESI 2019	7	73.7	62.9
DESI 2018	8	66.7	57.9
DESI 2017	13	56.1	54.0



	Latvia		EU	
	DESI 2017 value	DESI 2018 value	DESI 2019 value	DESI 2019 rank
5a1 e-Government users % internet users needing to submit forms	69%	77%	81%	8
5a2 Pre-filled forms Score (0 to 100)	58	71	83	4
5a3 Online service completion Score (0 to 100)	91	91	94	9
5a4 Digital public services for businesses Score (0 to 100) - including domestic and cross-border	93	93	91	10
5a5 Open data % of maximum score	NA	NA	66%	12
5b1 e-Health services % individuals	NA	14%	14%	17
5b2 Medical data exchange % of general practitioners	NA	NA	21%	22
5b3 e-Prescription % of general practitioners	NA	NA	91%	8

As regards Digital public services, Latvia ranks seventh in the EU. This is the only area where it is well above the EU average. The country's progress in this area is particularly noteworthy, with a significant improvement in the last two years driven by: (i) increased use of e-government; (ii) the availability of pre-filled forms; and (iii) the availability of open data. There is a high level of online interaction between public authorities and citizens: a growing number of Latvians use e-government services, which reach 81 % of internet users, well above the EU average. Latvia performed better in 2018 than in the previous year as regards pre-filled forms, coming fourth in the EU with 83 out of 100 and in online service completion, scoring 94 out of 100. However, the country is slightly less advanced in e-government services for business. In this area it scores 91 out of 100 – above the EU average of 85 out of 100 – making it the EU's 10th best performer. In e-health services, it ranks 17th in the EU, with 14 % of Latvians having used health and care services provided online. 91 % of general practitioners use e-prescriptions, but only 21 % exchange medical data, below the EU average of 43 %.

The implementation of the Data driven nation action plan²⁰⁸ in 2018 increased the availability of open data and data available for payment and improved the usability of the open data portal through new technical features to enable data and technology based innovative products and services. 2018

²⁰⁸<https://joinup.ec.europa.eu/document/cooperation-data-driven-nation-development-latvia>:
https://www.mk.gov.lv/sites/default/files/editor/ddn_plans_12.09_0.pdf

saw additional efforts to make public administration more effective through the efficient use of cloud computing as part of the newly approved Cloud Computing strategy²⁰⁹.

From January 2019 official e-addresses have been implemented for digital-by-default communication with citizens and businesses. Users can activate through a single click a 100 % digital communication with any local and national government institution. There are also innovative e-government projects, such as an artificial intelligence based virtual digital assistant service offered by the Register of Enterprises²¹⁰ and the state-owned free machine translation platform for Latvian²¹¹ (*hugo.lv*).

Latvia has implemented a centralised national information e-health system, which provides the patient's electronic health care record for everyone living in the country. Since 2018 e-prescriptions have been mandatory for all doctors and pharmacies, and sick-leave certificates are issued only electronically. The e-health system ensures processing and circulation among employees, health care and social insurance institutions, thus reducing the administrative burden associated with the processing of doctors' certificates on paper. Patients and health professionals can consult dedicated helplines services. The number of medical e-documents has increased in 2018, though this is not yet reflected by the DESI indicator.

Latvia is advancing in the area of digital public administration and additional progress is expected from the planned broader implementation of the digital-by-default approach in public service provision and the communication and training campaigns planned. Building on existing efforts, further promoting cross-sectoral partnership should make it possible to create data-driven innovative products and services, bringing additional positive results.

Highlight 2019: Communication and training programme My Latvija.lv! Do it digitally²¹²!

In April 2018 Latvia launched a triannual comprehensive communication and training programme called - '*My Latvija.lv! Do it digitally!*' - to encourage the general public to use government e-services and to inform people about online services and the benefits of eID.

The programme involves developing a 'digital friendly' visual identity, extensive information and training activities, national and regional events, and training for at least 6,000 national and local government officials, teachers, librarians and journalists, to improve their knowledge of digital solutions, so they can help people make the transition from on-site services to digital services. To promote a better understanding of digital solutions, video tutorials involving description of typical life situations have been developed. The programme includes advertising, marketing and public relations. It provides information about more than 500 e-services and brings together over 30 government institutions in a cooperative effort.

²⁰⁹ <http://tap.mk.gov.lv/lv/mk/tap/?pid=40441825&mode=mk&date=2018-02-20>

²¹⁰ <https://www.ur.gov.lv/en/>; <https://www.tilde.com/news/virtual-assistant-una-developed-tilde-helps-win-international-quality-awards-2018>

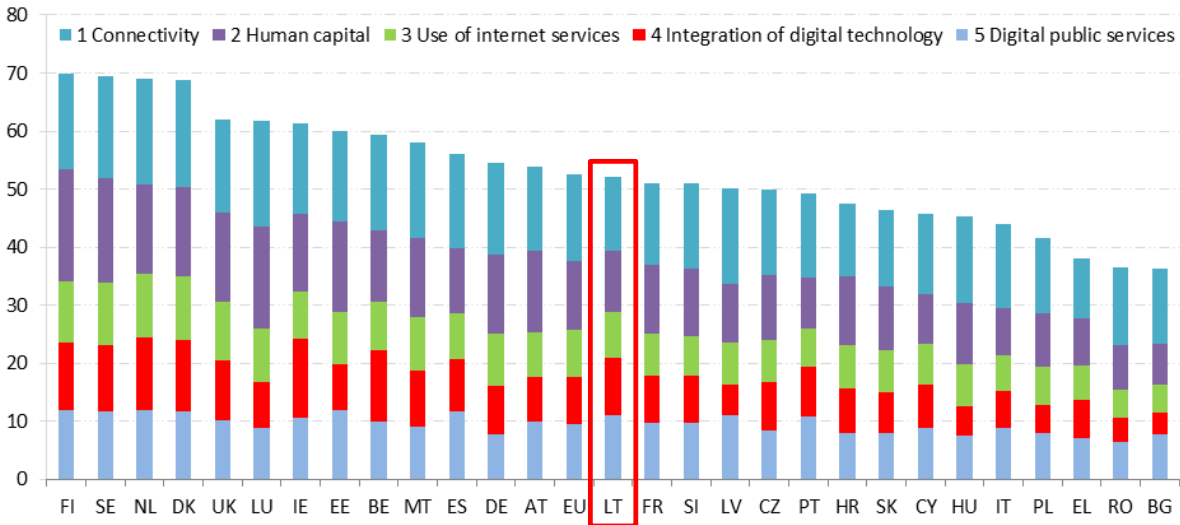
²¹¹ <https://hugo.lv/en/>; <https://joinup.ec.europa.eu/document/latvian-automated-translation-service>

²¹² <https://mana.latvija.lv/situacijas/>

Lithuania

	Lithuania		EU
	rank	score	score
DESI 2019	14	52.0	52.5
DESI 2018	14	49.2	49.8
DESI 2017	18	44.6	46.9

Digital Economy and Society Index (DESI) 2019 ranking



Lithuania ranks 14th out of the 28 EU Member States in the European Commission Digital Economy and Society Index (DESI) 2019.

Its score increased due to an improved performance in many of the DESI dimensions measured. Lithuania ranks highest (eighth) in the fields of Digital public services and Integration of digital technologies, thanks to widespread availability and continuous progress in the up-take of e-government services, while businesses have increased their e-commerce turnover and cross-border selling.

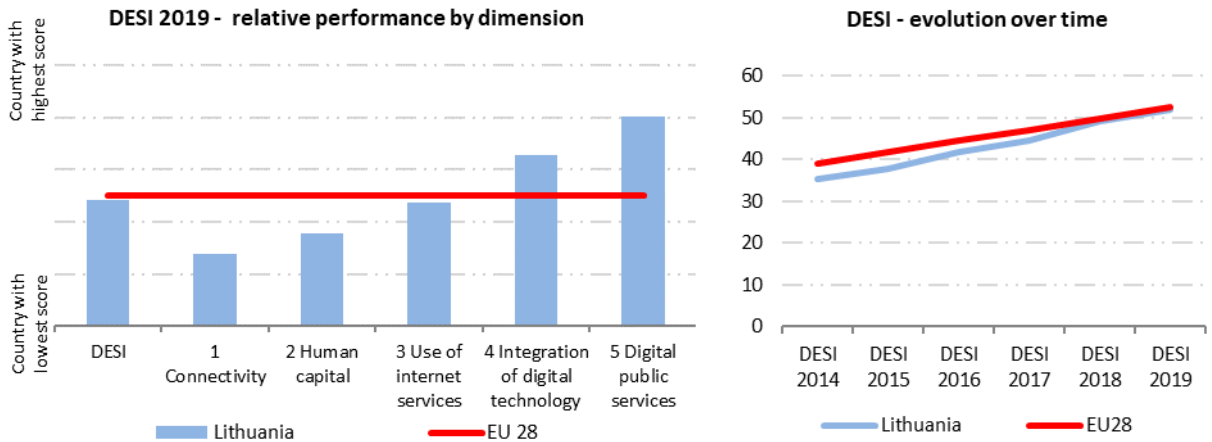
Lithuania has improved as regards the Human capital dimension and Use of internet services dimension but still scores below the EU average as regards the level of digital skills. As regards connectivity, there is room for improvement in NGA coverage.

The current Lithuanian Digital Agenda strategy, the Information Society Development Programme for 2014-2020 was adopted in 2014 and amended in December 2017²¹³. The strategy, under the responsibility of the Ministry of Economic Affairs and Innovation in cooperation with other relevant

²¹³ [http://eimin.lrv.lt/uploads/eimin/documents/files/30310_LRV%20nutarimas\(en\).pdf](http://eimin.lrv.lt/uploads/eimin/documents/files/30310_LRV%20nutarimas(en).pdf)

government ministries, is being implemented through an interinstitutional action plan²¹⁴ that is updated annually.

The renewed strategy covers all areas of the digital economy and society: digital skills, digital content in Lithuanian language, investments in high-speed broadband, e-government, use of open public data and innovative e-service creation, security, reliability and interoperability. This programme was complemented in August 2018 by a National Cybersecurity Strategy²¹⁵. The Lithuanian Industry Digitisation Roadmap for 2019-2030, setting a digitalised industry vision by 2030, will be added in the course of 2019.

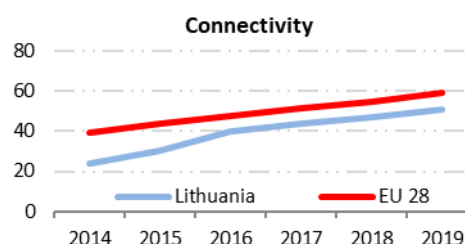


²¹⁴ <https://www.e-tar.lt/portal/lt/legalAct/a1e0ba10aa8211e88f64a5ecc703f89b>

²¹⁵ <https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/27107170d0lithu4511e8a82fc67610e51066?ifwid=axl7z9asu>

1 Connectivity

1 Connectivity	Lithuania		EU
	rank	score	score
DESI 2019	26	50.8	59.3
DESI 2018	25	47.1	54.8
DESI 2017	24	43.6	51.2



	DESI 2017	Lithuania	DESI 2019		EU
	value	value	value	rank	DESI 2019 value
1a1 Fixed broadband coverage % households	81%	82%	85%	27	97%
	2016	2017	2018		2018
1a2 Fixed broadband take-up % households	63%	65%	64%	23	77%
	2016	2017	2018		2018
1b1 4G coverage % households (average of operators)	96%	98%	98%	12	94%
	2016	2017	2018		2018
1b2 Mobile broadband take-up Subscriptions per 100 people	75	78	89	16	96
	2016	2017	2018		2018
1b3 5G readiness Assigned spectrum as a % of total harmonised 5G spectrum	NA	NA	0%	13	14%
			2018		2018
1c1 Fast broadband (NGA) coverage % households	50%	54%	63%	27	83%
	2016	2017	2018		2018
1c2 Fast broadband take-up % households	39%	45%	47%	13	41%
	2016	2017	2018		2018
1d1 Ultrafast broadband coverage % households	NA	54%	61%	18	60%
		2017	2018		2018
1d2 Ultrafast broadband take-up % households	12%	27%	29%	10	20%
	2016	2017	2018		2017
1e1 Broadband price index Score (0 to 100)	93	92	92	5	87
	2016	2017	2018		2017

Lithuania made some progress over the past year in Connectivity²¹⁶, which however did not translate into improvement of its overall rank (26th in 2019 compared to 25th in 2018)²¹⁷. Its progress has focused on mobile broadband take-up, fast (NGA) and ultrafast broadband coverage. Additionally, Lithuania has achieved better results than the EU average in 4G coverage, fast and ultrafast broadband take-up, ultrafast broadband coverage and the broadband price index (ranking as the fifth cheapest Member State). While its ultrafast coverage is higher (61 %) but close to the EU average (60 %), its fibre-to-the-premises (FTTP) coverage (60.6 %) is more than double the EU average (29.6 %). Nevertheless, Lithuania's performance is still being undermined by low fixed broadband coverage (85 %, against the EU average of 97 %), fixed broadband take-up (64 %, against the EU

²¹⁶ Broadband coverage figures have been revised since the 2018 DESI report.

²¹⁷ Figures have been substantially updated following a revision of broadband coverage indicators.

average of 77 %), mobile broadband take-up (89 subscriptions per 100 people, compared with the EU average of 96) and next generation access (NGA) coverage (63 %, against the EU average of 83 %).

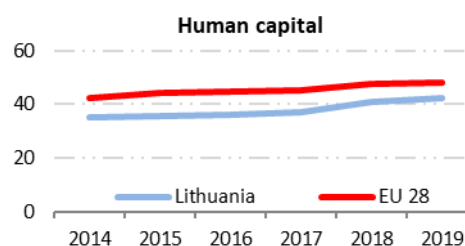
In 2018, the Commission approved the Development of Next Generation Access Infrastructure - RAIN3 project (a state aid measure). This project is designed to ensure further development of broadband networks in rural areas between 2018 and 2021. It entails offering electronic communication operators that wish to connect end-users with download speeds above 30 Mbps wholesale access to a newly built fibre backhaul network which will be provided by a state-owned body called *Plačijauostis internetas*. The new backhaul infrastructure will be deployed in areas currently not covered by next generation access (NGA) networks and lacking sufficient backhaul infrastructure, and where there are no plans for such coverage in the next three years (white areas). It will also help to bring fibre to the base stations and lay the basis for the rollout of 5G. In view of the above, Lithuania is expected to make further efforts to increase public investment in fibre networks, in addition to private investment, in order to develop the next generation of access infrastructure in white areas.

In 2018, Lithuania started preparation for 5G rollout by adopting a 5G Roadmap. Telia Lietuva (the incumbent operator), as well as Tele 2 and the state-owned LRTC, conducted initial 5G trials. The first 5G-related spectrum auction (covering frequencies in the 3.4-3.8 GHz band) was planned for September 2019 but is expected to be delayed. The conditions of the auction will include an obligation to cover one major city by 2020, in line with EU targets. The 700 MHz reassignment is planned to take place by 30 June 2020. Lithuania faces obstacles in preparing for the rollout of 5G, due to the restrictions stemming from unresolved cross-border coordination issues with non-EU countries (mainly Russia). To address this issue, Lithuania has requested the Commission's assistance. Another obstacle is associated with limits on electromagnetic fields (EMF). In Lithuania, these are lower than the maximum limits laid down in the 1999 Council Recommendation, which makes it challenging to densify the network in urban areas. 34 % of the spectrum harmonised at EU level for wireless broadband has been assigned so far in Lithuania.

Overall, Lithuania made some progress in 2018 towards meeting the gigabit society and 5G objectives but challenges remain, especially considering its low fixed broadband coverage and take-up and its low next generation access (NGA) coverage. Achieving these objectives depends on factors including the correct functioning of public institutions and on ensuring separation of regulatory and policy-making roles. The latter is also crucial to foster trust in the sector.

2 Human capital

2 Human capital	Lithuania		EU
	rank	score	score
DESI 2019	19	42.2	48.0
DESI 2018	20	40.7	47.6
DESI 2017	21	36.9	45.4



	Lithuania		EU	
	DESI 2017	DESI 2018	DESI 2019	DESI 2019
	value	value	value rank	value
2a1 At least basic digital skills % individuals	52% 2016	55% 2017	55% 16 2017	57% 2017
2a2 Above basic digital skills % individuals	29% 2016	32% 2017	32% 13 2017	31% 2017
2a3 At least basic software skills % individuals	54% 2016	57% 2017	57% 16 2017	60% 2017
2b1 ICT specialists % total employment	2.1% 2015	2.5% 2016	2.7% 21 2017	3.7% 2017
2b2 Female ICT specialists % female employment	0.8% 2015	1.2% 2016	1.4% 11 2017	1.4% 2017
2b3 ICT graduates % graduates	2.1% 2014	1.8% 2015	2.0% 25 2016	3.5% 2015

In Human capital, Lithuania ranks 19th in the EU, below the EU average. Although growing numbers of Lithuanians are going online, basic and advanced digital skills levels remain below the EU average. Only 55 % of people have basic digital skills (as opposed to 57 % in the EU as a whole), although Lithuania is one of the EU countries with the lowest proportion of adults with a low level of education (in 2017 only 12% Lithuanians have less than lower secondary education, against an EU average of 25%). Despite growing demand on the labour market and policy measures taken to fill this gap, the availability of ICT specialists is still below the EU average (2.7 % against 3.7 %). Among businesses that have recruited or tried to recruit ICT specialists, 40 % reported difficulties in filling their vacancies. Only 9 % of companies provide training for staff, against 23 % in the EU as a whole²¹⁸. As regards numbers of ICT graduates, Lithuania performs less well than most EU countries, with only 2 % of ICT graduates. Action taken in recent years to increase enrolment in ICT studies has yet to show results (more ICT graduates). ICT female specialists account for only 1.4 % of female employment.

Lithuania has no separate Digital Skills Strategy. However, the first goal of the Digital Agenda is to reduce the digital divide by encouraging Lithuanians to gain more skills in the safe and beneficial use of ICT. The latest update of the strategy places more emphasis on this goal. The priority target groups identified are rural, older, disabled and lower-income residents. The EU-funded project 'Connected Lithuania'²¹⁹ launched in 2018, implemented by the Information Society Development Committee

²¹⁸ Digital Scoreboard, 2019.

²¹⁹ www.prisijungusi.lt

together with members of the National Digital Skills and Jobs Coalition, supports local communities. 100,000 Lithuanians who do not yet use the internet will be trained by 2020, through a network of digital leaders and e-scouts, based on the European Digital competence framework.

The 2018 Code week was particularly successful, with the first involvement of the Ministry of Education and a considerable increase in the number of schools taking part (120) and 22,100 participants. Additionally, several ongoing projects aim to improve computer studies in primary schools such as the '*Kompiuteriukai Vaikams*' initiative²²⁰.

The Digital Agenda Strategy also seeks to tackle the shortage of ICT specialists. It includes measures designed to encourage more young people to choose ICT as a career, to attract more women and to improve vocational training for ICT specialists. The Akademija.IT²²¹ project encourages vocational training, trains trainers and retrains people with educational background for which there is less demand, in close partnership with businesses. Lithuania aims to attract ICT professionals in several ways. The country promotes relocation of start-ups from neighbouring non-EU countries. The Digital Explorers²²² project connects Lithuanian IT companies with Nigerian IT specialists and promotes their legal migration.

Increasing the number of Lithuanian ICT specialists, reducing the basic shortfall in digital skills, narrowing the gender-gap and boosting the industry investments in up-skilling the ICT labour force are essential to enable businesses to create, adopt and implement digitisation solutions and thereby to exploit the full potential of the digital economy.

Highlight 2019: Women Go Tech²²³

Women Go Tech is a nationwide professional mentorship programme designed to attract more female talents into ICT and Engineering careers. The programme is led by Infobalt, the ICT industry association, and it is financed by Infobalt's corporate partners and sponsors. It started in 2016 and reached 800 applications in 2018. The programme offers quality one-to-one mentoring and counselling sessions, provides expert knowledge and organises networking and content-focused events.

The objective is to create 500 success stories of women in tech by 2021. So far there are 79, with participants finding a job or getting promoted as ICT specialists, or creating an ICT start-up. Participants have different background, not only IT and engineering, but many are generalists (e.g. project managers and product development managers). A balanced mix of male and female mentors have already provided 1,728 hours of mentoring/consultancy/trainings sessions and the programme's events have reached over 3,800 people.

²²⁰ <http://www.kompiuteriukai.lt/>

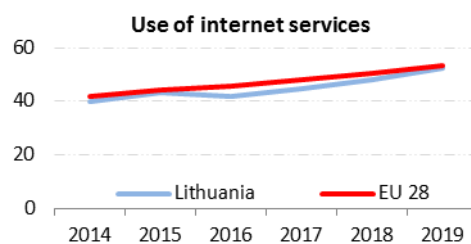
²²¹ <http://akademija.it/>

²²² <https://www.afriko.lt/ict4dprojectdigitalexplorers/>

²²³ <https://www.womengotech.lt/>

3 Use of internet services

3 Use of internet services	Lithuania		EU
	Rank	score	score
DESI 2019	13	52.1	53.4
DESI 2018	15	48.0	50.7
DESI 2017	18	44.5	47.8

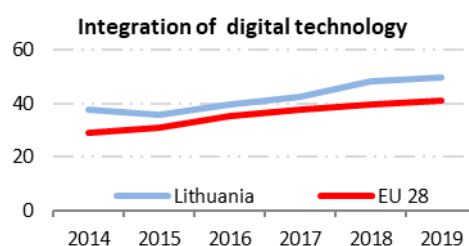


	DESI 2017	Lithuania		EU	
	value	DESI 2018 value	DESI 2019 value	rank	DESI 2019 value
3a1 People who never used the internet % individuals	22%	19%	17%	20	11%
3a2 Internet users % individuals	72%	75%	78%	20	83%
3b1 News % internet users	93%	93%	93%	1	72%
3b2 Music, videos and games % internet users	77%	77%	84%	11	81%
3b3 Video on demand % internet users	11%	11%	15%	21	31%
3b4 Video calls % internet users	69%	71%	74%	3	49%
3b5 Social networks % internet users	68%	69%	73%	15	65%
3b6 Professional social networks % internet users	6%	11%	11%	19	15%
3b7 Doing an online course % internet users	9%	9%	9%	8	9%
3b8 Online consultations and voting % internet users	7%	12%	12%	10	10%
3c1 Banking % internet users	73%	72%	76%	9	64%
3c2 Shopping % internet users	44%	49%	54%	19	69%
3c3 Selling online % internet users	7%	9%	10%	25	23%

The Use of internet services in Lithuania is broadly comparable with the EU average. Although the number of Lithuanians who have never been online continues to fall, the percentage still stands at 17 %, well above the EU average of 11 %. People in Lithuania are keen to engage in a variety of online activities as in the rest of the EU. The most popular activity (93 % of internet users) is reading the news, putting Lithuania at number 1 in the EU; only 72 % users in the EU as a whole do this. Growing numbers of Lithuanians also listen to music, watch videos and play games online (84 % against 81 % EU-wide). The use of banking (76 %) and video calls (74 %) is more widespread than in other EU countries, but the use of video on demand and professional social networks (15 % and 11 %, respectively) is below the EU average.

4 Integration of digital technology

4 Integration of digital technology	Lithuania		EU
	Rank	score	score
DESI 2019	8	49.7	41.1
DESI 2018	8	48.4	39.6
DESI 2017	10	42.5	37.6



	DESI 2017	Lithuania		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
4a1 Electronic information sharing % enterprises	40% 2015	47% 2017	47% 2017	3	34% 2017
4a2 Social media % enterprises	19% 2016	20% 2017	20% 2017	14	21% 2017
4a3 Big data % enterprises	12% 2016	12% 2016	14% 2018	10	12% 2018
4a4 Cloud % enterprises	13% 2016	17% 2017	17% 2018	12	18% 2018
4b1 SMEs selling online % SMEs	18% 2016	22% 2017	21% 2018	6	17% 2018
4b2 e-Commerce turnover % SME turnover	12% 2016	12% 2017	14% 2018	6	10% 2018
4b3 Selling online cross-border % SMEs	10% 2015	12% 2017	12% 2017	3	8% 2017

As regards the Integration of digital technology by businesses, Lithuania ranks eighth among EU countries, well above the EU average. It has made progress since 2017 as a result of improvements in the use of big data (14 % of enterprises) and due to the increase in e-commerce turnover. Lithuanian companies are increasingly seizing the opportunities offered by online commerce: 21 % of SMEs sell online (17 % in the EU as a whole), 12 % of total SMEs sell in other countries and 14 % of their turnover comes from the online segment (up from 12 % in 2017). The number of firms using social media (20 % in 2016) and cloud services (17 %) remains static.

The main policy-making dialogue is led by the National Industrial Competitiveness Commission 'Pramonė 4.0'²²⁴. Additionally, the digitisation platform launched in 2016 involves major stakeholders with a bottom-up approach and the participation of high-level representatives from policy making bodies, industry and research. During 2018, thematic working groups on digital manufacturing, digitisation services, standardisation and legal regulation, human resources and cybersecurity worked on proposing efficient solutions for industry digitisation.

An expert analysis completed in 2018 will help define the Lithuanian Industry Digitisation Roadmap for 2019-2030²²⁵. The benchmark analysis identified a shortfall in the share of the medium and high-

²²⁴ <https://industrie40.lt/platform-pramone-4-0-structure/>

²²⁵ <https://inovacijos.lt/media/industry%20digitalization%20ROADMAP%20pre-final%20draft.pdf>

tech sector and possible underinvestment in automation and robotisation. An interinstitutional plan laying out a digitised industry vision by 2030 is expected in the course of 2019.

The national cybersecurity strategy, approved in August 2018, will develop cyber defence capabilities, ensure the prevention and investigation of cyber-crime, promote a culture of cybersecurity and associated innovation, and step up public-private and international collaboration. One of the issues the strategy will tackle is the need to increase the number of cybersecurity experts.

Lithuania is committed to making progress with new digital technologies and to investing strategically through EU-coordinated programmes. For instance, it is a member of the EuroHPC Joint Undertaking and it has signed the Declaration establishing a European Blockchain Partnership and the Declaration on Cooperation on Artificial Intelligence. Lithuania already has four Digital Innovation Hubs specialising in advanced manufacturing, laser technology, robotics, photonics, e-business models and IT solutions. A growing ecosystem has been created around the Blockchain Centre in Vilnius²²⁶ and numerous blockchain-based solutions are being developed for both SMEs and start-ups in the field of sustainable financial and smart technologies, including by state-owned companies.

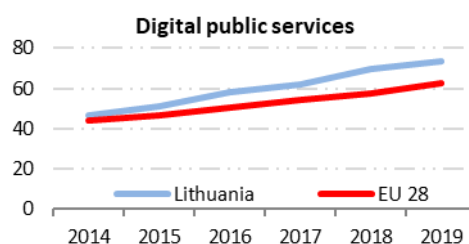
In 2018, the Ministry of Economic Affairs and Innovation set up a group of experts on artificial intelligence which has started drawing up a national AI strategy to be completed in the course of 2019.

The fact that firms have made great strides towards integrating digital technology into their business practice, coupled with support for start-ups, should provide a sound basis for future developments. Promoting digital transformation, will need to include further awareness, raising on the importance of digitising SMEs.

²²⁶ <https://bcgateway.eu/>

5 Digital public services

5 Digital public services	Lithuania		EU
	rank	score	score
DESI 2019	8	73.3	62.9
DESI 2018	7	69.5	57.9
DESI 2017	8	62.0	54.0



	DESI 2017	Lithuania	DESI 2019	EU
	value	DESI 2018	value rank	DESI 2019
	value	value	value rank	value
5a1 e-Government users % internet users needing to submit forms	78%	81%	81% 9	64%
5a2 Pre-filled forms Score (0 to 100)	69	85	88 3	58
5a3 Online service completion Score (0 to 100)	92	95	96 5	87
5a4 Digital public services for businesses Score (0 to 100) - including domestic and cross-border	91	93	97 4	85
5a5 Open data % of maximum score	NA	NA	46% 24	64%
5b1 e-Health services % individuals	NA	19%	19% 12	18%
5b2 Medical data exchange % of general practitioners	NA	NA	25% 18	43%
5b3 e-Prescription % of general practitioners	NA	NA	85% 9	50%

As regards Digital public services, Lithuania ranks eighth in the EU, well above the EU average. The country performs very well as regards pre-filled forms and digital public services for businesses. There is a high level of online interaction between public authorities and citizens: 81 % of Lithuanian online users actively engage with e-government services (64 % in the EU as a whole). The availability of e-government services for business is also impressive; in this Lithuania scores 97 out of 100, ranking fourth in the EU. It comes 12th in the EU in terms of e-health services, with 19 % of Lithuanians having used health and care services provided online. 85 % of general practitioners use e-prescriptions, while 25 % of them exchange medical data.

All the administrative and public e-services for which demand is highest are now available online, and Lithuania continues to digitise those that are less popular as well. There was a targeted publicity campaign in 2018 to promote the use of e-services. The e-government gateway²²⁷ provides links to a total of 608 e-services.

In the area of e-health, Lithuania has created an integrative platform for medical institutions MedVAIS to exchange and view medical images, diagnosis and reports. It also provides capabilities for off-site viewing and reporting, distance education and tele diagnosis; enables teleradiology and telecardiology and facilitates services in remote and rural parts of the country. Patients can view

²²⁷ <https://www.epaslaugos.lt/portal>

their diagnostic tests via web-based viewers using the public e-health portal. Data depersonalisation features enable data to be further used for education, research and innovation; however, these possibilities are not yet being fully exploited. A Lithuanian innovation project in the e-health sector is the start-up Oxipit ChestGlass project²²⁸. This is the first-to-market chest X-ray search solution that enables radiologically similar images to be identified in a given database. Lithuania has signed the European Declaration of cooperation towards access to at least 1 million sequenced genomes in the EU by 2022 a crucial initiative for genetic data sharing.

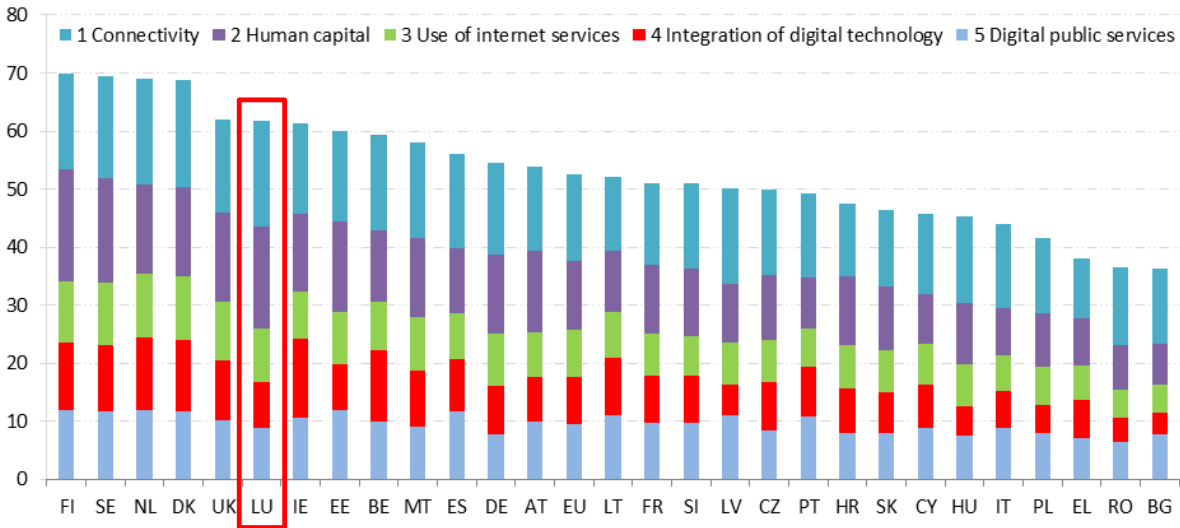
Lithuania has achieved remarkable results in terms of awareness-raising and use of e-government services. It has also introduced several e-health solutions. However, there is a recognised need for further efforts to support the take-up of e-health services, to ensure the necessary commitment from healthcare institutions and resources to help the adoption of new technologies in the health system. This includes ensuring that those using the system- both medical practitioners and patients – have sufficient computer skills.

²²⁸ <https://www.oxipit.ai/>

Luxembourg

	Luxembourg		EU
	rank	score	score
DESI 2019	6	61.8	52.5
DESI 2018	5	59.5	49.8
DESI 2017	5	56.4	46.9

Digital Economy and Society Index (DESI) 2019 ranking



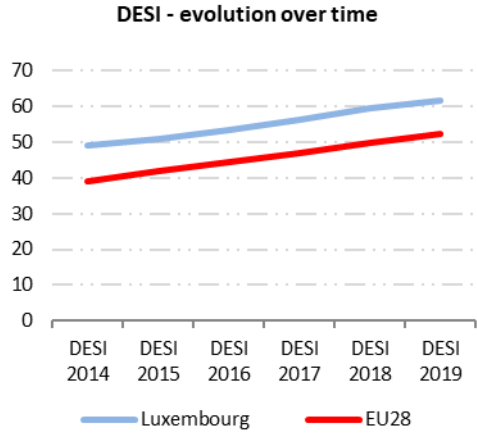
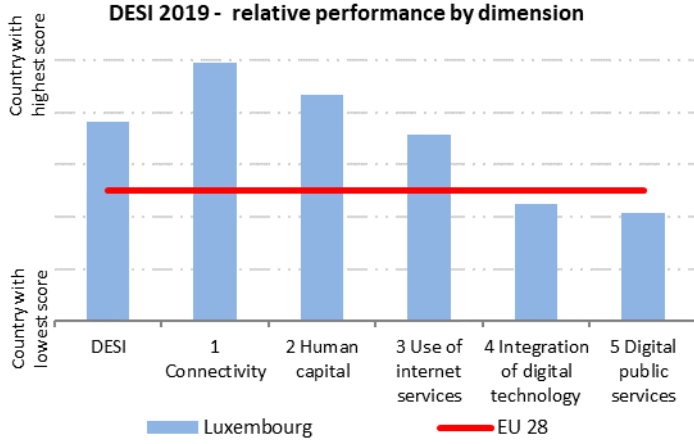
Luxembourg ranks 6th out of the 28 EU Member States in the European Commission Digital Economy and Society Index (DESI) 2019, a drop of one position.

Luxembourg performs best in Connectivity, in which it now ranks second among EU countries. Integration of digital technology and Digital public services continue to be the country's weakest points in the DESI, both scores being below the EU average, but the progress rates over the last two years indicate that the country is actively addressing both areas.

The country ranks well in all indicators of the Connectivity dimension, with wide availability of fast and ultrafast fixed and mobile broadband networks, and increasing take-up levels for fast and ultrafast broadband. The country ranks third in Human capital, with a slight improvement in its score compared to last year. The percentage of individuals with at least basic digital and software skills was well above EU average in 2017 (ranked first), while the share of ICT specialist as a percentage of total employment has increased to 5 % and is well above the EU average of 3.7 %. The country ranks 6th on the Use of internet services.

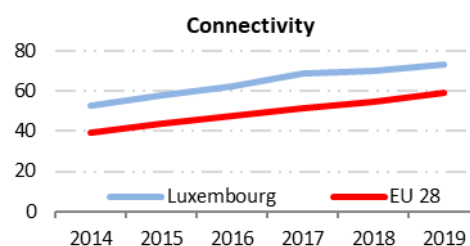
In Integration of digital technology, Luxembourg remains below the EU average but it is narrowing the gap and now ranks 17th. The country performs well in the share of enterprises analysis big data and there has been notable progress in the share of SMEs selling online, though this remains substantially below the EU average. Digital public services have continued to improve, but the score

remains several points below the EU average. Medical data exchange and e-prescriptions indicators show a performance well below the EU average.



1 Connectivity

1 Connectivity	Luxembourg		EU
	rank	score	score
DESI 2019	2	73.3	59.3
DESI 2018	2	70.1	54.8
DESI 2017	2	68.5	51.2



	DESI 2017 value	Luxembourg DESI 2018 value	DESI 2019 value	DESI 2019 rank	EU DESI 2019 value
1a1 Fixed broadband coverage % households	>99.5% 2016	>99.5% 2017	100% 2018	1	97% 2018
1a2 Fixed broadband take-up % households	96% 2016	94% 2017	88% ²²⁹ 2018	3	77% 2018
1b1 4G coverage % households (average of operators)	95% 2016	98% 2017	99% 2018	6	94% 2018
1b2 Mobile broadband take-up Subscriptions per 100 people	116 2016	123 2017	139 2018	4	96 2018
1b3 5G readiness Assigned spectrum as a % of total harmonised 5G spectrum	NA	NA	0% 2018	13	14% 2018
1c1 Fast broadband (NGA) coverage % households	94% 2016	95% 2017	98% 2018	4	83% 2018
1c2 Fast broadband take-up % households	47% 2016	52% 2017	62% 2018	4	41% 2018
1d1 Ultrafast broadband coverage % households	NA	87% 2017	92% 2018	5	60% 2018
1d2 Ultrafast broadband take-up % households	15% 2016	22% 2017	33% 2018	6	20% 2017
1e1 Broadband price index Score (0 to 100)	89 2016	89 2017	90 2018	7	87 2017

Luxembourg is among the leaders in Connectivity and has improved its score at almost the same pace as the EU average. The country is fully covered by fixed broadband networks. Next generation access (NGA) coverage is 98 %. Luxembourg performs very well in the take-up of mobile broadband services (139 subscriptions to mobile broadband services per 100 people, against an EU average of 96). To some extent, this growth in mobile broadband take-up (16 percentage points in 2018) comes at the expense of fixed broadband take-up. Although the latter is significantly above the EU average, it fell by six percentage points in 2018. Demand for fast and ultrafast broadband services, however, is increasing: 62 % of subscriptions are for fast broadband and 33 % for ultrafast broadband, compared with 52 % and 22 % respectively one year ago. Luxembourg's 4G coverage (99 %) is higher than the EU average (94 %). As fibre roll-out continues, FTTP (fibre-to-the premises) coverage has topped 63 %.

Luxembourg will probably miss its national policy target of having everyone connected by the end of 2020 at 1Gbps speed. Full coverage is not achievable by 2020 through fixed networks only, while 5G

²²⁹ Break in series.

could further improve coverage. So far, the country has relied mainly on market-driven broadband roll-out based on competition among operators. In the future, it is intended to address the digital divide by using national and EU funds as well. Further details are still to be defined. In 2018, new fibre was rolled out to another 3 % of households that were not connected previously, thanks to infrastructure works by the incumbent POST. The POST fibre network passes now 63 % of residential customers. This figure is expected to increase to at least 75 % by 2023. This fibre network already covers all business customers. Competitors are increasingly making use of fibre unbundling. Uptake of fibre has progressed significantly. The largest cable operator, Eltrona, has upgraded its cable network to DOCSIS 3.1.

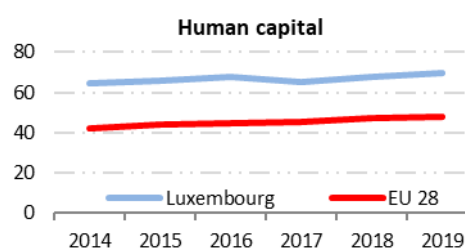
Luxembourg's national regulatory authority, the *Institut Luxembourgeois de Régulation* (ILR) is preparing award procedures for the 700 MHz and 3.6 GHz spectrum. It is planning to launch the public consultation in spring 2019. There are also plans to launch a public consultation and issue licences for the 26 GHz band in the second half of 2020. Some spectrum in the 2.6 GHz band was handed back in 2018. In Luxembourg, only 25 % of the spectrum harmonised at EU level for wireless broadband has been assigned. The national 5G action plan was published in September 2018.²³⁰ A cross-border trial with participants from Germany (DE), Luxembourg (LU) and France (FR) is running for automated driving on the motorway from Merzig (DE) through LU to Metz (FR), supported by the automotive industry and using 5G technology. The incumbent POST is providing the mobile infrastructure on the territory of Luxembourg for this trial. Luxembourg City is set to be the 5G city; both touristic, residential and business zones will be covered with the country's first 5G network. The process of defining the applications and the verticals involved has started. The launch of commercial services is expected before the end of 2020. State co-financing of further 5G pilots is planned. Luxembourg is also considering EU funding should such an option be available in the future. Luxembourg intends to examine technological solutions to avoid a situation in which people crossing borders and moving from one national mobile network lose their connection. Research in this area is suggested in the 5G action plan, including an analysis of potential regulatory obstacles.

Luxembourg is well on track to achieve the EU's fixed broadband targets for 2020: to supply every European with access to at least 30 Mbps connectivity, and to provide half of European households with connectivity speeds of 100 Mbps. However, it is unlikely to meet the more ambitious targets under national policy by 2020. The preparations by ILR to assign additional spectrum which can be used for 5G services are crucial to meet the EU target for 5G.

²³⁰ https://digital-luxembourg.public.lu/sites/default/files/2018-11/Digital-Luxembourg_Strategy5G_V1_WEB.pdf

2 Human capital

2 Human capital	Luxembourg		EU
	rank	score	score
DESI 2019	3	69.9	48.0
DESI 2018	3	67.6	47.6
DESI 2017	2	65.1	45.4



	DESI 2017	Luxembourg	DESI 2019	EU
	value	DESI 2018	value rank	DESI 2019
2a1 At least basic digital skills % individuals	86% 2016	85% 2017	85% 1 2017	57% 2017
2a2 Above basic digital skills % individuals	54% 2016	55% 2017	55% 1 2017	31% 2017
2a3 At least basic software skills % individuals	88% 2016	87% 2017	87% 1 2017	60% 2017
2b1 ICT specialists % total employment	4.6% 2015	4.1% 2016	5.0% 5 2017	3.7% 2017
2b2 Female ICT specialists % female employment	1.3% 2015	1.3% 2016	1.4% 12 2017	1.4% 2017
2b3 ICT graduates % graduates	3.6% 2014	5.9% 2015	5.8% 5 2016	3.5% 2015

In the Human capital dimension, Luxembourg ranks third, scoring well above the EU average. Based on the data from DESI 2018 (collected in 2017), Luxembourg ranked first in all three digital literacy indicators. In 2017, 87 % of 16-74-year-olds in Luxembourg had basic digital skills compared to 57 % in the EU. New data from 2018 shows that the country also performs comparatively well in advanced digital skills, with 5.8 % of graduates holding ICT degrees. Furthermore, the share of ICT specialist as a percentage of total employment has increased to 5 %, well above the EU average of 3.7 %. At the same time, Eurostat data²³¹ show that Luxembourg experiences significant labour shortages in terms of ICT specialists. Of the enterprises who recruited or tried to recruit ICT specialists in 2017, 71 % reported having had hard-to-fill vacancies, significantly above the EU average of 53 %. This rate was up from 61 % in 2016 and was as high as 78 % for companies in the ICT sector.

The government's digital education strategy, Digital(4)Education²³², was launched in 2015. It targets young people in primary, secondary and vocational education and has two components: Digital Education and Digital for Education. As part of this strategy, new specialisations focusing on digital competencies have been created throughout the different stages of the school system. In parallel, the Ministry of Education is in the second year of a programme that has equipped 30 % of secondary school students with tablets. The Ministry is also investing heavily in digital content, giving all teachers and students access to a wide selection of video streaming platforms for learning.

²³¹ Digital Scoreboard, 2019.

²³² <https://portal.education.lu/digital4education/>

In 2017, the Ministry of Education initiated a program for high schools innovating in ICT called Future Hub²³³. Signed up schools commit to offering innovative ICT courses (cloud computing, game development, etc.). The schools also offer extra-curricular activities for students and outside participants, such as science and robotics labs, as well as coding clubs.

In May 2018 the Ministry of Labour launched the pilot phase of the Digital Skills Bridge project²³⁴. The project helps companies and their workers anticipate and adapt to changes to their jobs brought by digital technologies. To this end, the programme supports firms' efforts to provide re-skilling and up-skilling through financial support, working time adaptations, etc. Over 300 people from a dozen companies in different sectors participated in the first phase of the pilot. A second phase is due in 2019.

A number of projects co-financed by the European Social Fund foster digital skills & literacy among jobseekers, migrants and young people. Of note are Fit4Coding²³⁵, which enables participants to become front-end developers following 3.5 months of full-time training, and Digi4All, that offers basic IT training in different languages to newly arrived migrants to help them integrate into the labour market.

The significant difficulties experienced by Luxembourg enterprises trying to recruit ICT specialists limit their capacity to innovate and grow. Increasing the number of ICT specialists, narrowing the employment gender gap, and re-skilling the labour force, is thus of utmost importance if Luxembourg is to reap the full benefits digitising its economy.

