



Digital Economy and Society Index (DESI) 2021

Luxembourg

About the DESI

The European Commission has monitored Member States' progress on digital and published annual Digital Economy and Society Index (DESI) reports since 2014. Each year, the reports include country profiles, which help Member States identify areas for priority action, and thematic chapters providing an EU-level analysis in the key digital policy areas.

In 2021, the Commission adjusted DESI to reflect the two major policy initiatives that will have an impact on digital transformation in the EU over the coming years: the Recovery and Resilience Facility and the Digital Decade Compass.

To align DESI with the four cardinal points and the targets under the Digital Compass, to improve the methodology and take account of the latest technological and policy developments, the Commission made a number of changes to the 2021 edition of the DESI. The indicators are now structured around the four main areas in the Digital Compass, replacing the previous five-dimension structure. 11 of the DESI 2021 indicators measure targets set in the Digital Compass. In future, the DESI will be aligned even more closely with the Digital Compass to ensure that all targets are discussed in the reports.

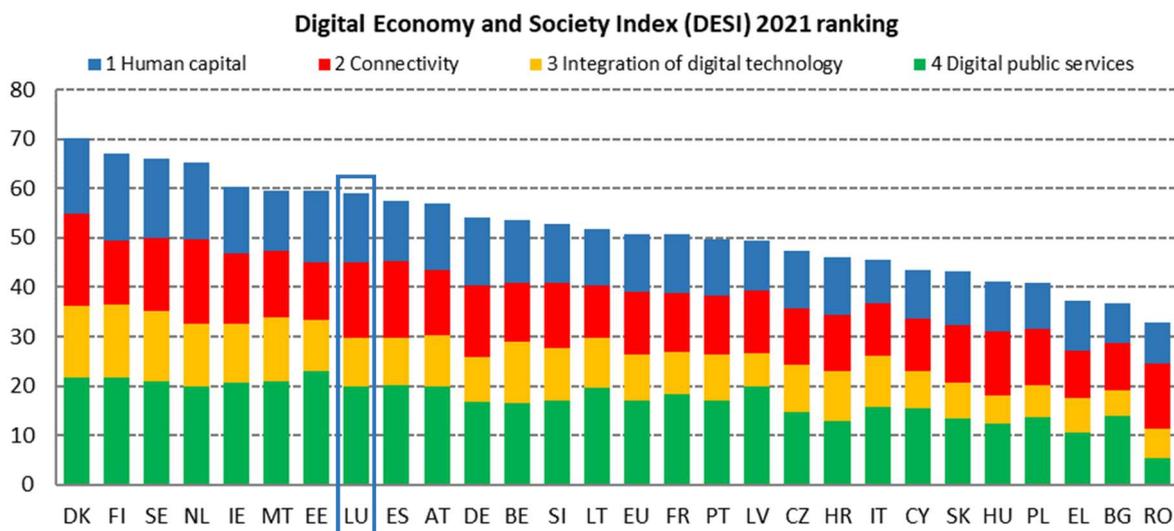
In addition, DESI now includes an indicator measuring the level of support that adopted ICT technologies provided companies in taking more environmentally-friendly measures (ICT for environmental sustainability) and the take up of gigabit services, plus the percentage of companies offering ICT training and using e-invoicing.

The DESI scores and rankings of previous years were re-calculated for all countries to reflect the changes in the choice of indicators and corrections made to the underlying data.

For further information, see the DESI website: <https://digital-strategy.ec.europa.eu/en/policies/desi>.

Overview

	Luxembourg		EU
	rank	score	score
DESI 2021	8	59.0	50.7



Luxembourg ranks 8th of 27 EU Member States in the 2021 edition of the Digital Economy and Society Index (DESI). It performs very well on Connectivity, ranking 4th in the EU. Luxembourg compares well in Human capital. It is also above the EU average score on Integration of digital technology.

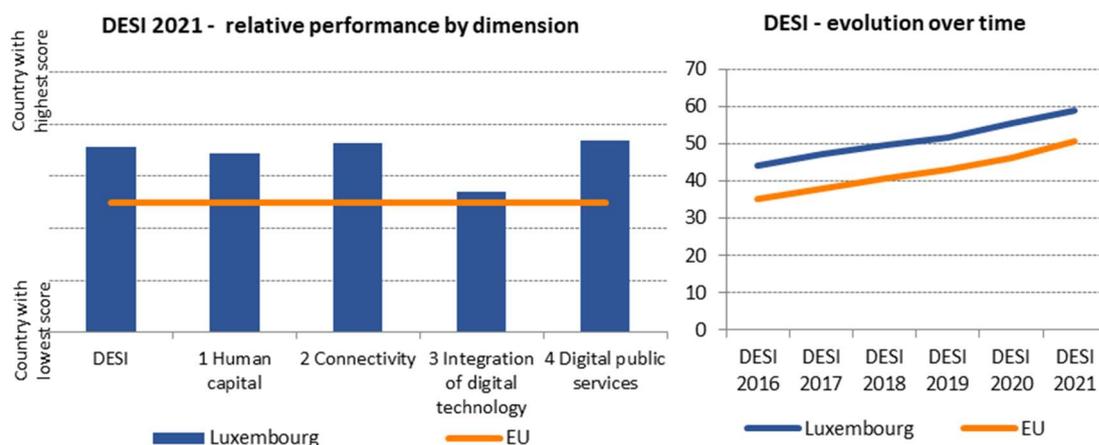
Luxembourg's share of ICT specialists and graduates is higher than the EU average, but there is still a shortage of ICT specialists and a decline in the share of ICT graduates since 2020 and this impedes the digitalisation of businesses. Luxembourg implements a range of strategies and initiatives to boost the digital skills of its population. The competent ministries launched an initiative for children and youth in the school system, and also support advanced digital-skills training for industry, education, research and the public sector. A coalition of private and public-sector bodies organises a range of thematic digital-skills webinars. 65% of 16-74 year-olds in Luxembourg have at least basic digital skills, compared to the EU average of 56%. The country continues to report an increase in the share of ICT specialists as a percentage of total employment, and in this respect is well above the EU average (6.3% and 4.3% respectively). 20% of ICT specialists are female, slightly above the EU average of 19% and a significant increase by five percentage points since 2020.

Luxembourg is improving in the roll-out and uptake of fibre and mobile 5G networks, addressing also the digital divide between urban and rural areas. The new national broadband strategy will focus on ensuring that private investment is sufficient to fulfil the gigabit objectives for 2025 and the situation will be re-assessed around 2022, by which time public-funding mechanisms could be established if necessary. Priority would be to cover the single-digit percentage of the population that does not have access to 100 Mbps today, in order to avoid a digital divide. Luxembourg performs very well in the take-up of fixed broadband services and 53% of households have opted for speeds of 100 Mbps and above. Coverage of 4G mobile networks stands at 99.8% and 5G services were commercially launched in the second half of 2020. Framing a strategy to streamline permit procedures and facilitate access to public property would further stimulate and accelerate the roll-out of both fixed and mobile infrastructure.

Luxembourg promotes the uptake of strategic digital technologies by businesses. The country invests in a high-performance computer and in 2019 launched a national public-sector blockchain.

In artificial intelligence (AI), the 'AI4Gov' initiative was launched and six teams received funding for projects on AI in public administration. The Government IT Centre is running a GovCloud which hosts the projects of around 90 public administrations and has been upgraded to meet administrations' AI needs. Deploying digital technologies in the broad business sector, including SMEs, would contribute to productivity growth. SMEs can benefit from a public-private partnership leveraging knowledge from accredited digitalisation experts. In June 2021 the Ministry of the Economy published a roadmap called 'Ons Wirtschaft vu muer' to accelerate the green transition and digital transformation of the economy and society, including through the creation of a national technological platform for the exchange, processing and governance of data. Luxembourg performs well on the share of companies that analyse big data (19% versus the EU average of 14%, ranking 9th). A high share of companies (41% versus the EU average of 36%) uses enterprise resource planning software to share information between different functional areas.

The 2021-2025 e-governance strategy for the public sector was adopted by the Government Council in early 2021 to explore new ways of working and to facilitate a paperless administration. Luxembourg ranks 3rd in the EU in the provision of digital public services to businesses and performs above the EU average on the number of administrative steps that can be done online for people's major life events.



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

Luxembourg's RRP is expected to contribute to the green and digital transition, while the components related to skills, health, housing and governance also significantly support cohesion and growth potential in the long term. The plan includes measures totalling EUR 183.1 million, of which EUR 93.4 million will be financed using the Recovery and Resilience Facility (RRF), and the rest from national or other EU funds. 31.6% of the EUR 93.4 million will finance its digital elements, well above the target of 20%. The digital elements include investments in future and digital skills (EUR 5.6 million), telemedicine, and a digital register for health professions (EUR 1.17 million). In addition, the RRF's digital pillar includes a contribution to a multi-country project on ultra-high-security communications based on quantum technologies (EUR 10 million), and several investments in digital public administration (EUR 12.73 million) which contribute to research and innovation, deployment of new technologies and digitalisation of the public administration.

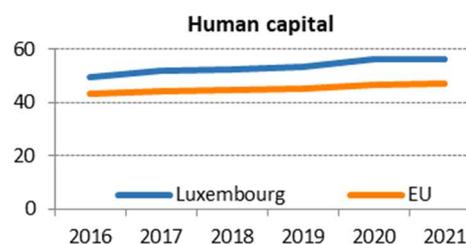
Some medium to long-term perspectives are given on how the measures of the RRP are expected to favour innovation and digitalisation of the business sector and investment-related economic

policy, which are Luxembourg's main digital challenges. The measures aimed at improving the digital inclusion of the population and workers and those expected to favour the digitalisation of SMEs have the potential to increase productivity growth.