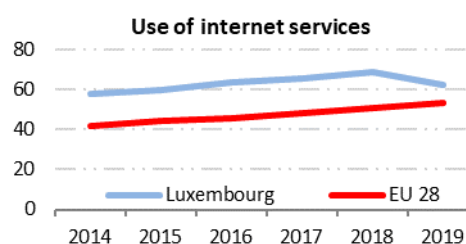
²³³ <https://portal.education.lu/futurehub/>

²³⁴ <https://www.skillsbridge.lu/>

²³⁵ <http://www.fonds-europeens.public.lu/fr/projets-cofinances/fse/2014-2020/1026/index.html>

3 Use of internet services

3 Use of internet services	Luxembourg		EU
	rank	score	score
DESI 2019	6	62.4	53.4
DESI 2018	4	68.7	50.7
DESI 2017	4	65.2	47.8



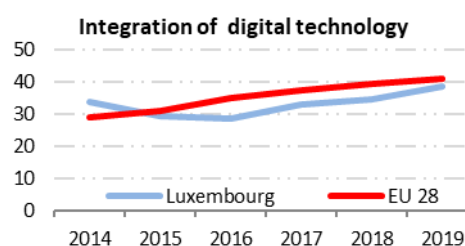
	Luxembourg ²³⁶				EU
	DESI 2017	DESI 2018	DESI 2019		DESI 2019
	value	value	value	rank	value
3a1 People who never used the internet	2%	2%	3%	2	11%
% individuals	2016	2017	2018	2018	2018
3a2 Internet users	97%	96%	92%	5	83%
% individuals	2016	2017	2018	2018	2018
3b1 News	89%	88%	88%	7	72%
% internet users	2016	2017	2017	2017	2017
3b2 Music, videos and games	89%	89%	72%	24	81%
% internet users	2016	2016	2018	2018	2018
3b3 Video on demand	29%	29%	24%	13	31%
% internet users	2016	2016	2018	2018	2018
3b4 Video calls	54%	57%	49%	19	49%
% internet users	2016	2017	2018	2018	2018
3b5 Social networks	69%	70%	66%	21	65%
% internet users	2016	2017	2018	2018	2018
3b6 Professional social networks	23%	24%	24%	3	15%
% internet users	2015	2017	2017	2017	2017
3b7 Doing an online course	10%	10%	10%	7	9%
% internet users	2016	2017	2017	2017	2017
3b8 Online consultations and voting	18%	33%	33%	1	10%
% internet users	2015	2017	2017	2017	2017
3c1 Banking	73%	78%	70%	13	64%
% internet users	2016	2017	2018	2018	2018
3c2 Shopping	80%	82%	74%	7	69%
% internet users	2016	2017	2018	2018	2018
3c3 Selling online	15%	18%	15%	18	23%
% internet users	2016	2017	2018	2018	2018

Overall, Luxembourg scores well in the Use of internet services dimension, ranking sixth among the EU Member States (somewhat lower than a year ago, probably because of a break in series for several indicators in this dimension). Internet use, in particular, is very high, with only 3 % of people reporting they have never used the internet and 92 % of people (down from 96 %) declaring themselves as internet users, against an EU average of 83 %. When compared with the average EU internet user, Luxembourg's users are more likely to bank and shop online, but less likely to sell online (15 % versus 23 % EU average).

²³⁶ There is a break in series for several indicators.

4 Integration of digital technology

4 Integration of digital technology	Luxembourg		EU
	rank	Score	score
DESI 2019	17	38.7	41.1
DESI 2018	21	34.6	39.6
DESI 2017	20	32.9	37.6



	Luxembourg		EU	
	DESI 2017	DESI 2018	DESI 2019	DESI 2019
	value	value	value	rank
4a1 Electronic information sharing % enterprises	39%	41%	41%	5
	2015	2017	2017	2017
4a2 Social media % enterprises	19%	20%	20%	13
	2016	2017	2017	2017
4a3 Big data % enterprises	13%	13%	16%	7
	2016	2016	2018	2018
4a4 Cloud % enterprises	12%	NA	16%	14
	2016	2017	2018	2018
4b1 SMEs selling online % SMEs	9%	8%	12%	20
	2016	2017	2018	2018
4b2 e-Commerce turnover % SME turnover	NA	NA	NA	10%
	2016	2017	2018	2018
4b3 Selling online cross-border % SMEs	6%	8%	8%	17
	2015	2017	2017	2017

On the Integration of digital technology by businesses, Luxembourg, ranked 17th and continues to perform below the EU average. The country has made good progress over the last year (21st position). In line with the country's ambition to transition to a data-driven economy, Luxembourg performs well in the share of enterprises analysing big data (16 % versus an EU average of 12 % ranking seventh). The country continues to perform well below the EU average as regards the share of SMEs selling online. However, progress over the last year has been promising, suggesting that Luxembourg SMEs are starting to take advantage of the opportunities offered by e-commerce (see highlight 2019).

Luxembourg is committed to advancing and deploying new digital technologies. The country is a member of the EuroHPC Joint Undertaking and has signed the Declaration of European Blockchain Partnership, as well as the Declaration on cooperation on Artificial Intelligence (AI). Digitisation continues to figure prominently in the Luxembourg's government political agenda following the October 2018 national elections: a new ministry in charge of all topics linked to digitisation has been created, while the development of AI is explicitly mentioned in the government programme.

In June 2018 it was announced that Luxembourg would host the EuroHPC headquarters. The government announced in parallel its intention to procure a national supercomputer in 2019, which will benefit from 35 % European co-funding and will later be connected to the EuroHPC network.

In July 2018 the Government signed a memorandum of understanding with the American chip manufacturer Nvidia. This partnership will establish a joint AI laboratory that brings together Nvidia's AI research experience with Luxembourg's research community.

The InfraChain initiative²³⁷, a public-private partnership founded in May 2017 by the Luxembourg government and 11 private actors, is a non-profit aimed at driving faster and wider adoption of blockchain technology. InfraChain aims to provide a framework that bridges the current gap where many blockchain pilots cannot be deployed in a public chain environment as these do not provide sufficient regulatory compliance. To do so InfraChain is building a community-driven permissioned node network able to host blockchain applications while providing trust and accountability in its nodes; a sustainable operational environment with a service level agreement, and regulatory compliance (e.g. GDPR). The node network has an additional level of governance rules that defines how the community governs the permissioned infrastructure and guarantees the independence of the actors involved in the operation of the hosted applications. This differentiates the initiative from current cloud alternatives on the market.

The initiative Digital4Industry²³⁸ (D4I) was launched in June 2016 by the Ministry of Economy to enable the early adoption of Industry 4.0 solutions by manufacturing companies. The initiative is designed to identify and address systemic challenges experienced by the local industry, and helps create awareness among enterprises about the risks and opportunities related to the implementation or non-implementation of Industry 4.0 solutions. In addition, D4I helps initiate collaborative pilot projects between companies to help showcase the potential for value creation brought by such solutions.

For Luxembourg to fully reap the rewards of the digitising its economy, it will need to seize the full range of benefits from the adoption of digital technologies by SMEs. Increasing awareness of the relevance of digitising SMEs and their needs will be important.

Highlight 2019: Fit4Digital²³⁹

Fit4Digital is an innovative programme launched in January 2018 by the Ministry of Economy and Luxinnovation to help SMEs in their digital transformation. Participating SMEs undergo a 360-degree review of their organisation and processes with an approved external consultant.

A digitisation-oriented action plan is put in place to help the companies integrate digital tools that will make it more profitable and efficient (for example helping SMEs, operating in retail sector, build an e-commerce website to reach more customers).

Public aid of up to a maximum of 50 % of the costs incurred is made available for the implementation of the plan.

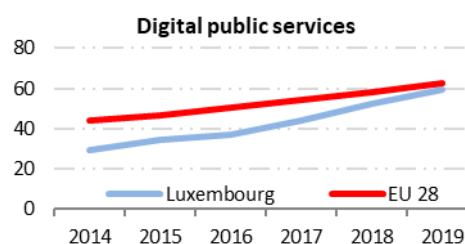
²³⁷ <https://infracchain.com/>

²³⁸ <https://digital4industry.lu/>

²³⁹ <https://www.luxinnovation.lu/innovate-in-luxembourg/performance-programmes/fit-4-digital/>

5 Digital public services

5 Digital public services	Luxembourg		EU
	Rank	score	score
DESI 2019	17	59.3	62.9
DESI 2018	18	52.5	57.9
DESI 2017	22	44.1	54.0



	Luxembourg				EU
	DESI 2017	DESI 2018	DESI 2019		DESI 2019
	value	value	value	rank	value
5a1 e-Government users % internet users needing to submit forms	45%	49%	55%	18	64%
	2016	2017	2018		2018
5a2 Pre-filled forms Score (0 to 100)	30	50	55	16	58
	2016	2017	2018		2018
5a3 Online service completion Score (0 to 100)	77	81	87	16	87
	2016	2017	2018		2018
5a4 Digital public services for businesses Score (0 to 100) - including domestic and cross-border	80	82	86	15	85
	2016	2017	2018		2018
5a5 Open data % of maximum score	NA	NA	76%	6	64%
			2018		2018
5b1 e-Health services % individuals	NA	19%	19%	12	18%
		2017	2017		2017
5b2 Medical data exchange % of general practitioners	NA	NA	25%	18	43%
			2018		2018
5b3 e-Prescription % of general practitioners	NA	NA	14%	23	50%
			2018		2018

In Digital public services, Luxembourg ranks 17th among EU countries. Although its score remains a few points below the EU average, its performance in Digital public services has been improving faster than the EU28 over the last few years. However, there is a low level of online interaction between public authorities and citizens. Only 55 % of Luxembourg internet users actively engage with e-government services (substantially below the EU average of 64 %). Luxembourg also performs below the EU average in pre-filled forms and online service completion, but both scores have shown significant progress over the last few years. In open data, the country performs particularly well (ranked sixth). In the new indicators for medical data exchange and e-prescriptions the country scores substantially below the EU average. Only 14 % of general practitioners used e-prescriptions in 2018, compared to an EU average of 50 %. However, Luxembourg performed well in the broader e-health services indicator measured last year, ranking 12th in the EU.

The government coalition confirmed by the general elections in October 2018 has highlighted digitisation as one of its top political priorities. A full chapter of the coalition agreement is dedicated to digitisation and improving digital public services.

In 2018 the Luxembourg Point of Single Contact '*Guichet.lu*', a one-stop shop for administrative procedures, was entirely redesigned and migrated to a new technical infrastructure. It serves as a central portal for both citizens and businesses and is available in French, German and English. As of

2018, 242 interactive online administrative procedures have been accessible²⁴⁰. The use of the MyGuichet transactional procedures has been growing exponentially in recent years with 393,620 procedures submitted through the platform in 2018, up from 75,121 in 2015.

In 2018 Luxembourg effectively implemented eIDAS. The country is among the few Member States who have already notified their e-ID scheme. Since September 2018, citizens from other Member States that have notified their home country e-ID scheme can thus prove their identity on 'MyGuichet' using their own national eIDs, thus obviating the need to get a separate Luxembourg e-ID.

Luxembourg's national e-health strategy aims to facilitate the exchange of personal health records to improve coordination between each patient's different treatments and enable a better patient follow-up. To fulfil this objective a national e-health platform has been put in place, with tools such as the Shared Health Care File²⁴¹ (DSP, *Dossier de Soins Partagé*), an electronic personal health record file that centralises all medical data needed to coordinate patient care. 10 % of the population already has access to their own DSP and can manage its rights of access. The Luxembourg government is now preparing the legal framework that will enable the DSP to be gradually made available to all patients.

Full implementation of the commitments made in the new coalition agreement have the potential to lead to major improvements in the area of digital public administration. In the area of e-health, speeding up the roll-out of the '*Dossier de Soins Partagé*' to all patients and deploying a country-wide e-prescription service will bring major benefits to citizens.

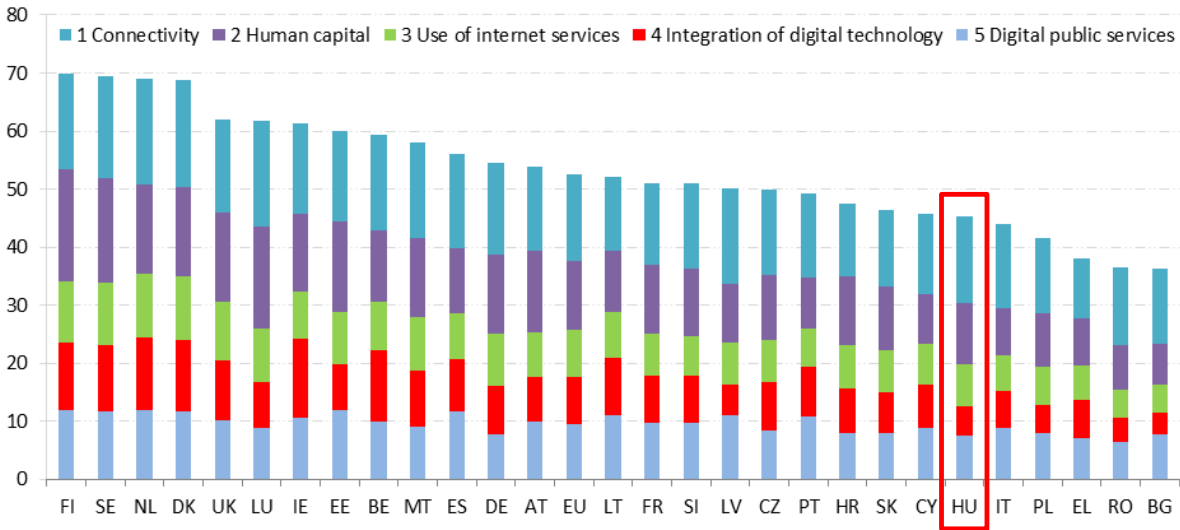
²⁴⁰ <https://guichet.public.lu/en/myguichet.html>

²⁴¹ <https://www.esante.lu/portal/fr/espace-professionnel/my-dsp,140.html>

Hungary

	Hungary		EU
	rank	score	score
DESI 2019	23	45.4	52.5
DESI 2018	23	43.2	49.8
DESI 2017	23	40.1	46.9

Digital Economy and Society Index (DESI) 2019 ranking



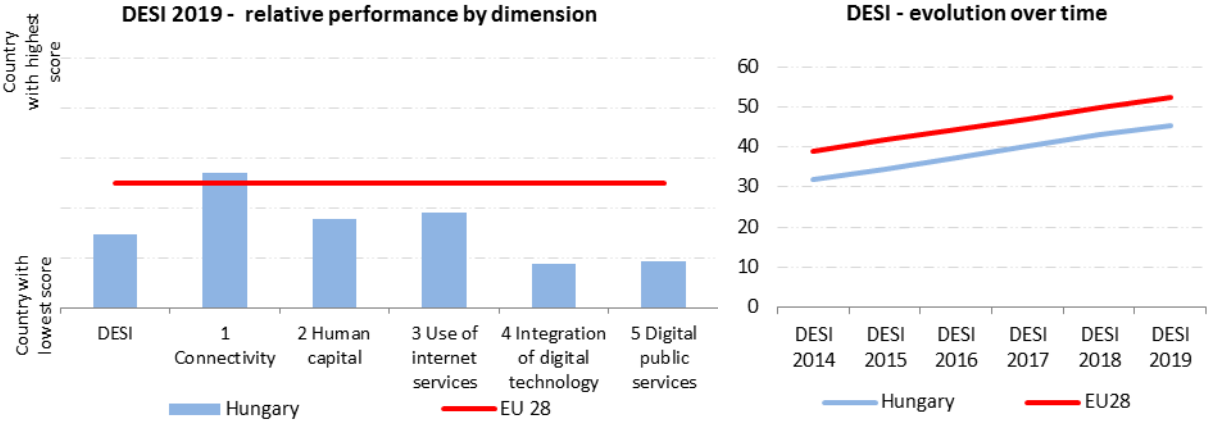
Hungary ranks 23rd out of 28 EU Member States in the Digital Economy and Society Index (DESI) 2019. Over the last few years, its score has increased in line with the EU average. However, Hungary has not managed to improve its position in the overall ranking.

Hungary performs best (slightly above the EU average) in the broadband Connectivity dimension, thanks to its widespread adoption of fast and ultrafast broadband and to its high coverage of next generation access (NGA) and ultrafast broadband infrastructure. The most challenging areas remain Digital public services and the Integration of digital technology in businesses. In both of these dimensions, Hungary scores well below the EU average, and it is among the worst performing Member States. The quality of e-government services is low and take-up is below average. Only 14 % of companies (the lowest share in the EU) use an enterprise resource planning software package to share information between different functional areas. The use of e-commerce, big data and cloud services shows a similar pattern. As regards Human capital, Hungary has a high proportion of ICT graduates and a close to average share of ICT specialists, though there is room for improvement as regards internet user skills.

In 2014, Hungary adopted its National Info-communication Strategy 2014-2020²⁴². The implementation started in 2014, and was confirmed with the adoption of the Digital Success

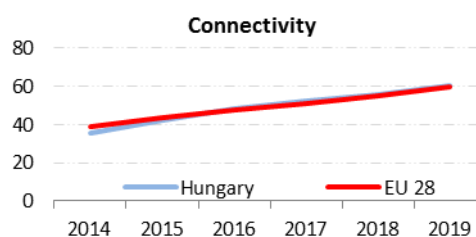
²⁴² http://www.kormany.hu/download/5/ff/70000/NIS_EN_clear.pdf

Programme (DJP) at the end of 2015 and the DJP 2.0 in 2016. In 2018, within the framework of the DJP, the government prepared the Digital Agricultural Strategy and the Digital Sports Strategy. In 2019, the country adopted its 5G strategy and it is planned to develop strategies on the Hungarian content industry, the health industry, artificial intelligence, fintech and blockchain. The implementation of several large-scale projects has continued. Examples include the Superfast Internet Programme, the Modern Enterprises Programme, the Support for Business Digital Development Programme and developments in e-government and e-health. On 31 October 2018, an Artificial Intelligence Coalition was established by 124 founders.



1 Connectivity

1 Connectivity	Hungary		EU
	rank	score	score
DESI 2019	14	60.4	59.3
DESI 2018	15	55.6	54.8
DESI 2017	15	51.9	51.2



	Hungary		EU	
	DESI 2017 value	DESI 2018 value	DESI 2019 value rank	DESI 2019 value
1a1 Fixed broadband coverage % households	95% 2016	95% 2017	94% 21 2018	97% 2018
1a2 Fixed broadband take-up % households	72% 2016	78% 2017	77% 11 2018	77% 2018
1b1 4G coverage % households (average of operators)	92% 2016	91% 2017	96% 14 2018	94% 2018
1b2 Mobile broadband take-up Subscriptions per 100 people	43 2016	49 2017	59 28 2018	96 2018
1b3 5G readiness Assigned spectrum as a % of total harmonised 5G spectrum	NA	NA	8% 12 2018	14% 2018
1c1 Fast broadband (NGA) coverage % households	81% 2016	83% 2017	87% 15 2018	83% 2018
1c2 Fast broadband take-up % households	40% 2016	49% 2017	58% 6 2018	41% 2018
1d1 Ultrafast broadband coverage % households	NA	76% 2017	82% 10 2018	60% 2018
1d2 Ultrafast broadband take-up % households	22% 2016	30% 2017	40% 4 2018	20% 2017
1e1 Broadband price index Score (0 to 100)	82 2016	85 2017	87 11 2018	87 2017

In connectivity, Hungary inched above the EU average, and now ranks 14th, after sustained relative improvement in recent years. Although fixed broadband coverage stagnated at around 94 % of homes, fast broadband coverage increased to 87 %. There is very strong platform-based competition illustrated by the stable technology share²⁴³ of cable (49 %), the declining share of DSL (25 % against 27 % in 2017) and the rising share of FTTH/B (22 % against 20 % in 2017). While fixed broadband take-up stagnated (at 77 %, the EU average), the quality of the connection improved significantly. Well above half of homes subscribe to at least 30 Mbps (58 %), above the EU average of 41 %. In addition, Hungary continues to score well on ultrafast connectivity, mainly owing to its widespread cable networks: coverage stands at 82 % (60 % in the EU as a whole) and take-up at 40 %, following a 10 percentage point increase (20 % in the EU as a whole). Mobile broadband coverage also increased to above the EU average. However, despite significant improvement, mobile broadband take-up is still the lowest in the EU (59 subscriptions per 100 people, against 96 in the EU overall). This may be, because prices for mobile phone users are persistently among the highest in Europe. Despite the fall

²⁴³ Data from July 2018

in mobile broadband prices for handset offers²⁴⁴ (from EUR 61.8 in 2017 to EUR 47.4 in 2018), these are more than double the EU average of €22.3. At the same time, the fixed broadband price index is very close to the EU average.

In 2016, the Superfast Internet Programme was launched. It started with a mapping exercise to identify areas where telecom operators are expected to make the full investment on their own. For areas that are not economically viable, a EUR 250 million state aid scheme has been developed to ensure broadband roll-out. The programme is co-funded by the European Structural Funds and by the Hungarian state, except for Budapest and its suburban area, for which only national resources will be used. The project intends to cover all Hungarian households with networks supplying at least 30 Mbps broadband internet service by 2023. The vast majority of projects under the Superfast Internet Programme deployed FTTH technology, enabling speeds in line with the gigabit society targets. The project deployment is reflected in the increase of rural FTTP coverage from 4 % in 2015 to 7 % in 2017 and 16 % in 2018. In 2018 from the initially foreseen ambitious coverage of 350,000 households 142,497 was realised.

In Hungary, 31 % of the 2090 MHz spectrum harmonised at EU level for wireless broadband has been assigned. The 5G Coalition (5GC), initiated by the Digital Success Programme, was formed with the aim of making Hungary a major European centre of 5G developments and taking a leading role in the region in testing 5G-based applications. Based on its proposals, the 5G strategy was adopted at the beginning of 2019 by the Hungarian Government. Hungary comes in 12th on the 5G readiness indicator, as, by the end of 2018, it had assigned spectrum in the 3.4- 3.6 GHz band in accordance with Commission Decision (EU) 2019/235, and the spectrum is available for use for 5G by 2020. A multi-band award process is being prepared for 2019. The targeted bands are the 5G pioneer bands, namely the 700 MHz and 3400-3800 MHz bands and remaining spectrum in the 2100 MHz and 2600 MHz bands. Assignment of the 26 GHz band is not yet envisaged. The Hungarian National Regulatory Authority, NMHH, held an RSPG²⁴⁵ peer review workshop in view of the planned auction in December 2018.

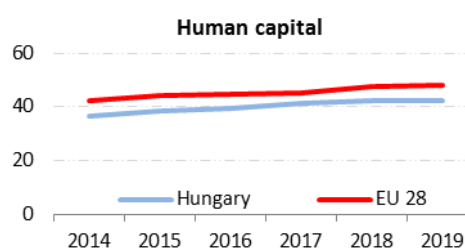
While significant advancements have been achieved in fixed broadband coverage through the Superfast Internet Programme, mobile network coverage and take-up are not improving at the required pace. The multi-band auction scheduled for 2019 will play a key role in the deployment of 5G in Hungary.

²⁴⁴ Offers including 1 GB, 300 calls and 225 SMS. Source: Mobile Broadband Price Study (Van Dijk and Empirica). Prices expressed in EUR/PPP, VAT included. Data as of February 2018.

²⁴⁵ Radio Spectrum Policy Group.

2 Human capital

2 Human capital	Hungary		EU
	rank	score	score
DESI 2019	20	42.1	48.0
DESI 2018	19	42.5	47.6
DESI 2017	18	41.2	45.4



	DESI 2017	Hungary		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
2a1 At least basic digital skills % individuals	51%	50%	50%	21	57%
2a2 Above basic digital skills % individuals	24%	26%	26%	21	31%
2a3 At least basic software skills % individuals	54%	52%	52%	22	60%
2b1 ICT specialists % total employment	3.6%	3.6%	3.6%	15	3.7%
2b2 Female ICT specialists % female employment	0.9%	1.0%	0.7%	26	1.4%
2b3 ICT graduates % graduates	3.1%	NA	4.3%	11	3.5%

In the Human capital dimension, Hungary ranks 20th among EU countries and below the EU average, with no significant changes since last year. Basic digital skills remain below the EU average (Hungary ranks 21st out of 28), basic software skills are also modest (22nd out of 28). Only half of people aged between 16 and 74 have basic digital skills (57 % in the EU as a whole). 26 % of the population has advanced internet user skills, which puts Hungary in 21st place in the ranking. ICT specialists account for a similar proportion of the workforce as in the rest of the EU (3.6 % against 3.7 % in the EU). As regards ICT graduates, Hungary exceeds the EU average at 4.3 %. The number of female ICT specialists is still low, less than 1 % of all female employees.

The Digital Education Strategy remains the main blueprint for developing digital skills at all levels of public education. Hungary has set up a Digital Pedagogical Methodology Centre (DPMK) to support the implementation of the strategy. The Digital Workforce Programme has been published and it gives the National Digital Skills Councils an important role in providing support and expertise. A new national curriculum is being prepared, which will reflect the importance of digital skills. EU funds are widely used to provide the necessary infrastructure and access. They are also used to support the development of digital skills in both the inactive and the working population, to narrow the skills gap and to boost the inclusion of disadvantaged people.

One of the core goals of the government's digital skills strategy is to give the digitally illiterate opportunities to familiarise themselves with computers. By the end of 2018, 1500 community digital access points (Digital Success Programme Points) were established across the country. More than 1500 Digital Success Programme mentors have also been trained, to provide the necessary support

and help at the community access points. These measures have also been coupled with programmes to include senior citizens in the digital world, by teaching them the necessary basic digital skills.

The lack of ICT professionals in the job market remains a significant issue in Hungary and the Digital Workforce Programme as well as multiple EU funded programmes aims to tackle this issue. Moreover, several universities and research institutes are among the founding members of the Hungarian Artificial Intelligence Coalition. All of them are involved directly or indirectly in activities associated with educational and training projects linked to AI research, development and application.

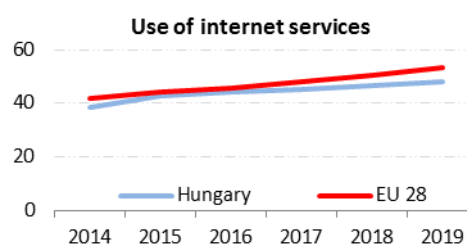
The 'Programme your Future' project also focuses on the younger generation of women to make ICT-related jobs and careers in the ICT sector more attractive to them, and to raise the percentage of women in IT higher education.

The National Coalition for Digital Skills and Jobs – which includes members from several ministries, public organisations, academia and the private sector - was very active in 2018. It contributed to the launch of the abovementioned Digital Pedagogical Methodology Centre and the Digital Workforce Programme, and to promoting digital skills through various events and projects. Cooperation among public authorities and between the public and private sector on the promotion of digital skills and jobs is very positive. This is especially true of projects that promote gender balance in ICT education and the acquisition of digital skills. 817 schools participated in EU Code Week in 2018. The government aims to increase this to 50 % of all schools by 2020.

Although not yet reflected in the current DESI value and ranking, Hungary continued to implement the various national strategies designed to tackle the issues related to digital skills. These efforts address all the main facets of the digital skills gap – including the goal of increasing the percentage of women in ICT. In 2018, the implementation of these initiatives progressed and in several cases has been completed. Hungary has actively participated in relevant EU initiatives. Good cooperation has been maintained among the government and relevant stakeholders. Citizens' interest in these initiatives has remained high.

3 Use of internet services

3 Use of internet services	Hungary		EU
	rank	score	score
DESI 2019	18	48.0	53.4
DESI 2018	17	46.5	50.7
DESI 2017	14	45.4	47.8



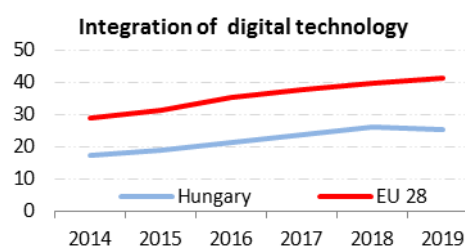
	Hungary		EU	
	DESI 2017 value	DESI 2018 value	DESI 2019 value	DESI 2019 rank
3a1 People who never used the internet % individuals	19%	17%	16%	19
3a2 Internet users % individuals	78%	76%	75%	21
3b1 News % internet users	88%	85%	85%	10
3b2 Music, videos and games % internet users	81%	81%	82%	14
3b3 Video on demand % internet users	8%	8%	11%	23
3b4 Video calls % internet users	54%	59%	60%	9
3b5 Social networks % internet users	83%	84%	86%	2
3b6 Professional social networks % internet users	15%	16%	16%	14
3b7 Doing an online course % internet users	5%	5%	5%	21
3b8 Online consultations and voting % internet users	3%	4%	4%	24
3c1 Banking % internet users	44%	49%	54%	20
3c2 Shopping % internet users	48%	49%	52%	21
3c3 Selling online % internet users	14%	14%	14%	19

Overall, Hungary ranks 18th in the Use of internet by citizens, below the EU average. 75 % of the population use the internet at least once a week, compared with 83 % in the EU as a whole. 86 % use social networks, the second highest score in the EU; 85 % read news online (72 % in the EU), and 60 % make video calls (49 % in the EU). On the other hand, only 5 % of the population engaged in e-learning activities and 4 % in online consultations and voting.

Online banking and shopping have become more popular. 54 % of people have used banking services online, up from 44 % two years ago. In 2018, 52 % of the population shopped online, 4 percentage points more than in 2016. In the overall use of both of these services, however, Hungary is still below the EU average.

4 Integration of digital technology

4 Integration of digital technology	Hungary		EU
	rank	score	score
DESI 2019	25	25.4	41.1
DESI 2018	24	26.2	39.6
DESI 2017	24	23.7	37.6



	DESI 2017	Hungary		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
4a1 Electronic information sharing	16%	14%	14%	28	34%
% enterprises	2015	2017	2017		2017
4a2 Social media	13%	15%	15%	22	21%
% enterprises	2016	2017	2017		2017
4a3 Big data	7%	7%	6%	27	12%
% enterprises	2016	2016	2018		2018
4a4 Cloud	8%	11%	11%	22	18%
% enterprises	2016	2017	2018		2018
4b1 SMEs selling online	12%	12%	12%	21	17%
% SMEs	2016	2017	2018		2018
4b2 e-Commerce turnover	8%	10%	9%	17	10%
% SME turnover	2016	2017	2018		2018
4b3 Selling online cross-border	4%	5%	5%	24	8%
% SMEs	2015	2017	2017		2017

Hungary is among the worst performing EU Member States in the Integration of digital technology in businesses. Uptake of ICTs is low across all the indicators measured in this dimension. Hungary has the lowest share of enterprises sharing information electronically in the EU. Only 7 % of companies rely on big data solutions (12 % in the EU), 11 % use cloud computing (18 % in the EU) and 15 % has social media activities on at least two channels (21 % in the EU). Despite the increased demand in online shopping, the percentage of SMEs selling online did not increase in 2018, and remained well below the EU average. According to the Digital Intensity Index²⁴⁶, 55 % of companies in Hungary has a very low level of digitisation (46 % in the EU), and only 15 % are highly digitised (18 % in the EU).

Many entrepreneurs still see the need to go digital as a burden, rather than as a means to become more competitive. The government aims to change this perception and convince SMEs to get rid of their distrust of digital technologies. In the Modern Enterprises Programme, there is a large focus on awareness-raising activities. Around 9,000 company audits have taken place, 174 events have been organised, a digital knowledge base has been prepared and a nationwide communication campaign has been launched as part of the programme. In addition, a supplier partnership network has been set up to serve SMEs with IT solutions. Businesses have the possibility to obtain the Digitally Qualified Enterprise classification, which allows them to acquire non-refundable additional financial support from certain EDIOP (Economic Development and Innovation Operational Programme) tenders.

²⁴⁶ Source: Digital scoreboard 2019, <https://ec.europa.eu/digital-single-market/en/digital-scoreboard>

The least digitally developed sectors are agriculture, construction, tourism and the food and beverages industry. All these sectors play a key role in the Hungarian economy. A specific emphasis is put on digitising SMEs in these sectors through the development of specific sectoral strategies.

Hungary is committed to the advancement of new digital technologies and to investing strategically in digital technologies in this area through EU-coordinated programmes. The country is a member of the EuroHPC Joint Undertaking and has also signed the Declaration on Cooperation on Artificial Intelligence.

To boost the digital transformation of the Hungarian economy, it is important for the government to continue carrying out the awareness-raising and funding programmes that target SMEs.

Highlight 2019: Artificial Intelligence Coalition

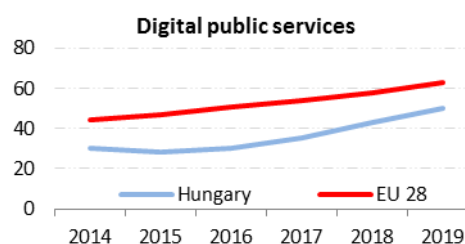
In October 2018, the Minister of Innovation and Technology initiated the foundation of the national Artificial Intelligence Coalition. The coalition has 124 founding members including representatives of all relevant stakeholders along the entire value chain, including researchers, developers and users. It represents stakeholders of all sizes and types as well, from start-ups and SMEs to large multinational corporations, research organizations, academia, state representatives and other bodies.

The coalition has the following specific goals:

- provide a constant professional and cooperation forum for AI developers, the market and state participants representing the AI user side, as well as the academic and professional organisations;
- develop a Hungarian AI Strategy, with the aid of which the AI-based technology development and its application will be able to achieve results in a favourable economic and regulatory environment;
- analyse the social and economic impacts related to the spread of AI.

5 Digital public services

5 Digital public services	Hungary		EU
	rank	score	score
DESI 2019	26	49.8	62.9
DESI 2018	26	42.8	57.9
DESI 2017	27	35.0	54.0



	Hungary		EU	
	DESI 2017	DESI 2018	DESI 2019	DESI 2019
	value	value	value	rank
5a1 e-Government users % internet users needing to submit forms	38%	45%	53%	20
	2016	2017	2018	2018
5a2 Pre-filled forms Score (0 to 100)	23	28	31	23
	2016	2017	2018	2018
5a3 Online service completion Score (0 to 100)	63	75	82	22
	2016	2017	2018	2018
5a4 Digital public services for businesses Score (0 to 100) - including domestic and cross-border	68	73	77	24
	2016	2017	2018	2018
5a5 Open data % of maximum score	NA	NA	NA	64%
			2018	2018
5b1 e-Health services % individuals	NA	7%	7%	26
		2017	2017	2017
5b2 Medical data exchange % of general practitioners	NA	NA	28%	15
			2018	2018
5b3 e-Prescription % of general practitioners	NA	NA	69%	14
			2018	2018

Digital public services remain one of the most challenging areas of a digital economy and society. In this dimension of the DESI Hungary ranks 26th out of 28 EU Member States, despite progress in the provision and the use of e-government services. It ranks 23rd in the re-use of information across administrations to make life easier for citizens (Pre-filled forms) and 22nd in the sophistication of services (Online service completion). Since 2016, e-government users have increased substantially, from 38 % to 53 %, although this is still below the EU average of 64 %. As for e-health, where the results of the latest policy developments cannot yet be tracked, Hungary performs well on the use of electronic prescriptions. As of March 2017, however, the use of e-health services by citizens was low.

The e-Administration Act (Act No. CCXXII of 2015) entered into force in January 2018, giving citizens and businesses alike the option to interact digitally with the public administration. The act obliges almost all public administration bodies, as well as other institutions such as courts and public prosecutor offices, to provide electronic channels for those services where one's physical presence is not required by law. For businesses the use of the online channel is mandatory.

To support the implementation of such services, the authentic digital mailbox and the e-delivery service have been renewed for both citizens and public administration offices, and a new e-delivery service has been launched for businesses (Company Gate). Furthermore, a new customizable e-

government point of single contact portal (*SZÜF - szuf.magyarorszag.hu*) has been set up as a new common platform for e-government service provision.

As for the background infrastructure, in January 2018, the Central Governmental Service Bus, a technical interoperability platform was launched to improve the automatic data exchange between services and base registries. The digitisation of local government has been enhanced with the expansion of the central Municipality ASP services, covering 100 % of municipalities as of January 2019.

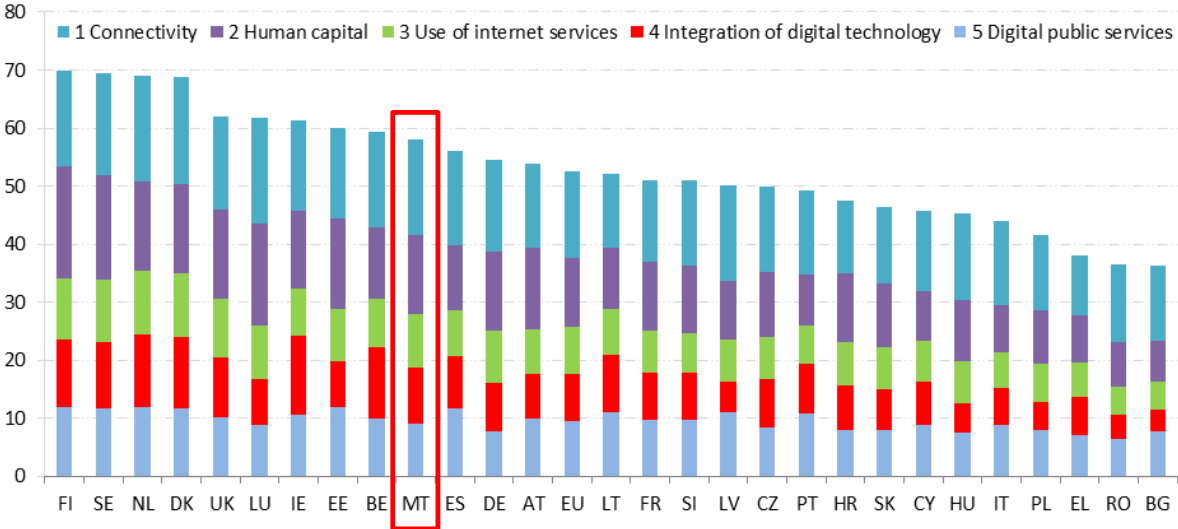
Having the legal framework and the underlying infrastructure in place, it is now important to assess the user-friendliness of the service provision, to increase the use of the online channel.

As for e-health, the new nationwide e-health platform (EESZT) was launched in November 2017. By December 2017, about 3000 pharmacies joined the platform, followed by all hospitals in 2018. Currently, about 85 % of general practitioners and outpatient institutes are also connected. The platform manages e-prescriptions, which represent over 70 % of all prescriptions. The challenge is to boost the use of the platform by the parties involved, including citizens.

Malta

	Malta		EU
	rank	score	score
DESI 2019	10	58.1	52.5
DESI 2018	10	56.6	49.8
DESI 2017	8	55.0	46.9

Digital Economy and Society Index (DESI) 2019 ranking



Malta ranks 10th out of the 28 EU Member States in the Digital Economy and Society Index (DESI) 2019. Over the last few years, its score has increased at a somewhat slower pace than the EU average.

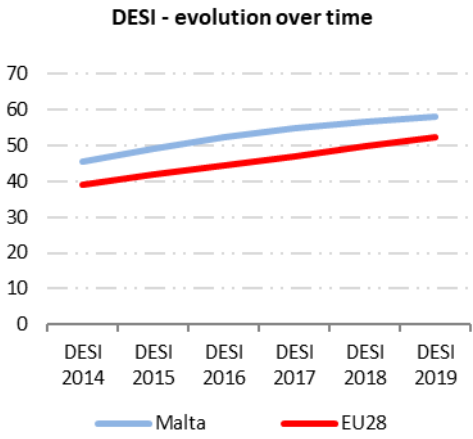
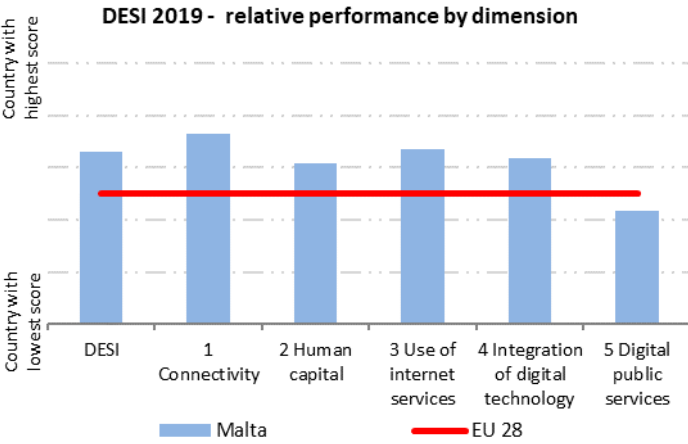
Malta performs above the EU average in four of the five dimensions of the index. Malta remains a European leader in the availability of fixed broadband (basic, fast and ultrafast), being the only Member State with full coverage of ultrafast networks. It does well in Human capital, mainly because it has a large number of ICT graduates. Maltese internet users score particularly well on online consultations and voting. Maltese businesses rank first on the use of big data. However, Malta scores below average in Digital public services. Although it is a leader in the provision of e-government services, it lags behind in the use of e-government and also in e-health. It is a challenge to further improve digital skills, which is vital also to enhance the Integration of digital technologies in enterprises.

The Digital Malta Strategy²⁴⁷ was launched in 2014. This is a policy document to guide the country towards the 2020 vision that 'Malta will prosper as a digitally-enabled nation in all sectors of the society'. The strategy puts forwards 71 actions under three strategic themes, namely Digital Business, Digital Government and Digital Citizen. These vertical strategic themes are underpinned by three

²⁴⁷ <https://digitalmalta.org.mt/en/Pages/Home.aspx>

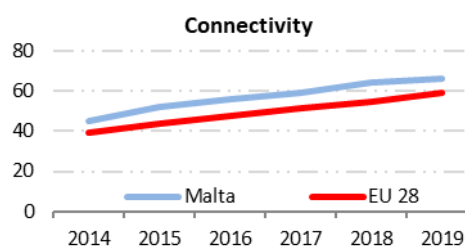
driving forces, namely (a) regulation and legislation, (b) infrastructure and (3) human capital. In 2017, the Malta Communications Authority (MCA) prepared a Strategy update for 2018-2020.

The key achievements in 2018 include a comprehensive strategy on blockchain, the launch of the Emerging Technologies Lab, the Innovation Hub Programme, a new strategy and various initiatives on digital skills, further developments of mobile e-government services and the Connected e-Government programme.



1 Connectivity

1 Connectivity	Malta		EU
	rank	score	score
DESI 2019	7	65.9	59.3
DESI 2018	6	64.3	54.8
DESI 2017	6	59.3	51.2



	DESI 2017	Malta	DESI 2019	EU
	value	DESI 2018 value	value rank	DESI 2019 value
1a1 Fixed broadband coverage % households	100% 2016	100% 2017	100% 1 2018	97% 2018
1a2 Fixed broadband take-up % households	79% 2016	83% 2017	83% 7 2018	77% 2018
1b1 4G coverage % households (average of operators)	99% 2016	99% 2017	83% ²⁴⁸ 26 2018	94% 2018
1b2 Mobile broadband take-up Subscriptions per 100 people	65 2016	88 2017	97 12 2018	96 2018
1b3 5G readiness Assigned spectrum as a % of total harmonised 5G spectrum	NA	NA	0% 13 2018	14% 2018
1c1 Fast broadband (NGA) coverage % households	>99.5% 2016	>99.5% 2017	>99.5% 1 2018	83% 2018
1c2 Fast broadband take-up % households	47% 2016	53% 2017	69% 2 2018	41% 2018
1d1 Ultrafast broadband coverage % households	NA	>99.5% 2017	>99.5% 1 2018	60% 2018
1d2 Ultrafast broadband take-up % households	3% 2016	11% 2017	23% 13 2018	20% 2017
1e1 Broadband price index Score (0 to 100)	NA 2016	NA 2017	NA 2018	87 2017

With an overall connectivity score of 65.9, Malta ranks seventh among Member States in connectivity, dropping one place compared with DESI 2018. Malta performs the best in all three coverage indicators (fixed, fast – NGA – and ultrafast) with almost 100 % of households covered. Fixed broadband take-up (83 %) remained stable and is above the EU average of 77 %. Significant improvements were registered in mobile broadband take-up (from 88 subscriptions per 100 people in 2017 to 97 in 2018) and in ultrafast broadband take-up (from 11 % of the homes subscribing to >=100 Mbps in 2017 to 23 % in 2018).

The Maltese national regulatory authority, MCA, is expected to launch a consultation on the new National Broadband Strategy in 2019. The strategy should pave the way for the future of fixed and mobile broadband in Malta including the establishment of the 5G ‘path-to-deployment’. In the meantime, the MCA is taking a number of demand driven initiatives such as the MCA Free WiFi

²⁴⁸ 4G coverage measures the average coverage of those mobile operators providing 4G services. In Malta, a third operator started 4G services in 2018, which caused a downward change in average 4G coverage.

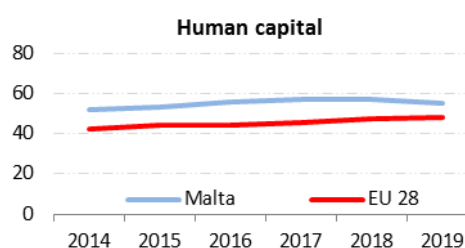
project, which aims to spread WiFi hotspots extensively across the Maltese islands. There are currently more than 420 free WiFi hotspots around Malta and Gozo with campaigns promoting the use of the smartphone as a productivity tool in e-commerce and training initiatives. To improve international connectivity, the MCA launched at national level the relevant state aid process to establish an incentive programme that would support investment in submarine cables. Malta is currently in the process of implementing the government's EUR 700 million plans to upgrade all the roads within seven years, so the island is witnessing a huge number of major infrastructural projects in various localities. While this would represent a good opportunity for operators to boost infrastructural competition, this would be hindered by the lack of a well-functioning single information point and of a complete mapping of the existing infrastructures caused by an only partial implementation of the Cost Reduction Directive.

In Malta, 30 % of the total 2090 MHz spectrum harmonised at EU level for wireless broadband has been assigned. In June 2018, the MCA adopted a roadmap for the ultra-high frequency (UHF) band between 470-790 MHz that lays out the key initiatives and milestones concerning the availability of the 700 MHz band for the provision of wireless broadband (WBB). To address unresolved spectrum coordination issues with non-EU countries, Malta requested the assistance of the Commission. Furthermore, the MCA is currently working to develop the relevant spectrum framework for the licensing of radio spectrum in the 3.6 GHz and 26 GHz bands. With regard to 5G trials, during 2018, the MCA received an application from Huawei Technologies and granted a trial licence. This trial licence enabled Huawei Technologies to carry out a demonstration of their 5G network equipment during a period of 5 days. While some mobile operators have reported that they are deploying a 5G-ready network, for the time being none of Malta's main mobile operators have expressed particular interest in deploying 5G, partly because of the significant investments recently made in 4.5G roll-out, as a result of which most of the territory is now covered with 4.5G services.

Malta performs well in broadband connectivity. It is ranked first in all fixed broadband coverage indicators of the DESI thus achieving the European broadband coverage objectives. Malta would benefit from focusing now on paving the way for 5G deployment, proceeding swiftly with the update of the National Broadband Plan, and making available of the pioneer bands for effective use by 2020.