Luxembourg's RRP does not include any investments in connectivity, as the policy focus is on ensuring that private investment is sufficient to fulfil the objectives for 2025. It is planned to re-assess the situation around 2022.

1 Human capital

1 Human capital	Luxembourg		EU
	rank	score	score
DESI 2021	6	56.2	47.1



	Luxembourg			EU
	DESI 2019	DESI 2020	DESI 2021	DESI 2021
1a1 At least basic digital skills	NA	65%	65%	56%
% individuals	2017	2019	2019	2019
1a2 Above basic digital skills	NA	36%	36%	31%
% individuals	2017	2019	2019	2019
1a3 At least basic software skills	NA	68%	68%	58%
% individuals	2017	2019	2019	2019
1b1 ICT specialists	5.9%	6.1%	6.3%	4.3%
% individuals in employment aged 15-74	2018	2019	2020	2020
1b2 Female ICT specialists	14%	15%	20%	19%
% ICT specialists	2018	2019	2020	2020
1b3 Enterprises providing ICT training	27%	27%	21%	20%
% enterprises	2018	2019	2020	2020
1b4 ICT graduates	4.6%	5.8%	5.0%	3.9%
% graduates	2017	2018	2019	2019

In the Human capital dimension, Luxembourg ranks 6th. It ranks above the EU average on the three digital-literacy indicators. 65% of 16-74 year-olds in Luxembourg have at least basic digital skills compared to the EU average of 56%. Luxembourg continues to report an increase in the share of ICT specialists as a percentage of total employment and is well above the EU average (6.3% and 4.3% respectively). 20% of specialists are female, slightly above the EU average of 19%. The share of companies providing ICT training to their employees dropped significantly from 27% in 2019 to 21% in 2020, which is still slightly above the EU average of 20%. The share of ICT graduates in the total pool of graduates increased in 2018 compared to the previous year, and remains above the EU average (5.0% and 3.9% respectively). At the same time, Luxembourg continues to experience a significant shortage of ICT specialists; 67% of companies that recruited or tried to recruit ICT specialists in 2019 reported difficulties in filling vacancies, considerably above the EU average of 55%.

In 2020, the Ministry of Education launched ‘Einfach Digital!’¹ (‘simply digital’), a new initiative that focuses on critical thinking, creativity, communication, collaboration and coding for children in the school system. It represents the next generation of the ministry’s digitalisation approach, replacing the former Digital4Education initiative. One of the key projects of the ‘Einfach Digital!’ initiative is ‘Einfach Kodéiren’ (‘simply coding’) which integrates coding into school curricula, providing specialised teachers, courses – some of them with external partners – training material and family afternoons that parents can attend together with their children². The Ministry for Education aims to improve digital literacy by strengthening it in the curriculum, combining a general cross-cutting approach

¹ <https://digital-luxembourg.public.lu/initiatives/einfach-digital>

² <https://digital-luxembourg.public.lu/stories/claude-meisch-introduces-einfach-kodeiren-keeping-pace-digital-world>

(‘Medienkompass’) with a more specific subject-oriented strand to ensure basic understanding of underlying technological and ethical concepts³.

Luxembourg strongly supports advanced digital skills in areas such as AI. Together with specialised partners, the ‘Digital Luxembourg’ initiative promotes advanced digital-skills training and upskilling opportunities for industry, education, research and the public sector. Examples include the AI academy, deep-learning training⁴, learning content on AI⁵, an online programme for people with nontechnical backgrounds⁶ and an upskilling seminar on 5G for companies with a low digitalisation level.

Launched in September 2019, Luxembourg’s Digital Coalition counts over 50 members comprising key participants from the private and public sectors. It is governed by the Digital Luxembourg initiative, together with the Luxembourg Chamber of Commerce and the Chamber of Skilled Trades and Crafts. Throughout the pandemic, thematic digital-skills webinars replaced physical meetings. Key topics of 2020/2021 meetings focused on remote learning and working, AI skills, digitalisation in traditional sectors, 5G, and space technologies. The Digital Skills and Jobs Coalition coordinated a consultation on digital skills and jobs from June to August 2020. Subjects included digital skills and remote working, new models and habits for events and training courses, the state of the market for ICT specialists, and new challenges⁷.

Luxembourg participated in the 2020 EU Code Week⁸, a grassroots movement run by volunteers to encourage people of all ages to discover coding and digital creativity. Despite the pandemic, Luxembourg organised significantly more activities with more participants than in 2019 (149 activities with 3,500 participants in 2020).

To continue improving the population’s digital-skills level and to tackle the shortage of ICT specialists, it is critical to continue working on the initiatives detailed above and encourage companies to provide targeted ICT training to their employees.

Human capital in Luxembourg’s Recovery and Resilience Plan

The component ‘skilling, reskilling and upskilling’ is part of the government’s general policy for digital inclusion, namely the process of narrowing the digital divide by including all people in the digital transformation of society and making digital skills accessible to everyone. The training courses planned under the Future skills and Digital Skills projects include courses at different degrees of difficulty in order to cater for different levels of digital skills and ensure equal access to public administration services for all, including people with low digital skills and older people.

The health crisis caused by the COVID-19 pandemic is significantly disrupting the Luxembourg economy, with a severe impact on businesses but also on the employment market. Continuing training is crucial for mobilising the potential of human capital and thus promoting long-term economic growth. In an environment of social distancing as a result of the pandemic, training centres are offering e-learning courses in order to be more flexible, allowing employees to have access to training at any time. Under Future Skills, the courses are expected to attract mainly job seekers aged 45 and above, to help reduce the widespread early retirements and to improve

³ <https://www.edumedia.lu/>

⁴ <https://www.competence.lu>

⁵ <https://KI-Campus.org>

⁶ <https://www.elementsofai.com/lu/>

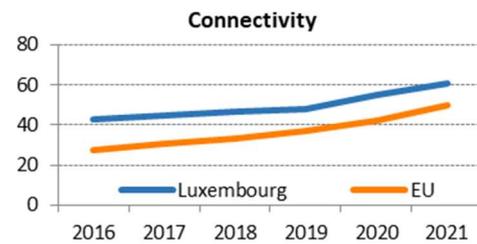
⁷ https://www.digitalcoalition.lu/wp-content/uploads/2020/09/Consultation-results-Digital_Skills_and_Jobs.pdf

⁸ <https://codeweek.eu>

skills. The contents generated by the programme shall be put at the disposal of a larger population of job seekers over a longer time horizon. Under Digital Skills, all employees placed on short-time work schemes between January and March 2021 may have access to e-learning courses of digital skills. Using vouchers worth up to EUR 500, they may choose from among basic and intermediary courses.

2 Connectivity

2 Connectivity	Luxembourg		EU
	rank	score	score
DESI 2021	4	61.0	50.2



	Luxembourg			EU
	DESI 2019	DESI 2020	DESI 2021	DESI 2021
2a1 Overall fixed broadband take-up % households	88% 2018	91% 2019	88% 2020	77% 2020
2a2 At least 100 Mbps fixed broadband take-up % households	33% 2018	45% 2019	53% 2020	34% 2020
2a3 At least 1 Gbps take-up % households	NA	0.46% 2019	1.80% 2020	1.3% 2020
2b1 Fast broadband (NGA) coverage % households	98% 2018	98% 2019	99% 2020	87% 2020
2b2 Fixed Very High Capacity Network (VHCN) coverage % households	63% 2018	92% 2019	95% 2020	59% 2020
2c1 4G coverage % populated areas	98.7% 2018	99.8% 2019	99.8% 2020	99.7% 2020
2c2 5G readiness Assigned spectrum as a % of total harmonised 5G spectrum	0% 2019	0% 2020	61% 2021	51% 2021
2c3 5G coverage % populated areas	NA	NA	0% 2020	14% 2020
2c4 Mobile broadband take-up % individuals	81% 2018	84% 2019	84% 2019	71% 2019
2d1 Broadband price index Score (0-100)	NA	71 2019	72 2020	69 2020

Luxembourg is almost fully covered by fast fixed broadband networks and also has very good coverage of very high-capacity networks (VHCNs), with 72.1% coverage of fibre to the premises and 88.9% of Docsis 3.1. Thanks to the wide availability of VHCNs, Luxembourg performs very well in the take-up of fixed broadband services and 53% of households have opted for speeds of 100 Mbps and above. The take-up of 1 Gbps services is however very low, albeit higher than the EU average. Broadband services (based on representative baskets of fixed, mobile, and converged broadband offers, adjusted for national household income levels) are slightly more affordable compared to the EU average.

In Luxembourg, 44% of the total 2,090 MHz spectrum harmonised at EU level for wireless broadband has been assigned. Luxembourg scores 61% on the 5G readiness indicator, as by the end of 2020 there were 60 MHz available in the 700 MHz band and 330 MHz in the 3.6 GHz band. 4G coverage stood at 99.8%. 5G services were commercially launched in the second half of 2020, so at mid-2020, 5G coverage still stood at 0%.