2 Human capital

2 Human capital	Malta		EU
	rank	score	score
DESI 2019	9	55.0	48.0
DESI 2018	8	57.3	47.6
DESI 2017	7	57.1	45.4



	Malta		EU	
	DESI 2017 value	DESI 2018 value	DESI 2019 value	DESI 2019 rank
2a1 At least basic digital skills % individuals	50% 2016	57% 2017	57% 2017	14
2a2 Above basic digital skills % individuals	32% 2016	39% 2017	39% 2017	7
2a3 At least basic software skills % individuals	52% 2016	57% 2017	57% 2017	15
2b1 ICT specialists % total employment	3.8% 2015	3.9% 2016	4.3% 2017	11
2b2 Female ICT specialists % female employment	1.7% 2015	1.2% 2016	1.1% 2017	17
2b3 ICT graduates % graduates	9.6% 2014	8.5% 2015	6.8% 2016	3

In the Human capital dimension, Malta ranks ninth among EU countries, above the EU average. Malta shows a mixed picture on internet user skills. 39 % have above basic digital skills compared with only 31 % in the EU, but Malta performs below average on software skills. The percentage of ICT specialists represents a relatively high proportion of the workforce (4.3 % as opposed to 3.7 % in the EU). Malta is among the leaders in terms of ICT specialists (6.8 % of all graduates).

Malta has recently developed a national e-skills strategy covering a large number of areas. The country will set up a national consultative committee on digital skills and establish a central reference on emerging and enabling technologies. It is a priority to continue funding in order to improve ICT teaching and guidance at local level. Digitisation in education will also be supported by the re-design of all educational curricula and the implementation of EU-based self-assessment tools in the educational sector. Sustained industry collaboration is key to preparing industry-based continued professional development (CPD) toolkits to provide short-cycle specific courses for industry. The strategy also aims at shifting the focus of young people from a consumer attitude towards a more participative use of technology and reducing the digital divide in the society. The implementation of the national e-skills strategy will start in 2019.

Malta has carried out numerous measures to improve digital skills, in which the e-Skills Malta Foundation played a key role. The foundation organised the Career Exposure Programme for secondary school pupils in collaboration with the Ministry for Education and Employment offering a one-week internship in various ICT companies or departments. Malta has launched a new ICT curriculum in secondary schools modernising both teaching and content. The Malta Information Technology Agency continued the Student Placement Programme, under which tertiary level

students are sponsored to work in the ICT industry for the summer months to gather more knowledge and experience in the field.

Malta has a National Coalition for Digital Skills, whose members include the Malta Information Technology Agency (MITA), the Malta Communications Agency (MCA), Malta Enterprise, the Malta Gaming Authority (MGA), the Malta Chamber of Commerce and the Ministry of Education and Employment. The coalition has carried out several initiatives such as awareness campaigns on digital skills and the IT profession, the organisation of PingFin 9, a pan-European fintech event and e-competence framework courses. The coalition was one of the key players for the Million Dollar Idea Event, a start-up competition organised by the ICT Students Association to develop entrepreneurial skills whilst building realistic business models.

Malta participated very actively in the EU Code Week in 2018. It ranked first on the number of events per capita. Over 80 % of schools, more than 6,000 teachers and 28,000 students participated.

Malta promotes the participation of women in the digital economy and society. In 2018, a women in ICT expert sub-group was set up within the e-Skills Malta Foundation to discuss issues and run specific projects and initiatives by the members of the group. Malta launched guidelines for increasing and retaining women in ICT, directed at industry and ICT related organisations. The government, through the foundation, collaborates with technology stakeholders in running specific digital skills related events for women, such as Digigirlz with Microsoft and Code like a Girl with Vodafone.

It is essential that Malta continues its efforts to further improve the internet user skills among the general public and also professional ICT skills.

Highlight 2019: Ċavetta Digitali (Digital Key)

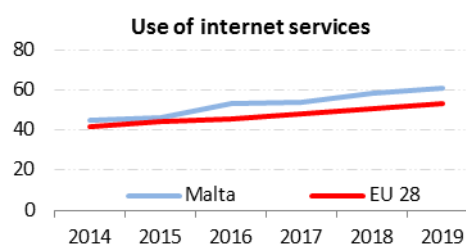
Ċavetta Digitali is a joint initiative of the Malta Communications Authority (MCA) and the Parliamentary Secretariat for the Rights of Persons with Disability and Active Ageing (PSDAA) within the Ministry for the Family and Social Solidarity (MFSS).

The project provides ICT training to the over 55s. There have been two phases so far. In the first phase training was provided to the members attending day centres, while the second phase focused more on elderly people in the community.

The course consists of four two-hour sessions, held weekly, to promote the use of basic services on the internet. It focuses on how to make effective use of commonly used communication platforms and tools: setting up an email account, using YouTube, Skype and search engine facilities, as well as online shopping.

3 Use of internet services

3 Use of internet services	Malta		EU
	rank	score	score
DESI 2019	8	60.6	53.4
DESI 2018	8	58.6	50.7
DESI 2017	8	53.5	47.8

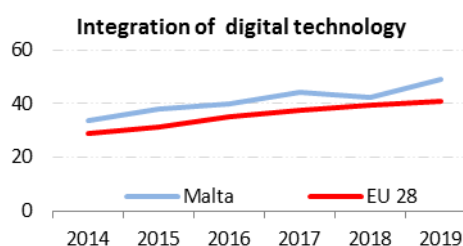


	DESI 2017 value	Malta DESI 2018 value	DESI 2019 value	DESI 2019 rank	EU DESI 2019 value
3a1 People who never used the internet % individuals	21%	18%	17%	21	11%
3a2 Internet users % individuals	77%	80%	80%	16	83%
3b1 News % internet users	79%	83%	83%	12	72%
3b2 Music, videos and games % internet users	90%	90%	88%	5	81%
3b3 Video on demand % internet users	26%	26%	47%	7	31%
3b4 Video calls % internet users	49%	56%	59%	10	49%
3b5 Social networks % internet users	82%	87%	85%	3	65%
3b6 Professional social networks % internet users	23%	17%	17%	9	15%
3b7 Doing an online course % internet users	4%	8%	8%	12	9%
3b8 Online consultations and voting % internet users	16%	22%	22%	2	10%
3c1 Banking % internet users	60%	62%	62%	16	64%
3c2 Shopping % internet users	63%	64%	66%	15	69%
3c3 Selling online % internet users	27%	36%	36%	2	23%

Overall, Malta ranks eighth in the Use of internet services by citizens, above the EU average. 80 % of the population uses the internet at least once a week, compared with 83 % in the EU. Maltese internet users engage in a broad range of activities online. 88 % of internet users play music, videos and games (81 % in the EU), 85 % use social media (the third highest in Europe, EU average is 65 %) and 83 % read news online (72 % in the EU). Malta outperforms the EU average also in video on demand (47 %) and in making video calls (49 %). 22 % participated in online consultations or voting - the second highest figure in the EU. However, Malta has an average performance in transactional services such as e-banking and online shopping. 66 % of internet users shop and 62 % bank online. Maltese internet users are very active in selling online.

4 Integration of digital technology

4 Integration of digital technology	Malta		EU
	rank	score	score
DESI 2019	9	48.7	41.1
DESI 2018	10	42.4	39.6
DESI 2017	8	44.1	37.6



	DESI 2017	Malta	DESI 2019	EU
	value	DESI 2018	value rank	DESI 2019
		value	value	value
4a1 Electronic information sharing % enterprises	30%	29%	29% 18	34%
4a2 Social media % enterprises	27%	26%	26% 8	21%
4a3 Big data % enterprises	19%	19%	24% 1	12%
4a4 Cloud % enterprises	14%	NA	22% 9	18%
4b1 SMEs selling online % SMEs	18%	15%	20% 7	17%
4b2 e-Commerce turnover % SME turnover	6%	6%	NA	10%
4b3 Selling online cross-border % SMEs	12%	9%	9% 10	8%

Malta performs above the EU average in the Use of digital technologies by enterprises, and ranks ninth. Maltese businesses are very strong in the use of big data analytics (24 %, the highest rate in the EU), social media (26 %, EU average 21 %) and also cloud computing (22 %, EU 18 %). Electronic information sharing stands, however, below average at 29 %. In e-commerce, 20 % of SMEs sell online, and e-commerce represents 6 % of SMEs turnover. Cross-border online sales of SMEs are somewhat above the EU average. According to the Digital Intensity Index²⁴⁹, only 29 % of companies in Malta have a very low level of digitisation (46 % in the EU), and 32 % are highly digitised (18 % in the EU).

Malta has set the ambition to become the 'Blockchain Island'. In 2018, a legislative package comprising three legal acts was adopted to regulate the use of distributed ledger technologies (DLT). This framework covers virtual financial assets, including crypto-currencies and innovative technology arrangements and services. It also establishes the Malta Digital Innovation Authority (MDIA). This is the primary authority responsible for supporting all governmental policies that promote Malta as a centre of excellence in technological innovation, while setting and enforcing standards that ensure compliance with any other international obligations. The authority seeks to protect and support all users and also encourages all types of innovations, by allowing for maximum flexibility in the certification of Innovative Technology Arrangements. The authority launched the consultation

²⁴⁹ Source: Digital scoreboard, <https://ec.europa.eu/digital-single-market/en/digital-scoreboard>

process to start registering service providers and blockchain applications. Malta has also signed the Declaration creating the European Blockchain Partnership (EBP), and co-operates in the establishment of a European Blockchain Services Infrastructure (EBSI) to support the provision of cross-border digital public services, with the highest standards of security and privacy.

The government is currently assessing the opportunities in artificial intelligence (AI) with the aim of defining a national strategy. It is leading a dialogue with stakeholders to build awareness around the key topics and issues that will inform a holistic national AI framework. It analyses the impact of AI in boosting the digital economy and is planning to build a policy framework for ethically aligned, transparent and socially responsible AI in line with the European AI strategy. Malta has also signed the Declaration of Cooperation on Artificial Intelligence.

As regards high-performance computing, Malta is currently following developments as an observer in the recently established European High-Performance Computing Joint Undertaking (EuroHPC JU).

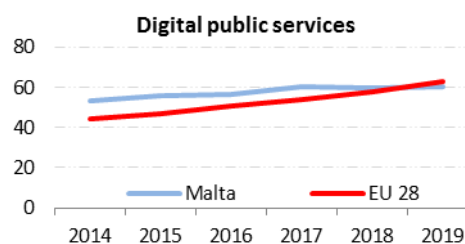
The Malta Information Technology Agency (MITA) contributes significantly to the integration of digital technologies by businesses. It runs an accelerator programme providing a pre-seed cash grant and advisory services worth EUR 30,000 to early stage tech start-ups with a business idea based on emerging technologies. In 2018, MITA supported 12 start-ups, of which seven were blockchain based, while the others focused on the internet of things, augmented reality, mobile technology, e-commerce and big data. MITA also organises various events such as meetups and workshops for the local tech start-up community.

In October 2018, MITA launched the Emerging Technologies Lab, which will be available for MITA employees, government employees, students and start-ups to explore emerging technologies, and share the knowledge gained and the benefits these technologies offer. The equipment already available in the lab includes a number of virtual and mixed reality headsets, augmented reality headsets, a 3D printer and a number of powerful computers that can be used for blockchain systems and cryptocurrency mining. The lab will organise events to familiarise participants with possible uses of these technologies.

In addition to the promotion of emerging technologies, a strong emphasis shall also be put on increasing the adoption of mature digital technologies, such as electronic information sharing, especially among SMEs.

5 Digital public services

5 Digital public services	Malta		EU
	rank	score	score
DESI 2019	16	60.2	62.9
DESI 2018	14	59.7	57.9
DESI 2017	10	60.1	54.0



	DESI 2017	Malta		EU	
	value	DESI 2018 value	DESI 2019 value	DESI 2019 rank	DESI 2019 value
5a1 e-Government users	60%	48%	50%	24	64%
% internet users needing to submit forms	2016	2017	2018		2018
5a2 Pre-filled forms	98	100	100	1	58
Score (0 to 100)	2016	2017	2018		2018
5a3 Online service completion	100	100	100	1	87
Score (0 to 100)	2016	2017	2018		2018
5a4 Digital public services for businesses	94	94	94	6	85
Score (0 to 100) - including domestic and cross-border	2016	2017	2018		2018
5a5 Open data	NA	NA	19%	28	64%
% of maximum score			2018		2018
5b1 e-Health services	NA	6%	6%	28	18%
% individuals		2017	2017		2017
5b2 Medical data exchange	NA	NA	24%	21	43%
% of general practitioners			2018		2018
5b3 e-Prescription	NA	NA	6%	28	50%
% of general practitioners			2018		2018

Malta ranks 16th in Digital public services, below the EU average. It is, however, a European leader in the provision of government services to citizens. It ranks first in the re-use of information across administrations to make life easier for citizens (Pre-filled forms) as well as in the sophistication of services (Online service completion); for both indicators it has the maximum score. The country also scores well on the online public services for businesses. However, e-government and e-health use by citizens remain low. Moreover, Malta is among the worst performing member states on open data, electronic prescriptions and medical data exchange between general practitioner and hospitals.

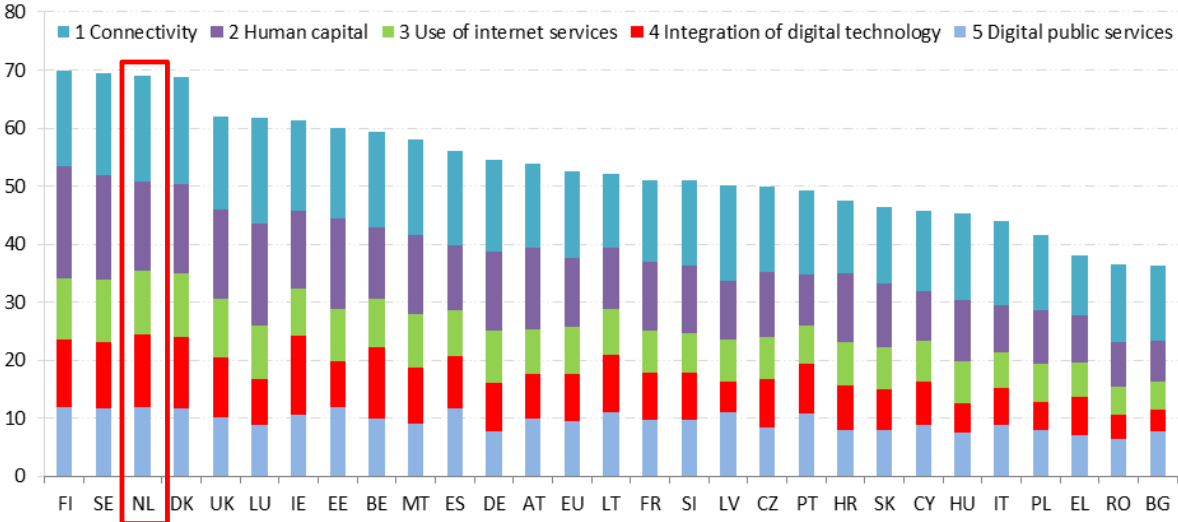
To modernise ICT infrastructure in its public administration, Malta launched the Connected e-Government (CONvErGE) programme in 2017, a EUR 40 million project co-financed by the EU. The project includes the development of a hybrid cloud infrastructure that will enable the self-provisioning and further automation of services and setting up a new platform to enable workflow-based services connected to government's back-end systems. It will also modernise several legacy information systems, and help implement a data infrastructure layer (including a national data portal) and an identity management solution. Malta has also continued to enhance the offer of mobile e-government services.

e-Health remains a challenging area in Malta, where there is low adoption of information and communication technologies both by citizens and general practitioners.

The Netherlands

	Netherlands		EU
	rank	score	score
DESI 2019	3	68.9	52.5
DESI 2018	2	66.8	49.8
DESI 2017	3	63.5	46.9

Digital Economy and Society Index (DESI) 2019 ranking

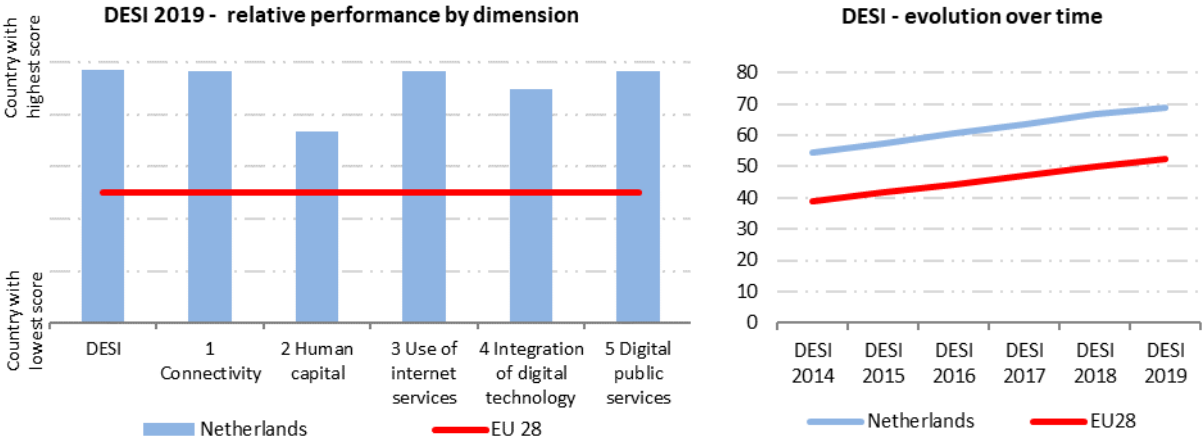


The Netherlands ranks 3rd out of the 28 Member States in the European Commission Digital Economy and Society Index (DESI) 2019.

Its score increased thanks to an improved performance in all of the DESI dimensions measured, although in some cases the increase was very limited. In terms of Connectivity, the Netherlands maintained the same excellent performance as in previous years, notably increasing mobile broadband take-up. There have also been noticeable increases in the dimensions of Use of internet services, Integration of digital technologies and Digital public services, all of which were in line with the average improvements in the EU.

The Netherlands ranks most highly in the Use of internet services and in Digital public services. However, its Human capital ranking fell somewhat. This reflects both an increased need for professionals with digital skills beyond the core ICT industries and the difficulty recognised by the current Dutch government and all stakeholders of adapting education policies to the complex challenges posed by the digital transformation of all sectors.

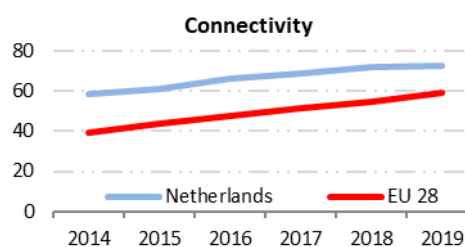
In June 2018, the Dutch government adopted the Dutch Digitalisation Strategy²⁵⁰, designed to enable the country to capitalise on the economic and social opportunities associated with the digital transformation, while addressing fundamental questions concerning matters such as privacy protection and the future of jobs. The strategy is designed to bring, as part of a coherent strategic outlook and policy framework, all the various efforts being made by various public authorities, the private sector and other stakeholders. It also proposes a number of new targeted initiatives such as the programme Accelerating the Digitalisation of SMEs (*'Versnelling digitalisering mkb'*) and efforts to make agriculture more sustainable through digital technologies. The strategy is designed to strengthen the foundations for digitisation, including privacy protection, cybersecurity, digital skills, fair competition and ground-breaking research and innovation.



²⁵⁰ 'Nederland Digitaal', <https://www.rijksoverheid.nl/documenten/rapporten/2018/06/01/nederlandse-digitaliseringsstrategie>; English version at <https://www.government.nl/documents/reports/2018/06/01/dutch-digitalisation-strategy>

1 Connectivity

1 Connectivity	Netherlands		EU
	rank	score	score
DESI 2019	3	72.6	59.3
DESI 2018	1	71.6	54.8
DESI 2017	1	68.7	51.2



	DESI 2017	Netherlands		EU	
	value	DESI 2018 value	DESI 2019 value	DESI 2019 rank	DESI 2019 value
1a1 Fixed broadband coverage % households	>99.5% 2016	>99.5% 2017	100% 2018	1	97% 2018
1a2 Fixed broadband take-up % households	95% 2016	98% 2017	97% 2018	1	77% 2018
1b1 4G coverage % households (average of operators)	91% 2016	>99.5% 2017	>99.5% 2018	1	94% 2018
1b2 Mobile broadband take-up Subscriptions per 100 people	85 2016	88 2017	94 2018	14	96 2018
1b3 5G readiness Assigned spectrum as a % of total harmonised 5G spectrum	NA	NA	0% 2018	13	14% 2018
1c1 Fast broadband (NGA) coverage % households	98% 2016	98% 2017	>99.5% 2018	2	83% 2018
1c2 Fast broadband take-up % households	65% 2016	73% 2017	76% 2018	1	41% 2018
1d1 Ultrafast broadband coverage % households	NA	97% 2017	97% 2018	2	60% 2018
1d2 Ultrafast broadband take-up % households	31% 2016	32% 2017	33% 2018	7	20% 2017
1e1 Broadband price index Score (0 to 100)	88 2016	88 2017	87 2018	12	87 2017

The Netherlands is among the top performers in Connectivity, ranking first in fixed broadband coverage and take-up, 4G coverage and fast broadband take-up. It also performs very well in fast and ultrafast broadband coverage. The Netherlands has full fixed and almost 100 % 4G mobile broadband coverage. The associated fixed take-up is the highest in the EU (97 % of households). Ultrafast broadband coverage is also very high (97 %), while take-up is about one third of households. While mobile broadband take-up has increased (94 subscriptions per 100 people), it remains relatively low, given the wide availability and widespread use of public WiFi networks. Broadband prices are in line with the EU average. As regards 5G readiness, the Netherlands is among the EU's lower performers.

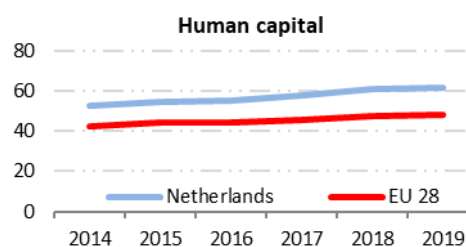
The Netherlands has already met most of the Digital Agenda Europe goals. In July 2018, the national broadband plan was updated with the connectivity action plan. This presents the action the government needs to take to provide all members of the public with access to ultrafast fixed broadband connections (with speeds of at least 100 Mbps) by 2023. By the same year, most households should be taking advantage of connection speeds of 1 Gbps. The Dutch authorities will help regional and local authorities create the right conditions for market players to roll out fast internet without public funding by sharing knowledge and best practices.

The Netherlands is focusing its future efforts on 5G applications and the Internet of Things as key drivers for future communications technologies. Furthermore, the Netherlands will launch before summer 2019 a national strategy for Artificial Intelligence, where 5G innovation and infrastructure are an essential part of “intelligent connectivity”. The national action plan aims at uninterrupted 5G wireless broadband coverage in all urban areas, as well as on major roads and railways, by 2025. In this context, it is anticipated that a 5G frequency multiband auction will be held in early 2020. At the auction, the 700 MHz band will be jointly auctioned with the 1,400 and 2,100 MHz bands for a period of 20 years. One source of concern about the deployment of 5G was potential interference in the 3.4-3.6 GHz frequency band in the north of the country from a satellite listening station used by the security services. In December 2018, the government took a preliminary decision to move the station, to free up the band for 5G. At the beginning of March 2019, the Dutch Ministry of Economic Affairs started consultation on its plans for the 3.5 GHz band, and the government aims to announce by end of 2019 the plans for auctioning the spectrum in 2021. Overall, the Netherlands has assigned 47 % of the 2090 MHz spectrum harmonised at EU level for wireless broadband. Moreover, in April 2018 the ACM has published its advice on competition safeguards for the upcoming 5G spectrum assignment.

The Netherlands has taken some steps to prepare the ground for 5G, in a public-private cooperation and preparations for a future approach towards intelligent connectivity, but there are uncertainties stemming from the absence of a specific roadmap for auctioning the 700 MHz spectrum and from the plans to delay the auction of the 3.4-3.6 GHz band beyond the 2020 deadline. Networks in the Netherlands are built predominantly through private investment, with very little public funding. Most of the network deployment is fibre to the cabinet (FTTC) in the cities, while in more rural areas the network roll-out is predominantly fibre to the home (FTTH). By creating conditions for a more uniform approach towards rights of way fees and speeding up of building permits authorisation a further boost in network roll-out in an already very advanced and mature market could be achieved.

2 Human capital

2 Human capital	Netherlands		EU
	rank	score	score
DESI 2019	5	61.8	48.0
DESI 2018	4	61.2	47.6
DESI 2017	6	58.0	45.4



	Netherlands			EU
	DESI 2017	DESI 2018	DESI 2019	DESI 2019
	value	value	value rank	value
2a1 At least basic digital skills % individuals	77% 2016	79% 2017	79% 2 2017	57% 2017
2a2 Above basic digital skills % individuals	45% 2016	48% 2017	48% 2 2017	31% 2017
2a3 At least basic software skills % individuals	78% 2016	80% 2017	80% 2 2017	60% 2017
2b1 ICT specialists % total employment	5.0% 2015	5.0% 2016	5.0% 5 2017	3.7% 2017
2b2 Female ICT specialists % female employment	1.4% 2015	1.7% 2016	1.8% 8 2017	1.4% 2017
2b3 ICT graduates % graduates	NA 2014	2.1% 2015	NA 2016	3.5% 2015

As regards the Human capital dimension, the Netherlands ranks 5th among EU countries and well above the EU average. Its position has however fallen slightly since 2018, when it ranked 4th. Basic and advanced digital skills, as well as the number of ICT specialists, are above the EU average. The percentage of female specialists has risen in recent years and is above the EU average, although it remains relatively low.

In recent years, there has been a significant shortage of ICT professionals on Dutch labour market in areas including big data, cybersecurity and artificial intelligence. In January 2018, there were more than 33 000 online ICT vacancies.²⁵¹ According to the Dutch employee insurance agency (UWV) the shortage is expected to continue and requires sustained policy focus and monitoring. The Dutch Ministry of Social Affairs and Employment recently confirmed this general trend.²⁵²

However, it is clear that tasks within existing jobs will change substantially, and some jobs will disappear altogether. Others will be created, in many cases requiring specific and sometimes rather advanced skills, such as data analysts.

A strategic and sustained effort to improve the level of digital skills and expertise across Dutch society is needed. A substantial acceleration in the pace at which tasks and occupations are changing as a result of digital developments is creating many opportunities for more and better work, as analysed in more detail in the Dutch Digitalisation Strategy. In this context, a number of new

²⁵¹ <http://www.pocbigdata.eu/monitorICTonlinevacancies>

²⁵² Letter to parliament of 15.6.2018, Kamerstuk 29544 nr. 833, vergaderjaar 2017-2018, available at <https://zoek.officielebekendmakingen.nl/blg-845833>

initiatives have been launched, or existing ones reinforced, to fully use the economic and societal opportunities of the digital transformation.²⁵³ Examples include the update of the curriculum for primary and secondary education, in which digital literacy is one of the main new topics;²⁵⁴ the launch of the Digitalisation Agenda for Primary and Secondary Education;²⁵⁵ the Acceleration Plan for educational innovation with ICT;²⁵⁶ the Human Capital Agenda ICT;²⁵⁷ and other sector-specific activities, for example with Small and Medium Enterprises.²⁵⁸

ECP – Platform for the Information Society²⁵⁹ works together closely with partners in public authorities, across different ministries, as well as with industry, teachers, researchers and civil society to advance this agenda. It is the coordinator of the Dutch National Coalition for Digital Skills, through which a number of relevant projects have already been launched and supported.

An example is ‘Mediawijzer’, a network which links more than 1,000 media literacy organisations (including businesses, schools and libraries), organises public campaigns, carries out research and offers educational services designed to make young people, teachers and educators more aware and critical of digital technologies.

Civil society and bottom-up initiatives to encourage creativity, problem solving and collaboration through programming and other tech activities, such as Code Week,²⁶⁰ show a widespread interest across the Netherlands for the development of digital skills.

The Dutch government’s current approach, largely supported by other stakeholders across society, is to “get and keep everyone on board”. The goals are ensuring that everyone learns basic digital skills early on, that people continue to learn and develop so as to adapt to changing professions, and that vulnerable groups that are already excluded from educational opportunities and the labour markets are not left even further behind.

²⁵³ Some of the initiatives mentioned here were announced in 2018, but launched only in 2019, and were therefore not assessed as part of this report.

²⁵⁴ <https://curriculum.nu/ontwikkelteam/digitale-geletterdheid/>

²⁵⁵ <https://www.nederlanddigitaal.nl/initiatieven/d/digitaliseringsagenda-primair-en-voortgezet-onderwijs/documenten/publicaties/2019/03/21/digitaliseringsagenda-primair-en-voortgezet-onderwijs>

²⁵⁶ <https://www.surf.nl/en/acceleration-plan-for-educational-innovation-with-ict>

²⁵⁷ <https://dutchdigitaldelta.nl/hca-ict>

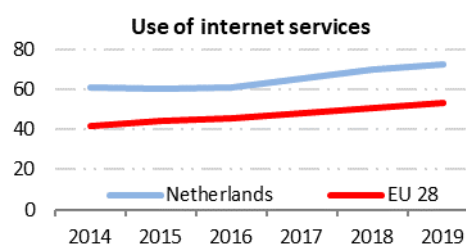
²⁵⁸ <https://www.rvo.nl/subsidies-regelingen/mkb-idee>

²⁵⁹ <http://www.ecp.nl/>

²⁶⁰ <https://codeweek.eu/about/>

3 Use of internet services

3 Use of internet services	Netherlands		EU
	rank	score	score
DESI 2019	2	72.7	53.4
DESI 2018	3	69.9	50.7
DESI 2017	3	65.5	47.8

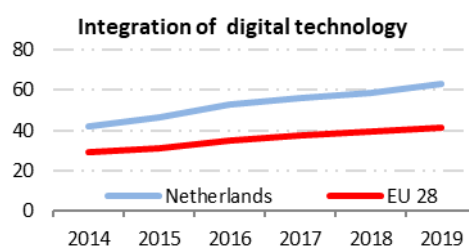


	Netherlands		EU	
	DESI 2017 value	DESI 2018 value	DESI 2019 value	DESI 2019 rank
3a1 People who never used the internet % individuals	5%	3%	4%	3
3a2 Internet users % individuals	92%	94%	94%	2
3b1 News % internet users	75%	80%	80%	15
3b2 Music, videos and games % internet users	88%	88%	92%	2
3b3 Video on demand % internet users	39%	39%	58%	2
3b4 Video calls % internet users	39%	46%	61%	8
3b5 Social networks % internet users	66%	70%	69%	19
3b6 Professional social networks % internet users	31%	36%	36%	1
3b7 Doing an online course % internet users	10%	11%	11%	6
3b8 Online consultations and voting % internet users	7%	10%	10%	12
3c1 Banking % internet users	91%	93%	94%	2
3c2 Shopping % internet users	79%	82%	84%	3
3c3 Selling online % internet users	36%	38%	37%	1

Overall, the Use of internet services is well above the EU average. People in the Netherlands are keen to engage in a variety of online activities, just as the rest of the EU, the most popular ones being banking, shopping and playing music, videos and games. 80 % of Dutch internet users read news online (against 72 % in the EU as a whole). Furthermore, the use of Video on Demand has grown very rapidly since last year (from 39 % to 58 % of Internet users).

4 Integration of digital technology

4 Integration of digital technology	Netherlands		EU
	rank	score	score
DESI 2019	2	63.0	41.1
DESI 2018	2	59.0	39.6
DESI 2017	4	55.9	37.6



	DESI 2017	Netherlands		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
4a1 Electronic information sharing % enterprises	45% 2015	48% 2017	48% 2017	2	34% 2017
4a2 Social media % enterprises	38% 2016	39% 2017	39% 2017	2	21% 2017
4a3 Big data % enterprises	19% 2016	19% 2016	22% 2018	2	12% 2018
4a4 Cloud % enterprises	29% 2016	NA 2017	42% 2018	3	18% 2018
4b1 SMEs selling online % SMEs	16% 2016	15% 2017	17% 2018	15	17% 2018
4b2 e-Commerce turnover % SME turnover	9% 2016	10% 2017	10% 2018	15	10% 2018
4b3 Selling online cross-border % SMEs	10% 2015	11% 2017	11% 2017	8	8% 2017

As regards the Integration of digital technology by businesses, the Netherlands ranks 2nd among EU countries, well above the EU average. The Netherlands kept its rank compared to last year, with slight improvements in a few indicators. 39 % of enterprises use social media and 22 % use big data (19 % in 2016). However, numbers of Dutch SMEs selling online and those doing so cross-border remain relatively low.

The Dutch government recognises that SMEs are under-utilising the opportunities brought upon by the digital transformation. The Annual Report on the State of the SME Sector (*'Jaarbericht Staat van het MKB'*²⁶¹) shows that SMEs' relatively low productivity across sectors is partly due to a lack of awareness and understanding of how to use digital innovation to support companies' growth. Accordingly, the Accelerating the Digitalisation of SMEs programme (*'Versnelling digitalisering mkb'*²⁶²) was launched in cooperation with the business community, regional parties, industry organisations, educational institutions and other organisations to share best practices and implement practical tests that focus on big data, automation and online sales and marketing.

The Netherlands is committed to the advancement of new digital technologies and to investing strategically in digital technologies through EU-coordinated programmes: the country is a member of the EuroHPC Joint Undertaking and has signed the Declaration on Cooperation Framework on High-

²⁶¹ <https://www.rijksoverheid.nl/documenten/rapporten/2017/11/17/jaarbericht-staat-van-het-mkb-2017>

²⁶² <https://www.rijksoverheid.nl/documenten/rapporten/2018/06/29/mkb-actieplan>

Performance Computing. It has also signed the Declaration of European Blockchain Partnership, as well as the Declaration on Cooperation on Artificial Intelligence.

The Dutch National Cybersecurity Agenda, adopted in April 2018, aims to capitalise in a secure way on the economic and social opportunities of digitisation, protecting national security in the digital domain. It focuses on strengthening the Netherlands' capabilities to detect, mitigate and respond decisively to cyber threats, building successful barriers against cybercrime and maintaining a resilient and robust infrastructure. Involving all relevant social institutions, including businesses, through strong, integrated public-private partnerships is seen as essential.

To boost the digital transformation of the Dutch economy even more, it is important to adopt a strategic and cross-cutting approach with the full involvement of all stakeholders. It is also essential to raise awareness of the relevance of digitisation of SMEs and further support their ability to develop the necessary capabilities and skills.

2019 highlight: Dutch Smart Industry Initiative

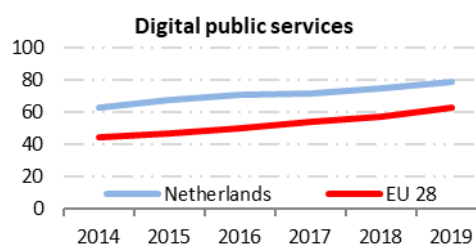
Recognizing the strategic importance of the digital transformation for industry, the Dutch Smart Industry Initiative²⁶³ aims to capitalise on the country's excellent infrastructure and high Internet penetration, as well as on the long-standing practice of public-private cooperation across networks and clusters. Through the initiative, 35 Smart Industry field labs were set up to host production facilities, plus five regional Smart Industry hubs, to stimulate the cooperation among different players in the broader ecosystem. The Smart Industry Implementation Agenda²⁶⁴ further details the focus of these efforts, which extends beyond core industry to the chemical and constructions industries, on three priorities. First, ensuring that SMEs participate and benefit from knowledge from, for example, field labs. Second, ensuring workers are prepared by investing in skills. Third, promoting safe and effective digital collaboration in the chain, for example when sharing data. For 2014-2017, an estimated total of EUR 163 Million was invested in the initiative.

²⁶³ <https://www.smartindustry.nl/english/>

²⁶⁴ <https://www.smartindustry.nl/wp-content/uploads/2018/03/SI-Implementation-Agenda-2018-English.compressed.pdf>

5 Digital public services

5 Digital public services	Netherlands		EU
	rank	score	score
DESI 2019	3	78.8	62.9
DESI 2018	4	75.5	57.9
DESI 2017	5	72.3	54.0



	Netherlands				EU
	DESI 2017	DESI 2018	DESI 2019	rank	DESI 2019
5a1 e-Government users	83%	84%	86%	5	64%
% internet users needing to submit forms	2016	2017	2018		2018
5a2 Pre-filled forms	74	77	81	8	58
Score (0 to 100)	2016	2017	2018		2018
5a3 Online service completion	89	91	92	10	87
Score (0 to 100)	2016	2017	2018		2018
5a4 Digital public services for businesses	79	81	85	18	85
Score (0 to 100) - including domestic and cross-border	2016	2017	2018		2018
5a5 Open data	NA	NA	73%	10	64%
% of maximum score			2018		2018
5b1 e-Health services	NA	23%	23%	9	18%
% individuals		2017	2017		2017
5b2 Medical data exchange	NA	NA	NA		43%
% of general practitioners			2018		2018
5b3 e-Prescription	NA	NA	NA		50%
% of general practitioners			2018		2018

As regards Digital public services, the Netherlands ranks 3rd among EU countries, well above the EU average. It performs very well in the number of e-government users and online service completion, and well in pre-filled forms and digital public services for businesses. Almost all indicators increased from the previous year. The use of e-prescriptions in the Netherlands has been very high for several years now (94 % of general practitioners in 2013²⁶⁵).

The Dutch Digitalisation Strategy puts the goal of a transparent and accessible e-government squarely at the centre of the country's priorities. The keyword identified by the Scientific Council for Government Policy²⁶⁶ is that the overall "service package" of public services must pass the "feasibility test" for members of the public. All the public organisations involved must, accordingly, operate simultaneously as a single government body, act proactively, seamlessly refer people to other services, and provide control over data. To achieve this, the strategy recognises that further work is needed to strengthen a sound, future-proof, basic digital infrastructure that enables the digital government to function in areas such as digital identities, e-invoicing and the development of proper digital skills by civil servants.

²⁶⁵ http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=8791

²⁶⁶ <https://www.wrr.nl/>

In e-health, the Netherlands is making substantial investments to encourage innovation. Examples include the Health Innovation School²⁶⁷ and coordination efforts on standardisation through the Healthcare Consultation Group.²⁶⁸ The Dutch government has set out some ambitious goals for 2019, including: at least 80 % of chronically ill people will have direct access to their own medical data, and at least 40 % of all Dutch people; 75 % of chronically ill and vulnerable elderly people can use self-measurements and share the results with their healthcare provider; people receiving healthcare and support at home will be able to contact a healthcare provider 24 hours a day using a monitor if they so wish. These and other goals for the further digitisation of healthcare should be achieved by focusing on increasing awareness, knowledge and competencies; increasing the innovative capacity of the healthcare system; and providing information, standardisation and safety.

The full implementation of the Dutch Digitalisation Strategy by all parties involved would achieve even more significant improvements in digital public administration and e-health.

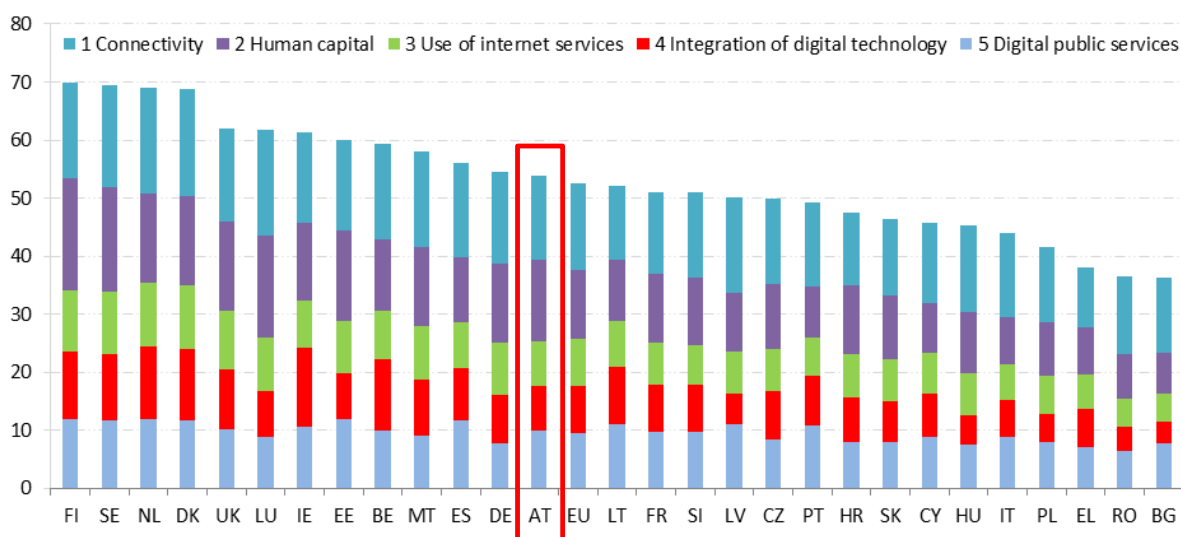
²⁶⁷ <http://zorginnovatieschool.nl/>

²⁶⁸ <https://www.informatieberaadzorg.nl>

Austria

	Austria		EU
	rank	score	score
DESI 2019	13	53.9	52.5
DESI 2018	12	51.9	49.8
DESI 2017	12	49.2	46.9

Digital Economy and Society Index (DESI) 2019 ranking

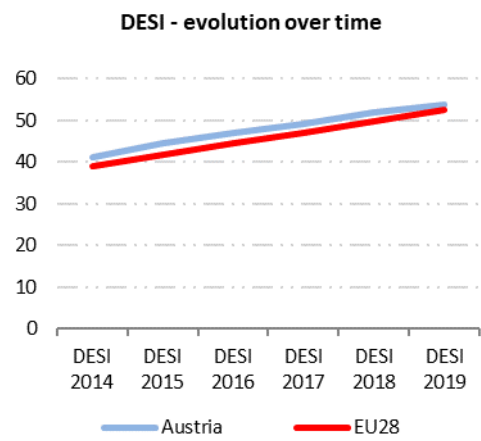
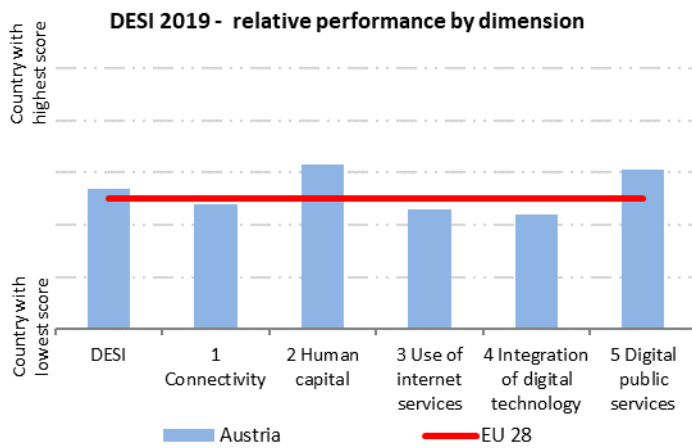


Austria ranks 13th out of the 28 EU Member States in the European Commission Digital Economy and Society Index (DESI) 2019.

Its score increased only slightly due to a limited performance in some of the DESI dimensions. While Austria remains slightly above the EU average, the distance to the best performing countries has increased. Austria is an above average performer in Human capital and Digital public services. While basic and advanced digital skills of Austrian citizens are above the EU average, they remain below the tops performers and there is a growing lack of skilled IT workers in the economy. It performs below average in Connectivity, Use of internet services and Integration of digital technologies. In particular, Austrian enterprises do not take full advantage of the use of digital technologies such as e-invoicing, cloud services or selling online.

The 'Digital Roadmap Austria' was published in January 2017 under the previous government. The current government incorporated many of the strategy's measures in its government programme. A new digital strategy, building on the Digital Roadmap, is currently being developed.²⁶⁹ Its goal is to make Austria a digital leader.

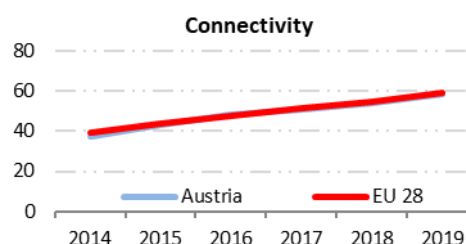
²⁶⁹ The development of the strategy falls under the responsibility of the Ministry of Digital and Economic Affairs together with the newly established Chief Digital Officer Taskforce. In 2018, a new digital agency was also



established to develop digital policies in five main areas: digital infrastructure, business, education and society, research, development and innovation, and data protection and data management.

1 Connectivity

1 Connectivity	Austria		EU
	rank	score	score
DESI 2019	16	58.5	59.3
DESI 2018	16	53.7	54.8
DESI 2017	17	50.6	51.2



	Austria		EU	
	DESI 2017	DESI 2018	DESI 2019	DESI 2019
	value	value	value	rank
1a1 Fixed broadband coverage	98%	98%	98%	11
% households	2016	2017	2018	2018
1a2 Fixed broadband take-up	68%	71%	69%	21
% households	2016	2017	2018	2018
1b1 4G coverage	89%	97%	98%	8
% households (average of operators)	2016	2017	2018	2018
1b2 Mobile broadband take-up	77	83	87	19
Subscriptions per 100 people	2016	2017	2018	2018
1b3 5G readiness	NA	NA	33%	7
Assigned spectrum as a % of total harmonised 5G spectrum			2018	2018
1c1 Fast broadband (NGA) coverage	87%	90%	91%	9
% households	2016	2017	2018	2018
1c2 Fast broadband take-up	16%	19%	23%	24
% households	2016	2017	2018	2018
1d1 Ultrafast broadband coverage	NA	56%	58%	20
% households		2017	2018	2018
1d2 Ultrafast broadband take-up	3%	5%	7%	25
% households	2016	2017	2018	2017
1e1 Broadband price index	91	91	93	4
Score (0 to 100)	2016	2017	2018	2017

Compared to the 2018 DESI, Austria kept the Connectivity ranking, positioning the country on the 16th place. While its performance in fixed and fast broadband coverage (98 % and 91 % respectively) is above the EU average, its ultrafast coverage is 58 %, 2 percentage points below the EU average, putting the country a low 20th in the ranking. Moreover, both total and ultrafast coverage are static year-on-year and reflect the upgrade of legacy networks; Austria's total FTTP coverage (13 %) is significantly lower than the EU average (29.6 %). At 23 %, Austria has very low take-up of fast broadband, and even lower take-up of ultrafast broadband (7 %), making it 25th in the EU ranking. This low performance could be attributed to the strong trend of substituting mobile for fixed services, due to fierce price-driven competition in the mobile market, both for voice and broadband. This strength is reflected by Austria's high 4G coverage (98 %). Furthermore, broadband prices, both for fixed and for mobile, are far below the EU average, placing Austria fourth in the broadband price index. However, despite the mobile substitution trend, mobile broadband take-up is not very high in Austria (87 subscriptions per 100 people, against an EU average of 96).