The national broadband strategy is currently being updated to align national targets with the EU 2025 gigabit targets. The focus is on ensuring that private investment is sufficient to fulfil the objectives for 2025. Under the new strategy, the situation will be reassessed in around 2022, and by then public-funding mechanisms could be established if necessary. This might include EU support for projects

(under CEF 2). The priority would be to cover the single-digit percentage of the population that does not currently have access to 100 Mbps, preventing a digital divide.

Luxembourg continues to be well on track to meet the EU broadband targets. Despite there being no public funding for broadband roll-out, the 100% state-owned incumbent operator POST is the only significant contributor to fibre roll-out. At the same time, cable operators are investing in the upgrade of their networks to DOCSIS 3.1 technologies. Given the good coverage of fibre to the premises, further roll-out is aimed at households nationwide that do not have fibre connections. POST had a 5.3% increase in the total number of new connections in 2020 compared to 2019, the increase being particularly significant in rural areas (53%).

In July 2020 the national regulatory authority 'Institut Luxembourgeois de Régulation' (ILR) held the spectrum auction for the 700MHz and 3.6 GHz bands. The auction lasted 5 days and demand was higher than anticipated. For the 700 MHz band, there was enough spectrum available for all participating bidders. In the 3.6 GHz band, there were five bidders, four of which successfully obtained spectrum. As a result of the auction there was a new market entrant, Luxembourg Online, which acquired a small (10 MHz) portion in the 3.6 GHz band. Electromagnetic field (EMF) strength requirements are a limiting factor for roll-out and use of 5G radio-access infrastructure. A public consultation on the 26 GHz was launched in October 2020. From the contributions, it was concluded that there was no demand and the ministry decided in March 2021 not to launch assignments at that juncture.

Main market & regulatory developments

In 2020, telecommunications market revenue⁹ stood at EUR 567.6 million and decreased very slightly by 0.1%. Investment increased by 14.6% compared to 2019, standing at EUR 91.7 million in 2020; it focused on the fixed network (EUR 67.7 million, up by 31.2%) while it decreased in the mobile network (EUR 24 million, down by 15.5%). 64.3% of the overall investment is made by POST.

The market share of POST in the fixed internet access market diminished very slightly by 0.2% compared to its competitors Luxembourg Online and Proximus and stood at 62.1% in 2020. On the mobile market, market shares in SIM cards of the three main operators showed no substantial changes. Alternative operators LUX Mobile and MTX gained slightly at the expense of POST, which had a market share of 44.4% in 2020¹⁰ for pre- and post-paid mobile subscriptions. The number of M2M SIM cards decreased for the second consecutive year, standing at 74,000, which is below the 2016 figure.

As for the business market, 14.3% of internet subscriptions in Luxembourg are by enterprises, accounting for a revenue of EUR 40.1 million. The revenue in the business market for data transmission increased by 12.6% and stood at EUR 61.5 million in 2020.

At the beginning of the lockdown in mid-March 2020, fixed networks experienced a sudden increase in demand for telephony services (between 40% and 50%; mobile voice minutes increased by only 30-40%). The use of SMS decreased by about 30%. Most notably, the number of mobile subscriptions fell sharply, by more than 60%¹¹. During the pandemic, the increase in demand of professional clients was twice that of residential clients.

⁹ <https://assets.ilr.lu/telecom/Documents/ILRLU-1461723625-872.pdf>

¹⁰ <https://assets.ilr.lu/telecom/Documents/ILRLU-1461723625-872.pdf>

¹¹ <https://assets.ilr.lu/telecom/Documents/ILRLU-1461723625-856.pdf>

In the fixed access market, Eltrona, one of the two Luxembourg cable operators, took over – through a merger – the business of the second cable operator SFR-Coditel. At the same time, the POST group, a shareholder in Eltrona since 1998, decided to sell its 34% holding to the Flanders-based company Telenet. The shareholders in Eltrona will hold 50% +1 share and Telenet 50% -1 of the merged entity.

On 4 February 2021, the Commission opened infringement procedures against 24 Member States for failing to enact new EU telecom rules, more specifically the European Electronic Communications Code (EECC), and the Commission sent Luxembourg a letter of formal notice. Luxembourg's law No 7632 will implement the EECC and is based closely on the text of the Directive. It was under discussion in parliament in April 2021 and is not yet adopted.

The wholesale price for unbundled fibre access, which is regulated through an economic replicability test approach, increased from EUR 18 per month to EUR 19 per month.

In July 2020, ILR updated the rules for the economic replicability test.

Regarding the markets for terminating segments of leased lines (market 4 of the 2014 Decision on relevant markets), in October 2020, ILR finalised the market analysis and identified an operator with significant market power along with its obligations. In the same month, ILR notified new prices for this market, based on a bottom-up long-run incremental cost-plus model. The Commission commented on the use by ILR of the weighted average cost of capital value.¹² It was also working on a new analysis of the markets for fixed and mobile termination (markets 1, 2 and 4 of the 2014 Decision on relevant markets).

The ILR commissioned a study on the national numbering plan.

Luxembourg communicated its roadmap¹³ to implement the Connectivity Toolbox¹⁴. In March 2020, the government adopted a strategy to adapt to the effects of climate change in Luxembourg. One component is a consultation of datacentre and telecommunications operators to analyse risks and measures taken to adapt to more extreme weather conditions.

The Checkmynet.lu tool measures the performance and quality of internet access services for end users and is free of charge. If a consumer finds the measured bandwidth to be lower than the one contracted, they can contact their provider; if they do not receive a reply or the reply is unsatisfactory, the consumer can use ILR's mediation service free of charge. Between the second quarter of 2018 and the first quarter of 2021, the average download speed increased by more than 110% for fixed subscriptions and by 245% for mobile subscriptions, and upload speeds over local area networks (LAN), including wireless LAN, increased by almost 70 Mbit/s. The share of measured fixed download speeds above 100 Mbit/s increased from 14% in 2018 to 28% in 2021¹⁵.

In 2020 there was a decrease in consumer complaints. Complaints concerned contract terms and contract termination (35%); quality of service, disturbances & installation (30%); billing (26%); premium services (9%) and bundled services (29%).

Luxembourg continues to improve in roll-out and uptake of fibre networks, also addressing the digital divide. Conditions for 5G roll-out have been improved by the significant spectrum assignments in the

¹² ILR updated this value in June 2021.

¹³ <https://digital-strategy.ec.europa.eu/en/library/connectivity-toolbox-member-states-develop-and-share-roadmaps-toolbox-implementation>

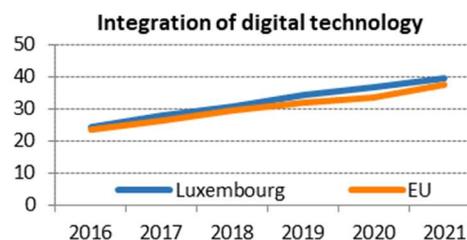
¹⁴ <https://digital-strategy.ec.europa.eu/en/news/connectivity-toolbox-member-states-agree-best-practices-boost-timely-deployment-5g-and-fibre-0>

¹⁵ <https://assets.ilr.lu/telecom/Documents/ILRLU-1461723625-871.pdf>

700 and 3.6 GHz bands. Framing a strategy to streamline permit procedures and facilitate access to public property to extend and densify mobile networks would further stimulate and accelerate the roll-out of both fixed and mobile infrastructure.

3 Integration of digital technology

3 Integration of digital technology	Luxembourg		EU
	rank	score	score
DESI 2021	14	39.4	37.6



	Luxembourg			EU
	DESI 2019	DESI 2020	DESI 2021	DESI 2021
3a1 SMEs with at least a basic level of digital intensity % SMEs	NA	NA	64%	60%
3b1 Electronic information sharing % enterprises	41%	41%	41%	36%
3b2 Social media % enterprises	20%	29%	29%	23%
3b3 Big data % enterprises	16%	16%	19%	14%
3b4 Cloud % enterprises	16%	16%	23%	26%
3b5 AI % enterprises	NA	NA	32%	25%
3b6 ICT for environmental sustainability % enterprises having medium/high intensity of green action through ICT	NA	NA	80%	66%
3b7 e-Invoices % enterprises	16%	16%	14%	32%
3c1 SMEs selling online % SMEs	12%	9%	9%	17%
3c2 e-Commerce turnover % SME turnover	NA	NA	NA	12%
3c3 Selling online cross-border % SMEs	8%	8%	8%	8%

On the integration of digital technology by businesses, Luxembourg ranks 14th. Consistent with the country's ambition to make the transition to a data-driven economy, Luxembourg has made major progress in the uptake of digital innovation. In particular, it performs well on the share of companies that analyse big data (19% versus the EU average of 14%, ranking 9th). A high share of companies (41% versus the EU average of 36%) uses enterprise resource planning software to share information between different functional areas such as accounting, planning, production and marketing. By contrast, Luxembourg continues to perform well below the EU average on the share of SMEs selling online, with only 9% compared to the EU average of 17%. Furthermore, only 8% of SMEs sell online to other EU countries.

Luxembourg is committed to fully engaging at European level on digital technology. It is a member of the Euro High Performance Computing (Euro HPC) Joint Undertaking¹⁶. The government invested in a High Performance Computer as a key infrastructure necessary for a data-driven economy. In 2019 it signed the declaration creating a European Blockchain Partnership¹⁷ and in 2020 the Ministry for Digitalisation and the Government IT Centre launched a national public-sector blockchain, operated

¹⁶ <https://ec.europa.eu/digital-single-market/en/eurohpc-joint-undertaking>

¹⁷ <https://ec.europa.eu/digital-single-market/en/news/european-countries-join-blockchain-partnership>

by a series of public-sector bodies at central government and municipality level. This project offers new capabilities to all public-sector bodies. Also in 2019, Luxembourg signed the declaration on cooperation on AI.