Austria's broadband strategy for 2020 is designed to achieve 70 % coverage of ultrafast-broadband (defined as 100 Mbps downstream) in metropolitan areas by 2018, coupled with a 99 % coverage of ultrafast-broadband for all households in Austria by 2020. The Ministry for Transport, Innovation and Technology is currently preparing a new broadband strategy for 2030, which was published for consultation in February 2019. As part of the broadband funding initiative 'Broadband Austria 2020', the Ministry has provided by the end of 2018 €470 million in funds for the roll-out of broadband infrastructure. Additional public tenders making available €400 million in funds are either underway or planned until 2020. This funding programme covers four areas: access, backhaul, connect and ducts. In the context of this initiative, 174 beneficiaries have already received funding in 694 projects. 838,000 residents will benefit directly from these projects in 341 municipalities.

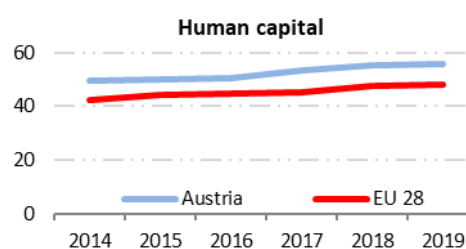
In Austria 47 %²⁷⁰ of the total 2090 MHz spectrum harmonised at EU level for wireless broadband has been assigned. Austria wants to become a 5G pioneer in the EU and published a 5G strategy in April 2018. This includes a three-phase roadmap whose final objective is to have nationwide 5G availability by 2025. Implementation of the strategy has started, including an amendment to the Telecommunications Act at the end of 2018. All operators are on board and committed to implementing 5G swiftly; they are already taking preparatory action, and intend to start the 5G roll-out as soon as the frequencies have been allocated. The auction of the 3.4-3.8 GHz band ended on 5 March 2019 and enabled the acquisition of large blocks of spectrum facilitating the provision of gigabit 5G services at reasonable prices (€6 cents/MHz/pop). The assignment of the 700 MHz band is scheduled for one year later, while a public consultation for the 26 GHz band will be carried out in the coming months.

Austria is characterised by top mobile coverage, but scores far below the EU average for fixed high-speed broadband, mainly due to the high costs of fibre roll-out (lack of ducts) combined with a low retail price levels and a low willingness to pay for higher bandwidths. Austria has strong ambitions to become a pioneer in the roll-out of 5G, and the achievement of this goal is facilitated by the results of the 3.4-3.8 GHz frequency auction which was a very promising start to the implementation of Austria's ambitious 5G strategy. If Austria wants to tackle its low performance in the fixed sector, particularly in very high-speed connectivity, including in rural areas, its new broadband strategy 2030 could play a role creating the right conditions and incentives for more investments in fixed networks.

²⁷⁰ The auction was concluded in March 2019; the percentage is being calculated. The updated data is expected at the beginning of April 2019.

2 Human capital

2 Human capital	Austria		EU
	rank	score	score
DESI 2019	8	55.7	48.0
DESI 2018	9	55.4	47.6
DESI 2017	9	53.2	45.4



	Austria			EU
	DESI 2017	DESI 2018	DESI 2019	DESI 2019
	value	value	value rank	value
2a1 At least basic digital skills	65%	67%	67% 8	57%
% individuals	2016	2017	2017	2017
2a2 Above basic digital skills	35%	36%	36% 9	31%
% individuals	2016	2017	2017	2017
2a3 At least basic software skills	69%	71%	71% 7	60%
% individuals	2016	2017	2017	2017
2b1 ICT specialists	4.0%	4.2%	4.4% 8	3.7%
% total employment	2015	2016	2017	2017
2b2 Female ICT specialists	1.2%	1.5%	1.5% 10	1.4%
% female employment	2015	2016	2017	2017
2b3 ICT graduates	4.5%	4.0%	4.1% 12	3.5%
% graduates	2014	2015	2016	2015

In Human capital, Austria ranks 8th among EU countries, above the EU average. 67 % of people in Austria have at least basic digital skills and 36 % exhibit above average digital skills (the EU averages are 57 % and 31 %, respectively). Employment of ICT specialists is also higher (4.4 % in 2017, compared to an EU average of 3.7 %), and has been growing; it rose by 4 percentage points between 2014 and 2017). However graduations fell by 4 percentage points over this period. These divergent trends are contributing to a shortage of ICT specialists on the Austrian labour market²⁷¹. In particular, female talent is being underexploited in the IT sector (only 1.5% of employed women work in this field), although the situation has been improving (+3 pp. between 2014 and 2017).

Digital skills are included in the 'Digital Roadmap Austria', adopted in January 2017. Digital literacy and IT have been on the school curriculum for several years. Their practical implementation is supported by the 'Dig.Komp' framework²⁷², which sets out the specific skills and competences to be learned and the digi.check²⁷³ which allows students and teachers to assess their digital skills using the framework. The 'eEducation initiative' provides support to the digital development of schools²⁷⁴.

²⁷¹ 43 % of Austrian firms report a lack of IT staff and 74 % fear that the situation will deteriorate further (Österreichische Industriellenvereinigung, 2018).

²⁷² <https://bildung.bmbwf.gv.at/schulen/schule40/digikomp/digikomp.html>

²⁷³ <https://bildung.bmbwf.gv.at/schulen/schule40/digicheck/digicheck.html>

²⁷⁴ <https://bildung.bmbwf.gv.at/schulen/schule40/eeducation/eeducation.html>

In primary, the focus is on teaching media design, safe use of the internet and learning technical and analytical skills through play. To support this, education innovation studios were set up in 100 primary schools and universities for the 2017-18 school year²⁷⁵.

For the 2017-2018 school year, a pilot project²⁷⁶ was started in 178 secondary schools introducing mandatory lessons in basic digital skills. This programme was extended to all secondary schools nationwide in autumn 2018. The schools themselves decide whether the training is separate or integrated into other lessons. Over a four year period, pupils receive training on: digitisation of the media landscape, information competences, data and media handling, media design, digital communication and social media, security, dealing with technical problems and computational skills.

In mid-2018, the government (Ministry for Education, Science and Research) started working on a new master plan for the digitisation of the education system²⁷⁷. Its three key areas consist of systematically including digital matters in the curriculum of all schools, equipping all school sites with suitable digital infrastructure, and improving teachers' digital skills through mandatory training. Work on the master plan started in summer 2018 and should be completed – with the support of other ministries and experts – by summer 2019. It is planned to complete the implementation of the plan by the end of 2023.

While there is no national Digital Skills and Jobs Coalition, linked to the European Level initiative, in 2018, 'fit4internet'²⁷⁸ was launched. This association was founded on the initiative of the Federal Ministry for Digital and Economic Affairs (BMDW) as a hub and platform. In close cooperation with companies, institutions and organisations, the association aims to improve digital skills in Austria and enable society as a whole to participate in digitisation. As such, it focuses on improving the digital skills of the over-60s with focused courses (including the 'mobile driving licence'), working people and the young. It also promotes the use of the European Commission's Digital Competence Framework (DigComp Framework). Austria also actively participated in EU Code Week in 2018 recoding 43 activities and 4,600 participants.

Digital skills in Austria are gradually improving and are above the EU average. Nevertheless, Austria still lags behind the top performing countries in this domain. In particular, a growing lack of ICT specialists in the labour market, as demand for these skills is rising, limits firms' capacity to innovate and reap the gains of digitisation. Digital re-skilling of the labour market and providing adequate digital infrastructure in schools²⁷⁹, in particular primary schools, is of the utmost importance to exploit the full potential of the digital economy.

²⁷⁵ <https://bildung.bmbwf.gv.at/schulen/schule40/dgb/dipl.html>

²⁷⁶ <https://bildung.bmbwf.gv.at/schulen/schule40/dgb/index.html>

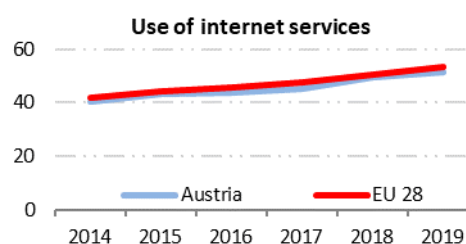
²⁷⁷ <https://bildung.bmbwf.gv.at/schulen/schule40/index.html>

²⁷⁸ <https://www.fit4internet.at/>

²⁷⁹ An infrastructure review by the Ministry of Education in 2016 showed that 35 % of schools lacked WLAN in at least 50 % of their premises (BMB, 2016) with significant differences between different school types.

3 Use of internet services

3 Use of internet services	Austria		EU
	rank	score	score
DESI 2019	14	51.5	53.4
DESI 2018	12	49.5	50.7
DESI 2017	16	45.2	47.8

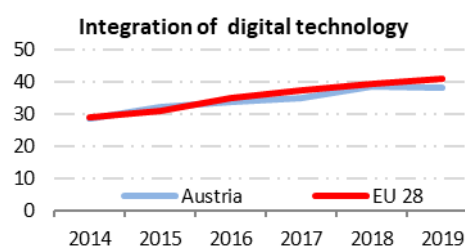


	DESI 2017	Austria		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
3a1 People who never used the internet	13%	10%	10%	12	11%
% individuals	2016	2017	2018		2018
3a2 Internet users	82%	85%	85%	10	83%
% individuals	2016	2017	2018		2018
3b1 News	66%	71%	71%	23	72%
% internet users	2016	2017	2017		2017
3b2 Music, videos and games	79%	79%	80%	17	81%
% internet users	2016	2016	2018		2018
3b3 Video on demand	14%	14%	28%	10	31%
% internet users	2016	2016	2018		2018
3b4 Video calls	32%	42%	45%	24	49%
% internet users	2016	2017	2018		2018
3b5 Social networks	58%	58%	61%	26	65%
% internet users	2016	2017	2018		2018
3b6 Professional social networks	12%	17%	17%	7	15%
% internet users	2015	2017	2017		2017
3b7 Doing an online course	5%	5%	5%	20	9%
% internet users	2016	2017	2017		2017
3b8 Online consultations and voting	9%	8%	8%	16	10%
% internet users	2015	2017	2017		2017
3c1 Banking	63%	65%	67%	14	64%
% internet users	2016	2017	2018		2018
3c2 Shopping	68%	70%	69%	11	69%
% internet users	2016	2017	2018		2018
3c3 Selling online	13%	15%	16%	17	23%
% internet users	2016	2017	2018		2018

Use of internet services in Austria is broadly comparable with the EU average. 85 % of people in Austria use the internet on a regular basis (at least once a week) and the numbers who have never used the internet have fallen to 10 % (- 3 percentage points between 2016 and 2018). People in Austria engage in a variety of online activities. The most popular of which are downloading music, videos and games (80 %), reading the news (71 %) and shopping (69 %). Use of video calls has also become more popular in recent years (+13 percentage points between 2016 and 2018 to 45 %). However, it remains below the EU average (49 %). Only 16 % of internet users sell online, in comparison to an EU average of 23 %.

4 Integration of digital technology

4 Integration of digital technology	Austria		EU
	rank	score	score
DESI 2019	19	38.2	41.1
DESI 2018	15	38.5	39.6
DESI 2017	18	35.0	37.6



	DESI 2017	Austria		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
4a1 Electronic information sharing	41%	40%	40%	7	34%
% enterprises	2015	2017	2017	2017	2017
4a2 Social media	19%	21%	21%	11	21%
% enterprises	2016	2017	2017	2017	2017
4a3 Big data	NA	NA	6%	26	12%
% enterprises	2016	2016	2018	2018	2018
4a4 Cloud	10%	11%	11%	23	18%
% enterprises	2016	2017	2018	2018	2018
4b1 SMEs selling online	15%	16%	13%	18	17%
% SMEs	2016	2017	2018	2018	2018
4b2 e-Commerce turnover	6%	6%	7%	22	10%
% SME turnover	2016	2017	2018	2018	2018
4b3 Selling online cross-border	10%	14%	14%	2	8%
% SMEs	2015	2017	2017	2017	2017

In Integration of digital technology by businesses, Austria ranks 19th among EU countries, scoring somewhat below the EU average. Austrian enterprises perform relatively well in terms of electronic information sharing (40 %, compared to an EU average of 34 %) and use of social media stands at the EU average (21 % for both). By contrast, on uptake of big data (6 %, compared to an EU aver of 12 %) and cloud services (11 %, compared to an EU average of 18 %) they lag behind. In addition, SMEs in Austria are not taking advantage of the opportunities offered by e-commerce (13 % sell online, compared to an EU average of 17 %) and, as such, turnover from e-commerce is low (7 %, compared to an EU average of 10 %). By contrast, SMEs in Austria rank highly in terms of selling online cross-border²⁸⁰.

In EU comparison, Austria's large businesses rank much better than its SMEs in terms of their digital intensity, which increases the risk of an in-country digital divide. 41.7 % of SMEs are considered to have a very low level of digital intensity (using no more than three digital technologies), compared with 7.3 % for large firms²⁸¹. The 'KMU Digital' programme supports Austrian SMEs in their digitisation process (see Highlight 2019). As take-up by SMEs has been considerable, the programme has been extended and more trainers have been trained (400, instead of 200).

²⁸⁰ This is part helped by the nature and geography of the economy: as a small, open economy neighbored by one or more larger countries having the same language, cross-border e-Commerce is facilitated.

²⁸¹ Digital Scoreboard 2019

In 2019, the Ministry for Digital and Economic Affairs intends to establish a regulatory sandbox for innovative enterprises to support use of artificial intelligence. It is also extending its 'JumpStart' and 'Global Incubator Network' (GIN) programmes to support innovative digitisation of start-ups and attract international top accelerators. Over the period 2016-2019, financial support is being provided to the Austrian Cooperative Research network (€ 2.9 million p.a.) for SME digitisation. Furthermore, a call has been launch by the Austrian Research Promotion Agency to set up digital innovation hubs in Austria. They will provide information and training, and support the implementation of specific digital innovation projects for SMEs. The government is providing funding of € 3 million for the project over the period 2019-2022.

Austria is committed to making progress with new digital technologies and is making strategic investments in them at national level and through EU-coordinated programmes. It is a member of the EuroHPC Joint Undertaking and has signed the Declaration on European Blockchain Partnership and the Declaration on Cooperation on Artificial Intelligence. Austria has also requested support from the EU's Structural Reform Support Programme to improve the structure, expertise and know-how of its Digitisation Agency, including through the development of an action plan on the digitisation of the Austrian SME sector.

The Austrian government is aware of the importance of digitising its SMEs and is putting in place policies and measures focused to achieve its goal of making Austria a technology leader in Europe. It will take more time for the results of many of these measures to materialise.

Highlight 2019: 'KMU DIGITAL' project

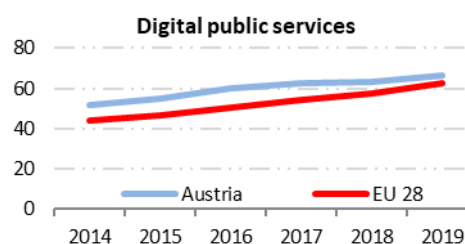
The Austrian Government, together with the Austrian Chamber of Commerce, have successfully launched the 'KMU Digital' project to support SMEs in their digitisation process. The project has 4 main steps:

1. The KMU DIGITAL Online status check: *How digital is my business?* In a first step, firms can check how digital their business is by using an online tool. Almost 10,000 checks were carried out between September 2017 and August 2018.
2. The KMU DIGITAL potential analysis: *What should be changed and how?* As a second step, companies get an individual consultation with a specially trained consultant who carries out a 'potential analysis'. By August 2018, a total of 2,576 such potential analyses had been carried out.
3. The KMU DIGITAL consultation: *How do I start?* In a third step, firms can receive focused consultations responding to specific needs in areas such as e-commerce and social media, IT security, data protection and digitisation of internal processes.
4. The KMU DIGITAL qualification: *digital skills training courses for entrepreneurs and employees.* So far, over 1200 training courses have been provided nation wide.

Through the project, each business can receive up to € 4,000 in financial support.

5 Digital public services

5 Digital public services	Austria		EU
	rank	score	score
DESI 2019	12	66.7	62.9
DESI 2018	11	63.4	57.9
DESI 2017	7	62.9	54.0



	DESI 2017	Austria		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
5a1 e-Government users % internet users needing to submit forms	59%	64%	68%	15	64%
	2016	2017	2018		2018
5a2 Pre-filled forms Score (0 to 100)	72	79	81	6	58
	2016	2017	2018		2018
5a3 Online service completion Score (0 to 100)	97	97	97	4	87
	2016	2017	2018		2018
5a4 Digital public services for businesses Score (0 to 100) - including domestic and cross-border	90	84	87	14	85
	2016	2017	2018		2018
5a5 Open data % of maximum score	NA	NA	65%	16	64%
			2018		2018
5b1 e-Health services % individuals	NA	18%	18%	14	18%
		2017	2017		2017
5b2 Medical data exchange % of general practitioners	NA	NA	29%	14	43%
			2018		2018
5b3 e-Prescription % of general practitioners	NA	NA	10%	24	50%
			2018		2018

In Digital public services, Austria ranks 12th among EU countries, above the EU average. Austria performs very well in the availability of public services, which can be completed online, in particular, via mobile devices and by making use of pre-filled online forms. 68 % of Austrian internet users actively engage with e-government services, which is slightly above the EU average. However, Austria only ranks around average in terms of online availability of public services needed to start a business and to conduct regular business operations. It ranks 14th for e-health services, with 18 % of Austrians having used health and care services provided online. e-Prescriptions are used by 10 % of general practitioners, and 29 % exchange medical data.

The online one-stop-shop, which has enabled the start-up of one-man businesses since 2018, is expected to have a positive impact, as one-man companies are the most common businesses in Austria. Austria is also working to extend the one-stop shop to other types of businesses.

For citizens, Austria is expanding the functionalities of the one-stop-shop (*oesterreich.gv.at*) and of the eID to an electronic document. The implementation of the legal right of citizens to electronic communications with public authorities is also on-going. In this context, Austria is increasingly implementing the once-only principle related to notification requirements with national authorities; as well as with public authorities outside of Austria at international level. Austria also intends to extend and increase the use of shared online services such as electronic delivery of public documents.

While Austria is developing an open-data strategy, it continues to rank at around the EU average on open data policies.

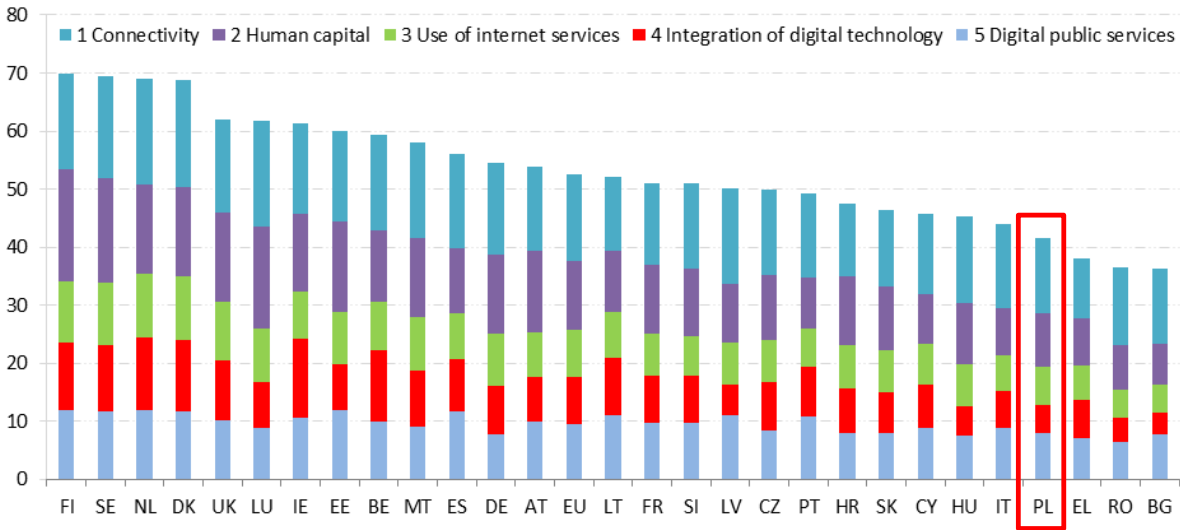
Austria continues the rollout of the Electronic Health Record (ELGA), an information system that offers personalised health data to all citizens and eligible health service providers (hospitals, pharmacies, general practitioners, specialists etc.). ELGA has already been rolled out in 5 regions in Austria, and will be available nationwide by the end of 2019. The introduction of a funding programme (*e-Health-Beitrag*), which compensates part of the required investments, had a positive effect on the acceptance of the medical profession. In parallel, works are ongoing to increase the usability and accessibility of ELGA documents and to adapt ELGA infrastructure for usage of future services (e.g. related to primary care and extension of e-card services).

While Austria scores well on providing digital public services, it has lost its place as a top performing country as others have seen faster progress. It is lagging behind in e-health, especially as regards use of e-prescriptions and medical data exchange by general practitioners, but has set itself and is implementing ambitious targets in this area. These plans should lead to a significant improvement in e-health in Austria in the coming years.

Poland

	Poland		EU
	rank	score	score
DESI 2019	25	41.6	52.5
DESI 2018	25	38.8	49.8
DESI 2017	25	36.1	46.9

Digital Economy and Society Index (DESI) 2019 ranking



Poland ranks 25th out of the 28 EU Member States in the European Commission Digital Economy and Society Index (DESI) 2019. Over the last few years, its score has increased in line with the EU average. However, Poland has not managed to improve its position in the overall ranking.

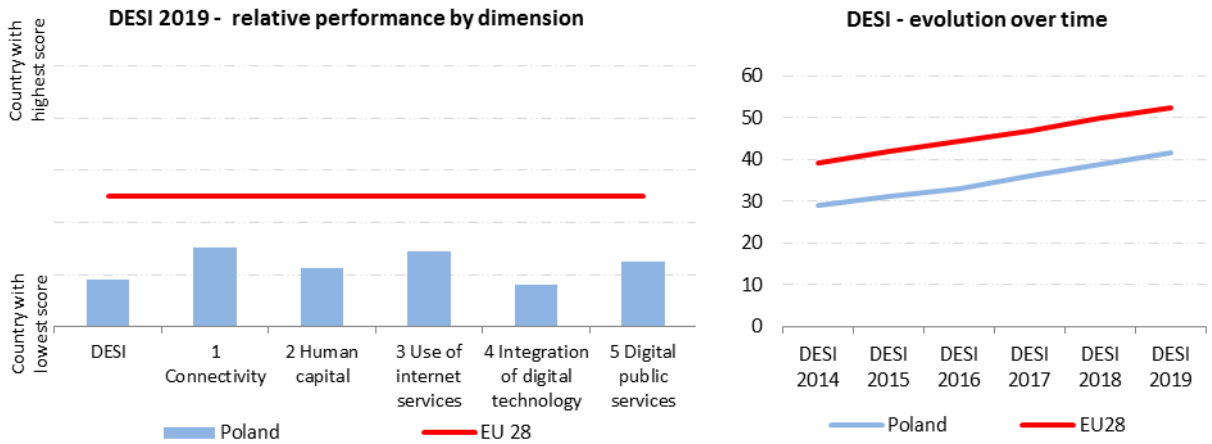
Poland has the highest mobile broadband take-up in the EU. However, Connectivity along with Use of internet services and Integration of digital technology remain the most challenging areas. There has been a slight improvement in Human capital and Digital public services, but Poland still scores below the EU average.

In particular, one fifth of people in Poland are not yet online and nearly half of still lack basic digital skills. The supply of ICT specialists and graduates is growing steadily, but is still below the EU average. Polish businesses are in favour of using new technologies, a trend reflected in the increasing use of big data, cloud computing and online selling. However, according to the Digital Intensity Index, 56 % of companies have a very low level of digitisation (EU: 46 %), and only 12 % are highly digitised (EU: 18 %)²⁸².

Poland ranks highest in Digital public services domain. It improved its performance in using pre-filled forms, online service completion and e-health services, and is an above average user of open data.

²⁸² Digital Scoreboard 2019

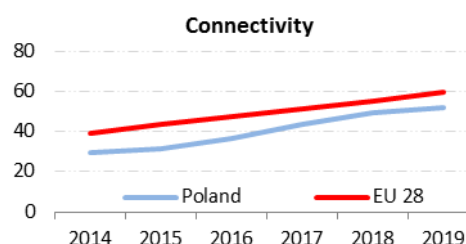
The Operational Programme for a Digital Poland (OPDP)²⁸³, introduced in 2014 for 2014-2020, is designed to consolidate the digital foundations of the country's development, through broad access to high-speed internet, effective and user-friendly public e-services, and growing digital literacy in Polish society as a whole. The Ministry of Digital Affairs, in cooperation with other ministries, has launched the design of the new strategy for developing digital competences, which is expected to be adopted by the end of 2019.



²⁸³ https://ec.europa.eu/regional_policy/en/atlas/programmes/2014-2020/europe/2014pl16rfop002

1 Connectivity

1 Connectivity	Poland		EU
	rank	score	score
DESI 2019	24	51.9	59.3
DESI 2018	23	49.3	54.8
DESI 2017	25	43.5	51.2



	DESI 2017	Poland		EU	
	value	value	value	rank	value
1a1 Fixed broadband coverage % households	81% 2016	81% 2017	79% 2018	28	97% 2018
1a2 Fixed broadband take-up % households	59% 2016	61% 2017	60% 2018	26	77% 2018
1b1 4G coverage % households (average of operators)	91% 2016	91% 2017	93% 2018	22	94% 2018
1b2 Mobile broadband take-up Subscriptions per 100 people	115 2016	144 2017	163 2018	1	96 2018
1b3 5G readiness Assigned spectrum as a % of total harmonised 5G spectrum	NA	NA	0% 2018	13	14% 2018
1c1 Fast broadband (NGA) coverage % households	61% 2016	65% 2017	66% 2018	25	83% 2018
1c2 Fast broadband take-up % households	26% 2016	32% 2017	36% 2018	19	41% 2018
1d1 Ultrafast broadband coverage % households	NA	49% 2017	54% 2018	22	60% 2018
1d2 Ultrafast broadband take-up % households	8% 2016	13% 2017	23% 2018	12	20% 2017
1e1 Broadband price index Score (0 to 100)	88 2016	88 2017	86 2018	14	87 2017

Poland has made most progress on ultrafast broadband take-up and mobile broadband take-up, achieving better results than the EU average. As regards the latter, Poland ranks 1st in the EU, with 163 subscriptions per 100 people. It remains close to the EU average in terms of 4G coverage (93 %) and the broadband price index (86 out of 100), and is slightly below it in ultrafast broadband coverage (54 %) and fast (NGA) broadband take-up (36 %). Nevertheless, its performance is still being undermined by low fixed broadband coverage (79 %, against an EU average of 97 %) and its related take-up (60 % of households compared to the EU average of 77 %). As regards next generation access (NGA), coverage is 66 %, against an EU average of 83 %, but associated take-up has improved.

An update to the National Broadband Plan is planned for 2019 to implement the goals of the gigabit society strategy and to include an assessment of both the funding gaps and the funds needed to achieve them. The Polish authorities have also proposed establishing a new Broadband Fund²⁸⁴. For the time being, the Operational Programme Digital Poland for 2014-2020 remains the main source of funding currently dedicated to supporting the objectives of the National Broadband Plan. The new financial tools for network deployment (relying on national resources) are under preparation as part

²⁸⁴ Link to the legislative proposal: <https://legislacja.rcl.gov.pl/projekt/12318651/katalog/12553345#12553345>

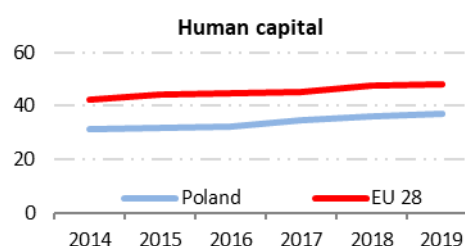
of the update to the plan. For the time being, Poland has contracted projects in the 'First Axis' of the OPDP (universal access to fast broadband) for a total value of € 1.54 billion with participation of EU funds coming to € 0.89 billion. As a result, at least 726,517 households should be connected to broadband infrastructure. However, the beneficiaries of OPDP have committed to cover 1.86 million households and 12,378 schools altogether, over 68% of which are in low population areas (areas with less than 5,000 inhabitants). Access to broadband for schools is ensured through the implementation of the National Education Network project, which effectively started in 2018. Nevertheless, Poland is still far from achieving goal 2 of the Digital Agenda for Europe (connectivity of 30 Mbps or more for all citizens by 2020). The main difficulties are still related to the geographical conditions that raise the cost of network deployment.

At the beginning of 2018, Poland published a draft 5G Strategy outlining the necessary legislative changes to facilitate 5G rollout, plus milestones and general objectives. After the initial plan to launch a 700 MHz auction by 2020, at the beginning of 2019 Poland notified the Commission about its intention to delay this process until 30 June 2022 owing to unresolved spectrum coordination with third countries. To address this issue, Poland also requested the Commission's assistance. High fragmentation of frequencies in the 3.4 - 3.8 GHz band requires proper refarming tools to ensure effective management of spectrum for 5G rollout. To this end, the government proposed a set of legislative amendments aimed to improve spectrum auction rules in general and to facilitate 5G rollout, which are expected to enter into force in 2019. In Poland, 47 % of the 2090 MHz spectrum harmonised at EU level for wireless broadband has been assigned so far. In 2018, first 5G trials were carried out by T-Mobile Polska and Orange Polska. Nevertheless, all stakeholders agree that there is a risk of delay in the development of 5G networks in Poland as a result of low electromagnetic fields (EMF) limits, high fragmentation of 5G-dedicated spectrum and lack of spectrum coordination with non-EU countries, namely Russia.

Overall, Poland took a number of steps towards 5G rollout in 2018. Regarding gigabit society objectives, it started implementing the National Education Network project aimed at connecting all schools to broadband networks of at least 100 Mbps speed. The Polish authorities also proposed setting up a new broadband fund to support demand and supply for fast networks. Additionally, an update to the national broadband plan is also planned for 2019. The Polish market would benefit from more regulatory certainty, which could be improved by addressing market delays, finalising robust rules for future spectrum auctions as well as by solving long-standing spectrum assignment issues.

2 Human capital

2 Human capital	Poland		EU
	rank	score	score
DESI 2019	22	36.8	48.0
DESI 2018	24	36.2	47.6
DESI 2017	22	34.5	45.4



	DESI 2017	Poland		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
2a1 At least basic digital skills	44%	46%	46%	24	57%
% individuals	2016	2017	2017		2017
2a2 Above basic digital skills	19%	21%	21%	24	31%
% individuals	2016	2017	2017		2017
2a3 At least basic software skills	47%	49%	49%	26	60%
% individuals	2016	2017	2017		2017
2b1 ICT specialists	2.6%	2.7%	2.8%	19	3.7%
% total employment	2015	2016	2017		2017
2b2 Female ICT specialists	0.8%	0.9%	0.9%	22	1.4%
% female employment	2015	2016	2017		2017
2b3 ICT graduates	2.9%	3.0%	3.1%	20	3.5%
% graduates	2014	2015	2016		2015

In Human capital, Poland ranks 22nd out of EU countries. Despite an increasing number of Poles going online, basic and advanced digital skills remain below the EU average. Only 46 % of individuals between 16 and 74 have basic digital skills (against an EU average of 57 %). Despite growing demand for ICT specialists in the labour market, in 2018 one third of Polish enterprises in need of ICT specialist reports difficulties in filling the vacancies²⁸⁵. The supply of ICT specialists is gradually growing, but remains below the EU average. ICT specialists represent a lower proportion of the workforce

(2.8 %) against the EU average (3.7 %) and only 0.9 % employed women are ICT specialists.

Digital Skills are covered under the third priority ‘Digital competences of society’ of OPDP for 2014-2020. The activities are addressed to all groups of society emphasising digital inclusion of the elderly, people with disabilities and people with special teaching needs. In order to match the demand for specialists, measures were taken by the National Coalition in Poland²⁸⁶ and through the active participation in EU Code Week²⁸⁷. Poland was the second most active country in the EU with 5,049 activities with participation of 314,100 people, out of whom every third was a woman.

e-Pionier, one of the OPDP projects supports talented programmers. The solutions under e-Pionier are built using the advanced technologies of blockchain (e.g. securing medical data in hospitals), drone technology (e.g. to measure pollution levels) and big data (e.g. for weather forecasts, research purposes and alert systems for people living in areas endangered by meteorological phenomena).

²⁸⁵ Digital Scoreboard 2019

²⁸⁶ More about the Broad Alliance on Digital Skills: <http://umiejetnoscicyfrowe.pl>

²⁸⁷ <https://codeweek.eu/>

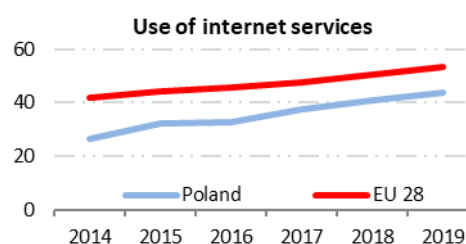
The IT Master Centre (*Centrum Mistrzostwa Informatycznego*) targets talented pupils (classes IV-VIII) and helps them develop their interests through algorithms and programming. In December 2018, the contract for co-financing the IT Master Centre, of nearly € 12 million, was signed. An estimated 750 teachers and 6,000 pupils will take part in Centre activities in the first year of the programme.

Poland launched a new OPDP strategy for 2021-2027, which will cover advanced digital skills in cybersecurity, HPC, Artificial Intelligence, big data and blockchain.

To derive maximum benefit from the digital economy and support long-term productivity, Poland needs to continue raising levels of digital skills and improve female participation of in the digital domain.

3 Use of internet services

3 Use of internet services	Poland		EU
	rank	score	score
DESI 2019	24	43.9	53.4
DESI 2018	24	40.9	50.7
DESI 2017	24	37.7	47.8

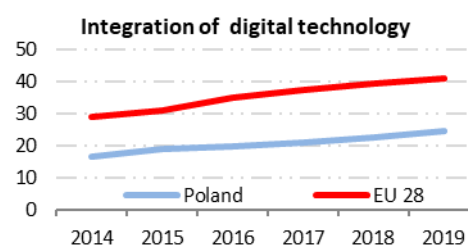


	DESI 2017	Poland	DESI 2019		EU
	value	DESI 2018	value	rank	DESI 2019
3a1 People who never used the internet % individuals	22% 2016	20% 2017	18% 2018	22	11% 2018
3a2 Internet users % individuals	70% 2016	73% 2017	75% 2018	22	83% 2018
3b1 News % internet users	79% 2016	79% 2017	79% 2017	16	72% 2017
3b2 Music, videos and games % internet users	68% 2016	68% 2016	75% 2018	21	81% 2018
3b3 Video on demand % internet users	6% 2016	6% 2016	15% 2018	19	31% 2018
3b4 Video calls % internet users	38% 2016	42% 2017	44% 2018	26	49% 2018
3b5 Social networks % internet users	60% 2016	63% 2017	64% 2018	22	65% 2018
3b6 Professional social networks % internet users	6% 2015	13% 2017	13% 2017	15	15% 2017
3b7 Doing an online course % internet users	5% 2016	5% 2017	5% 2017	22	9% 2017
3b8 Online consultations and voting % internet users	4% 2015	5% 2017	5% 2017	20	10% 2017
3c1 Banking % internet users	53% 2016	52% 2017	57% 2018	18	64% 2018
3c2 Shopping % internet users	56% 2016	58% 2017	60% 2018	18	69% 2018
3c3 Selling online % internet users	21% 2016	20% 2017	18% 2018	15	23% 2018

Overall, the Use of internet services in Poland is below the EU average and Poland ranks 24th. Poles are keen to engage in a variety of online activities, just as in the EU. The most popular online activities are reading news, listening to music, watching videos, playing video games, and using social networks. 79 % of Polish internet users read news online, above the EU average of 72 %. Poles use the internet for banking (57 %, against an EU average of 64 %) and shopping (60 %, against an EU average of 69 %). Use of video on demand rose by 150 % by comparison with 2016.

4 Integration of digital technology

4 Integration of digital technology	Poland		EU
	rank	score	score
DESI 2019	26	24.8	41.1
DESI 2018	26	22.6	39.6
DESI 2017	25	20.9	37.6



	DESI 2017	Poland		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
4a1 Electronic information sharing % enterprises	21%	26%	26%	22	34%
4a2 Social media % enterprises	9%	10%	10%	26	21%
4a3 Big data % enterprises	6%	6%	8%	22	12%
4a4 Cloud % enterprises	5%	6%	7%	27	18%
4b1 SMEs selling online % SMEs	10%	9%	12%	23	17%
4b2 e-Commerce turnover % SME turnover	7%	7%	NA		10%
4b3 Selling online cross-border % SMEs	4%	4%	4%	26	8%

As regards the Integration of digital technology within businesses, Poland ranks 26th among EU countries. Polish enterprises are increasingly taking advantage of the opportunities offered by online commerce: 12 % of SMEs sell online, as increase compared with DESI 2018, but is still below the EU average of 17 %. Only 4 % of all SMEs sell online cross-border and an average of 7 % of all Polish SMEs turnover comes from the online segment. Social media are used by 10 % of enterprises (EU average: 21 %) while 26 % of enterprises use electronic information sharing tools (compared with 21 % in 2016).

Poland is committed to making progress with new digital technologies and invests in digital technologies through EU-coordinated programmes. It is a member of the EuroHPC Joint Undertaking, and has four entries listed in the Global top 500 HPC (which ranks and details the world's 500 most powerful non-distributed computer systems), with the highest positioned in 131st position. The PRACE (Partnership for Advanced Computing in Europe) project, designed to boost EU competitiveness through high-impact scientific discovery, engineering research and development, is scheduled for 2019-2023, but Poland already started work in 2018. Poland has also signed the Declaration establishing a European Blockchain Partnership and the Declaration on Cooperation on Artificial Intelligence.

The Polish Agency for Enterprise Development (PARP), with the 'Innovation Vouchers for SMEs' project (*Bon na innowacje*), continued to strengthen cooperation between SMEs and scientific units.

The Foundation of Polish Platform of Industry 4.0 (*Platforma Przemysłu Przyszłości*)²⁸⁸ will cooperate, coordinate and standardise Digital Innovation Hubs; the first pilotage programme targeting hubs was launched between August and December 2018. Activities were launched in the first half of 2019, and first are results expected by the turn of the year.

The Industrial Development Agency (*Polski Fundusz Rozwoju*) continues its work to boost the start-up ecosystem in Poland. The Open Innovation Network²⁸⁹ programme supports the purchase of licences and technology for enterprises. The Starting Platforms²⁹⁰, an incubation programme, supports innovators and start-ups from eastern Poland. The ScaleUp acceleration pilot, operating under Start in Poland²⁹¹, has helped set up 10 accelerators, supported 300 start-ups, and led to 190 implementations of new solutions in the value chains of large companies.

In 2018, Poland adopted national legislative measures to transpose the Network and Information Systems Directive (Directive (EU) 2016/1148) of 6 July 2016 into Polish law, to increase the level of cybersecurity in Poland. The key act laying down these national cybersecurity rules is the Act of 5 July 2018 on the National Cybersecurity System. As of April, there are 60 operators of essential services, obliged by the act, to conform to higher security measures.

To boost the digital transformation of the Polish economy, it is important to keep encouraging digitisation. Particular attention needs to be paid to encouraging SMEs to digitise, to business in disadvantaged areas, and to female digital entrepreneurs. Beefing up support for new digital and innovative business models will help increase productivity, enabling SMEs to achieve more efficiency and boost their competitiveness.

²⁸⁸The Sejm adopted the law on the Polish Platform of Industry 4.0 Foundation in December 2018. More: <https://www.mpit.gov.pl/strony/aktualnosci/sejm-przyjal-ustawe-o-fundacji-platforma-przemyslu-przyszlosci/>

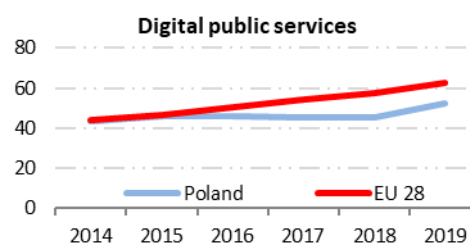
²⁸⁹ <https://www.startup.pfr.pl/en/news/next-call-open-innovation-network/>

²⁹⁰ <https://www.startup.pfr.pl/en/news/starting-platforms-recruitment-next-edition/>

²⁹¹ Start In Poland: <https://www.gov.pl/web/przedsiębiorczosc-technologie/start-in-poland>

5 Digital public services

5 Digital public services	Poland		EU
	rank	score	score
DESI 2019	23	52.5	62.9
DESI 2018	25	45.2	57.9
DESI 2017	19	45.4	54.0



	DESI 2017 value	Poland DESI 2018 value	DESI 2019 value	DESI 2019 rank	EU DESI 2019 value
5a1 e-Government users % internet users needing to submit forms	45%	45%	49%	25	64%
5a2 Pre-filled forms Score (0 to 100)	58	48	54	17	58
5a3 Online service completion Score (0 to 100)	79	81	84	20	87
5a4 Digital public services for businesses Score (0 to 100) - including domestic and cross-border	69	70	77	25	85
5a5 Open data % of maximum score	NA	NA	66%	13	64%
5b1 e-Health services % individuals	NA	14%	14%	17	18%
5b2 Medical data exchange % of general practitioners	NA	NA	16%	26	43%
5b3 e-Prescription % of general practitioners	NA	NA	7%	26	50%

On Digital public services, Poland ranks 23rd in the EU, well below the EU average. It performs very well in open data, above the EU average. However, there is still a low level of online interaction between public authorities and the public. Only half of Polish online users actively embrace e-government services. In 2018, Poland performed better than in 2017 as regards pre-filled forms, getting closer to the EU average. Poland also does well in the availability of e-government services for business, scoring 77 out of 100. In e-health services, Poland ranks 17th in the EU, with 14 % of Poles having used health and care services provided online. e-Prescriptions are used by only 7 % of general practitioners and 16 % of them exchange medical data (compared with EU averages of 50 % and 43 % respectively).

The 'Strategy for Responsible Development'²⁹² and the National Integrated Informatisation Programme (PZIP) lay down the basis for the digital strategy for public administrations. In line with these strategies, the Ministry of Digital Affairs launched the creation of an information and service gate for the Polish state (Portal of the Republic of Poland). In 2018, the websites of the Ministries of the Republic of Poland and the Chancellery of the Prime Minister started migration to the portal <https://www.gov.pl/>. Trusted Profile (*Profil Zaufany*) can confirm users' identity on internet and submit a trusted signature. Biznes.gov.pl, a digital portal for entrepreneurs, offers over 200 updated

²⁹² <https://rio.jrc.ec.europa.eu/en/library/strategy-responsible-development>

business guides, 1,000 procedure descriptions and 500 articles on how to run a business. In 2018, over 600,000 users accessed it, which is an increase of over 30 % in comparison to 2017.

Legislative changes in 2018²⁹³ facilitated the adaptation of domestic online services to cross-border authentication, by creating connection rules to the Polish eIDAS node. Organisational and technical work was carried out on electronic ID cards. The first eID cards were issued in the first half of 2019.

The Ministry of Health (MoH) is pursuing a range of projects, which significantly contribute to the digital transformation of healthcare through the 'Electronic Platform for Collection, Analysis and Access to digital resources on Medical Events' (P1 Platform). The Polish National Centre for Health Information Systems (CSIOZ), an agency operating under the auspices of the MoH, is responsible for digital health solutions and has implemented security systems at both organisational and technical level. Several important milestones were reached in 2018 in e-health (see Highlight 2019).

Easier access, more user-friendly e-services for the public and businesses could lead the way to even more significant improvements in digital public administration. Additional measures that facilitate the usage of e-health services by everyone, regardless of geographical location, could boost the take-up of those services.

Highlight 2019: Digital Transformation of Healthcare in Poland

e-Prescriptions were piloted on a small scale. From May to December 2018, over 110,000 e-prescriptions have been issued, 77 % of which have already been used. This approach allowed for identifying any technical and organizational flaws in the system, which would otherwise be costly or challenging to identify during a national rollout. As of January 1st 2020 e-prescription will be mandatory nationwide.

e-Medical Leave Certificates, allowing doctors to access to patient data and automatically deliver the sick leave, have been issued only by electronic means since 1 December 2018. The very first e-referral was registered on December 2018, ushering in e-referrals in Poland. e-Referrals are currently piloted and as of January 2021, e-Referrals shall be mandatory.

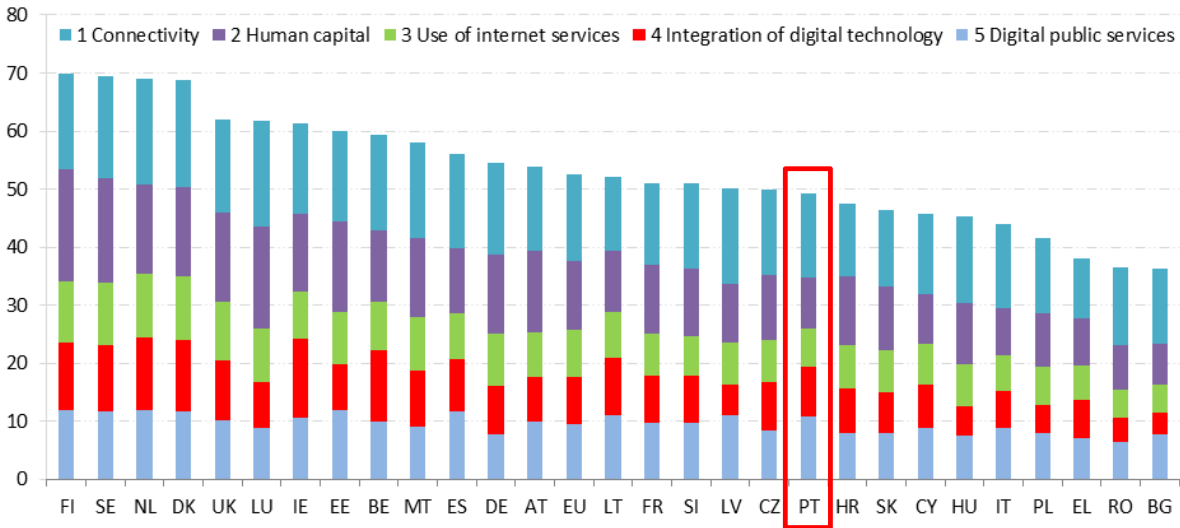
Since May 2018, the Patient Internet Account (PIA) - an internet platform, has enabled patients to access to information about medical services and to gain consent in order to access personal health data. PIA currently stores individual e-prescriptions, e-referrals, displays the history of patient interactions with the system (covered by the National Health Payer), allows for the sharing of personal health data with a relative or a physician and contains information on the amount refunded, medicines purchased, medical procedures undergone, and the recommended medicine dosage. This tool enables the inclusion of the patient in the treatment process and allows for a reduction of administrative costs. It is expected that by the end of 2019, the number of users of the platform will reach 10 million.

²⁹³ <http://prawo.sejm.gov.pl/isap.nsf/DocDetails.xsp?id=WDU20180001544>

Portugal

	Portugal		EU
	rank	score	score
DESI 2019	19	49.2	52.5
DESI 2018	19	46.8	49.8
DESI 2017	17	44.6	46.9

Digital Economy and Society Index (DESI) 2019 ranking

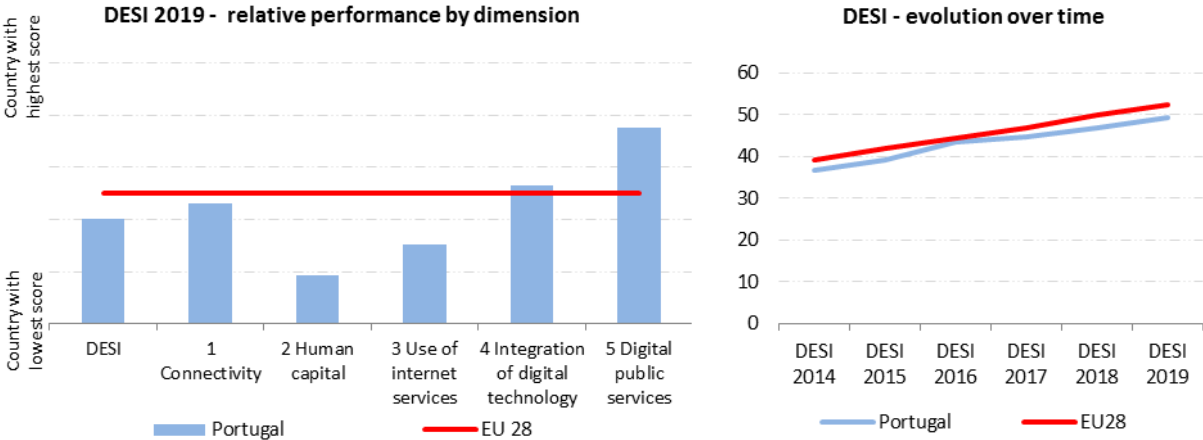


Portugal ranks 19th out of the 28 EU Member States in the European Commission's Digital Economy and Society Index (DESI) 2019. Compared with the previous edition of DESI, the country scored slightly better overall as well as in four of the five dimensions considered, but it did not improve its ranking. The largest improvement corresponds to the Digital public services dimension (Portugal's best performance), driven by a sizeable increase in the share of e-government users. Progress was also observed in the Connectivity dimension, thanks to an improvement in take-up rates for both fixed and mobile ultrafast broadband services. The country performs weakly in both the Human capital and Use of internet services dimensions, which is partly explained by the relatively large number of people who do not use the internet on a regular basis.

The Digital Agenda for Portugal, which was adopted in 2012 and subsequently updated, seeks to improve broadband connectivity and address societal challenges; e.g. delivering better public services to citizens, promoting smart mobility, employment, e-commerce and the digital economy, and reducing the digital gap between urban and peripheral regions. In 2017, the Strategy for Public Administration's Digital Transformation was launched²⁹⁴. Also in 2017, Portugal launched two comprehensive policy initiatives on digital competences and digitisation of the economy:

²⁹⁴ <https://www.tic.gov.pt/>

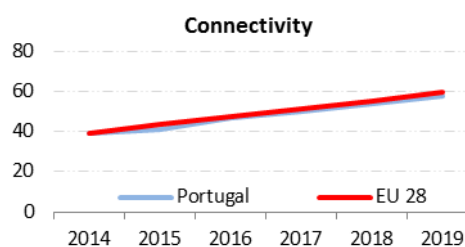
respectively, *INCoDe.2030*²⁹⁵ (also acting as Portugal’s national coalition in the context of the Digital Skills and Jobs Coalition) and '*Indústria 4.0*'. Implementation of both continued during 2018.



²⁹⁵ <https://www.incode2030.gov.pt/en/incode2030>

1 Connectivity

1 Connectivity	Portugal		EU
	rank	score	score
DESI 2019	18	57.9	59.3
DESI 2018	17	53.6	54.8
DESI 2017	18	49.9	51.2



	DESI 2017	Portugal		EU	
	value	DESI 2018	DESI 2019	DESI 2019	DESI 2019
		value	value	rank	value
1a1 Fixed broadband coverage	94%	93%	94%	23	97%
% households	2016	2017	2018		2018
1a2 Fixed broadband take-up	68%	72%	74%	16	77%
% households	2016	2017	2018		2018
1b1 4G coverage	93%	94%	96%	16	94%
% households (average of operators)	2016	2017	2018		2018
1b2 Mobile broadband take-up	55	65	70	27	96
Subscriptions per 100 people	2016	2017	2018		2018
1b3 5G readiness	NA	NA	0%	13	14%
Assigned spectrum as a % of total harmonised 5G spectrum			2018		2018
1c1 Fast broadband (NGA) coverage	67%	72%	76%	22	83%
% households	2016	2017	2018		2018
1c2 Fast broadband take-up	43%	51%	56%	7	41%
% households	2016	2017	2018		2018
1d1 Ultrafast broadband coverage	NA	72%	76%	13	60%
% households		2017	2018		2018
1d2 Ultrafast broadband take-up	25%	35%	50%	2	20%
% households	2016	2017	2018		2017
1e1 Broadband price index	69	72	78	21	87
Score (0 to 100)	2016	2017	2018		2017

Portugal ranks 18th in the Connectivity dimension of DESI 2019. Portugal has good ultrafast broadband coverage (76 % of households, compared to an EU average of 60 %) and take-up (50 %, compared to an EU average of 20 %). Fixed broadband take-up rose from 72 % in 2017 to 74 % in 2018, narrowing the gap with the EU average (77 %). While there was a substantial improvement in mobile broadband take-up (from 65 subscriptions per 100 people in 2017 to 70 in 2018), it still lags behind the EU average (96 subscriptions per 100 people). Despite an improvement in the broadband price index in 2018, Portugal still ranks 21st. However, concerning this ranking, it should be noted that convergent bundling (i.e. including fixed and mobile internet and voice services) is the most representative method used by operators to sell electronic communications services in Portugal. Mobile 4G coverage has reached 96 %, two percentage points above the EU average. Mobile broadband prices for handset offers²⁹⁶ have fallen over the past year (from EUR 29.8 to EUR 25.7), but are still above the EU average (EUR 22.3).

²⁹⁶ 1 GB + 300 calls basket.

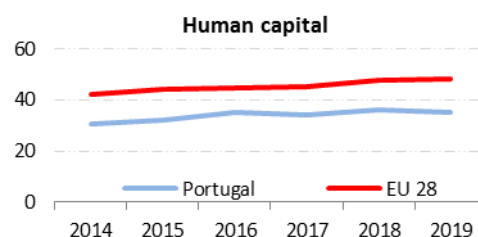
Investment and competition between private operators continue to drive the expansion of broadband. However, the Portuguese authorities continue to monitor projects in rural areas that benefitted from state aid in the past. In May 2018, the national regulatory authority, ANACOM, revised the wholesale tariffs for access to these rural networks and proposed to the government a reduction between 30 % and 66 % of Fibroglobal's offers. In addition, ANACOM proposed that Fibroglobal's bitstream offer be extended to 200 Mbps, 400 Mbps or 1 Gbps speeds and that a multicast functionality be introduced. The proposal was analysed by the government and a final decision was issued in April 2019. As submarine cables connecting mainland Portugal, the Azores and Madeira are expected to reach the end of their useful life in 2024/2025 (Columbus III in 2024 and Atlantis-2 in 2025), the 2019 state budget approved in October 2018 by the Portuguese Parliament provides for the government to take the necessary measures to maintain connectivity between Mainland Portugal and the Autonomous regions (Madeira and Azores) and between the Islands of such regions.

As regards 5G, in March 2018, ANACOM launched a public consultation regarding the assignment of the 700 MHz band. In July, it issued the national roadmap for the release of the 700 MHz band. The release of the band, which is to start in the last quarter of 2019 and to be completed by the end of May 2020, requires the migration of digital terrestrial television, DTT, to a new frequency band. The national roadmap includes the adoption of the simplest migration scenario, through the maintenance of current technology and without the need for any period of simultaneous transmission. The assignment of the 3.4 - 3.8 and 26 GHz bands was also subject to consultation. There are two operators with rights of use for 200 MHz in the 3.4 - 3.6 GHz band until 2024-2025. Portugal is studying the possible scenarios in order to reorganise and allow the use of sufficiently large blocks in this band by 31 December 2020. As of the first quarter of 2019, Portugal had assigned 36 % of the total 2090 MHz spectrum harmonised at EU level for wireless broadband.

Portugal performs well in the deployment of fast and ultrafast broadband connectivity. An additional effort is still required to ensure that fast broadband (by 2020) and ultrafast broadband (by 2025) reaches all households, including those in rural areas. Mobile broadband prices remain a challenge. Public authorities are preparing the ground for the deployment of 5G.

2 Human capital

2 Human capital	Portugal		EU
	rank	score	score
DESI 2019	23	35.2	48.0
DESI 2018	23	36.2	47.6
DESI 2017	23	34.2	45.4



	Portugal		EU		
	DESI 2017	DESI 2018	DESI 2019	DESI 2019	
2a1 At least basic digital skills	48%	50%	50%	20	57%
% individuals	2016	2017	2017		2017
2a2 Above basic digital skills	28%	31%	31%	16	31%
% individuals	2016	2017	2017		2017
2a3 At least basic software skills	52%	55%	55%	19	60%
% individuals	2016	2017	2017		2017
2b1 ICT specialists	2.3%	2.4%	2.2%	26	3.7%
% total employment	2015	2016	2017		2017
2b2 Female ICT specialists	0.7%	0.8%	0.7%	27	1.4%
% female employment	2015	2016	2017		2017
2b3 ICT graduates	1.2%	1.2%	1.2%	27	3.5%
% graduates	2014	2015	2016		2015

In DESI's Human capital dimension, Portugal ranks 23rd out of 28 Member States and scores significantly below the EU average. In 2017, half of the Portuguese population lacked basic digital skills and about 30 % had no digital skills at all (the EU average being 43 % and 17 % respectively). This is largely linked to the fact that many people have never used the internet (see section 3). In addition, Portugal continues to have one of the smallest shares of professionals with specialised ICT skills in total employment in the EU: 2.2 % in 2017 compared to an EU average of 3.7 %. In the same vein, the proportion of ICT specialists in total female employment is roughly half the EU average, and the share of ICT graduates in the total graduate pool is very low by EU standards.

Several initiatives seeking to improve digital skills and competences were undertaken over the past year, mostly in the context of *INCoDe.2030*, the country's national initiative in this domain. These notably include the definition of a work plan for '*Capacitar i4.0*', which seeks to integrate '*INCoDe.2030*' and '*Indústria 4.0*' (Portugal's strategy to modernise its productive tissue through digitisation) and increase digital preparedness. It involves the development of a number of assessment tools and capacity building activities. In addition, a financial envelope of EUR 20 million (for 2018-2019) has been allocated to training interventions, including mandatory ICT modules, for unemployed people with low qualifications ('*Vida Ativa Qualifica+*'). Promising initiatives to promote digital inclusion are also underway, such as *Creative Communities for Digital Inclusion*, which targets vulnerable groups of the population (see Highlight 2019 below), and the development of an Action Plan to close the gender gap in digital technologies that is in line with EU-level actions in this area. In

2018, a good number of schools and other organisations took part in the EU Code Week, a²⁹⁷ grassroots movement to encourage people of all ages to code. More than 140 events were held in Portugal attracting nearly 18,000 participants.

Digital skills deficits remain a major obstacle for Portugal if it is to achieve its policy goals in terms of both social cohesion and economic competitiveness. Timely implementation and upscaling of existing initiatives, a number of which are at the pilot stage, will be crucial in this respect.

Highlight 2019: Developing a network of Creative Communities for Digital Inclusion

Creative Communities for Digital Inclusion (CCDIs), which has been underway since March 2018, is the flagship project under Axis 1 of INCoDe.2030 (*Inclusion*). It follows a collaborative and participatory approach to address barriers to digital inclusion such as socioeconomic inequalities, gender, age, special needs and cultural factors (e.g. people issued from minority groups, migrants). Ten CCDIs are being developed throughout the country around the following five models:

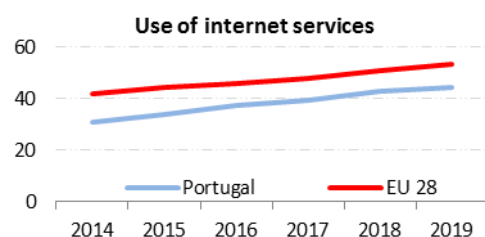
- *Municipal plans for digital inclusion*: with municipalities as activator entities and involving local stakeholders (typically, about 100 beneficiaries)
- *Mobile*: training measures targeting people with mobility difficulties, usually due to age and combined with isolation and geographic factors
- *Intergenerational*: usually involving two different groups; e.g. higher education students mentoring young people and children, or young people mentoring elderly people so they can "go digital"
- *Start-ups of digital inclusion initiatives*: with large organisations (e.g. foundations) as activators that cooperate with smaller ones such as schools to promote the development of CCDI
- *Networks*: incorporating digital aspects into the activities of existing networks in a range of sectors

CCDIs have 750 direct beneficiaries at the time of writing, with a total of 40 mentors involved. In addition, the project has served to develop training programmes in areas including certified training for mentoring, junior mentoring workshops, and teacher training on digital inclusion. Mapping, assessment and monitoring tools have likewise been developed in this context.

²⁹⁷ <https://codeweek.eu/>

3 Use of internet services

3 Use of internet services	Portugal		EU
	rank	score	score
DESI 2019	23	44.5	53.4
DESI 2018	23	42.8	50.7
DESI 2017	23	39.6	47.8

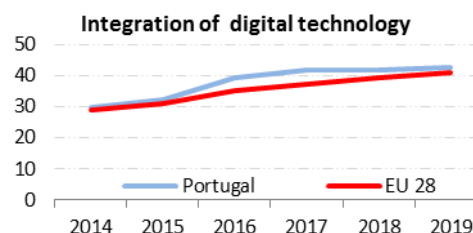


	Portugal		EU	
	DESI 2017 value	DESI 2018 value	DESI 2019 value	DESI 2019 rank
3a1 People who never used the internet % individuals	26%	22%	23%	26
3a2 Internet users % individuals	68%	71%	71%	25
3b1 News % internet users	78%	80%	80%	13
3b2 Music, videos and games % internet users	83%	83%	83%	13
3b3 Video on demand % internet users	9%	9%	14%	22
3b4 Video calls % internet users	39%	44%	46%	22
3b5 Social networks % internet users	74%	76%	79%	8
3b6 Professional social networks % internet users	15%	16%	16%	13
3b7 Doing an online course % internet users	6%	6%	6%	17
3b8 Online consultations and voting % internet users	14%	15%	15%	3
3c1 Banking % internet users	41%	42%	52%	23
3c2 Shopping % internet users	43%	45%	49%	23
3c3 Selling online % internet users	11%	11%	11%	24

Despite a higher overall score compared with a year earlier, Portugal has not progressed in this dimension's ranking and remains in the 23rd position out of 28 Member States. The share of people who have never used the internet, which remained stable in 2018, is double the EU average. In the same vein, relatively few Portuguese people use the internet at least once a week: 71 % compared to 81 % for the EU as a whole. The share of internet users who engage in online banking grew significantly, from 42 % in 2017 to 52 % in 2018, as did the share of those shopping online (from 45 % to 49 %). These figures remain, however, below the EU average of 64 % and 69 % respectively. Conversely, the shares of Portuguese internet users using social networks, participating in online votes and consultations, and reading news online are all above the EU average.

4 Integration of digital technology

4 Integration of digital technology	Portugal		EU
	rank	score	score
DESI 2019	11	42.8	41.1
DESI 2018	11	41.8	39.6
DESI 2017	11	41.8	37.6



	DESI 2017	Portugal		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
4a1 Electronic information sharing % enterprises	44%	40%	40%	8	34%
4a2 Social media % enterprises	17%	16%	16%	19	21%
4a3 Big data % enterprises	13%	13%	13%	12	12%
4a4 Cloud % enterprises	11%	14%	16%	15	18%
4b1 SMEs selling online % SMEs	18%	17%	18%	12	17%
4b2 e-Commerce turnover % SME turnover	12%	13%	15%	5	10%
4b3 Selling online cross-border % SMEs	8%	8%	8%	16	8%

As regards the Integration of digital technology by businesses²⁹⁸, Portugal ranks 11th in the EU with an above-average overall score. The country registered progress regarding companies' use of cloud computing services and, following improvements over the past year, the proportion of both large outfits and SMEs selling online is now higher than for the EU as a whole. As a general rule, Portuguese SMEs are much less actively engaged in digitisation than their larger counterparts and, while data coverage for microenterprises (i.e. those with fewer than ten employees) is patchy, available evidence suggests that they are significantly lagging behind in this respect. For example, in 2016 only 32 % of Portuguese microenterprises had some sort of online presence and fewer than 10 % did any business online, compared with much larger shares among companies with ten employees or more²⁹⁹. This situation warrants particular attention considering that microenterprises account for about 41 % of employment and 24 % of added value in Portugal (compared with about 30 % and 21 % for the EU as a whole³⁰⁰).

Portugal is committed to the development of innovative digital technologies including by means of strategic investments coordinated at EU level: it is a member of the EuroHPC Joint Undertaking and has signed the European Blockchain Partnership Declaration and the Declaration on cooperation on

²⁹⁸ Unless otherwise stated, figures exclude companies in the financial sector as well as those with fewer than 10 employees.

²⁹⁹ Source: IDC, ACEPI (2017): Estudo Anual da Economia e da Sociedade Digital em Portugal.

³⁰⁰ Source: European Commission (2018): 2018 SBA Fact Sheet Portugal

Artificial Intelligence (AI). In addition, implementation of '*Indústria 4.0*' has progressed over the past year, with 60 out of the 64 measures initially announced having already been initiated³⁰¹. For example, the first call under the (voucher-based) *Vale i4.0* initiative served to co-finance 340 projects to promote the adoption of digital technologies by SMEs and microenterprises. The second call foresees EUR 3.4 million worth of incentives. Eligible projects, which benefit from co-funding from EU funds, include those in areas such as cloud computing, cybersecurity, AI and advanced analytics, web content and customer relationship management, e-commerce and e-marketplaces, search engine optimisation and web analytics³⁰². In the same vein, EUR 100 million have been made available for production projects or application of solutions within the scope of '*Indústria 4.0*' through a credit line as part of '*Capitalizar 2018*'.

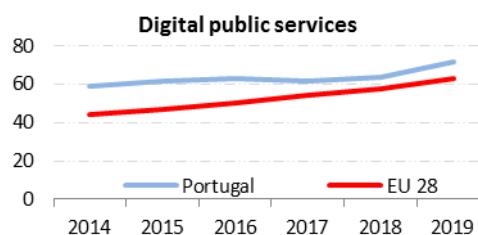
The Portuguese authorities have produced tentative estimates of expected impact of '*Indústria 4.0*' so far: 4,200 jobs and EUR 700 million worth of additional exports (for approved incentives totalling EUR 380 million). These estimates suggest that continued efforts to promote decisive action to help Portuguese companies regardless of their size incorporate digital technologies into their business and production processes are likely to pay off.

³⁰¹ The second phase of '*Indústria 4.0*' was presented in April 2019.

³⁰² <https://www.iapmei.pt/getattachment/PRODUTOS-E-SERVICOS/Incentivos-Financiamento/Sistemas-de-Incentivos/Industria-4-0/GuiaIndustria40-pdf.pdf.aspx?lang=pt-PT>

5 Digital public services

5 Digital public services	Portugal		EU
	rank	score	score
DESI 2019	9	71.4	62.9
DESI 2018	9	63.7	57.9
DESI 2017	9	61.9	54.0



	Portugal		EU	
	DESI 2017 value	DESI 2018 value	DESI 2019 value	DESI 2019 rank
5a1 e-Government users % internet users needing to submit forms	58%	56%	70%	14
5a2 Pre-filled forms Score (0 to 100)	74	74	81	7
5a3 Online service completion Score (0 to 100)	96	98	99	2
5a4 Digital public services for businesses Score (0 to 100) - including domestic and cross-border	88	88	88	13
5a5 Open data % of maximum score	NA	NA	51%	23
5b1 e-Health services % individuals	NA	14%	14%	17
5b2 Medical data exchange % of general practitioners	NA	NA	63%	8
5b3 e-Prescription ³⁰³ % of general practitioners	NA	NA	NA	50%

Portugal has made significant progress over the past year in the dimension on Digital public services of DESI and remains among the EU's best performers in this area: it ranks 9th out of 28 Member States and shows an above-average overall score. Online interaction levels between internet users and public authorities increased significantly compared with 2017, and the country's performance is a long way above the EU average with regard to online service completion and the amount of data being pre-filled in public services' online forms. In contrast, there is room for improvement in areas such as open data use and availability of digital public services for businesses (where progress is flattening out)³⁰⁴. About 14 % of the country's citizens used e-health services (e.g. online consultations) in 2017, compared to an EU average of 18 %. 63 % of general practitioners, in turn, declared to exchange medical data online in 2018 (EU average 43 %).

Portugal's Strategy for Public Administration's Digital Transformation, which runs until 2020, has three main axes: integration and interoperability; innovation and competitiveness, and resource sharing. It seeks to promote the use of ICT for administrative simplification and public service

³⁰³ Data has been removed due to potential inconsistencies.

³⁰⁴ [National authorities expect more public services for business to be available to other EU Member States soon, notably thanks to improved cross-border recognition systems.](#)

improvement. Increased e-government use is likely to be linked to Portugal's efforts to broaden its network of citizen spots, which provide access to, and support with online services (more than 500 of these spots are currently in operation, offering approximately 200 public services³⁰⁵), as well as to expand the use of the '*chave móvel digital*' (digital mobile key)³⁰⁶. In addition, the Portuguese public employment services recently introduced an online "one-stop shop" interface for job-seekers and employers (*IEFPonline*) allowing users to obtain full responses to their queries remotely. Although there are plans for effective inter-institutional connectivity and information sharing (the 2019 draft budget law envisages a new connection between employment and health services), some features such as the implementation of job integration agreements in areas like health, education or social action are still under development. Portugal's second annual e-health summit, one of Europe's largest events in this field, took place in Lisbon in March 2018. It signals Portugal's commitment to promoting e-health as part of the country's efforts to modernise public services. The 2019 edition of the Portugal eHealth Summit will be held in conjunction with the conference of the International Society for Telemedicine & eHealth (ISfTeH).³⁰⁷

Portugal is also making considerable efforts to promote digitally-enabled innovative approaches to public service provision. In October 2018, the Portuguese authorities presented 15 research projects designed to apply artificial intelligence and data science in the work of public administrations. EUR 3.8 million will be made available through the *Fundação para a Ciência e Tecnologia* (FCT) for these projects, which are part of Axis 5 of '*INCoDe.2030*' (*Research*) and will cover areas including health, education, culture, mobility and territorial management³⁰⁸. Moreover, in April 2018 Portugal's Administrative Administration Agency launched GovTech³⁰⁹, a contest for start-ups to present functional prototypes of products and services that help meet the United Nations' sustainable development goals.³¹⁰

Portugal is adopting relevant measures to continue to modernise public services with the help of digital technologies and is one of the leaders in the EU in this regard. However, the relatively large share of the Portuguese population who do not use the internet or only seldom do so is, by definition, unlikely to benefit from the country's digital public services.

³⁰⁵ <https://www.ama.gov.pt/web/english/citizen-spot>

³⁰⁶ <https://www.autenticacao.gov.pt/stats-chave-movel-digital>

³⁰⁷ <https://ec.europa.eu/digital-single-market/en/news/conference-international-society-telemedicine-and-ehealth-portugal-ehealth-summit>

³⁰⁸ For further details, please see <https://www.incode2030.gov.pt/en/featured/government-promotes-best-practice-applications-artificial-intelligence-public-administration>

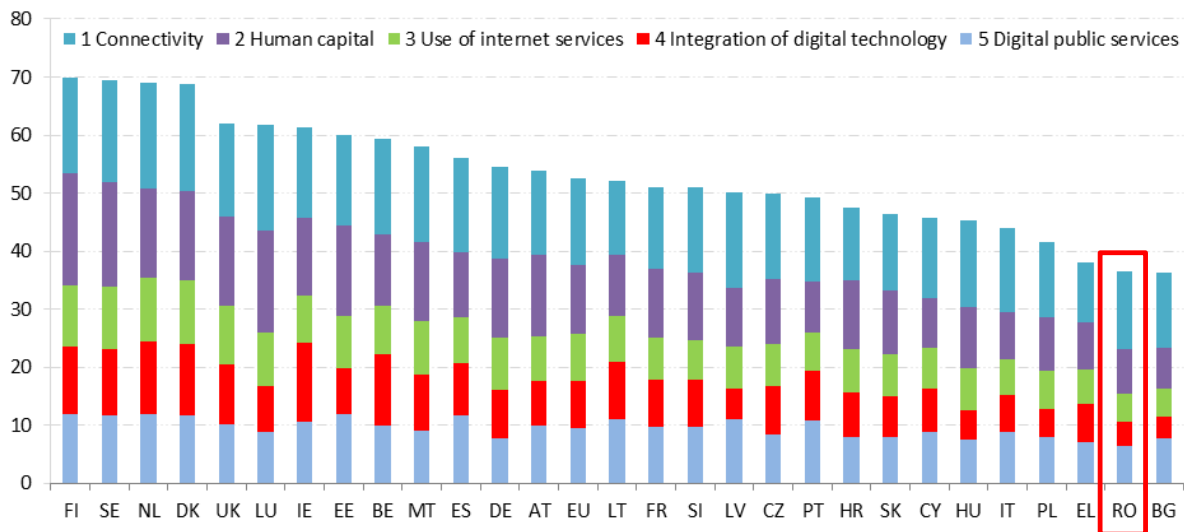
³⁰⁹ Further information including the list of winning projects available at <https://govtech.gov.pt/>

³¹⁰ This contest involves the use of blockchain technologies.

Romania

	Romania		EU
	rank	score	score
DESI 2019	27	36.5	52.5
DESI 2018	27	35.4	49.8
DESI 2017	28	32.0	46.9

Digital Economy and Society Index (DESI) 2019 ranking



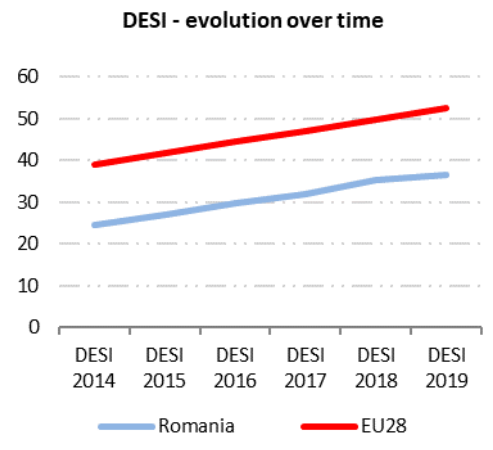
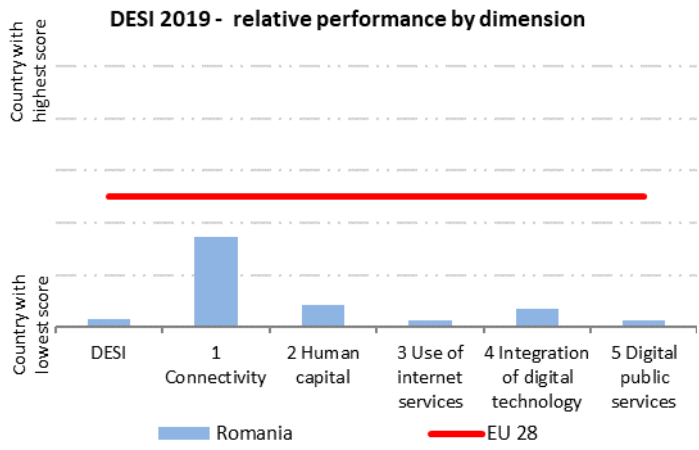
Romania ranks 27th out of the 28 EU Member States in the European Commission Digital Economy and Society Index (DESI) 2019.

Although Romania shows slight improvements in performance in almost all of the DESI dimensions measured, its ranking remained stable given that the overall progress was slow. Romania performs best in the Connectivity dimension, thanks to the wide availability of fast and ultrafast fixed broadband networks (especially in urban areas). However, digitisation of the economy is lagging behind, more than one fifth of Romanians have never used the internet, and fewer than a third have basic digital skills.

When it comes to Digital public services, Romania has the lowest performance among the Member States, despite the large share of e-government users (7th in the EU). On the other hand, 45 % of Romanian homes subscribe to ultrafast broadband, which is the 3rd highest figure in the EU. As regards female ICT specialists, Romania is well positioned as it ranks 16th, with 1.3 % of Romanian women in employment.

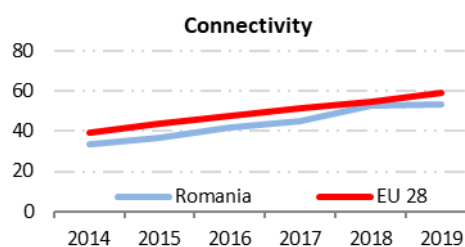
Romania adopted its National Strategy on the Digital Agenda for Romania for 2020 (SNADR) in February 2015³¹¹ setting out four areas of action, but progress with implementation remains limited.

³¹¹ <https://www.comunicatii.gov.ro/agenda-digitala-pentru-romania-2020/>



1 Connectivity

1 Connectivity	Romania		EU
	rank	score	score
DESI 2019	22	53.5	59.3
DESI 2018	19	52.5	54.8
DESI 2017	23	45.2	51.2



	DESI 2017	Romania		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
1a1 Fixed broadband coverage % households	89%	88%	87%	26	97%
1a2 Fixed broadband take-up % households	63%	67%	66%	22	77%
1b1 4G coverage³¹² % households (average of operators)	45%	72%	77%	28	94%
1b2 Mobile broadband take-up Subscriptions per 100 people	71	82	85	20	96
1b3 5G readiness Assigned spectrum as a % of total harmonised 5G spectrum	NA	NA	0%	13	14%
1c1 Fast broadband (NGA) coverage % households	72%	74%	76%	21	83%
1c2 Fast broadband take-up % households	44%	53%	55%	9	41%
1d1 Ultrafast broadband coverage % households	NA	73%	75%	14	60%
1d2 Ultrafast broadband take-up % households	32%	44%	45%	3	20%
1e1 Broadband price index Score (0 to 100)	85	87	86	16	87

Romania ranks 22nd in the Connectivity dimension. In 2018, Romania did not continue the trend of improvement at the same speed as in previous years. Notably, fixed broadband coverage stagnated at around 87 % of households covered and still lags behind most Member States (ranked 26th in the EU). Broadband take-up stalled at 66 % of households and it is well below the EU average of 77 %. The strong infrastructure-based competition in Romania, mainly in urban areas, is reflected in the indicators in which the country performs very well, namely ultrafast broadband coverage and take-up (75 % and 45 % respectively). However, Romania's urban-rural digital divide is illustrated by the figures for ultrafast broadband coverage, where 39 % of rural areas are covered (although above the EU average of 29 %). A significantly higher ratio of homes (55%) subscribe to fast broadband (≥ 30 Mbps) than the EU average of 41 %, although in the last year average EU growth (8 percentage points) outperformed Romanian growth (2 percentage points). Similarly, as regards ultrafast broadband take-up, Romania still largely outperforms the EU average (45 % versus 20 %). However, Romania improved only marginally with regard to this indicator (1 percentage point) after an

³¹² Figures refer to population coverage.

impressive improvement of 12 percentage points the year before. Romania lags behind on 4G coverage (77 %), well below the EU average of 94 %. Similarly, the mobile broadband take-up indicator places Romania amongst the least performing Member States, despite the significant drop in mobile broadband prices for handset offers³¹³ (from EUR 21 in 2017 to EUR 10 in 2018), well below the EU average of EUR 22 in 2018.

To address the urban-rural digital divide, under the 2014-2020 financial framework, the Romanian Operational Programme for Competitiveness has earmarked EUR 100 million from the European Regional Development Fund (ERDF), while the 2014-2020 Rural Development Operational Programme had initially foreseen an indicative amount of EUR 25 million from the European Agricultural Fund for Rural Development (EAFRD) under LEADER³¹⁴, out of which less than EUR 2 million were effectively allocated to broadband infrastructure measures. The RoNet project to support deployment of backhaul networks in 'white areas' was granted ERDF financing of EUR 45 million, of a total of EUR 54 million, to finalise the intended coverage in the current financing period, ensuring broadband backhaul infrastructure for a target of 721 localities. At the end of September 2018, the national authorities reported the reception of works in 607 localities while in 484 localities the works have been finalised and have been accepted. A new grant scheme for next-generation networks (NGN) deployment, with a total estimated budget of EUR 64 million, was set up to provide support to private operators deploying backhaul and last-mile access infrastructure for additional localities in underserved (white) areas. The first call of the project was launched in October 2018, and projects are now under evaluation. A second call, under public consultation until the beginning of January 2019, is expected to be launched in the first half of 2019.

Overall, in Romania, 38 % of the spectrum harmonised at EU level for wireless broadband has been assigned. In November 2018, the National Strategy for the Implementation of 5G in Romania was published for public consultation. The National Strategy is planned to be adopted before the organisation of the spectrum multi-band auction in the 700 MHz, while several other bands remain for the second half of 2019 (including 800 MHz, 1500 MHz, 2600 MHz and 3400-3600 MHz bands). However, the whole process seems to be affected by the adoption of Emergency Ordinance No 114/2018³¹⁵ that set a very high level of the reserve price that seems to go beyond European benchmark levels for future licences as well as similarly increased minimum fees for the renewal of existing licences. In addition, the Emergency Ordinance substantially raises the yearly monitoring tariff levied on the sector. These changes could affect the deployment of future-oriented digital infrastructure in Romania.

Romania would benefit from keeping the momentum of developing its broadband connectivity, as in previous years. In 2018, the growth of the sector stalled while the measures adopted at the end of the year could undermine the potential development of future 5G networks.

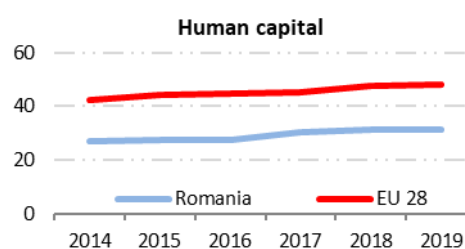
³¹³ Offers from February 2018 compared to those from February 2017 including 1 GB, 300 calls and 225 SMS. Prices expressed in €/PPP, VAT included. Source: Mobile Broadband Prices in Europe (Van Dijk and Empirica).

³¹⁴ The term 'LEADER' is the French acronym for "Liaison Entre Actions de Développement de l'Économie Rurale", meaning 'Links between the rural economy and development actions'.

³¹⁵ Published in the Official Journal of Romania on 29 December 2018.

2 Human capital

2 Human capital	Romania		EU
	rank	score	score
DESI 2019	27	31.1	48.0
DESI 2018	28	31.5	47.6
DESI 2017	27	30.2	45.4



	Romania		EU	
	DESI 2017 value	DESI 2018 value	DESI 2019 value	DESI 2019 rank
2a1 At least basic digital skills % individuals	28%	29%	29%	28
2a2 Above basic digital skills % individuals	9%	10%	10%	28
2a3 At least basic software skills % individuals	30%	32%	32%	27
2b1 ICT specialists % total employment	1.9%	2.0%	2.1%	27
2b2 Female ICT specialists % female employment	1.2%	1.2%	1.3%	16
2b3 ICT graduates % graduates	NA	5.4%	4.9%	6

As regards the Human capital dimension, Romania ranks 27th among EU countries, well below the EU average. Basic and advanced digital skills levels remain lowest among EU Member States. Only 29 % of people aged between 16 and 74 have basic digital skills (57 % in the EU as a whole) and 10 % have advanced digital skills (against an EU average of 31 %). Despite the increase in the percentage of ICT specialists from last year, they represent a lower proportion of the workforce by comparison with the EU as a whole (2.1 % against an EU average of 3.7 %). When it comes to ICT graduates, Romania is performing well, as the country ranks 6th among EU Member States, with 4.9 % of all graduates. As regards female ICT specialists, Romania ranks 16th, as they represent 1.3 % of Romanian women in employment, which is just slightly below the EU average of 1.4 %. Romania has the third highest share of women among all ICT specialists (25.7 % in 2017, against an EU average of 17.2 %) ³¹⁶. Romania ranks 11th in terms of the gender pay gap, with 16 % difference in pay ³¹⁷.

Given that the number of ICT places at universities is limited and there is a lack of ICT graduates, there are several private companies investing in digital skills, offering IT specialisation programmes. Several Romanian universities have started offering online courses (MOOC) ³¹⁸. The tax exemption provided for IT professionals in the country helps fill the high number of IT vacancies.

³¹⁶ [https://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:Distribution_of_persons_employed_as_ICT_specialists_by_sex_education_level_and_age_2007_and_2017_\(%25\)_ICT2018.png](https://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:Distribution_of_persons_employed_as_ICT_specialists_by_sex_education_level_and_age_2007_and_2017_(%25)_ICT2018.png)

³¹⁷ <https://ec.europa.eu/digital-single-market/en/news/country-reports-women-digital-scoreboard>

³¹⁸ <https://www.mooc-list.com/countries/romania>
<http://www.biblioteca-digitala.ase.ro/biblioteca/model/index2.asp>

The SNADR is the steering document for all digital matters, including digital skills. The strategy focuses on: providing ICT infrastructure in schools; developing pupils' and teachers' digital skills; using ICT in the learning process and in lifelong learning; updating the ICT skills of public administration staff, and ensuring e-inclusion by developing digital skills and e-skills.

Romania has a National Coalition for Digital Skills and Jobs³¹⁹ - Skills4IT³²⁰. This open platform includes several stakeholders and has political backup from several Ministries. Activities are focusing on rolling out coding and IT classes in schools, organising cybersecurity courses and educational events. The coalition also provides training to upgrade the digital skills of the labour force. Romania actively participated in EU Code Week³²¹ in 2018, a grassroots movement to encourage people of all ages to code. There were 458 activities organised around the country, with an estimated number of 25,400 participants.

In 2018, the Romanian Government launched the tender³²² for a project entitled 'Wireless Campus' - a national integrated platform that will provide wireless internet in 4,500 state-run schools. The project will get a RON 117 million (EUR 25 million) financing from the ERDF and RON 32.8 million (EUR 7 million) from the state budget.³²³

There are several initiatives from the private sector. In October 2018, the University of Bucharest, together with Google Romania, launched an innovation hub for digital skills, the Google Digital Workshop hub.

A high level of skills mismatches in companies' workforces limit their capacity to innovate and capitalise on innovation. Increasing the number of Romanian ICT specialists, ensuring the necessary training of teachers in order for education supply to meet the high demand, but also re-skilling the labour force is of the utmost importance if Romania is to derive full benefit from the digital economy.

³¹⁹ <https://ec.europa.eu/digital-single-market/en/national-local-coalitions>

³²⁰ <http://coalitiait.ro/>

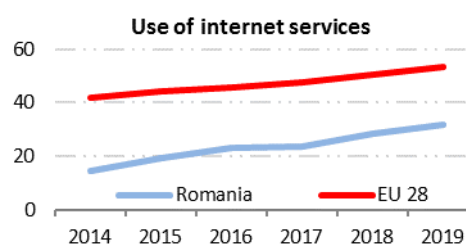
³²¹ <https://codeweek.eu/>

³²² <https://www.romania-insider.com/romania-eur-35-mln-tender-wifi-schools>

³²³ <https://www.romania-insider.com/govt-substantiation-note-wireless-campus-schools/>

3 Use of internet services

3 Use of internet services	Romania		EU
	rank	score	score
DESI 2019	28	31.9	53.4
DESI 2018	28	28.5	50.7
DESI 2017	28	23.8	47.8

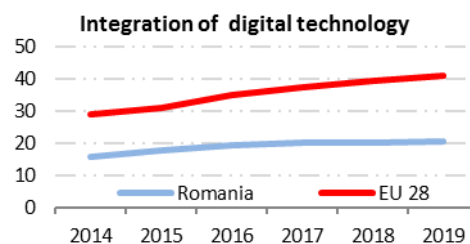


	Romania		EU	
	DESI 2017 value	DESI 2018 value	DESI 2019 value	DESI 2019 rank
3a1 People who never used the internet % individuals	30%	27%	21%	24
3a2 Internet users % individuals	56%	61%	68%	27
3b1 News % internet users	63%	69%	69%	24
3b2 Music, videos and games % internet users	67%	67%	63%	28
3b3 Video on demand % internet users	6%	6%	10%	26
3b4 Video calls % internet users	45%	53%	51%	15
3b5 Social networks % internet users	74%	82%	86%	1
3b6 Professional social networks % internet users	6%	6%	6%	25
3b7 Doing an online course % internet users	4%	5%	5%	23
3b8 Online consultations and voting % internet users	4%	5%	5%	23
3c1 Banking % internet users	8%	11%	10%	28
3c2 Shopping % internet users	18%	23%	26%	28
3c3 Selling online % internet users	5%	4%	5%	26

Overall, the Use of internet services in Romania continues to be the lowest among the EU Member States. 21 % of individuals aged 16-74 have never used the internet (compared to the EU average of 11 %). People in Romania are keen to engage in a variety of online activities, especially social networks and video calls. The use of social networks is more widespread than in all the other EU countries, the country ranks first with 86 % of internet users (65 % in the EU). Romanians used video calls (51 %) also above the EU average (49 %). However, the use of banking, shopping as well as music, videos and games (10 %, 26 % and 63 % respectively) is below the EU average, mainly due to a lack of trust in digital technology.

4 Integration of digital technology

4 Integration of digital technology	Romania		EU
	rank	score	score
DESI 2019	27	20.5	41.1
DESI 2018	27	20.1	39.6
DESI 2017	27	20.3	37.6



	DESI 2017	Romania		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
4a1 Electronic information sharing	22%	17%	17%	27	34%
% enterprises	2015	2017	2017		2017
4a2 Social media	8%	9%	9%	27	21%
% enterprises	2016	2017	2017		2017
4a3 Big data	11%	11%	11%	14	12%
% enterprises	2016	2016	2018		2018
4a4 Cloud	5%	6%	7%	25	18%
% enterprises	2016	2017	2018		2018
4b1 SMEs selling online	7%	8%	8%	27	17%
% SMEs	2016	2017	2018		2018
4b2 e-Commerce turnover	4%	5%	5%	25	10%
% SME turnover	2016	2017	2018		2018
4b3 Selling online cross-border	2%	2%	2%	28	8%
% SMEs	2015	2017	2017		2017

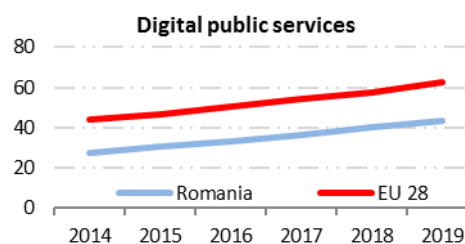
On the Integration of digital technology by businesses, Romania ranks 27th among EU countries, well below the EU average. Romania's ranking remained stable in this dimension compared to the last two years. There was almost no change in any of the indicators. Romanian enterprises are taking advantage of the possibilities offered by big data analysis (11 % versus 12 % EU average), where the country ranks 14th. 9 % of Romanian enterprises are using social media (versus 21 % EU average). There was a slight improvement in the use of cloud services from 6 % in 2017 to 7 % in 2018, however it remains well below the EU average of 18%. Only 8 % of total SMEs are selling online (against an EU average of 17%), while 2 % of them are selling online cross-border (versus 8 % EU average).

Romania has committed to invest in digital technologies, via EU-coordinated programmes. The country is a member of the EuroHPC Joint Undertaking; it has also signed the Declaration creating the European Blockchain Partnership and the Declaration on Cooperation on Artificial Intelligence. Digitising enterprises remains an important challenge. One of the measures to support SMEs is the 'Start-up nation' programme³²⁴. About 10,000 companies per year are targeted, with a maximum financing of EUR 44,000 that can be obtained for e.g.: IT equipment, website, software licenses, courses, consulting etc. (not all related to IT). In 2017 over 8,000 new companies were created that signed financing programmes, in a total amount of RON 1.7 billion (about EUR 380 million).