The Ministry for Digitalisation identified demand for dedicated AI computing infrastructure which could not be provided through offers in public clouds. In view of the integrity and confidentiality of the data, as well as the type of processing and the type of applications, the existing GovCloud infrastructure was upgraded to service the AI computer needs of the public administration.

The law on electronic invoicing in public procurement and concession contracts¹⁸ was approved on 26 March 2019. It aims to improve companies' productivity and increase private sector competitiveness, and to work towards a more efficient public administration. For all electronic invoices issued under a public or concession contract, the law establishes an obligation for contracting authorities and contracting entities to accept and process them in electronic form, provided they comply with the European standard on electronic invoicing and with one of the syntaxes on the list published by the European Commission.

The Fit4Digital¹⁹ initiative helps Luxembourg-based SMEs benefit from digital tools by leveraging knowledge from digitalisation experts and receive financial support. Fit4Digital is a public-private partnership operated by the Luxembourg innovation agency 'Luxinnovation'²⁰ and the Luxembourg Ministry of the Economy, while the digitalisation experts are private firms. These experts – referred to as 'Fit4Digital consultants' – are chosen and accredited by Luxinnovation.

In June 2021, the Ministry of the Economy published a roadmap called 'Ons Wirtschaft vu muer' to support the transformation of the Luxembourg economy by 2025. In response to the COVID-19 pandemic and the vulnerabilities it has revealed, the roadmap proposes a vision and a way forward for the coming years. The roadmap further accelerates the green transition and digital transformation of Luxembourg's economy and society and provides for six short-term pilot measures to provide rapid strategic support for Luxembourg's industrial fabric, including the creation of a national technological platform for the exchange, processing, and governance of data to position Luxembourg among the pioneers of the data economy. The platform makes available an inventory of data to private or public operators, specifying the respective conditions of access and use and protecting privacy and intellectual property. The implementation of data-set interoperability standards and a range of tools and services for this data platform facilitate the users' access to the value chain of the data economy²¹.

Luxembourg is implementing large and diverse initiatives and projects on the integration of digital technologies. It is important that these programmes which are first targeted at the government sector will ensure that in the long run they help attract private international investment, companies and skills.

Highlight 2020-2021: Luxembourg's participation in the EuroHPC initiative

Luxembourg is a founding member of the European High Performance Computing Joint Undertaking set up with the aim of developing a world-class pan-European infrastructure of supercomputers. The new Luxembourg supercomputer Meluxina, hosted in the data centre of LuxConnect in Bissen, has been fully operational since June 2021. It will provide leading-edge HPC

¹⁸ <http://legilux.public.lu/eli/etat/leg/loi/2019/05/16/a345/jo>

¹⁹ <https://www.luxinnovation.lu/innovate-in-luxembourg/performance-programmes/fit-4-digital/>

²⁰ <https://www.luxinnovation.lu/>

²¹ https://meco.gouvernement.lu/fr/actualites.gouvernement%2Bfr%2Bactualites%2Btoutes_actualites%2Bcommunes%2B2021%2B06-juin%2B21-fayot-wirtschaft-muer.html

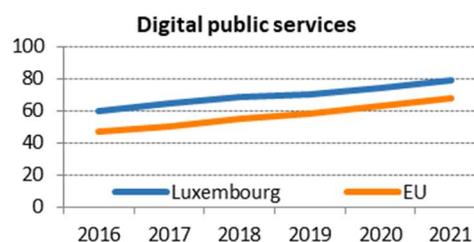
infrastructures and services to a wide range of users, including SMEs. As part of the EuroHPC network, Meluxina will deliver a peak performance of more than 10 Petaflops/second of computing power. Meluxina will be one of the five petascale supercomputers designed to upgrade Europe's computing power to go operational in 2021.

Integration of digital technology in Luxembourg's Recovery and Resilience Plan

The use of new digital solutions help to fulfil the government's ambition to strengthen institutional resilience. The establishment of an ultra-secure communication infrastructure based on quantum technology will facilitate the exchange of confidential information within the public and private sectors. The project consists of developing and deploying a national testbed which will be fully integrated into an EU multi-country project and will stimulate the creation of a new ecosystem in Luxembourg. The technology protects communications and data against future attacks, complementing and reinforcing existing technologies and making them more productive for security purposes. Within the EU multi-country project, it is envisaged that Luxembourg will coordinate the space segment, considered to be essential for all connections above 100 km in length.