³²⁴ <https://start-upnation.ro/>

5 Digital public services

5 Digital public services	Romania		EU
	rank	score	score
DESI 2019	28	43.2	62.9
DESI 2018	27	40.4	57.9
DESI 2017	26	36.5	54.0



	Romania		EU	
	DESI 2017 value	DESI 2018 value	DESI 2019 value	DESI 2019 rank
5a1 e-Government users % internet users needing to submit forms	84%	80%	82%	7
5a2 Pre-filled forms Score (0 to 100)	12	12	10	28
5a3 Online service completion Score (0 to 100)	55	62	67	27
5a4 Digital public services for businesses Score (0 to 100) - including domestic and cross-border	48	51	54	28
5a5 Open data % of maximum score	NA	NA	62%	18
5b1 e-Health services % individuals	NA	11%	11%	21
5b2 Medical data exchange % of general practitioners	NA	NA	19%	24
5b3 e-Prescription % of general practitioners	NA	NA	39%	18

As regards Digital public services, Romania's rank decreased, putting the country last in the EU. Nonetheless, the country performs relatively well regarding certain indicators. There is a high level of online interaction between public authorities and citizens, as Romania ranks seventh regarding e-government users, with 82 % of internet users versus 64 % EU average. This contrasts with the low scores for pre-filled forms and online service completion, which could indicate a systemic problem with the quality and usability of the services offered.

Although the use of medical data exchange is low (19 % of general practitioners versus 43 % EU average), e-prescription services are more widespread, and Romania ranks 16th with 39 % of general practitioners using it (versus 50 % EU average). In 2018, Romania's performance improved by 5 points compared to last year regarding online service completion (from a score of 62 to 67). Furthermore, Romania is just slightly below the EU average as regards open data policy and the national open data portal (62 % versus 64 %).

A Government Decision has been adopted establishing a National Interoperability Framework, based on the European Interoperability Framework. A proposal for an Interoperability Law is being drafted by the Ministry of Communications and Information Society.

As of 2018, the eDelivery Access Point is operational. This will contribute to achieving compliance with the eIDAS Regulation and will support the implementation of access points for other services, such as e-invoicing, transportation, environment, health, e-tendering or e-justice. Romania's eIDAS

node is currently being built through an ERDF financed project (“SITUE”) and is expected to be finalized by end of 2019.

Romania is planning to introduce an electronic identification system (eID) based on chip-based ID cards. The government intends to use the eID as the legal tool for the interaction between citizens and companies with the government. The large-scale deployment of eID was planned for early 2019, but the process is delayed, awaiting for the adoption of relevant legislation.

The new Centre for Financial Information, reorganized in October 2017, allows the government to communicate electronically with taxpayers and to receive tax declarations online. It was redesigned and simplified in 2018 and is now available via the Single Contact Point (PCUe). During the first three months the number of tax returns submitted electronically increased to more than 600,000 tax returns/months, i.e. 96% of all tax returns. The Virtual Private Space (SPV) is the system of management of declarations and tax liabilities of citizens, where payment obligations are established; however it does not include a payment module. Ghiseul.ro, acts as a payment platform for the SPV. The adoption of the SPV by businesses exceeded 200,000 new users/month during the first three months from March 2018.

In 2018, several authorities at central and local level have simplified their procedures, which are now available via the PCUe. However, not all procedures can be fulfilled online, but rather the documentation needed is available.

The Ministry of Health has simplified its procedures so that the dossier on the approval and correction of medicine prices can be transmitted electronically and communication to operators can be done online. The Ministry envisages projects in the domain of e-health, such as the Disease Registry Project and the Electronic Clinical Informatics System.

The National Office Trade Register (NOTR) has implemented the complete online registration process for new companies, including the changes and modifications in the business register, the sale or transfer of ownership (social shares transfer), and insolvency procedures. The simplified online registration has a response time of maximum 3 working days. The NOTR provides now 30 digital public services.

Overall, the national administration’s IT system is fragmented, which represents an administrative burden for citizens and businesses. The level of interoperability between the public administration services is generally low, as each public institution focused on its own digital public service. As a result, it is unclear how much information once submitted is then re-used by the other institutions.

Highlight 2019: the Romanian Electronic System for Public Procurement

The Electronic System for Public Procurement (ESPP) (*Sistemul Electronic de Achizitii Publice (SEAP)*) is an electronic environment which enables all users (contracting authorities and economic operators) to conduct public procurement procedures. It enforces national legislation in the public procurement field, according to EU legislation and it is currently used by approximately 20,000 contracting authorities and 140,000 economic operators (it is compulsory in Romania to conduct public procurement procedures by electronic means only).

The platform is available at www.e-licitatie.ro in Romanian and English. The system uses forms and structured data, with advanced security through the use of digital certificates, as well as advanced search and reporting criteria. The system allows for automatic notifications based on interest and extensive web services for interoperability, including for mobile terminals.

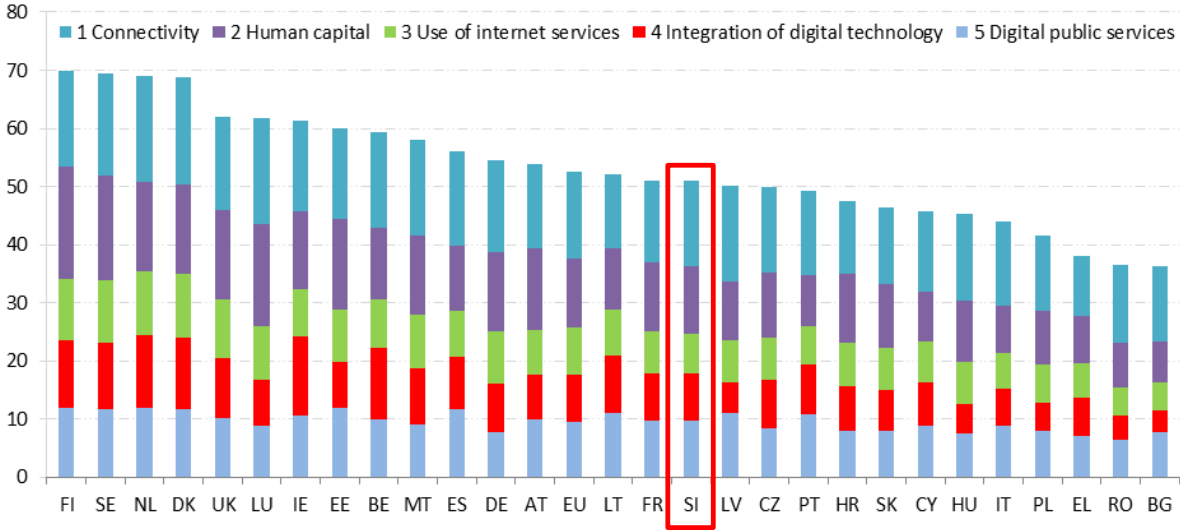
Any interested person can access the public interface freely. The following categories of information can be visualised: all types of notices; contract notices that contain documentations of the award procedures; all procurement intentions grouped by each contracting authority; all documents issued by the contracting authorities; all direct purchases conducted online; information on European and national legislation in the field, the list of all users etc.

The ESPP will be enhanced through the implementation of the Open Contracting Data Standard, the integration of the European Single Procurement Document (ESPD) and e-Certis platform and the electronic invoice.

Slovenia

	Slovenia		EU
	rank	score	score
DESI 2019	16	50.9	52.5
DESI 2018	15	47.9	49.8
DESI 2017	16	45.1	46.9

Digital Economy and Society Index (DESI) 2019 ranking

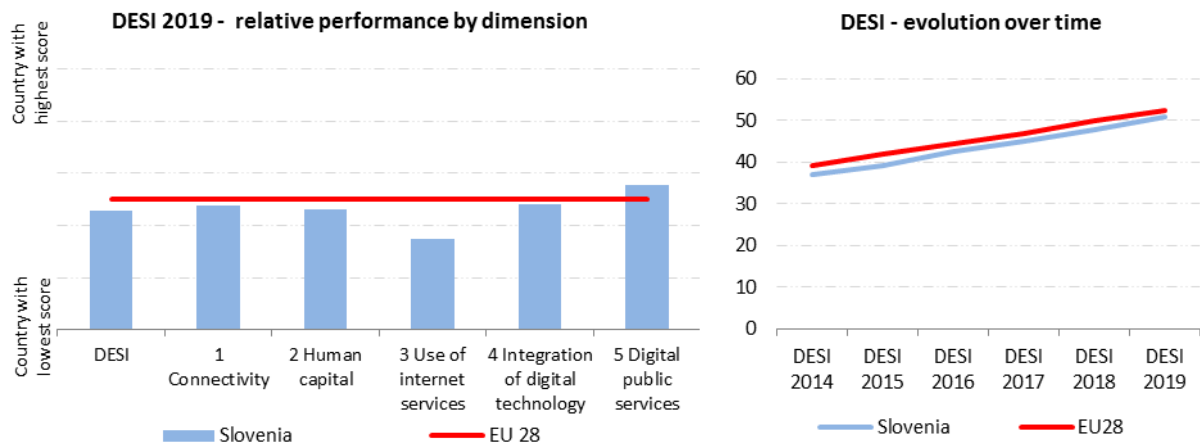


Slovenia ranks 16th out of the 28 EU Member States in the European Commission Digital Economy and Society Index (DESI) 2019.

Its score increased due to an improved performance in some of the DESI dimensions measured. Slovenia performs better in Connectivity and Digital public services dimensions. Slovenia did incrementally improve the score but not its rank in the Use of internet services and Integration of digital technology dimension. Slovenia is at standstill and lost one rank in the Human capital dimension, while still scoring in line with the EU.

In the Human capital dimension, Slovenia is not advancing at the same pace as other Member States. Slovenia performed at the level of the EU average due to good results in the past, but current trends show room for improvements in this dimension. Slovenia advanced in the Use of internet services dimension, but did not close the gap to the EU average. While Slovenians are keen users of internet of online leisure services and online access to news, this is not the case for using internet for business, creativity or adding value. Slovenia has slightly improved in the dimension Integration of digital technologies. However, in this very competitive dimension Slovenia lost one rank. Increased awareness of the importance of digital transformation could lead to increased productivity in Slovenia. Among all dimensions, Slovenia ranks highest in e-government domain. This is mainly due to good results in the re-use of public sector data and an updated e-health system.

The current Digital Slovenia 2020 agenda (DSI 2020) was adopted in 2016³²⁵. In 2018 agenda has been updated by an addendum to the Rollout plan for next-generation networks until 2020³²⁶. A Slovenian Digital Coalition has been in place since 2017³²⁷.



³²⁵ http://www.mju.gov.si/fileadmin/mju.gov.si/pageuploads/DID/Informacijska_druzba/DSI_2020.pdf

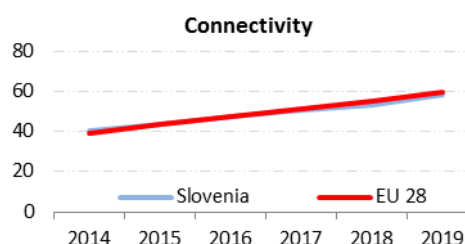
³²⁶

http://www.mju.gov.si/fileadmin/mju.gov.si/pageuploads/DID/1_Dodatek_k_Nacrtu_NGN_2020_5.7.2018.pdf

³²⁷ <http://www.digitalna.si/digitalna-koalicija.html>

1 Connectivity

1 Connectivity	Slovenia		EU
	rank	score	score
DESI 2019	17	58.5	59.3
DESI 2018	18	53.4	54.8
DESI 2017	16	50.9	51.2



	DESI 2017	Slovenia	DESI 2019		EU
	value	value	value	rank	value
1a1 Fixed broadband coverage % households	98% 2016	98% 2017	98% 2018	12	97% 2018
1a2 Fixed broadband take-up % households	77% 2016	77% 2017	85% 2018	5	77% 2018
1b1 4G coverage % households (average of operators)	90% 2016	96% 2017	98% 2018	10	94% 2018
1b2 Mobile broadband take-up Subscriptions per 100 people	54 2016	66 2017	74 2018	26	96 2018
1b3 5G readiness Assigned spectrum as a % of total harmonised 5G spectrum	NA	NA	0% 2018	13	14% 2018
1c1 Fast broadband (NGA) coverage % households	82% 2016	83% 2017	86% 2018	18	83% 2018
1c2 Fast broadband take-up % households	19% 2016	24% 2017	38% 2018	17	41% 2018
1d1 Ultrafast broadband coverage % households	NA	75% 2017	80% 2018	12	60% 2018
1d2 Ultrafast broadband take-up % households	9% 2016	13% 2017	16% 2018	17	20% 2017
1e1 Broadband price index Score (0 to 100)	75 2016	73 2017	75 2018	25	87 2017

With an overall Connectivity score of 58.5, Slovenia ranks 17th, slightly below the EU average, albeit improving its position. While fixed broadband coverage remained stable with 98 % of homes covered— slightly above the EU average 97 % —, Slovenia increased its fast broadband (NGA) coverage to 86 %, exceeding the EU average (83 %). Fixed broadband connections are available in 85 % of households, which is above EU average of 77 %. On ultrafast (100 Mbps and above) broadband, Slovenia has 80 % coverage, outperforming the EU by 20 percentage points. Slovenia increased its mobile broadband take-up to 74 subscriptions per 100 people, but remains far below the EU average of 96. Moreover, whereas NGA networks are comparatively new in much of the country and the rate of fast broadband subscriptions showed an increase last year up from 24 % in 2017 to 38 % in 2018, take-up of fast internet is still below the EU average of 41 %.

All major operators actively invest in very high capacity networks and the penetration fibre-to-the-home (FTTH) technology is rising. The incumbent operator plans to migrate users from the copper to the fibre access network. The next-generation network (NGN) 2020 plan faces a slowdown due to lack of governmental funding. Slovenia published a call for tender for the construction of open

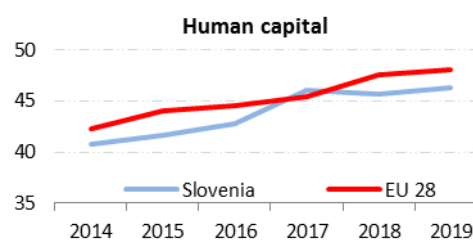
broadband networks for the entire concession territory in January 2018, but did not receive any application. Therefore, in July 2018 a second public invitation to tender was published splitting the concession territory in two regions. However, all four applications were rejected after the assessment. Additionally, in September 2018, the Slovene authorities published a call for a statement of commercial interest for the construction of broadband networks in areas where a commercial interest has not been tested so far for the construction of network connection points with a bandwidth of at least 30 Mbps. The difficulty that arose is that the construction of broadband infrastructure is more expensive than planned due to low population density.

Regarding 5G, Slovenia has several testing projects in place and envisaged further spectrum for testing of 5G technology. In March 2019, the Government adopted a Plan for the use of the 470-700 MHz frequency band in the Republic of Slovenia. The 700 MHz frequency band should be awarded together with other free bands through a multi-frequency auction by 30 June 2020. Frequencies in the 3.4 – 3.8 GHz and 26 GHz band will be assigned at the same time. Slovenia assigned all spectrum in the 2.6 GHz band and overall, 30 % of the 2090 MHz of harmonised spectrum. In addition, it appears that Slovenia will have to adopt the appropriate legislative environment (e.g. environment, construction law) to be fully prepared for the 5G mobile technology.

Slovenia has slightly improved its connectivity ranking by one position. Slovenia is encouraged to continue its efforts to improve regulatory conditions, ensure stable competition to improve private investments in network rollout, and make the steps necessary to complete the announced 5G spectrum auctioning. Independence of the NRA is key for regulatory predictability, which is necessary to attract investment in enhanced networks.

2 Human capital

2 Human capital	Slovenia		EU
	rank	score	score
DESI 2019	15	46.3	48.0
DESI 2018	14	45.7	47.6
DESI 2017	13	46.1	45.4



	DESI 2017	Slovenia		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
2a1 At least basic digital skills % individuals	53% 2016	54% 2017	54% 2017	18	57% 2017
2a2 Above basic digital skills % individuals	28% 2016	30% 2017	30% 2017	17	31% 2017
2a3 At least basic software skills % individuals	57% 2016	57% 2017	57% 2017	17	60% 2017
2b1 ICT specialists % total employment	3.6% 2015	3.5% 2016	3.8% 2017	12	3.7% 2017
2b2 Female ICT specialists % female employment	1.3% 2015	1.3% 2016	1.3% 2017	14	1.4% 2017
2b3 ICT graduates % graduates	4.1% 2014	3.5% 2015	3.5% 2016	17	3.5% 2015

As regards the Human capital dimension, Slovenia ranks 15th among EU countries and performs below the EU average. Slovenia did not substantially progress in the human capital dimension in the recent years. While remaining close to the EU average Slovenia is losing one rank in this dimension compared with other countries. Slovenia slightly advanced in shares of population having at least basic (54 %) or above basic digital skills (30 %), however it did not improve in the shares of individuals having basic software skills (57 %). All of them are slightly below the EU average. The shares of female ICT specialists and ICT graduates remains stable, and only the share of ICT specialist increased in the last year from 3.5 % to 3.8 %, slightly above the EU average. On a positive note, more women have above basic digital skills in younger cohorts than their male Slovenians counterparts. Slovenia ranks 1st among all EU Member States in the share of female STEM graduates. In Slovenia 20.5 % of all STEM graduates are female, well above the EU average of 13.1 % female STEM graduates³²⁸.

Slovenia used to be an early adapter in the introducing informatics in the school curricula. The DSI 2020 contains references to objectives for improvement of digital literacy, e-skills and better e-inclusion. While the Strategic guidelines for further implementation of ICT in the Slovenian education until 2020³²⁹ (adopted in 2016) feature a vision and some principles for the introduction of ICT into the educational programme, they miss to define in a more concrete way operational objectives and measurable benchmarks. A study commissioned by the Ministry for education, science and sport in

³²⁸ Digital Scoreboard 2019

³²⁹

http://www.mizs.gov.si/fileadmin/mizs.gov.si/pageuploads/StrateskeUsmeritveNadaljnijegaUvajanjaIKT1_2016.pdf

2018 (Generators of digital future or only digital users³³⁰) took stock of the current situation and highlighted the shortcomings. The e-school book projects has been successfully finalized in 2016, but has not been updated since then³³¹. The open project e-schoolbag is focusing on procuring equipment, rather than on e-skills or content³³². Informatics is facultative optional subject in the curriculum of primary schools (4th, 5th and 6th grade). In secondary schools,³³³ informatics is a mandatory subject with between 70 to 105 teaching hours. On the other hand, students from professional or vocational schools are not being taught computer skills, except in technical schools³³⁴.

Further involvement of the industry could play a key role in advising which competences need to be developed in the preparation and implementation of the Guidelines³³⁵. According to the business sector, the educational system does not deliver enough ICT experts, despite a share of STEM graduates close to the EU average. The lack of ICT specialists is especially relevant in the areas of coding and programming. According to the business sector, this is due to non-updated school programmes and to curriculum based instead of objective based teaching. The Slovenian Digital Skills and Jobs Coalition³³⁶ could help to further address this gap and to improve digital literacy and competences, e-skills and to better integrate ICT in education.

One of the biggest strengths of Slovenia is human capital. The knowledge needed for digital transformation exists in the country. However, advancement in the Human capital dimension has stagnated from a relatively good position in the previous years. Putting in place sufficient and relevant actions will diminish the risks of Slovenia and strengthen its position in an increasingly digitised economic environment.

³³⁰ Snovalci digitalne prihodnosti ali le uporabniki? Poročilo strokovne delovne skupine za analizo prisotnosti vsebin računalništva in informatike v programih osnovnih in srednjih šol ter za pripravo študije o možnih spremembah (RINOS)

³³¹ <http://eucbeniki.sio.si/>

³³² <https://projekt.sio.si/e-solska-torba/>

³³³ Slovenian: gimnazije

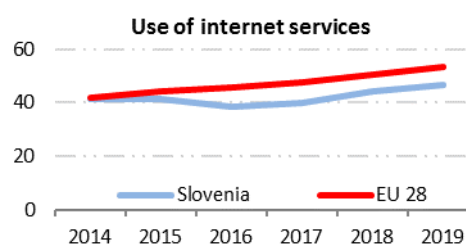
³³⁴ Snovalci digitalne prihodnosti ali le uporabniki? Poročilo strokovne delovne skupine za analizo prisotnosti vsebin računalništva in informatike v programih osnovnih in srednjih šol ter za pripravo študije o možnih spremembah (RINOS), p. 21 – 31.

³³⁵ http://www.mizs.gov.si/fileadmin/mizs.gov.si/pageuploads/StrateskeUsmeritveNadaljnegaUvajanjaIKT1_2016.pdf

³³⁶ <http://www.digitalna.si/>

3 Use of internet services

3 Use of internet services	Slovenia		EU
	rank	score	score
DESI 2019	21	46.6	53.4
DESI 2018	21	44.4	50.7
DESI 2017	22	39.9	47.8

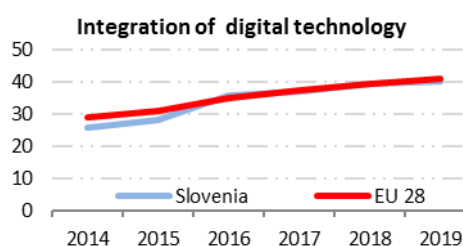


	Slovenia				EU
	DESI 2017 value	DESI 2018 value	DESI 2019		DESI 2019 value
3a1 People who never used the internet % individuals	22%	18%	16%	18	11%
3a2 Internet users % individuals	73%	77%	79%	18	83%
3b1 News % internet users	80%	77%	77%	19	72%
3b2 Music, videos and games % internet users	78%	78%	84%	10	81%
3b3 Video on demand % internet users	18%	18%	16%	18	31%
3b4 Video calls % internet users	42%	47%	50%	16	49%
3b5 Social networks % internet users	51%	57%	61%	25	65%
3b6 Professional social networks % internet users	8%	9%	9%	21	15%
3b7 Doing an online course % internet users	4%	7%	7%	14	9%
3b8 Online consultations and voting % internet users	6%	5%	5%	22	10%
3c1 Banking % internet users	47%	50%	53%	22	64%
3c2 Shopping % internet users	53%	57%	63%	16	69%
3c3 Selling online % internet users	22%	27%	22%	13	23%

Overall, the use of internet services in Slovenia has increased in 2018, but remains below with the EU average. People in Slovenia are keen to engage in a variety of online activities in line with the rest of the EU, the most popular online activity being watching music, videos, gaming and reading news. 77 % of Slovenian internet users read news online (72 % in the EU). 84 % of Slovenians watch videos, listen to music and play games online, which is above the EU average of 81 %. Furthermore, the use of online courses (14 %) is more widespread than in other EU countries.

4 Integration of digital technology

4 Integration of digital technology	Slovenia		EU
	rank	score	score
DESI 2019	15	40.1	41.1
DESI 2018	14	39.5	39.6
DESI 2017	15	37.0	37.6



	Slovenia		EU	
	DESI 2017	DESI 2018	DESI 2019	DESI 2019
	value	value	value	rank
4a1 Electronic information sharing	33%	30%	30%	17
% enterprises	2015	2017	2017	2017
4a2 Social media	17%	18%	18%	15
% enterprises	2016	2017	2017	2017
4a3 Big data	11%	11%	10%	18
% enterprises	2016	2016	2018	2018
4a4 Cloud	15%	13%	17%	11
% enterprises	2016	2017	2018	2018
4b1 SMEs selling online	13%	18%	17%	14
% SMEs	2016	2017	2018	2018
4b2 e-Commerce turnover	NA	NA	NA	10%
% SME turnover	2016	2017	2018	2018
4b3 Selling online cross-border	10%	NA	NA	6
% SMEs	2015	2017	2017	2017

As regards the Integration of digital technology by businesses Slovenia ranks 15th among EU countries, just below the EU average. Slovenia lost one rank compared to last year. Slovenia made no progress on most of the indicators, except use of cloud services and SMEs selling online. Slovenian enterprises are increasingly taking advantage of the possibilities offered by online commerce: 17 % of SMEs sell online (17 % on EU average) and 12 % of total SMEs sell cross-border (8 % in the EU). 18 % of enterprises use social media and 17 % of Slovenian enterprises use cloud services (up from 13 % in 2017).

Slovenia is committed to the advancement of new digital technologies and to investing in digital technologies through EU-coordinated programmes. It is a member of the EuroHPC Joint Undertaking; it has also signed the Declaration creating the European Blockchain Partnership, the Declaration on Cooperation on Artificial Intelligence and the Declaration on cooperation towards access to at least 1 million sequenced genomes in the European Union by 2022.

The Digital Slovenia 2020 is the starting point for the Slovenian Smart Specialisation Strategy focusing on the digital and circular economies and industry.

In 2018, the Digital Innovation Hub Slovenia (DIH Slovenia) was established³³⁷. Its key initial partners come from the specialisation platform Strategic Research and Innovation Partnerships (SRIP -

³³⁷ <http://dih slovenia.si/>

Factories of the Future, ICT innovation network, Smart cities and communities), the industry, the national FabLab network, universities, the Chamber of Commerce and Industry of Slovenia (CCIS) and the Ljubljana Technology Park. Besides DIH Slovenia, there are five other market-specific DIHs in Slovenia³³⁸.

Strategic Research and Innovation Partnerships (SRIPs) are long-term partnerships between business community, research organisations, state and municipalities and facilitators, innovation users and NGOs. The aim of these partnerships is to pool investment and intellectual potentials of Slovenian stakeholders, and help the stakeholders setting up a comprehensive innovation ecosystem with the aim of entering global markets and improving the position in priority areas. There is a SRIP created for each of nine priority domains outlined in the Slovenian Smart Specialisations Strategy.

Another project is the FabLab Network Slovenia³³⁹, a network of creative laboratories. The main objective of the network is to recognize and use the entrepreneurial potential of local communities in Slovenia. In total, there are 28 FabLabs in Slovenia. The CCIS has set up the Digital Academy³⁴⁰ aiming to raising awareness of the importance of digital transformation in management and SMEs.

Slovenia has successful start-ups in the ICT sector, mainly active in some niche services: block-chain, development of business applications, cybersecurity and measurement equipment. Nevertheless, the degree of uptake of digital technologies by business differs from sector to sector. Some sectors have a high degree of digital integration due to their foreign owners or foreign principals, as for example in the automotive sector³⁴¹. Other structural challenges include access to finance and shortage of ICT specialists.

To boost the digital transformation of the Slovenian economy, it is important to raise awareness of the relevance of digitisation for SMEs and traditional industries, to improve access to finance and address the shortage of workers with e-skills. That way the full range of benefits from the adoption of digital technologies by SMEs can be captured.

³³⁸ 1. Digital Innovation Hub for Smart Manufacturing (Pomurje Technology Park), 2. Digital Innovation Hub of Eastern Slovenia (DIGITECH SI -East), 3. DIH AGRIFOOD - Digital Innovation Hub for Agriculture and Food production, 4. HPC5-High Performance and Cloud Computing Cross-border Competence Consortium, 5. Styrian Technology Park, STP.

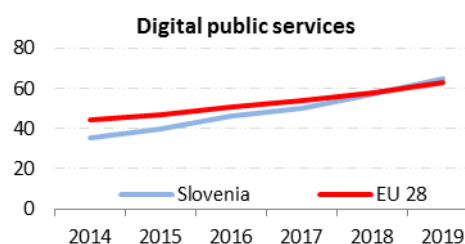
³³⁹ <http://fablab.si/en/>

³⁴⁰ https://www.gzs.si/zbornica_elektronske_in_elektroindustrije/vsebina/Strokovna-podro%C4%8Dja/Digitalna-akademija-DA

³⁴¹ <http://www.acs-giz.si/en>

5 Digital public services

5 Digital public services	Slovenia		EU
	rank	score	score
DESI 2019	14	64.7	62.9
DESI 2018	16	57.0	57.9
DESI 2017	16	49.8	54.0



	Slovenia		EU	
	DESI 2017 value	DESI 2018 value	DESI 2019 value	DESI 2019 rank
5a1 e-Government users % internet users needing to submit forms	50%	54%	56%	17
	2016	2017	2018	2018
5a2 Pre-filled forms Score (0 to 100)	43	51	61	14
	2016	2017	2018	2018
5a3 Online service completion Score (0 to 100)	84	84	86	18
	2016	2017	2018	2018
5a4 Digital public services for businesses Score (0 to 100) - including domestic and cross-border	67	73	78	23
	2016	2017	2018	2018
5a5 Open data % of maximum score	NA	NA	75%	7
			2018	2018
5b1 e-Health services % individuals	NA	27%	27%	6
		2017	2017	2017
5b2 Medical data exchange % of general practitioners	NA	NA	27%	16
			2018	2018
5b3 e-Prescription % of general practitioners	NA	NA	98%	3
			2018	2018

As regards Digital public services, Slovenia ranks 14th among EU countries and above the EU average. It performs very well in access to open data and e-health. In 2018, Slovenia performed better than the previous year in the use of pre-filled forms (61 against an EU average of 58). However, the take-up of e-government services for businesses is lower in Slovenia than in the EU overall, although a wide range of online services for businesses are being available. In e-health services, Slovenia ranks 6th among EU Member States, with 27 % of Slovenes having used health and care services provided online. The use of e-prescription is almost ubiquitous (it is used by 98 % of general practitioners) and 27 % of them exchange medical data.

Slovenia continues to implement the goals and principles set out in the EU's e-Government Action Plan. The Digital Slovenia 2020 Strategy provides for the rollout of digital public services by 2020 at all levels of government. The strategy introduces the digital by default and once only principles and encompasses the development of various key enablers for access and interoperability of e-government services. However, the take-up of use of digital public services remains suboptimal in Slovenia especially if compared with the wide scope of online services available. There is a serious divergence in take-up of e-government services, compared to other sectors. National statistical survey from 2017 showed that 90 % of people that hold e-signature certificate are using them for e-banking, 60 % for e-taxes and only 20 % for e-government services. There might be various reasons for the low up-take of e-government services: the lack of a widely spread and easy to use national electronic identification means for using e-government services, low awareness of all available

options and complexity of procedures. Further, the degree of availability of mobile access and interoperability issues for accessing services and registries within remits of different departments when implemented in electronic way might constitute a significant barrier to uptake. In Slovenia, almost all e-government services require users to authenticate using their qualified certificate for e-signature, and only about 25 % of the population have valid certificates³⁴². In 2018, an important step was made with the service called smsPASS enabling Slovenian citizens to use their mobile phones for authentication and e-signatures. New legislation on electronic identities is currently being drafted that will address e-identities and trust services. Slovenia has made significant effort in recent years to make the process of electronic identification and electronic signature in e-government services simpler and more user friendly by developing central building blocks that provide the same user experience in all e-government services that are connected to the central platform.

Slovenia continues to be a champion of reuse of public sector data. Digitisation contributes to the transparency of public administration in Slovenia. Almost all public sector documents are available online, which benefits both press and citizens control of public affairs and spending.

Slovenia is well on the way to implementing the Digital Slovenia 2020 Strategy and the EU's e-Government Action Plan by 2020. Better interoperability across all public actors involved and the design of a single identifier will help boost the take-up rates of digital public services.

Highlight 2019: Slovenian e-health system³⁴³

The Slovenian e-health system is based on the following components: 1) the national health insurance card; 2) e-prescriptions; 3) e-appointments; 4) a central registry of patient's data; 5) patients' consent on the government patient portal zVEM and; 6) a central registry of vaccinations. The e-prescription system enables people to get a prescription without the need to visit a doctor (e.g. repeat prescriptions for certain chronic diseases). The e-appointment module manages the patient's appointments, e-referrals from general practitioners to specialists and waiting times. The patient can make an appointment with a medical specialist online and check national waiting lists. The central registry of patient data enables the general practitioner to look at the specialist results online, patient vaccination data, medical history and any medicines prescribed and dispensed.

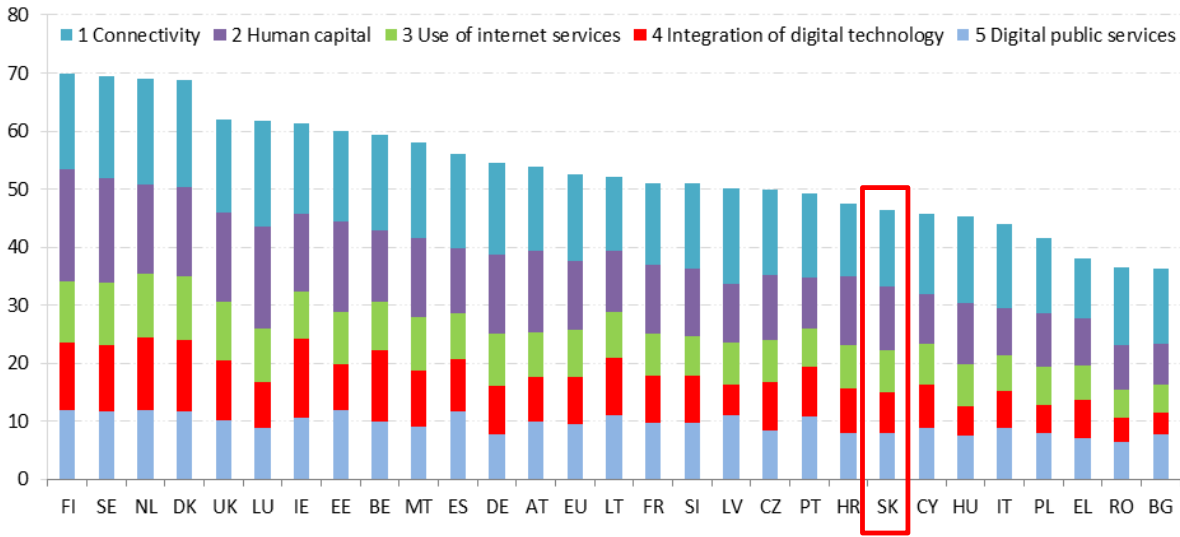
³⁴² According to Slovenian authorities.

³⁴³ <http://www.nijz.si/en>

Slovakia

	Slovakia		EU
	rank	score	score
DESI 2019	21	46.3	52.5
DESI 2018	20	44.5	49.8
DESI 2017	21	41.0	46.9

Digital Economy and Society Index (DESI) 2019 ranking



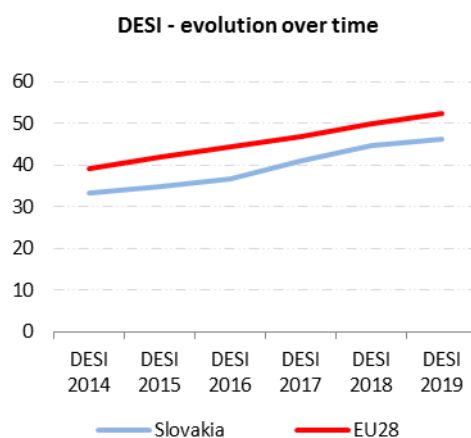
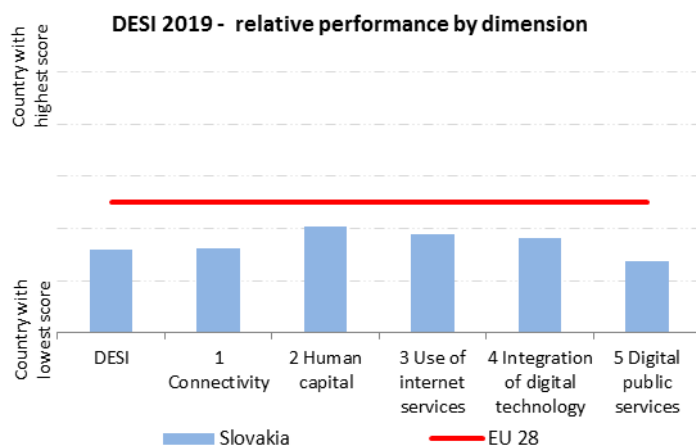
Slovakia ranks 21st out of the 28 EU Member States in the European Commission Digital Economy and Society Index (DESI) 2019.

Its score increased thanks to an improved performance in some of the DESI dimensions measured. Slovakia performs well in Human capital, thanks to the share of population with at least basic and above basic digital skills which are both above the EU average. The country also improved in the Connectivity, Use of internet services and especially in the Digital public services dimensions. Nevertheless, Slovakia’s overall score in all the dimensions remains below the EU average and the country decreased by one place in EU ranking.

Slovakia is significantly extending the fast and ultrafast broadband coverage. The share of Slovaks who never used the internet is declining. A growing share of Slovak internet users shop and sell goods and services online, and nearly three thirds of them participate in social networks. Slovakia is performing well in the open data indicator and is improving digital public services for businesses.

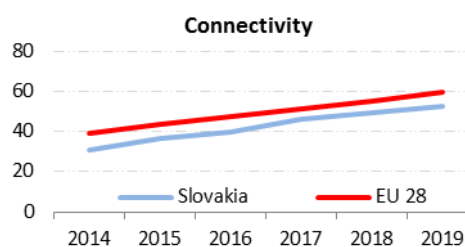
Public authorities are finalising a new Strategy for Digital Transformation of Slovakia. Based on a benchmark analysis and lessons learned from similar strategic documents in France, Finland, UK and Singapore, the strategy will target three main areas: 1) Education, employability and digital skills, 2) Data and digital economy, 3) Digital public services including transport and healthcare. The Deputy Prime Minister for Investments and Digitisation will manage a new team that will be responsible for

coordinating the implementation of the new strategy. The government foresees to adopt the document during 2019.



1 Connectivity

1 Connectivity	Slovakia		EU
	rank	score	score
DESI 2019	23	52.6	59.3
DESI 2018	22	49.4	54.8
DESI 2017	20	45.9	51.2



	DESI 2017	Slovakia		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
1a1 Fixed broadband coverage % households	88%	89%	88%	25	97%
1a2 Fixed broadband take-up % households	72%	70%	70%	20	77%
1b1 4G coverage % households (average of operators)	71%	82%	87%	25	94%
1b2 Mobile broadband take-up Subscriptions per 100 people	73	84	88	18	96
1b3 5G readiness Assigned spectrum as a % of total harmonised 5G spectrum	NA	NA	0%	13	14%
1c1 Fast broadband (NGA) coverage % households	75%	79%	86%	17	83%
1c2 Fast broadband take-up % households	23%	29%	34%	20	41%
1d1 Ultrafast broadband coverage % households	NA	68%	80%	11	60%
1d2 Ultrafast broadband take-up % households	8%	10%	13%	21	20%
1e1 Broadband price index Score (0 to 100)	88	88	90	8	87

Slovakia's overall performance in connectivity confirms the previous trend of a relatively slower improvement than in the rest of the EU, with an overall connectivity score of 52.6. Slovakia ranks 23rd, one place down compared with 2018. The country has made virtually no progress in fixed broadband coverage, with 88 % of households covered (89 % previously), and is thus still below the EU average (97 %). Fixed broadband take-up remained static, at 70 % of households, below the EU average (77 %). 4G coverage increased to 87 %, but is still below the EU average (94 %). While mobile broadband take-up increased to 88 subscriptions per 100 people (84 subscriptions per 100 people in 2017), it remains below the EU average (96 subscriptions per 100 people). Slovakia showed good progress on fast broadband NGA coverage covering 86 % of households (above the EU average of 83 %). Progress was made on fast broadband take-up, with 34 % of households covered (29 % in 2017), which is below the EU average (41 %). Slovakia performed very well on ultrafast broadband coverage, a more future-proof technology, with 80 % of households covered (68 % previously), outperforming the EU average by 20 percentage points. Some progress was made on ultrafast broadband take-up, with 13 % of households subscribing (10 % in 2017), still below the EU average (20 % in 2017). The

broadband price index in Slovakia scored 90, above the EU average, showing a very good performance in retail prices.

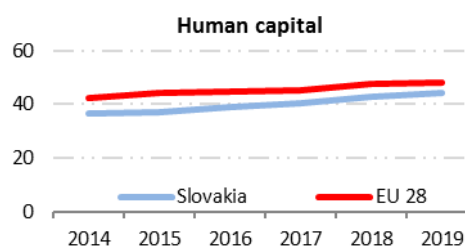
The 2011 national broadband strategy is still in place and needs to be updated to the common EU broadband targets for 2025 under the Gigabit Society Communication. As regards use of the EU funds, €68 million remains to be used from the European Regional Development Fund and from the European Agricultural Fund for Rural Development, in the context of the Operational Programme Integrated Infrastructure. While under the Rural Development Programme €27 million were allocated for last mile access in villages with under 500 inhabitants, the relevant Ministry intends to reallocate part of that amount to projects other than those related to connectivity. In 2019, a new broadband mapping project at lower (household) level, is expected to be launched as a replacement for the previously cancelled project 'Atlas for passive infrastructure', which, however, covered utility infrastructure as well. Slovakia intends to eliminate its remaining few hundred white spots by 2020. A demand-oriented measure designed to reach free wifi coverage project (under de minimis) at municipal level was launched in 2018. It is based on the principles of WiFi4EU and is financed from the Operational Programme for Integrated Infrastructure.

As regards mobile connectivity ambitions, the Ministry of Transport and Construction plans to develop a 5G action plan document in 2019. The Slovak national regulatory authority for electronic communications (the Regulatory Authority for electronic communications and postal services, RÚ) has not yet disclosed its detailed plans for 5G trials or deployments. In Slovakia, 46 % of the spectrum harmonised at EU level for wireless broadband has been assigned. The assignment of frequencies in the lower part of the 3.4-3.8 GHz band was already completed in 2016 and licences will run until August 2025. Part of the band will have to be transitioned to TDD terms to be aligned with the most recent technical conditions. Moreover, there could be difficulty with allowing the use of sufficiently large blocks of frequencies by all operators by 31 December 2020 with regard to the 3.4 - 3.8 GHz band. There is one nationwide network operator on the Slovak market holding the rights to use the 700 MHz spectrum beyond 2020. In December 2017, the RÚ concluded cross-border coordination agreements with the national regulatory authorities of the neighbouring countries concerning the new DTT frequency plans for the 470-694 MHz frequency band. The Slovak legislator adopted in March 2019 a new law, with the aim of enabling a compensation for the provider who currently holds the right to use frequencies in the 700 MHz band.

The Slovak market confirmed some positive trends with regard to ultrafast broadband coverage, which exceeds the EU average; but issues with regard to low total fixed broadband coverage and low coverage by 4G networks remain and also the ultrafast broadband take-up is very low relative to network availability. An early definition of a comprehensive 5G strategy might address some of the market needs and propose solutions to issues in 5G pioneer bands, which are observed in the 3400-3800 MHz band and in the 700 MHz band. An effective implementation of the Operational Programme Integrated Infrastructure could be a beneficial opportunity for the market and intense coordination between public and private stakeholders could help make the use of EU funds efficient, also with a view to achieving coverage of 'white spots'.

2 Human capital

2 Human capital	Slovakia		EU
	rank	score	score
DESI 2019	18	44.2	48.0
DESI 2018	18	42.9	47.6
DESI 2017	19	40.6	45.4



	Slovakia		EU	
	DESI 2017 value	DESI 2018 value	DESI 2019 value	DESI 2019 rank
2a1 At least basic digital skills % individuals	55% 2016	59% 2017	59% 2017	12
2a2 Above basic digital skills % individuals	29% 2016	33% 2017	33% 2017	12
2a3 At least basic software skills % individuals	57% 2016	63% 2017	63% 2017	10
2b1 ICT specialists % total employment	2.8% 2015	2.9% 2016	2.8% 2017	19
2b2 Female ICT specialists % female employment	0.7% 2015	0.6% 2016	0.8% 2017	23
2b3 ICT graduates % graduates	2.9% 2014	2.9% 2015	3.2% 2016	18
				3.5% 2015

In the Human capital dimension, Slovakia ranks 18th among EU countries and below the EU average. This is Slovakia's strongest DESI dimension in terms of overall ranking. A growing share of Slovak population (63 %) has at least basic software skills (EU average: 60 %). In addition, the share of people with basic (59 %) and above basic (33 %) digital skills is slightly higher than the EU average. Only 0.8 % of employed women are ICT specialists, which is the sixth lowest score in the EU. Additionally, the overall share of ICT specialists on employment stagnates at 2.8 % and is far from reaching the EU average (3.7 %). It is becoming difficult for Slovak companies to find ICT experts: 60 % of enterprises report the hard-to-fill vacancies for jobs requiring ICT specialist skills (EU average: 53 %) ³⁴⁴.

Slovakia does not have a stand-alone strategy focused on improving digital skills. Nevertheless, the National Action Plan for Smart Industry ³⁴⁵ adopted in October 2018 addresses the issue by including "education and job market" as one of its 5 pillars. The document focuses mainly on ensuring digitally skilled workforce for industry. It underlines the lack of qualified experts in key industrial sectors and mentions the general mismatch between the skills that graduates gain at school and the skills demanded by the employers. The strategy foresees actions to develop proposals for the transformation of education, to improve life-long learning programmes, better understand the industry's demand for digitally skilled workers or improve cooperation between private sector and universities. Most of the actions should be implemented by the end of 2019. Digital skills should also

³⁴⁴ https://ec.europa.eu/eurostat/statistics-explained/index.php/ICT_specialists_-_statistics_on_hard-to-fill_vacancies_in_enterprises

³⁴⁵ <https://www.mhsr.sk/inovacie/strategie-a-politiky/akcny-plan-inteligentneho-priemyslu-sr>

play an important role in a new strategy for digital transformation of the economy and society and a related action plan which the government is expected to adopt in 2019.

In 2018, Slovak government adopted the new National Education Strategy³⁴⁶. It highlights the need to extend the use of digital technologies in classrooms and adapt education to reflect the future socio-economic impact of digital transformation.

The Slovak Digital Skills and Jobs Coalition³⁴⁷ has 67 members including ministries, social partners, universities, companies, NGOs and associations. Since the Coalition's launch in September 2017, they committed 208 pledges to improve Slovakia's digital competitiveness. The Coalition benefits from a strong governmental support and focuses mainly on skills for ICT professionals, workforce and education. For example, the Coalition aims to increase the quality of mathematics classes at Slovak schools. It also invites foreign students and professionals to work or study in Slovakia. The coalition's activities have reached over 30,000 people so far.

In 2018, Slovakia hosted more 150 EU Code Week events with over 10,000 participants. The average age of participants was 12 years old and 41 % of coders were girls or women.

Despite not having a complex overseeing strategy focused on digital skills, education and literacy, Human capital is Slovakia's strongest dimension in the DESI 2019. The government's effort to improve Slovaks' digital skills is targeted on the needs of the industry. A more general approach especially in schools would give a chance to gain the right digital skills to a larger share of population.

Highlight 2019: IT Fitness test³⁴⁸

IT Fitness test follows the DigComp 2.1³⁴⁹ framework and offers Slovaks the possibility to test their ICT skills. This is the biggest project of this kind in Slovakia. After completing the online test with 20-25 tasks, the participants receive a certificate with their score and a set of recommendations in which areas they need to improve the most. The initiative focuses mainly on pupils, students and teachers and the organisers encourage schools to use the results for self-assessment. The test questions were designed in cooperation with experts on ICT and education and they cover 5 main categories:

- Internet
- Cybersecurity and computer systems
- Collaborative tools and social networks
- Office tools
- Complex tasks

In 2018 during the 7th edition of the IT Fitness test, over 31,000 people participated. Respondents had mainly difficulties in analysing text, assessing the reliability of information and identifying security notifications on their PCs. The Slovak IT Association, which runs the IT Fitness test, makes the anonymised results available on the website and shows the average success rate per region and category.

³⁴⁶ 'Národný program rozvoja výchovy a vzdelávania' - <https://www.minedu.sk/data/att/13285.pdf>

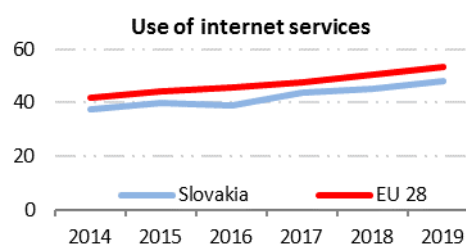
³⁴⁷ <https://digitalnakoalicia.sk/>

³⁴⁸ <https://www.itfitness.sk/sk/>

³⁴⁹ <https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/digcomp-21-digital-competence-framework-citizens-eight-proficiency-levels-and-examples-use>

3 Use of internet services

3 Use of internet services	Slovakia		EU
	rank	score	score
DESI 2019	20	47.9	53.4
DESI 2018	19	45.4	50.7
DESI 2017	19	43.5	47.8

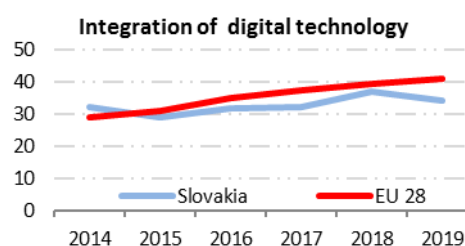


	Slovakia				EU
	DESI 2017	DESI 2018	DESI 2019		DESI 2019
	value	value	value	rank	value
3a1 People who never used the internet	15%	14%	13%	15	11%
% individuals	2016	2017	2018	2018	2018
3a2 Internet users	78%	79%	78%	19	83%
% individuals	2016	2017	2018	2018	2018
3b1 News	74%	77%	77%	18	72%
% internet users	2016	2017	2017	2017	2017
3b2 Music, videos and games	69%	69%	66%	26	81%
% internet users	2016	2016	2018	2018	2018
3b3 Video on demand	7%	7%	17%	17	31%
% internet users	2016	2016	2018	2018	2018
3b4 Video calls	57%	55%	51%	14	49%
% internet users	2016	2017	2018	2018	2018
3b5 Social networks	71%	72%	74%	10	65%
% internet users	2016	2017	2018	2018	2018
3b6 Professional social networks	4%	5%	5%	27	15%
% internet users	2015	2017	2017	2017	2017
3b7 Doing an online course	4%	4%	4%	25	9%
% internet users	2016	2017	2017	2017	2017
3b8 Online consultations and voting	2%	4%	4%	25	10%
% internet users	2015	2017	2017	2017	2017
3c1 Banking	56%	63%	62%	17	64%
% internet users	2016	2017	2018	2018	2018
3c2 Shopping	68%	70%	71%	9	69%
% internet users	2016	2017	2018	2018	2018
3c3 Selling online	16%	14%	29%	6	23%
% internet users	2016	2017	2018	2018	2018

The Use of internet services in Slovakia has improved but stays below the EU average and the country descended to the 20th position. The share of people who have never used the internet is decreasing (13 %) but remains still above the EU average (11 %). The share of Slovak internet users who sell goods and services online grew by 15 percentage points to 29 % and is the sixth highest in the EU. The popularity of video on demand subscriptions is growing (17 %); participation in social networks (74 %) is above the EU average and more Slovak internet users than before shop online (71 %). However Slovakia is among the EU's lowest performers in professional social networks (5 % in comparison to EU average 15 %) and music, videos and games (66 %, EU average is 81 %). Doing an online course or participating in online consultation and voting are also some of the least popular activities when compared to the rest of the EU.

4 Integration of digital technology

4 Integration of digital technology	Slovakia		EU
	rank	score	score
DESI 2019	21	34.5	41.1
DESI 2018	19	36.9	39.6
DESI 2017	21	32.3	37.6



	Slovakia		EU	
	DESI 2017	DESI 2018	DESI 2019	DESI 2019
	value	value	value	rank
4a1 Electronic information sharing	30%	31%	31%	16
% enterprises	2015	2017	2017	2017
4a2 Social media	13%	17%	17%	17
% enterprises	2016	2017	2017	2017
4a3 Big data	11%	11%	9%	20
% enterprises	2016	2016	2018	2018
4a4 Cloud	12%	15%	14%	20
% enterprises	2016	2017	2018	2018
4b1 SMEs selling online	11%	15%	13%	19
% SMEs	2016	2017	2018	2018
4b2 e-Commerce turnover	11%	12%	11%	14
% SME turnover	2016	2017	2018	2018
4b3 Selling online cross-border	6%	8%	8%	18
% SMEs	2015	2017	2017	2017

On the Integration of digital technology by businesses, Slovakia ranks 21st among the EU countries. The ranking and score decreased compared to DESI 2018 and the score is well below the EU average. The previous progress in this dimension froze and the only significant improvement was in the use of social media by enterprises – from 13 % to 17 %. Lower share of SMEs sell online (13 %) and the share of e-commerce on their turnover has decreased to 11 %. In 2018 from 12 % in 2017. This remains the only indicator above the EU average.

Slovak businesses are in favour of using new technologies, nevertheless according to the Digital Intensity Index, every second company in Slovakia has a very low level of digitisation (52 % in comparison with the EU average of 46 %) and only 13 % of companies are highly digitised (EU 18 %)³⁵⁰.

Slovakia aims to re-activate the digitisation of businesses with the national Action Plan for Smart Industry³⁵¹ adopted in October 2018. This plan is in line with the strategy to Digitise European industry published in 2016³⁵². It aims to increase the competitiveness of Slovak businesses, support technological development, connect enterprises with universities and ensure the availability of the

³⁵⁰ <http://bit.ly/2u4YGRL>

³⁵¹ <https://www.mhsr.sk/inovacie/strategie-a-politiky/akcny-plan-inteligentneho-priemyslu-sr>

³⁵² <https://ec.europa.eu/digital-single-market/en/policies/digitising-european-industry>

right talent on the job market. It introduces 35 actions divided into 5 focuses areas: research and innovation, cybersecurity, labour market and education, standardisation and communication and promotion. The government foresees full implementation by the end of 2020.

Slovakia is among the signatories of the Declarations of European Blockchain Partnership and of Cooperation on Artificial intelligence. It also works with other EU countries in the EuroHPC Joint Undertaking. The country does not yet have any operational Digital Innovation Hub but two hubs are being prepared. These centres of excellence will help to stimulate the uptake of Artificial Intelligence, HPC and cybersecurity by all industry and public sector organisations.

Slovakia has the 15th highest robot density in the world - 151 industrial robots per 10 thousand employees³⁵³ in the manufacturing industry. The recent survey by Industry4UM showed that companies are becoming more interested in industry 4.0³⁵⁴: 33 % of respondents are preparing or already have in place a dedicated strategy. They expect that digitisation will make the business more effective, will improve internal processes and that digital technologies will complement the lack of qualified workers. 56 % of respondents stated that their company has or will soon have a dedicated team to deal with solutions for industry 4.0.

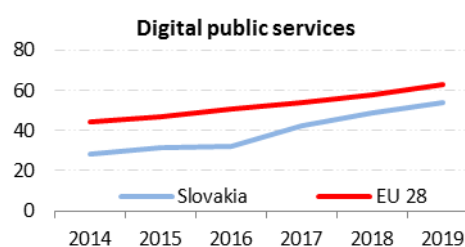
Slovakia is increasing its efforts to stimulate the integration of technology by businesses. It is also well connected to the relevant European initiatives. In order to have a measurable impact, the key next step is to follow the plan, transform the strategy into tangible actions and address businesses' needs in the process of digital transformation.

³⁵³ <https://ifr.org/ifr-press-releases/news/global-industrial-robot-sales-doubled-over-the-past-five-years>

³⁵⁴ <https://industry4um.sk/vyhodnotenie-prieskumu-industry-4-0-sr-2018/>

5 Digital public services

5 Digital public services	Slovakia		EU
	rank	score	score
DESI 2019	21	53.6	62.9
DESI 2018	22	48.5	57.9
DESI 2017	24	42.4	54.0



	Slovakia		EU	
	DESI 2017 value	DESI 2018 value	DESI 2019 value	DESI 2019 rank
5a1 e-Government users % internet users needing to submit forms	65%	55%	54%	19
5a2 Pre-filled forms Score (0 to 100)	28	34	35	22
5a3 Online service completion Score (0 to 100)	67	78	79	24
5a4 Digital public services for businesses Score (0 to 100) - including domestic and cross-border	57	73	80	21
5a5 Open data % of maximum score	NA	NA	74%	8
5b1 e-Health services % individuals	NA	16%	16%	15
5b2 Medical data exchange % of general practitioners	NA	NA	10%	28
5b3 e-Prescription³⁵⁵ % of general practitioners	NA	NA	NA	50%

On Digital public services, Slovakia ranks 21st among EU countries and is well below the EU average. The score is not growing fast enough in comparison with EU trends to bring Slovakia to higher positions. The best performing indicator is open data where Slovakia ranks 8th in the EU and is above the EU average. Slovakia keeps improving digital public services for businesses. The indicator grew from 57 points in 2016 to 80 points in 2018, but it still remains below the EU average. The share of internet users who submit forms to public authorities online has decreased to 54 % compared to the EU average 64 %. Only 10 % of Slovak general practitioners exchange medical data, which is the lowest score in the EU, and the EU average is four times higher.

To improve the digital public services Slovakia follows the Action plan of the National Concept of e-government adopted in 2017 and regularly amended³⁵⁶. In 2018, several new e-government measures entered into force including the duty for all public authorities to communicate with companies registered in Slovakia electronically. The country is also committed to the 'once-only' principle ensuring that companies do not have to submit the same data to public authorities multiple times.

³⁵⁵ Data has been removed due to potential inconsistencies

³⁵⁶ <https://www.vicpremier.gov.sk/sekcie/informatizacia/egovernment/strategicke-dokumenty/strategicke-priority-nikvs/index.html>

In January 2018, Slovakia launched the central e-health system (*'e-Zdravie'*)³⁵⁷. It aims to ease access for patients and healthcare providers (doctors, pharmacists) to health and medication data. The system also offers the possibility to issue e-prescriptions or to book an appointment with the doctor online. The objective is to limit duplication in health examinations, improve the general quality of healthcare and better monitor the use of medication. Since its launch, doctors registered over 63 million e-prescriptions and 19 million entries about examination³⁵⁸. However, on the patients' side the take-up remains limited. In theory, the system will hold health e-records of all citizens. Currently it allows over 3 million Slovaks with an eID card to access their online health data but only 7 thousand did it so far³⁵⁹.

Slovakia is introducing new e-government and e-health services. They promise to change the trends and improve the scores in most of the monitored indicators. The challenge remains in making sure that people, businesses and institutions are equipped with the right skills, tools and incentives to use these services even further.

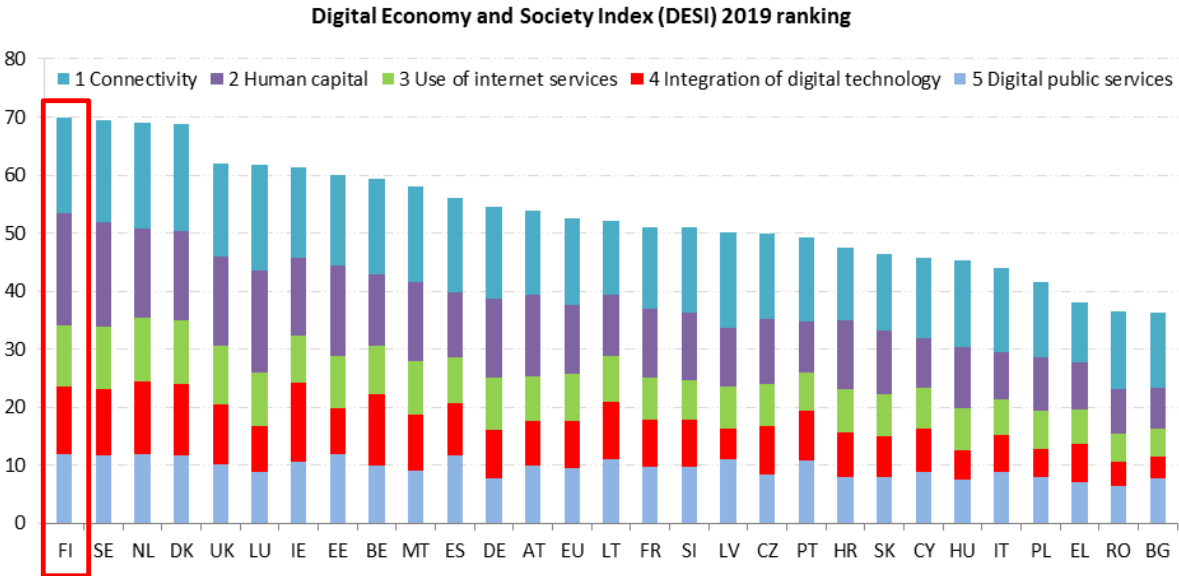
³⁵⁷ <https://www.ezdravotnictvo.sk/en/web/ezdravie/home>

³⁵⁸ <https://www.ezdravotnictvo.sk/sk/-/do-systemu-ezdravie-je-pripojenych-66-percent-pzs>

³⁵⁹ http://www.nczisk.sk/Documents/aktuality/tlacove_spravy/2018/TS_eID_08102018.pdf

Finland

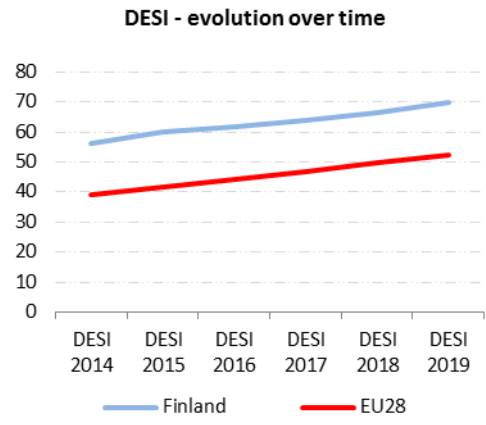
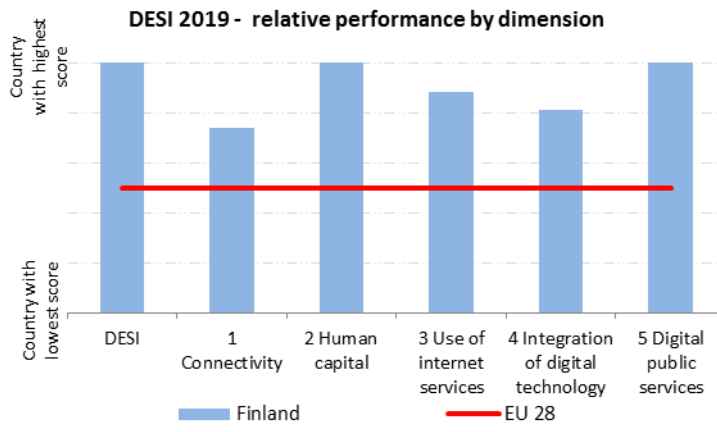
	Finland		EU
	rank	score	score
DESI 2019	1	69.9	52.5
DESI 2018	3	66.3	49.8
DESI 2017	2	63.7	46.9



Finland ranks first out of the 28 EU Member States with a score of 69.9 in the European Commission’s Digital Economy and Society Index (DESI) 2019. Its overall score largely surpasses the EU average of 52.5, allowing Finland, for the first time, to become the EU digital leader. Finland fares least well in the indicator of connectivity due to the low concentration of fixed broadband connections. Although fixed broadband access is offered to almost all households, its use in Finland is below the EU average (Finland 58 %, EU 77 %). In mobile broadband use, Finland ranks first by a clear margin and is close to twice the EU average. Finland excels in digital public services and integration of digital technologies. Its human capital is one of its strongest competitive advantages where 76 % of the population have basic or above basic digital skills, a long way above the EU average (57 %).

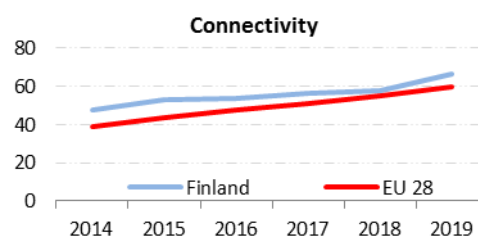
Finland ranks highest in digital public services and human capital. Overall, it maintains its lead in digitisation. It belongs to the high-performing cluster alongside Sweden, Denmark, the Netherlands, Luxembourg, Ireland, the United Kingdom, Belgium and Estonia.

Finland does not have a national Digital Skills and Jobs Coalition (DSJC), nor a digitising industry strategy in place.



1 Connectivity

1 Connectivity	Finland		EU
	rank	score	score
DESI 2019	5	66.1	59.3
DESI 2018	11	57.3	54.8
DESI 2017	7	56.4	51.2



	Finland		EU	
	DESI 2017	DESI 2018	DESI 2019	DESI 2019
	value	value	value	rank
1a1 Fixed broadband coverage % households	97%	97%	94%	20
	2016	2017	2018	2018
1a2 Fixed broadband take-up % households	61%	57%	58%	27
	2016	2017	2018	2018
1b1 4G coverage % households (average of operators)	97%	98%	99%	4
	2016	2017	2018	2018
1b2 Mobile broadband take-up Subscriptions per 100 people	147	146	156	2
	2016	2017	2018	2018
1b3 5G readiness Assigned spectrum as a % of total harmonised 5G spectrum	NA	NA	67%	1
			2018	2018
1c1 Fast broadband (NGA) coverage % households	75%	75%	75%	24
	2016	2017	2018	2018
1c2 Fast broadband take-up % households	22%	23%	29%	22
	2016	2017	2018	2018
1d1 Ultrafast broadband coverage % households	NA	59%	58%	19
		2017	2018	2018
1d2 Ultrafast broadband take-up % households	16%	17%	21%	14
	2016	2017	2018	2017
1e1 Broadband price index Score (0 to 100)	94	94	94	1
	2016	2017	2018	2017

With an overall connectivity score of 66, Finland ranks 5th among the Member States. Fixed broadband is available to 94 % of households, despite the specific geographical characteristics of the country. While Finland is slightly below the EU average of ultrafast broadband coverage (58 % against 60 % in the EU as a whole), its fibre-to-the-premises coverage is above the EU average (37.5 % against 29.6 % in the EU as a whole.)

At 58 %, fixed broadband take-up is significantly behind the EU average of 77 %. Only 29 % of households with fixed broadband chose to subscribe to fast broadband (at 30 Mbps or above), which is far below the EU average of 41 %. One of the reasons for the relatively low take-up of fixed broadband connectivity can be seen in Finland's excellent performance in mobile broadband. It should be noted that the relevant pattern is not price-related either in so far as Finland leads the ranks in terms of broadband price index (94 against 87 for the EU), which pertains to fixed technology and mobile broadband prices are also below the EU average (the least expensive offer for handset (1 GB + 300 calls basket) was €19.3/PPP against €22.3/PPP for the EU). Finland is second in mobile broadband take-up and is not far off twice the EU average: its mobile broadband take-up was

156 in June 2018 (subscriptions per 100 subscribers), against 96 for the EU as a whole over the same period.

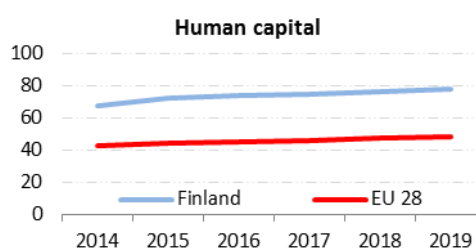
Finland's national broadband plan, the 'fast broadband project', runs until the end of 2019. The project aims at providing an optical fibre or cable network enabling connections of 100 Mbps within two kilometres of 99 % of all permanent residences and offices in Finland. State aid is available under the Fast Broadband project to finance high-speed broadband networks. Broadband access and take-up are lower in rural areas. There are two programmes to support the rollout of fibre networks in those areas; namely the National State Aid Scheme for sparsely populated areas and EU funding through EAFRD. As of January 2019, the combined use of those sources of funding had enabled the rollout of about 24,000 km of fibre network, corresponding to 95,000 dwellings. Network building companies have had difficulties in finding financing for their part of the costs. Therefore, they have not been able to run the project on time as planned in the initial phase of the 'fast broadband project'. Amended state aid rules applicable to broadband funding are reportedly working better and have enabled many projects to be undertaken.

In October 2018, the Ministry of Transport and Communications published a digital infrastructure strategy, applicable to both wireless and fixed connections. Through the relevant digital infrastructure strategy, Finland aims to meet the gigabit connectivity objectives set by the Commission, as a minimum. Indeed, by 2025, all Finnish households should have access to at least 100 Mbit/s connections and it should be possible to increase the speed of the connection to one gigabyte per second. The measures proposed in the strategy notably involve the construction of 5G networks and spectrum policy, streamlining network permit and construction procedures. In Finland, 50 % of the spectrum harmonised at EU level for wireless broadband has been assigned. In terms of spectrum policy, Finland is a frontrunner and this is reflected in its position in the 5G readiness indicator: the entire 3410-3800 MHz spectrum band was assigned in September 2018 in accordance with Commission Decision (EU) 2019/235, and the latter spectrum is available for 5G use by 2019. The assignment process has enabled the acquisition of large blocks of spectrum (130 MHz), facilitating the provision of gigabit 5G services at reasonable prices (€4 cents/MHz/pop). Nevertheless, there are use restrictions due to unresolved cross-border coordination issues with a non-EU country. Furthermore, the strategy provides that the 26 GHz spectrum band will also be allowed for use for wireless broadband, so that the user rights for the entire spectrum will be issued in spring 2020. The 700 MHz band was auctioned in November 2016 under the obligation to cover 99% of the population of mainland Finland within three years of the start of the licence period (1 February 2017).

While Finland has good fixed broadband and 4G coverage overall, coverage in rural areas could be further improved. The main problem encountered has been the lack of incentive for market players to invest in sparsely populated areas of the country. State aid rules were amended in order to tackle this issue. So far, many broadband rollout projects are ongoing as a result of better functioning rules.

2 Human capital

2 Human capital	Finland		EU
	rank	score	score
DESI 2019	1	77.5	48.0
DESI 2018	1	76.1	47.6
DESI 2017	1	74.7	45.4



	Finland		EU	
	DESI 2017 value	DESI 2018 value	DESI 2019 value	DESI 2019 rank
2a1 At least basic digital skills % individuals	73% 2016	76% 2017	76% 2017	4
2a2 Above basic digital skills % individuals	44% 2016	45% 2017	45% 2017	6
2a3 At least basic software skills % individuals	76% 2016	76% 2017	76% 2017	4
2b1 ICT specialists % total employment	6.5% 2015	6.6% 2016	6.8% 2017	1
2b2 Female ICT specialists % female employment	3.0% 2015	3.0% 2016	3.1% 2017	1
2b3 ICT graduates % graduates	6.6% 2014	6.7% 2015	7.1% 2016	1
				EU DESI 2019 value
				57% 2017
				31% 2017
				60% 2017
				3.7% 2017
				1.4% 2017
				3.5% 2015

Finland ranks first among EU countries and well above the EU average in human capital. The country boasts high digital social inclusion, with 76 % of the population possessing basic or above basic digital skills. Finland outperforms the EU average and ranks first in female ICT specialists. It is doing well compared to other countries when it comes to basic digital skills of women: 77 % of women have at least basic digital skills (55 % in the EU overall) while 22 % of ICT specialists are women in Finland (17% in the EU as a whole). In Finland, STEM is an integral part of the school curriculum, as it is considered a problem-solving approach to education tied to the instructional standard. Despite Finland's high ranking in digital skills, almost 60 % of Finnish companies reported hard-to-fill vacancies for jobs requiring information and communications technology specialist skills.

As of 2018, Finland is implementing a comprehensive reform of its vocational education and training system to increase digital and workplace learning. The new funding model will encourage VET providers to improve the effectiveness and quality of learning. As of 2016-2017, the new curriculum for primary and lower secondary education includes coding as a mandatory, cross-curricular theme starting from first grade.

Finland does not have an e-skills strategy or a national digital skills and jobs coalition. The Digital Skills and Jobs Coalition is one of the 10 key actions under the New Skills Agenda for Europe. It has been operational since 2016 and brings together Member States and stakeholders from the private and public sectors to develop a large digital talent pool and ensure that Europe's citizens and labour force are equipped with adequate digital skills.

As of mid-2018, more than 100 Enterprisesenterprises, education providers and NGOs have pledged to reduce digital skills gaps by taking actions such as training courses, matching for digital jobs, certification and awareness raising.

The main policy strategy for the information society in Finland is the Digital Agenda for 2011-2020, 'Productive and inventive Finland'³⁶⁰. It contains a range of policy measures to support ICT development in Finland, and clearly identifies e-skills and ICT-related education as a cornerstone for the future of the country. Multi-stakeholder partnerships of major relevance to the e-skills include INFORTE.fi and Rails girls. The first of these is a state-wide programme for ICT professionals with networking and education goals. The second one, Rails girls, is a grassroots initiative launched in 2010 aiming to organise all-female workshops for practising and developing programming skills. Today it has become an international non-profit volunteer community where everybody, including the programming professionals coaching in the workshops, works on a voluntary basis.

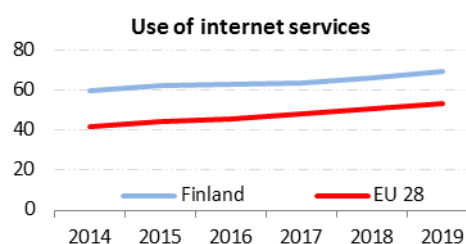
In EU Code Week 2018, Finland registered 39 activities and an estimated 1300 participants. EU Code Week is a voluntary grass-root movement that promotes coding and related activities in their countries as Code Week Ambassadors.

Finland's first position among EU countries as regards human capital is flanked by difficulties experienced by a significant number of Finnish companies to fill ICT-related vacancies. Finland is addressing this challenge through an extensive reform of its vocational and training schemes with a strong focus on digital skills and the quality of learning. Introducing coding and embedding it as a mandatory transversal element of the school curriculum is a long-term action with the potential to satisfy the current appetite for qualified ICT-related labour.

³⁶⁰ http://www.oph.fi/download/135323_productive_and_inventive_finland.pdf

3 Use of internet services

3 Use of internet services	Finland		EU
	rank	score	score
DESI 2019	4	69.2	53.4
DESI 2018	5	66.2	50.7
DESI 2017	5	63.7	47.8

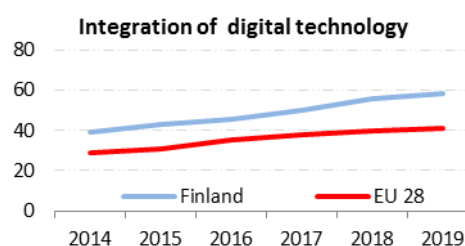


	Finland		EU	
	DESI 2017 value	DESI 2018 value	DESI 2019 value	DESI 2019 rank
3a1 People who have never used the internet % individuals	4%	5%	4%	6
3a2 Internet users % individuals	91%	92%	93%	4
3b1 News % internet users	85%	90%	90%	4
3b2 Music, videos and games % internet users	91%	91%	94%	1
3b3 Video on demand % internet users	37%	37%	50%	5
3b4 Video calls % internet users	34%	37%	46%	21
3b5 Social networks % internet users	66%	70%	71%	17
3b6 Professional social networks % internet users	17%	20%	20%	6
3b7 Doing an online course % internet users	15%	17%	17%	2
3b8 Online consultations and voting % internet users	16%	14%	14%	6
3c1 Banking % internet users	92%	93%	94%	1
3c2 Shopping % internet users	72%	75%	74%	8
3c3 Selling online % internet users	22%	25%	29%	8

Overall, the use of internet services in Finland is well above the EU average. Finns are keen to engage in a variety of online activities in line with the rest of the EU, the most popular online activity being banking, followed by music, video and games, and news. 90 % of Finnish internet users read news online (72 % in the EU as a whole). Finns score above the EU average in all internet activities, with notable leadership in online banking. Furthermore, with 50 % of users, video on demand is the activity that has grown most, followed by video calls. With only 4 % of Finns who have never used the internet, Finland is well below the EU average (11 %).

4 Integration of digital technology

4 Integration of digital technology	Finland		EU
	rank	score	score
DESI 2019	5	58.3	41.1
DESI 2018	5	55.9	39.6
DESI 2017	6	49.9	37.6



	Finland		EU	
	DESI 2017 value	DESI 2018 value	DESI 2019 value	DESI 2019 rank
4a1 Electronic information sharing % enterprises	37%	39%	39%	9
4a2 Social media % enterprises	26%	29%	29%	6
4a3 Big data % enterprises	15%	15%	19%	5
4a4 Cloud % enterprises	40%	48%	50%	1
4b1 SMEs selling online % SMEs	17%	20%	20%	8
4b2 e-Commerce turnover % SME turnover	NA	NA	NA	
4b3 Selling online cross-border % SMEs	6%	6%	6%	23

On the integration of digital technology by businesses, Finland ranks 5th among EU countries, well above the EU average, maintaining its position from last year. Results across all indicators remain stable with a slight increase in the enterprises using big data and cloud solutions. Finnish enterprises continue to take advantage of the possibilities offered by online commerce: 20 % of SMEs sell online (above the EU average of 17 %) and 6 % of all SMEs sell cross-border. Furthermore, 50 % of enterprises use cloud computing (up from 48 % in 2016) and 19 % take advantage of big data (up from 15 % in 2016).

Currently, and despite the overall strong position and policy support for digitisation, there remain significant disparities among businesses. According to the Finnish Innovation Survey, the importance of digitalisation for enterprises' business activity is much more strongly acknowledged in services than in manufacturing enterprises: 41 % of service enterprises consider one form or another of digitalisation key to the firm's operations, compared to 25.4 % of manufacturing enterprises.

Finland is committed to the advancement of new digital technologies and to investing strategically in digital technologies through EU-coordinated programmes (e.g. the country is a member of the EuroHPC Joint Undertaking; it has also signed the Declaration on European Blockchain Partnership, and the Declaration on Cooperation on Artificial Intelligence).

Finland's national Artificial Intelligence (AI) strategy (2017)³⁶¹ is designed to make it a leader in applying AI. In May 2018, the Finnish government launched a free online course on artificial intelligence, 'The Elements of AI', targeting anyone interested in learning about AI, with no prior mathematical or programming skills required. The initiative seeks to attract 1 % of the population to learn the basics in AI topics such as machine learning and neural networks by the end of 2018. The Finnish AI programme engages companies to take part in a year-long project of training for their workforce.

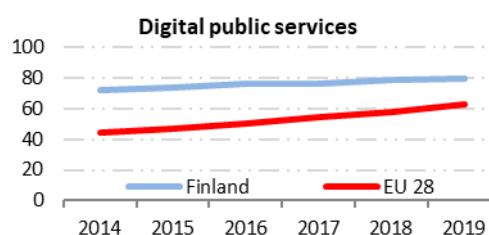
The Finnish government has allocated more than €100 million, including direct capital funding and regional grants, to support various digital projects being run by the country's local authorities between 2018 and 2022. This investment is linked to the government's Digital Finland Framework, which aims to maximise future opportunities, based on global megatrends, and Finnish expertise in specialised IT sectors. This strategy is designed to encourage more IT enterprises to invest in commercialising their innovations and digitising their offerings for both domestic and export markets. The planned regional digitisation process will require new information management legislation and the establishment of a one-stop-shop service system. The government plans to have laws in place to support this during the second half of 2019.

Recent action includes the identification of priority areas (clean-tech, bio economy, ICT and health) to focus investment on technology-intensive sectors with the potential for upscaling. Finnish enterprises continue to be among the most advanced business in the EU in the integration of digital technologies.

³⁶¹ http://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/160391/TEMrap_47_2017_verkkojulkaisu.pdf

5 Digital public services

5 Digital public services	Finland		EU
	rank	score	score
DESI 2019	1	79.9	62.9
DESI 2018	2	78.6	57.9
DESI 2017	3	76.3	54.0



	DESI 2017	Finland		EU	
	value	DESI 2018	DESI 2019	rank	DESI 2019
5a1 e-Government users % internet users needing to submit forms	91%	91%	92%	3	64%
	2016	2017	2018		2018
5a2 Pre-filled forms Score (0 to 100)	82	86	82	5	58
	2016	2017	2018		2018
5a3 Online service completion Score (0 to 100)	93	94	96	6	87
	2016	2017	2018		2018
5a4 Digital public services for businesses Score (0 to 100) - including domestic and cross-border	80	80	86	16	85
	2016	2017	2018		2018
5a5 Open data % of maximum score	NA	NA	62%	19	64%
			2018		2018
5b1 e-Health services % individuals	NA	49%	49%	1	18%
		2017	2017		2017
5b2 Medical data exchange % of general practitioners	NA	NA	65%	7	43%
			2018		2018
5b3 e-Prescription % of general practitioners	NA	NA	99%	2	50%
			2018		2018

In digital public services, Finland ranks first among EU countries, well above the EU average. That is attributable especially to the improved availability of open data and to digital healthcare services. There is a high level of online interaction between public authorities and the public. 92 % of Finnish online users actively engage with e-government services, 1 % up from last year. For e-health services, Finland ranks first in the EU, with 49 % of Finns having used health and care services provided online, which is over double the EU average. E-prescription is used by almost all general practitioners and 65% of them exchange medical data.

The public sector ICT department at the Ministry of Finance is tasked with digitising Finland's public services. It collaborates with local government to develop user-focused digital public services. The objective is to create an agreed framework between central government and municipalities covering the digitisation of all public services. The regional digitisation process will require new information management legislation and the establishment of a one-stop-shop service system. The government plans to have laws in place to support this in the second half of 2019. Municipalities will also launch projects to increase public sector productivity and pave the way for greater streamlining of public services. It will include the use of spatial data in services, scaling up supervision and the development of automated financial management processes, procurement activities and reporting systems.

The Government's 'special three-year fund for digitisation', with €100 million, has allocated €30 million for regional and local governments to implement their own digital projects. That includes direct capital funding and regional grants to support various digital projects by local authorities

between 2018 and 2022. One of these projects uses blockchain to provide welfare payments to asylum seekers. The national immigration service now provides payment cards containing grants for refugees to get a basic standard of living.

The Suomi.fi portal is a one-stop service shop where members of the public and businesses can receive messages and decisions from authorities electronically; reply or submit additional information to them; authorise another party to act on their behalf or request a mandate to act on behalf of another person or company, as well as view their information in different registers. Finland introduced e-authorisation to assist those without easy access to a computer or the skills to use it, allowing people to use e-services on behalf of another person. For instance, people can now book medical appointments on behalf of ailing parents who cannot use the digital services. Finland is the first country in the world that allows people to electronically authorise another person to make important decisions for them.

The digitisation of municipal administration and frontline healthcare infrastructure is an essential part of the government-led Smart Economy project. The initiative aims to ensure the availability of public funding and capital investments for digital transformation schemes. The Finnish Research and Innovation Council (FRIC) with oversight from the prime minister's office oversees the government's national digital strategy. It expects public and private sector investments in research and innovation to reach 4 % of Finland's GDP by 2025. Finland has introduced a virtual hospital hub where healthcare professionals can diagnose, treat patients and refer them to specialists remotely, and where patients can access self-help exercises and therapies, both on websites and through mobile apps. Additionally, My Kanta is a citizens' online service where they can browse their own health records and medication recorded by healthcare services.

Finland ranks top in the section on digital public services, and is one of the world leaders in the domain. Its government has prioritized the digitisation of public services approaching it as a transversal theme that cuts across all milestone projects. The ultimate goal is to make available public services that are digital and user-centred by developing principles for the digitisation of all public services and a one-stop-shop service system and information management legislation.

2019 highlight: cross-border e-prescriptions and e-dispensation between Finland and Estonia

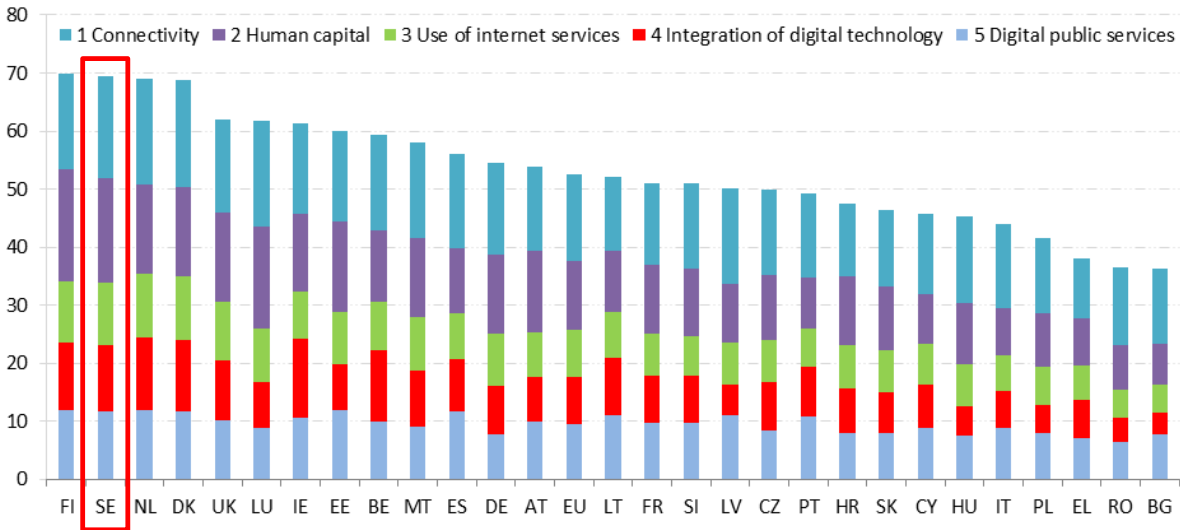
Since January 2019, Finnish patients have been able to buy medicine in pharmacies in Estonia prescribed electronically by their doctor in Finland. A first step in line with the Commission's policy on digital health and care, a policy that aims to empower patients and ensure continuity of care.

E-prescription and e-dispensation allow any EU citizen to retrieve his/her medication in a pharmacy located in another EU Member State, thanks to the electronic transfer of their prescription from his/her country of residence to the country of travel. The country of residence is then informed about the retrieved medicine in the visited country. Data protection rules are strictly observed and patients must provide their consent before these services are accessed. This service was made possible thanks to the e-health Digital Service Infrastructure, which allows e-health national services to exchange health data. They are funded by the Commission's Connecting Europe Facility.

Sweden

	Sweden		EU
	rank	score	score
DESI 2019	2	69.5	52.5
DESI 2018	1	66.9	49.8
DESI 2017	4	63.2	46.9

Digital Economy and Society Index (DESI) 2019 ranking



Sweden ranks 2nd out of the 28 EU Member States in the European Commission Digital Economy and Society Index (DESI) 2019. Progress is in line with the EU average.

Sweden’s rank remained the same in Connectivity, Human capital and the Integration of digital technology but decreased in the Use of internet services and Digital public services categories compared to last year.

Among all dimensions, Sweden ranks highest in Human capital (2nd) with 77 % of the population having at least basic digital skills and 46 % advanced skills. Sweden also has the second highest number of ICT specialists in the EU (6.6 %), but still suffers from a lack of professionals with advanced digital skills.

One of the five areas in the Swedish digitalisation strategy³⁶² adopted in 2017 addresses digital skills. There is also a separate Strategy for the digitisation of primary and secondary school³⁶³ and a Smart industry strategy³⁶⁴ with two action plans focused on tackling the shortage of skilled labour. Moreover, the Swedish Association of Local Authorities and Regions has been tasked to boost digital

³⁶² <https://www.government.se/information-material/2017/06/fact-sheet-for-sustainable-digital-transformation-in-sweden--a-digital-strategy/>

³⁶³ <https://www.regeringen.se/informationsmaterial/2017/10/regeringen-beslutar-om-nationell-digitaliseringsstrategi-for-skolasystemet/>

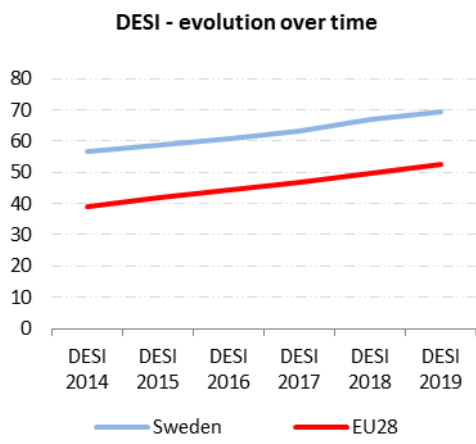
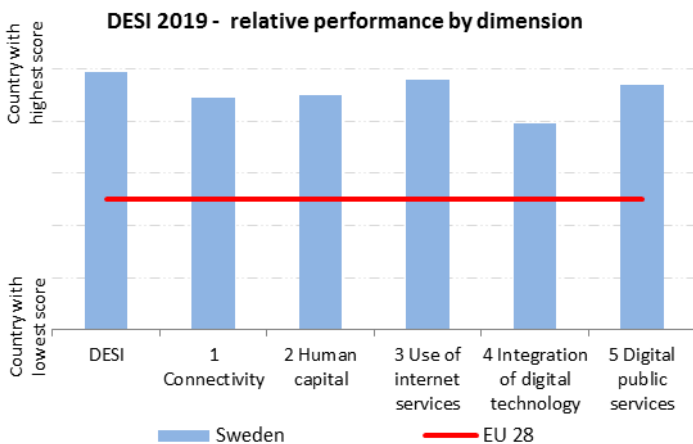
³⁶⁴ <https://www.regeringen.se/informationsmaterial/2016/01/smart-industri---en-ny-industrialiseringsstrategi-for-sverige/>

competences of politicians, senior officials and other key people in the administration³⁶⁵. Results should be reported in February 2021.

Almost all Swedes are regular or frequent internet users, with only a few percent never being online. Swedes are especially keen to study and watch films and TV-series on line compared with other Europeans.

Swedish businesses embrace new technologies such as cloud services, but lags behind in big data. Every third SME sells online and 10 % of turnover comes from online sales.

Swedish public administration is decentralised. The new Agency for Digital Government (DIGG³⁶⁶) will lead and coordinate work in digitisation of the public administration including open data, the only area where Sweden lags behind the EU average.

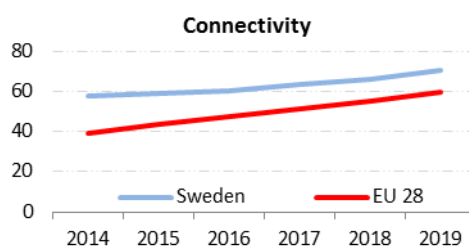


³⁶⁵ <https://www.regeringen.se/pressmeddelanden/2018/08/okad-digital-kompetens-ska-lyfta-kommuner-och-landsting/>

³⁶⁶ <https://www.digg.se/>

1 Connectivity

1 Connectivity	Sweden		EU
	rank	score	score
DESI 2019	4	70.4	59.3
DESI 2018	4	66.3	54.8
DESI 2017	5	63.2	51.2



	Sweden		EU	
	DESI 2017	DESI 2018	DESI 2019	DESI 2019
	value	value	value	rank
1a1 Fixed broadband coverage % households	99% 2016	99% 2017	97% 2018	16
1a2 Fixed broadband take-up % households	72% 2016	78% 2017	76% 2018	12
1b1 4G coverage % households (average of operators)	95% 2016	96% 2017	96% 2018	15
1b2 Mobile broadband take-up Subscriptions per 100 people	120 2016	122 2017	123 2018	7
1b3 5G readiness Assigned spectrum as a % of total harmonised 5G spectrum	NA	NA	22% 2018	10
1c1 Fast broadband (NGA) coverage % households	75% 2016	78% 2017	86% 2018	16
1c2 Fast broadband take-up % households	45% 2016	57% 2017	60% 2018	5
1d1 Ultrafast broadband coverage % households	NA	76% 2017	84% 2018	8
1d2 Ultrafast broadband take-up % households	36% 2016	48% 2017	54% 2018	1
1e1 Broadband price index Score (0 to 100)	97 2016	87 2017	86 2018	15
				87 2017

Sweden ranks 4th in Connectivity scoring well above the EU average (70.4 against 59.3 for the EU). Take-up of fixed broadband fell from 78 % in 2017 to 76 % in 2018. The share of fast broadband connections (providing at least 30 Mbps) is significantly higher than the EU average (60 % compared with 41 % across the EU) and has slightly increased since last year, when it stood at 57 %. Fast broadband coverage increased from 78 % in 2017 to 86 % in 2018. Sweden has also achieved a 54 % take-up rate for ultrafast broadband, almost three times the EU average (20 %). Ultrafast broadband coverage also increased, reaching 84 % of homes, and Sweden now ranks 8th. In 2018, there was a slight price increase in high-speed broadband (score 86 comparing with 87 in 2017), but prices remain close to the EU average (score 87). Take-up of mobile broadband has reached 123 % and is one of the highest in Europe. Average 4G coverage in Sweden reaches 96 % while the European average is 94 %.