4 Digital public services

4 Digital public services	Luxembourg		EU
	rank	score	score
DESI 2021	11	79.4	68.1



	Luxembourg			EU
	DESI 2019	DESI 2020	DESI 2021	DESI 2021
4a1 e-Government users % internet users	65%	62%	64%	64%
4a2 Pre-filled forms Score (0 to 100)	NA	NA	68	63
4a3 Digital public services for citizens Score (0 to 100)	NA	NA	90	75
4a4 Digital public services for businesses Score (0 to 100)	NA	NA	97	84
4a5 Open data % maximum score	NA	NA	65%	78%

In Digital public services, Luxembourg has made major progress. It now ranks 11th in the EU, significantly improving its score to more than 11 percentage points higher than the EU average. The country performs particularly well and ranks 3rd in the EU in the provision of digital public services to businesses, scoring 97 out of 100, against the EU average of 84. By contrast, there is an average level of online interaction between public authorities and the public: 64% of individuals used the internet in 2020 to interact with public services. Luxembourg performs above the EU average on pre-filled forms and the number of administrative steps that can be performed online for major life events such as the birth of a child or a move to a new residence. It performs below average on open data, ranking 22nd in the EU.

One of the strategic competence strands of the Ministry for Digitalisation is to strengthen e-government, enabling the transition to a digital government so that it can respond effectively to the needs of society.

The 2021-2025 electronic governance strategy²² developed by the Ministry for Digitalisation and the Government IT Centre (CTIE) establishes the essential elements of the State's successful digital transition in order to provide high-quality digital services.

The overarching objective is to facilitate the transition to an efficient paperless administration and to ensure an IT environment conducive to new ways of working by relying on a central IT partner that is competent, agile and reliable. To this end, the Government IT Centre aims to strengthen its digitalisation services, develop cutting-edge infrastructures and guarantee very high levels of security and reliability. The six principles guiding and supporting the digitalisation of public services are (1) Once Only; (2) Digital by Default; (3) inclusion and accessibility; (4) openness and transparency; (5) reliability and security; (6) interoperability and standardisation.

²² <https://ctie.gouvernement.lu/fr/publications/2021/strategie-gouvernance-electronique-2021-2025.html>

The Guichet.lu portal²³, aimed at both individuals and companies and acting as a single point of contact (SPOC) for interactions with administrative bodies, has seen major updates. The primary objective is to improve the value and quality of electronic services, integrating various administrative formalities in a single internet portal that gathers all relevant procedures, forms and information made available by the State. The interactive portal MyGuichet.lu allows users to: carry out administrative procedures in a simple and transparent manner reusing their personal data from authentic sources; view their personal data held by official bodies; receive electronic documents issued by official bodies (e-delivery); and book appointments with administrative bodies. Users can log in to their personal space with electronic authentication certificates that guarantee secure information exchanges and confidentiality of personal data. In June 2021, around 1,300 administrative procedures were made available online and almost 400 transactional administrative procedures were available to companies and individuals.

In November 2020, the GovTech Lab²⁴ was launched, which aims to accelerate the digitalisation of public services through innovation partnerships.

The Ministry for Digitalisation's central coordination role has the potential to lead to major improvements on digital public administration. The public sector is digitally advanced. Continued work to create further digital public services is essential to complete the process of modernising the public administration.

Highlight 2020-2021: Luxembourg's initiative to validate digital health technologies

The Ministry of the Economy, the National Research Fund (FNR) and Luxinnovation have joined forces to offer a new funding opportunity to companies, research and healthcare organisations seeking to work together to evaluate digital health technologies. A joint call was launched in April 2021 with the goal of developing and validating innovative digital health solutions benefiting the national healthcare system (patients and healthcare professionals, among others). The call aims to provide a financial incentive to stakeholders who have an identified technology / product / solution and have to demonstrate its relevance and benefit for human health. Clinical investigations will be carried out in close collaboration with hospitals or care organisations. FNR will fund the costs of the accredited research organisations in Luxembourg, up to EUR 700,000 per project covering all project-specific costs. The Ministry of the Economy will co-finance costs borne by eligible Luxembourg companies up to EUR 700,000 per project, using the R&D aid scheme. The results of this pilot will be evaluated at the beginning of next year and may lead to a renewal.

Digital public services in Luxembourg's Recovery and Resilience Plan

Measures to digitalise public administration set out in the RRP include: (1) establishing and making operational a platform for the electronic management of documents and document exchanges of public administrations; (2) extending an existing e-government platform to allow for virtual appointments with the public administration; (3) implementing 12 new online services to expand the digital offer to people and business; (4) establishing and making operational a platform for electronic management of public consultations and surveys; and (5) improving an existing electronic system for customer management of public employment and labour-market administration.

²³ <https://guichet.public.lu/english.html>

²⁴ <https://govtechlab.public.lu/en.html>