In its 2016 Broadband strategy, Sweden set three ambitious goals. First, by 2020, 95 % (as opposed to the initial 90 % target) of all households and businesses should have broadband access of at least 100 Mbps. Second, by 2023 the whole country should have access to stable mobile services of good quality. Third, by 2025 the whole country should have access to high-speed broadband. According to

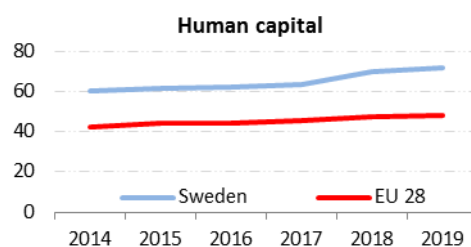
the Swedish regulator's (PTS, Post- och Telestyrelsen) forecast and assessment, it seems that Sweden will not succeed in reaching the first nor the third goals described above. The European Agricultural Fund for Rural Development (EARDF) and national co-funding is used in the rural development programme and the European Regional Development Fund (ERDF) and regional and local co-funding in the regional development programmes for 2014-2020. Currently, the Ministry examines the shape of a new aid scheme for broadband deployment. The high use of internet in Sweden and the consumer demand for high-speed connections, in combination with the increased consumption of data-intensive services, are the main drivers for take-up of very-high speed networks above 100 Mbps and for gigabit access. Households have been willing to pay an installation fee of around €2,000 to connect their homes to a fibre network. There is also political commitment at national and regional level for broadband deployment and digitalized public services, which stimulates consumer demand. However, there are still difficulties and delays concerning the deployment in the sparsely populated areas due to permit granting procedures. The government and PTS continue working with the relevant authorities and stakeholders to find solutions to remove obstacles for an efficient broadband deployment. In addition, there is a discussion for a national aid scheme which will improve the allocation of funding, directing it to areas where it is most needed.

During 2018, 14 trial licences in 9 different locations were issued for spectrum in the 5G pioneer bands, 3.4-3.8 GHz & 24.25-27.5 GHz as well as in 2.3 GHz. In Sweden, 48 % of the spectrum harmonised at EU level for wireless broadband has been assigned. In December 2018, Sweden concluded the 700 MHz auction issuing two FDD (Frequency Division Duplex) licences for a total of 40 MHz to three out of four interested operators (the two of them bid as a joint venture), while the remaining available spectrum SDL (Supplementary Downlink) spectrum remained unsold and an additional 20 MHz was reserved, thus leading to high prices relative to the investment needs, i.e. €67 cents/pop./MHz. The outcome of the auction has been appealed. Uninterrupted 5G wireless broadband coverage in all urban areas in Sweden as defined by EU, is expected to be fulfilled by commercial roll-out mainly in the 3.4-3.8 GHz band, which will be auctioned in 2020. In May 2018, PTS published a preliminary study on frequency use for 5G in the 24.25-27.5 GHz band, which was based on an assessment of the national situation as well as of the demand and need for frequencies for 5G in Sweden. Sweden ranks 10th on 5G readiness, scoring 22 %, as by the end of 2018, had assigned spectrum in the 700 MHz band. Spectrum in the 3.4-3.8 GHz band will be available for use for 5G by 2020.

Sweden is a front-runner for ultrafast connectivity and one of the most competitive telecoms markets in Europe. The biggest challenge for achieving the goals of its ambitious broadband strategy by 2020 is to address the difficulties of roll-out and coverage to the remaining sparsely populated areas. In this respect, a spectrum policy consistent with its investment needs will be key. The Ministry in cooperation with PTS and the other relevant authorities continue working in order to solve the delays with the permit granting procedures and achieve a more efficient allocation of funding.

2 Human capital

2 Human capital	Sweden		EU
	rank	score	score
DESI 2019	2	71.6	48.0
DESI 2018	2	69.9	47.6
DESI 2017	3	63.4	45.4



	Sweden				EU
	DESI 2017 value	DESI 2018 value	DESI 2019 value	DESI 2019 rank	DESI 2019 value
2a1 At least basic digital skills % individuals	69%	77%	77%	3	57%
	2016	2017	2017		2017
2a2 Above basic digital skills % individuals	39%	46%	46%	4	31%
	2016	2017	2017		2017
2a3 At least basic software skills % individuals	70%	78%	78%	3	60%
	2016	2017	2017		2017
2b1 ICT specialists % total employment	6.1%	6.3%	6.6%	2	3.7%
	2015	2016	2017		2017
2b2 Female ICT specialists % female employment	2.4%	2.8%	2.9%	2	1.4%
	2015	2016	2017		2017
2b3 ICT graduates % graduates	3.6%	3.5%	3.7%	15	3.5%
	2014	2015	2016		2015

In the Human capital dimension, Sweden remains in second place after Finland. Almost half of the population have above basic skills. Nearly eight out of ten Swedes have basic software skills and are for example able to create digital content. ICT specialists represent 6.6 % of the workforce, second highest in the EU, but the country still suffers from a lack of professionals with advanced digital skills. The high number of ICT specialists and low number of ICT graduates may be caused by the inclination of Swedish companies to recruit ICT specialists before graduation and an overall tendency of Swedish students not to take out their diploma as much as their European peers.

The National digitisation strategy adopted in 2017 addresses digital skills and competences. It highlights the need for all citizens to contribute to and participate in a digital society; to modernise the education system including ensuring that tertiary education corresponds to students' and the labour market's need for digital skills; and to focus on lifelong learning and increasing digital competences in the public sector. Moreover, the 2016 Smart industry strategy targets the shortage of skilled labour and the National digitisation strategy for compulsory and upper secondary school from 2017 introduces digital skills, including programming in the curricula. There are no specific strategies or action plans for tertiary education, vocational education and upskilling of citizens. Despite this, many projects are ongoing. One example is the establishment of physical digital centres, *Digidelcenter*³⁶⁷ in 15 municipalities across Sweden, where citizens can take part in digital skills trainings, get help with digital issues and test technology provided by numerous stakeholders. The action is financed with €1 million from the government and the Internet Foundation.

³⁶⁷ <https://internetstiftelsen.se/kunskap/for-alla/digital-delaktighet/>

In 2018, the Digitisation Council analysed the situation related to digital competences³⁶⁸ linked to the digitisation strategy and amongst others concluded that there is a lack of clear targets and responsibilities.

Despite the relatively high number of ICT specialists, Sweden lacks professionals with advanced digital skills. To tackle this issue the labour market partners call for life-long learning models and for modernising the higher education system and ensuring that the knowledge and competences of university students match business needs. Employers also call for more flexibility around job and residence permits for foreign workers and students with advanced digital skills in order to attract and retain talent from abroad.

Digital Skills and Jobs Coalition Sweden brings together 20 stakeholders and is led by the Swedish IT and Telecom Industries³⁶⁹. In 2019, the Coalition will focus on gender and diversity equality perspectives related to digital skills.

Out of a total of 2.7 million participants,³⁷⁰ around 35,000 Swedes participated in EU Code Week³⁷¹, which aims to bring programming and related technology skills to schools. The average age of participants was 12 years in Sweden and 43 % of participants were girls.

Sweden continues to lack ICT specialists and other professionals with advanced digital skills. Improving the overall responsibility, coordination and follow-up in the area of digital competences for the overall population and workforce will ultimately lead to an increase in the competitiveness and digitally readiness of the country.

Highlight 2019: AI knowledge platform and training courses for professionals

Linked to its National Roadmap on Artificial Intelligence³⁷², the Swedish government has assigned Chalmers University together with six other Swedish universities to develop an artificial intelligence (AI) knowledge platform and framework for competence development within AI³⁷³.

The platform will function as a one-stop-shop and help companies and the public sector to get in contact and collaborate more with academia regarding AI. The universities will also develop AI courses at university level for both professional engineers and other professionals from e.g. public sector who need a better basic understanding of the technology in order to see its potential and use within their own organisation and sector.

The allocated budget is €3.9 million for 2018 and 2019.

³⁶⁸ <https://digitaliseringsradet.se/sveriges-digitalisering/digital-kompetens/>

³⁶⁹ <https://www.itot.se/2019/01/sverige-etablerar-koalition-att-framja-digital-kompetens/>

³⁷⁰ <https://ec.europa.eu/digital-single-market/en/news/eu-code-week-2018-breaks-all-time-record-27-million-participants-and-nearly-44000-events>

³⁷¹ <https://codeweek.eu/>

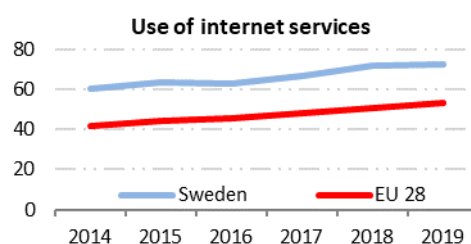
³⁷²

https://www.regeringen.se/49a828/contentassets/844d30fb0d594d1b9d96e2f5d57ed14b/2018ai_webb.pdf

³⁷³ <https://www.regeringen.se/pressmeddelanden/2018/06/regeringen-satsar-40-miljoner-kronor-pa-vidareutbildning-inom-ai/>

3 Use of internet services

3 Use of internet services	Sweden		EU
	rank	score	score
DESI 2019	3	72.4	53.4
DESI 2018	2	71.5	50.7
DESI 2017	2	66.4	47.8



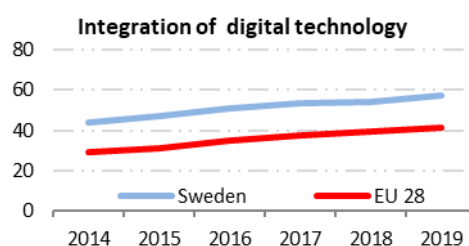
	Sweden		EU	
	DESI 2017 value	DESI 2018 value	DESI 2019 value	DESI 2019 rank
3a1 People who never used the internet % individuals	3%	2%	4%	5
3a2 Internet users % individuals	91%	95%	91%	6
3b1 News % internet users	87%	88%	88%	6
3b2 Music, videos and games % internet users	91%	91%	92%	3
3b3 Video on demand % internet users	49%	49%	61%	1
3b4 Video calls % internet users	51%	58%	58%	11
3b5 Social networks % internet users	75%	74%	76%	9
3b6 Professional social networks % internet users	19%	24%	24%	4
3b7 Doing an online course % internet users	9%	18%	18%	1
3b8 Online consultations and voting % internet users	13%	15%	15%	4
3c1 Banking % internet users	89%	90%	91%	4
3c2 Shopping % internet users	80%	84%	84%	4
3c3 Selling online % internet users	19%	22%	27%	10

Swedes are advanced internet users. In particular, they follow training courses and watch movies and TV series most of all Europeans. 91 % of Swedes are online at least weekly. However, the group of non-users, which are more likely to be low-income households, elderly and/or people with special needs, risk not getting appropriate services. One example is the fast transition towards a cashless society: 1.5 million out of roughly 8.2 million Swedes aged over 15 years have no mobile BankID, which enables people to access online banking and public services³⁷⁴.

³⁷⁴ <https://internetstiftelsen.se/kunskap/rapporter-och-guider/svenskarna-och-internet-2018/>

4 Integration of digital technology

	Sweden		EU
	rank	score	score
DESI 2019	6	57.3	41.1
DESI 2018	6	54.0	39.6
DESI 2017	5	53.7	37.6



	Sweden		EU	
	DESI 2017 value	DESI 2018 value	DESI 2019 value	DESI 2019 rank
4a1 Electronic information sharing	NA	31%	31%	15
% enterprises	2015	2017	2017	2017
4a2 Social media	24%	25%	25%	9
% enterprises	2016	2017	2017	2017
4a3 Big data	10%	10%	10%	19
% enterprises	2016	2016	2018	2018
4a4 Cloud	33%	NA	43%	2
% enterprises	2016	2017	2018	2018
4b1 SMEs selling online	26%	28%	30%	3
% SMEs	2016	2017	2018	2018
4b2 e-Commerce turnover	15%	15%	18%	2
% SME turnover	2016	2017	2018	2018
4b3 Selling online cross-border	10%	10%	10%	9
% SMEs	2015	2017	2017	2017

On the Integration of digital technology by businesses, Sweden remains in 6th place in 2019. Swedish enterprises are increasingly taking advantage of the opportunities offered by online commerce. 30 % of SMEs sell online, with 10 % selling across borders to other European countries and almost one fifth of SMEs turnover comes from the online segment. More than four out of ten SMEs use cloud services – up 10 percentage points from 2016 – but companies lag behind when it comes to using big data.

The Smart Industry Strategy's³⁷⁵ second action plan³⁷⁶ proposes 37 new actions and reports results on the 46 existing ones in the areas of Industry 4.0, Sustainable production, Knowledge-boosted industry and Testbed Sweden. New measures include *Robotlyftet*³⁷⁷, which was launched in 2018 with a budget of €10.5 million for 2018-2021. It aims to reduce the technological and economic risks of investing in modern automation technologies and raise awareness of how automation and robotisation can help to strengthen the competitiveness of SMEs. Companies can apply for financial support in the form of vouchers that can be used for consultancy services to develop the work.

³⁷⁵ <https://www.regeringen.se/informationsmaterial/2016/01/smart-industri---en-nyindustrialiseringsstrategi-for-sverige/>

³⁷⁶ <https://www.regeringen.se/informationsmaterial/2017/12/handlingsplan-2-for-smart-industri--en-nyindustrialiseringsstrategi-for-sverige/>

³⁷⁷ <https://tillvaxtverket.se/amnesomraden/digitalisering/robotlyftet.html>

In May 2018, the government adopted the Swedish roadmap for artificial intelligence³⁷⁸ (AI) which aims at making the country a world leader while improving welfare and competitiveness. It pinpoints three areas where the government sees the importance of stakeholders working together: education and research; innovation and use; and framework and infrastructure. Suggested actions include not only increasing the number of AI experts by training engineers and already active people but also introducing AI content in non-technical education paths. Additionally, launching infrastructure for AI applications and ensuring that AI is introduced in an ethical, safe and sustainable way. Finally, the roadmap includes developing rules, standards, norms and ethical principles to guide ethical and sustainable AI.

The provision of capital for start-ups, for example through *Saminvest* – a private equity investor set up by the government in 2016 – is largely working. However, financing scale-ups is still a challenge. The largest problem for small business is the lack of staff with the right digital competences.

In 2018, seven authorities, led by the Swedish Civil Contingencies Agency, were mandated to develop a comprehensive action plan³⁷⁹ based on the objectives of the National Cybersecurity strategy³⁸⁰ for 2019-2022. The aim of the plan is to contribute to the coordination of actions and activities carried out by the authorities.

Sweden is committed to advancing and to investing strategically in new digital technologies, through EU-coordinated programmes. The country is a member of the EuroHPC Joint Undertaking and it has signed the Declaration establishing a European Blockchain Partnership and the Declaration on cooperation on Artificial Intelligence.

To further boost the digital transformation it is important to raise awareness of the relevance of digitisation among SMEs and as well as to tackle the lack of advanced digital skilled experts. It is also important to encourage business to use big data to ensure a sound foundation for data-driven innovation.

³⁷⁸

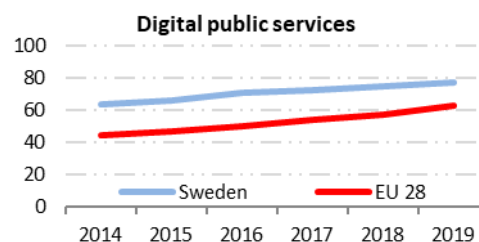
https://www.regeringen.se/49a828/contentassets/844d30fb0d594d1b9d96e2f5d57ed14b/2018ai_webb.pdf

³⁷⁹<https://www.regeringen.se/4a095b/contentassets/f06e5fa24a854133b6d8d6c48802e960/uppdrag-om-en-samlad-informations--och-cybersakerhetshandlingsplan-for-aren-20192022.pdf>

³⁸⁰<https://www.regeringen.se/pressmeddelanden/2017/06/ny-nationell-informations--och-cybersakerhetstrategi/>

5 Digital public services

5 Digital public services	Sweden		EU
	rank	score	score
DESI 2019	6	77.7	62.9
DESI 2018	5	75.4	57.9
DESI 2017	4	72.4	54.0



	Sweden				EU
	DESI 2017 value	DESI 2018 value	DESI 2019		DESI 2019 value
5a1 e-Government users % internet users needing to submit forms	83%	90%	93%	1	64%
	2016	2017	2018		2018
5a2 Pre-filled forms Score (0 to 100)	71	74	76	9	58
	2016	2017	2018		2018
5a3 Online service completion Score (0 to 100)	90	90	92	11	87
	2016	2017	2018		2018
5a4 Digital public services for businesses Score (0 to 100) - including domestic and cross-border	99	92	92	9	85
	2016	2017	2018		2018
5a5 Open data % of maximum score	NA	NA	52%	22	64%
			2018		2018
5b1 e-Health services % individuals	NA	33%	33%	4	18%
		2017	2017		2017
5b2 Medical data exchange % of general practitioners	NA	NA	81%	3	43%
			2018		2018
5b3 e-Prescription % of general practitioners	NA	NA	100%	1	50%
			2018		2018

On digital public services, Sweden ranks sixth among EU countries, dropping one position from last year. Sweden ranks first for e-government users as well as e-prescription and third in medical data exchange. Sweden continues to lag behind other EU countries (22nd place) when it comes to open data.

A new Agency for digital government (DIGG) was set up in 2018. The aim is to improve the coordination of public sector digitisation and support it at both central and local level. It has 45 employees and the proposed budget for 2019-2021 is about €55 million. DIGG's priorities are to develop further e-identification, e-invoicing, digital post, web accessibility, data and information exchange.

One of the goals of the digitisation of the public sector is to simplify administration for Swedish businesses. The e-business portal³⁸¹ gathers over 45 different government agencies who provide information, targeted support and enable e.g. company registrations and tax calculation. The pilot programme *Serverat* has already streamlined application processes through digital services for microenterprises in the food and beverage industry and it has now been extended to cover the hospitality industry.

³⁸¹ <https://www.verksamt.se/>

The Swedish Agency for Public Management concluded in 2018 that public authorities publish data in a way that makes them difficult to use, especially for advanced users, such as programmers and service developers³⁸². It concludes that the authorities themselves could solve most problems and it lists actions they could take to improve the situation. It also recommended a number of actions for the government to speed up the work for example by including regular reporting on the issue. In 2018, DIGG was given the permanent task of improving open data and has taken over responsibility for the open data portal.

Swedish primary care is digitised to a great extent. The health guide platform 1177³⁸³, where patients for example can search for health information, book appointments and check which medicines they have been prescribed. 1177 is accessible to everyone with an e-id. One of the projects of the eHealth agency is to establish the 'national list of medicines', which will be a nationwide source of information for carers, pharmacies and patients about their prescribed and fetched medicine. The aim is to increase patient safety and minimise the risk of abuse of medicine.

The digitisation of the Swedish public administration is challenged by its size and differences in activities in terms of scale, geography, remit, financial resources and competences. The coordination and leadership by the new Agency for digital government could lead the way to improvements in all areas, especially open data.

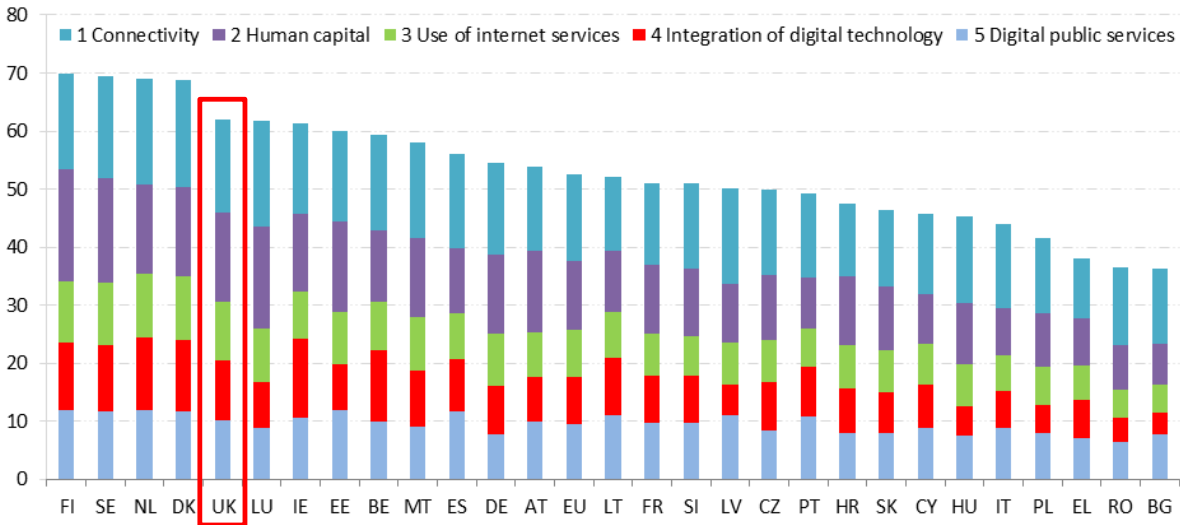
³⁸² <http://www.statskontoret.se/publicerat/publikationer/2018/hinder-for-att-anvanda-myndigheternas-oppna-data/>

³⁸³ www.1177.se

United Kingdom

	United Kingdom		EU
	rank	score	score
DESI 2019	5	61.9	52.5
DESI 2018	6	58.8	49.8
DESI 2017	6	55.6	46.9

Digital Economy and Society Index (DESI) 2019 ranking



The United Kingdom ranks fifth out of the 28 EU Member States in the European Commission Digital Economy and Society Index (DESI) 2019.

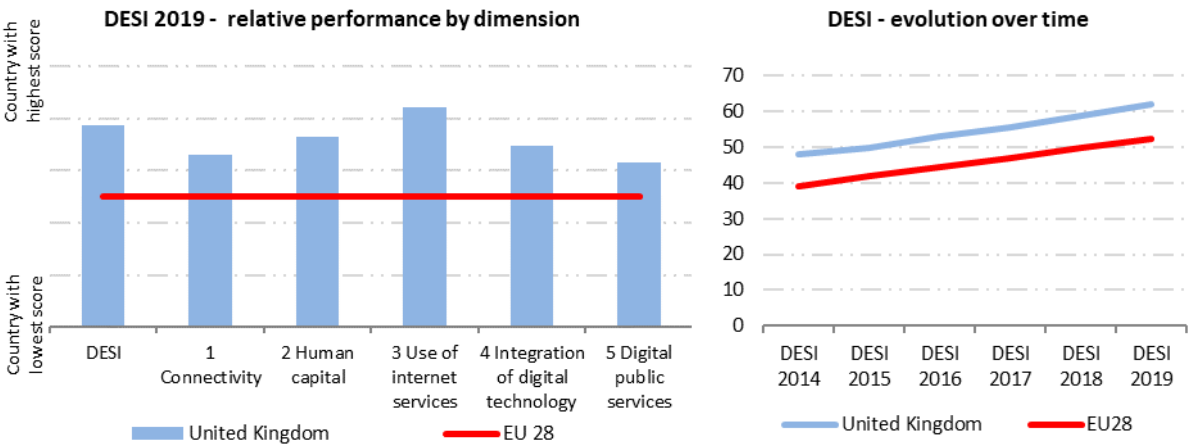
Its score increased due to an improved performance in all of the DESI dimensions. The United Kingdom performs particularly well in the Use of internet services, where it ranks fifth among EU countries - thanks to a very high rate of regular internet use and a strong uptake of a wide variety of online services.

In Connectivity the UK ranks 10th, above the EU average. However, while it performs well in most indicators, on ultrafast broadband coverage and take-up it lags behind. In Human capital the UK ranks sixth with a large share of people in the UK having basic digital skills or above. However, strong demand for ICT specialists on the labour market has led to supply shortages and measures put in place to combat this have not yet had a significant impact.

In Integration of digital technology by businesses the UK ranks seventh. While use of social media and cloud services are high, uptake of electronic information sharing is low. Uptake of other technologies is average. Finally, in Digital public services the UK ranks 11th, performing somewhat above average for the EU.

The UK Digital Strategy³⁸⁴ was published in March 2017. The strategy has seven strands addressing: connectivity, digital skills and inclusion, the digital sectors, the wider economy, a safe and secure cyberspace, digital government and data. The strategy is complemented by an updated Digital Economy Act (April 2017)³⁸⁵, and through digital measures developed in a number of other strategies such as the Industrial strategy (November 2017), the Government Digital Strategy³⁸⁶ and the NHS Long-Term Plan.

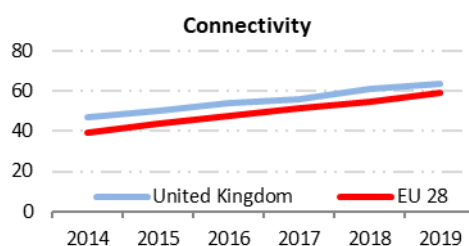
New digital measures were supported with £500 million in the 2017 autumn budget³⁸⁷, for the development of Artificial Intelligence (AI), investment in 5G networks and digital skills. The latest budget (Autumn 2018)³⁸⁸ announced the introduction of a digital services tax - a 2 % tax on the revenues of certain digital businesses - to be introduced from April 2020.



³⁸⁴ <https://www.gov.uk/government/publications/uk-digital-strategy>
³⁸⁵ <http://www.legislation.gov.uk/ukpga/2017/30/contents/enacted/data.htm>
³⁸⁶ <https://www.gov.uk/government/publications/government-digital-strategy>
³⁸⁷ <https://www.gov.uk/government/publications/autumn-budget-2017-documents>
³⁸⁸ <https://www.gov.uk/government/publications/budget-2018-documents>

1 Connectivity

1 Connectivity	United Kingdom		EU
	rank	score	score
DESI 2019	10	63.6	59.3
DESI 2018	7	60.7	54.8
DESI 2017	8	55.9	51.2



	United Kingdom			EU
	DESI 2017	DESI 2018	DESI 2019	DESI 2019
	value	value	value rank	value
1a1 Fixed broadband coverage % households	>99.5%	100%	100% 1	97%
1a2 Fixed broadband take-up % households	87%	88%	93% 2	77%
1b1 4G coverage % households (average of operators)	93%	98%	98% 11	94%
1b2 Mobile broadband take-up Subscriptions per 100 people	91	89	99 10	96
1b3 5G readiness Assigned spectrum as a % of total harmonised 5G spectrum	NA	NA	0% 13	14%
1c1 Fast broadband (NGA) coverage % households	92%	94%	95% 7	83%
1c2 Fast broadband take-up % households	37%	47%	53% 12	41%
1d1 Ultrafast broadband coverage % households	NA	48%	52% 24	60%
1d2 Ultrafast broadband take-up % households	10%	15%	16% 18	20%
1e1 Broadband price index Score (0 to 100)	85	87	86 17	87

With an overall connectivity score of 63.6, the UK ranks 10th among the EU countries. The fixed broadband coverage is ubiquitous with a value of 100 %, placing the UK at the top of the list. The UK marginally increased its fast broadband (NGA) coverage (95 %), which lies significantly above the EU average (83 %). However, with only 52 % of the households covered by ultrafast (100 Mbps and above) broadband, the UK lags behind (compared to an EU average of 60 %) and ranks near the bottom (24th). Furthermore, this figure reflects mainly the wide availability of upgraded legacy networks, UK FTTP networks only covering 3.8 % of the population (EU 29.6 %). On take-up, mobile broadband take-up lies at 99 subscriptions per 100 people, slightly above the EU average (96) and increased by 10 points. Fixed broadband take-up also increased and it ranks second among EU countries. Take-up of fast and ultrafast broadband remains relatively low, with the country still ranked 12th and 18th in the EU, respectively. The 4G coverage remained stable at 98 %, somewhat above the EU average (94 %). The UK's ambition is to extend mobile coverage to 95 % of the territory by 2022. Broadband prices perform at EU average levels.

The Broadband Delivery UK (BDUK) programme continues the roll-out of superfast internet (above 24 Mbps), including in rural areas, and is expected to reach at least a further 2 % of UK premises by 2020. The Department for Environment, Food and Rural Affairs announced a €87 million investment

through the Rural Broadband Infrastructure Scheme with plans to utilise EU funding from the 2014-2020 Rural Development Programme for England (RDPE) funded by the EAFRD. A €327 million local full fibre networks (LFFN) programme is designed to stimulate commercial investment in full fibre networks in both rural and urban locations across the UK. In July 2018, the UK Government published the 'Future telecoms infrastructure review' announcing its goal to achieve nationwide full fibre coverage by 2033. The Rural Gigabit Connectivity programme is the first step of this approach, with €233 million from the National Productivity Investment Fund to support full fibre roll-out in rural and remote areas. Lastly, Ofcom published its plans for how regulation will support investment in fibre: regulating business and residential markets together (single fixed telecoms review) in 2021, an unrestricted access to Openreach's ducts and poles, regulating different geographic markets, smoother transition from copper to fibre networks ('Regulatory certainty to support investment in full fibre broadband' presenting). A number of alternative network operators has also increased their investment activity in fibre deployment.

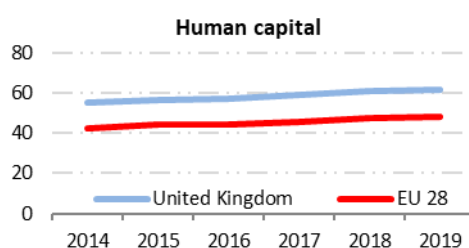
The UK aims to be a world leader in 5G and to ensure that the majority of the population have access to a 5G signal by 2027. The UK has already had a relevant 5G strategy since March 2017, which was updated in December 2017. The Government's 5G Testbeds and Trials Programme, working in partnership with industry and others, aim to stimulate the market for 5G services including calls for 5G security and self-driving cars and improve the commercial case for investment. After running a competition as part of the Programme's first Phase of funding, in March 2018 the UK Government selected six proposals from across the UK. As part of a second phase, the 5G Programme is currently working on the creation of large-scale testbeds - the Connected Communities projects - in both rural and urban settings. In September 2018, the location for the Urban Connected Community (UCC) project was announced as the West Midlands.

Ofcom assigned spectrum licences in the 2.6 GHz and 3.4-3.6 GHz band in 2018. Spectrum auctions for 5G bands (700MHz and 3.6-3.8 GHz) are planned only for early 2020. In the UK, 44 % of the 2090 MHz spectrum harmonised at EU level for wireless broadband has been assigned. Three of the UK's mobile network operators have announced their intention to launch commercial 5G services in the second half of 2019.

Despite the currently modest level of rolled-out fibre networks, the UK is significantly increasing its public support to ensure that in the near future everyone in the country benefits from a future-proof and innovative digital economy. On 5G, while the UK has launched the first phase of funding of the 5G Testbeds, a lot will depend on the auction of the 5G bands, scheduled for early 2020. At the same time, work on the 4G front should continue to increase territorial coverage.

2 Human capital

2 Human capital	United Kingdom		EU
	rank	score	score
DESI 2019	6	61.6	48.0
DESI 2018	5	61.0	47.6
DESI 2017	5	59.0	45.4



	United Kingdom			EU
	DESI 2017	DESI 2018	DESI 2019	DESI 2019
2a1 At least basic digital skills	69%	71%	71%	57%
% individuals	2016	2017	2017	2017
2a2 Above basic digital skills	43%	46%	46%	31%
% individuals	2016	2017	2017	2017
2a3 At least basic software skills	71%	73%	73%	60%
% individuals	2016	2017	2017	2017
2b1 ICT specialists	5.0%	5.1%	5.1%	3.7%
% total employment	2015	2016	2017	2017
2b2 Female ICT specialists	1.7%	1.8%	1.9%	1.4%
% female employment	2015	2016	2017	2017
2b3 ICT graduates	3.5%	3.6%	3.6%	3.5%
% graduates	2014	2015	2016	2015

In Human capital, the UK ranks sixth, above the EU average. The percentage of the population with at least basic digital skills (71 %) has been increasing, despite an already above average performance (+14 pp. than the EU average of 57 %). Furthermore, the percentage of those with above basic digital skills is also relatively high (46 %, compared to an EU average of 31 %). The UK continues to experience an increase in ICT specialist employment as a percentage of total employment, despite its already relatively high share (5.1 %, compared to an EU average of 3.7 %). However, women remain under represented - only 1.8 % of employed women are ICT specialists. Though this is above the EU average (1.4 %). Despite strong demand, graduations in ICT remain relatively low (3.6 % of total graduates) and companies report difficulty filling ICT posts.

The UK's strategy towards digital skills and inclusion is outlined in its Digital Strategy (March 2017). The strategy focuses on tackling digital exclusion, developing the full range of digital skills that individuals and companies need and developing strong collaboration between the public, private and third sector. To support its implementation, in August 2018 the UK launched a Digital Innovation Fund to help people from underrepresented groups gain the skills they need to work in digital roles. At the same time, it launched a Digital Inclusion Fund to help older and disabled people develop the digital skills – such as booking medical appointments and using online communication services and search engines.

To support the digital upskilling of adults, in October 2018, the UK government launched a consultation³⁸⁹ on its plans for an overhaul of adult digital skills training and qualifications (see Highlight 2019). These plans also include the introduction of a basic digital skills entitlement - which

³⁸⁹ <https://www.gov.uk/government/news/adults-to-benefit-from-digital-skills-overhaul>

from 2020 will offer adults in England who lack basic digital skills access to free training. Full funding for the latter was announced in January 2018.

In 2017 the UK government launched a Digital Skills Partnership together with businesses, charities and voluntary organisations³⁹⁰. Since its launch it has provided 2.5 million free training opportunities to develop basic digital skills, coding and cybersecurity skills etc. It has developed four delivery groups focusing on 1) increasing the national coherence of digital skills provision, 2) supporting the development of Local Digital Skills Partnerships in English regions, 3) increasing digital enterprise by helping small businesses and charities to upskill their employees and 4) convening industry and other partners to support the teaching of the new computing curriculum in English³⁹¹ schools.

In 2014 computing became a statutory national curriculum subject, and a new Computer Science GCSE and A Level have been introduced in English schools. A £84m programme to support the teaching of the new computing curriculum was announced in 2017. Digital skills are also a core part of new standards for apprenticeships and 'T' Levels. The government is also working with companies to develop digital apprenticeships and T Levels.

The basic digital skills of UK citizens are above that of the EU average and policies put in place to support their further development mean that they should continue to improve. By contrast the availability of advanced digital skills remains a problem, partly due to rising demand for these skills. While a number of initiatives have been put in place to address advanced digital skills gaps, such as a programme to create 1,000 new Artificial Intelligence PhDs over the next 5 years, these have yet to bear fruit. While this is no doubt partly due to their longer-term nature, going forward it will be important to monitor and ensure their full implementation.

Highlight 2019: Consultation on adult digital skills qualifications

To help boost adult digital skills the UK government has launched a consultation setting out plans to:

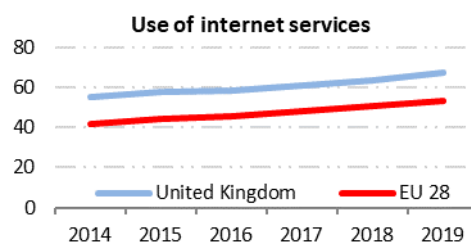
- overhaul the current national standards setting out the core digital skills people need to get on in life and work – supporting them to use digital devices like tablets, smart phones and laptop computers, and to perform everyday activities that most people take for granted like how to navigate the internet, send an email, complete online forms and make online payments.
- introduce improved basic digital skills qualifications at two levels – beginner and essential.
- introduce a nationwide entitlement for all adults without basic digital skills to enrol on the new qualifications free of charge from 2020.

³⁹⁰ <https://www.gov.uk/guidance/digital-skills-partnership>

³⁹¹ Policy for skills, education and training are devolved responsibilities in the UK meaning that England, Scotland, Wales and Northern Ireland maintain their own separate policies.

3 Use of internet services

3 Use of internet services	United Kingdom		EU
	rank	score	score
DESI 2019	5	67.6	53.4
DESI 2018	6	63.8	50.7
DESI 2017	6	60.6	47.8

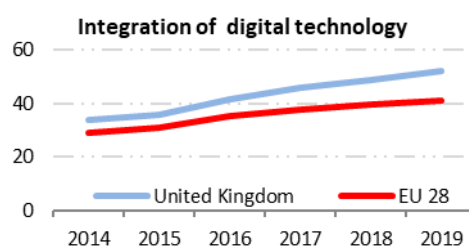


	United Kingdom				EU
	DESI 2017	DESI 2018	DESI 2019		DESI 2019
	value	value	value	rank	value
3a1 People who never used the internet % individuals	4%	4%	4%	4	11%
3a2 Internet users % individuals	93%	93%	94%	3	83%
3b1 News % internet users	68%	72%	72%	22	72%
3b2 Music, videos and games % internet users	80%	80%	88%	7	81%
3b3 Video on demand % internet users	34%	34%	53%	4	31%
3b4 Video calls % internet users	49%	53%	51%	13	49%
3b5 Social networks % internet users	73%	75%	74%	11	65%
3b6 Professional social networks % internet users	17%	24%	24%	5	15%
3b7 Doing an online course % internet users	13%	14%	14%	4	9%
3b8 Online consultations and voting % internet users	10%	14%	14%	7	10%
3c1 Banking % internet users	68%	72%	78%	7	64%
3c2 Shopping % internet users	87%	86%	87%	1	69%
3c3 Selling online % internet users	22%	22%	28%	9	23%

Internet use is widespread in the UK with 94 % of people going on line every week. Only 4 % of people in the UK have never used the internet. People in the UK use a wide variety of internet services and use of most internet services is above the EU average. The most popular online activities include downloading music, videos and games (88 %), shopping (87 %) and online banking (78 %). Furthermore, strong growth has been witnessed in the use of video on demand (+19 pp. over DESI 2018) and selling online (+6 pp. over DESI 2018).

4 Integration of digital technology

4 Integration of digital technology	United Kingdom		EU
	rank	score	score
DESI 2019	7	52.0	41.1
DESI 2018	7	48.6	39.6
DESI 2017	7	46.0	37.6



	United Kingdom			EU
	DESI 2017 value	DESI 2018 value	DESI 2019 value rank	DESI 2019 value
4a1 Electronic information sharing % enterprises	17% 2015	19% 2017	19% 26 2017	34% 2017
4a2 Social media % enterprises	40% 2016	42% 2017	42% 1 2017	21% 2017
4a3 Big data % enterprises	15% 2016	15% 2016	NA 2018	12% 2018
4a4 Cloud % enterprises	22% 2016	NA 2017	30% 7 2018	18% 2018
4b1 SMEs selling online % SMEs	19% 2016	19% 2017	19% 9 2018	17% 2018
4b2 e-Commerce turnover % SME turnover	9% 2016	9% 2017	11% 13 2018	10% 2018
4b3 Selling online cross-border % SMEs	9% 2015	9% 2017	9% 12 2017	8% 2017

In Integration of digital technology by businesses, the UK ranks seventh, above the EU average. However, the picture varies widely by technology. While the UK ranks first in use of social media by enterprises, it ranks 26th on sharing of electronic information. For other technologies, the UK's performance is similar to the EU average. Most indicators have seen little development over time. The main exception is for uptake of cloud services (+8 pp. since 2016, to 30 %).

Digitisation of businesses is addressed under pillar four of the UK's Digital Strategy (March 2017)³⁹². Encouraging the digitisation of businesses is seen as a way of boosting innovation and improving productivity, which continues to be weak. Through its modern Industrial Strategy, the Government is supporting businesses to become more digital and adopt proven technologies that boost productivity. For example, the £9 million 'Business Basics' Programme and by providing up to £18.6 million for the business-led 'Be the Business' initiative (formerly the Productivity Council).

The UK Government's Business Productivity Review found that businesses can make significant productivity gains from adopting basic digital technologies and proposed tangible and scalable solutions. Its recommendations have led to further funding announcements in the 2018 Budget to boost productivity.

³⁹² <https://www.gov.uk/government/publications/uk-digital-strategy/4-the-wider-economy-helping-every-british-business-become-a-digital-business>

UK Industrial Strategy (November 2017)³⁹³ makes a commitment to put the UK at the forefront of the Artificial Intelligence and data revolution. Within the strategy, growing the AI and the data-driven economy are identified as one of four Grand Challenges. To address this challenge it identifies four priorities: making the UK a global centre for artificial intelligence and data-driven innovation; supporting sectors to boost their productivity through artificial intelligence and data analytic technologies; leading the world in safe and ethical use of data and AI; and helping develop the skills needed for the jobs of the future.

To support the implementation of the strategy the government has agreed an Artificial Intelligence Sector Deal with industry³⁹⁴. Amongst the many supporting actions, the strategy provides for a number of new institutions and bodies to support the advancement of AI including the Alan Turing Institute will become the national research centre for AI, an Industry-led AI council to support uptake of AI across sectors, a new government office for AI and a new Centre for Data Ethics and Innovation. Investments are also foreseen for extra PhDs (£45m) and masters courses (industry developed and funded) in AI and related disciplines, for improving the teaching of computing (£84m) and driving up participation in computer science (£406m) and improving adults skills, in particular digital skills, to deal with a changing economy through the establishment of an adult digital skills entitlement (see Human Capital section) and a new National Retraining scheme.

The UK also takes part in EU-coordinated programmes for the advancement of new digital technologies. For instance, it has signed the Declaration on Cooperation on a European Blockchain Partnership, as well as the Declaration on Cooperation on Artificial Intelligence.

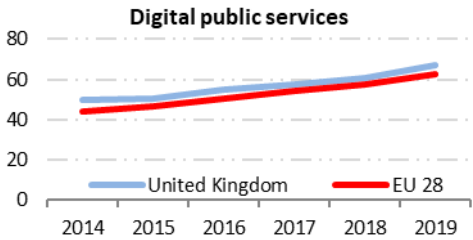
The UK is taking a comprehensive and holistic approach to boosting the digitisation of industry and the economy more broadly. To ensure the success of its digitisation strategies, it will need to ensure that its policies are also inclusive in order to avoid exacerbating existing digital divides. In particular, attention should be paid to providing support for digitisation to SMEs, businesses in disadvantaged regions and female digital entrepreneurs.

³⁹³ <https://www.gov.uk/government/publications/industrial-strategy-building-a-britain-fit-for-the-future>

³⁹⁴ <https://www.gov.uk/government/publications/artificial-intelligence-sector-deal>

5 Digital public services

5 Digital public services	United Kingdom		EU
	rank	score	score
DESI 2019	11	67.3	62.9
DESI 2018	13	60.6	57.9
DESI 2017	12	57.2	54.0



	United Kingdom				EU
	DESI 2017 value	DESI 2018 value	DESI 2019 value	rank	DESI 2019 value
5a1 e-Government users % internet users needing to submit forms	75%	80%	84%	6	64%
5a2 Pre-filled forms Score (0 to 100)	16	17	18	27	58
5a3 Online service completion Score (0 to 100)	76	81	86	18	87
5a4 Digital public services for businesses Score (0 to 100) - including domestic and cross-border	92	92	99	2	85
5a5 Open data % of maximum score	NA	NA	71%	11	64%
5b1 e-Health services % individuals	NA	25%	25%	7	18%
5b2 Medical data exchange % of general practitioners	NA	NA	70%	4	43%
5b3 e-Prescription % of general practitioners	NA	NA	79%	10	50%

In Digital public services, the United Kingdom ranks 11th among EU countries, showing a somewhat above average performance. Regarding e-government, while active e-government use and availability of digital public services for businesses is above the EU average, online service completion and availability of online forms (18 out of 100) could be improved³⁹⁵. The UK is an above average performer in the use of open data. In the area of e-health services, the UK is an above average performer. 79 % of general practitioners in the UK use e-prescriptions and 70 % exchange medical data, compared to 50 % and 43 % on average for the EU. Furthermore, 25 % of UK residents go online to use health and care services such as e-prescriptions and online consultations, compared to 18 % for the EU average.

In February 2017 the UK government published its Government Transformation Strategy 2017-2020³⁹⁶. In February 2018, the Government Digital Service published an update on its implementation³⁹⁷. More than 175 services across government used one of the digital service platforms operated by the Government Digital Service. Including digital services such as GOV.UK

³⁹⁵ The latter can in part be attributed to UK citizens' dislike of public administrations retaining their personal information and an adapted public service provision to take account of this.

³⁹⁶ <https://www.gov.uk/government/publications/government-transformation-strategy-2017-to-2020/governmenttransformation-strategy>

³⁹⁷ <https://gds.blog.gov.uk/2018/02/08/the-government-transformation-strategy-one-year-on/>

Notify, GOV.UK Platform as a service, GOV.UK Verify and GOV.UK Pay etc. In the following year it was planned to put a focus on exploring how new technologies such as Artificial Intelligence and biometrics can support public service provision, capacity building/skills development of staff and supporting the UK's exit from the EU. A further update provided by the UK government shows that as of February 2019, there were over 700 services, across 248 organisations using 'Government as a Platform' (GaaP) products.

The NHS Long Term Plan (January 2019)³⁹⁸ builds on previous measures in further expanding and exploiting digital technologies for a more effective and efficient health service. In particular, going forward it is planned to expand the use of the new NHS app. It is intended to use the app as a gateway for people to access health services and information. By 2021 people will be able to use the app to access their care plan and communications from health professionals. A right to online consultations will be introduced from 2024. The plan also envisages for people to be increasingly cared for and supported at home using remote monitoring. Digital technologies will also support the redesign of outpatient services and support doctors and other healthcare professionals with diagnoses (e.g. use of AI). To support these ambitions all secondary care providers should be fully digitised by 2024 (previously the goal was 2020).

The UK performs relatively well in the area of Digital public services and policies and measures it has introduced in this area are designed to strengthen its position further. To ensure these ambitious plans are successful, attention should be paid to ensuring that patients and staff have the sufficient skills, knowhow and support to use the new digital tools and that their data is sufficiently protected. Furthermore, as health provision becomes increasingly 'remote', fast and reliable connectivity will become a must.

³⁹⁸ <https://www.longtermplan.nhs.uk/wp-content/uploads/2019/01/nhs-long-term-plan.pdf>