

DIGITAL ECONOMY AND SOCIETY IN CATALONIA

DESI 2022



**Generalitat
de Catalunya**

**CERCLE
TECNOLÒGIC**

SUMMARY

The European Commission has been monitoring Member States' digital progress since 2014, and publishes an annual report on the Digital Economy and Society Index (DESI).

This work presents the results of the fourth edition of the DESI calculated for Catalonia, corresponding to the year 2022, in accordance with the methodology of the European Commission. It has been prepared by the Cercle Tecnològic de Catalunya.

As in the previous three editions, the study also analyzes the comparison of the Catalan reality with the member states of the European Union according to the different levels of the index.

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1. PRESENTATION

This report presents the DESI or Digital Economy and Society Index in Catalonia 2022, following the same structure as last year's report corresponding to DESI Catalonia 2021.

Starting from the final DESI value, the presentation of results follows an order from more global/aggregate to more specific, that is, first the dimensions are described and in a second section, the sub-dimensions and indicators¹. The results at the level of dimensions are shown with graphs that allow us to locate the position of Catalonia in relation to the set of states of the EU-27, while for the levels of sub-dimensions and indicators, the results are shown in table form with the aim to present the most detailed and synthesized information. The values that are taken as reference for the comparison in the tables are that of Spain, that of the leading state, and the average of the EU-27. In addition, the evolution of all the indicators for the period 2020-2022 is also shown.

The Commission has aligned the DESI to the four cardinal points established in the Commission proposal taking into account the [political program "Path to the Digital Decade"](#), which is being negotiated in the European Parliament and council. The proposal sets EU-wide targets to be achieved by 2030 in order to reach a global and sustainable digital transformation in all sectors of the economy. Eleven of the 2022 DESI indicators measure targets are laid out in *the Digital Decade*. In the future, DESI will further align with *the Digital Decade* so that all its objectives are addressed in the reports.

The structure of DESI 2022 is very similar to that of DESI 2021: the same 4 dimensions (Human capital, Connectivity, Integration of Digital technology and Digital Public Services) and the 10 sub-dimensions are maintained. The number of indicators are still 33, although one has been eliminated and one has been added, and the calculation methodology of some of them has also been modified.

As a result of these changes it has been necessary to once again calculate the DESI index values of the previous years applying methodological changes from 2022 in order to carry out the analysis of the 2020-2022 evolution that is presented at the end of this report.

For additional information, see the DESI project [website](#).

¹ 1 See the appendix for detailed information on the structure and composition of DESI 2022.

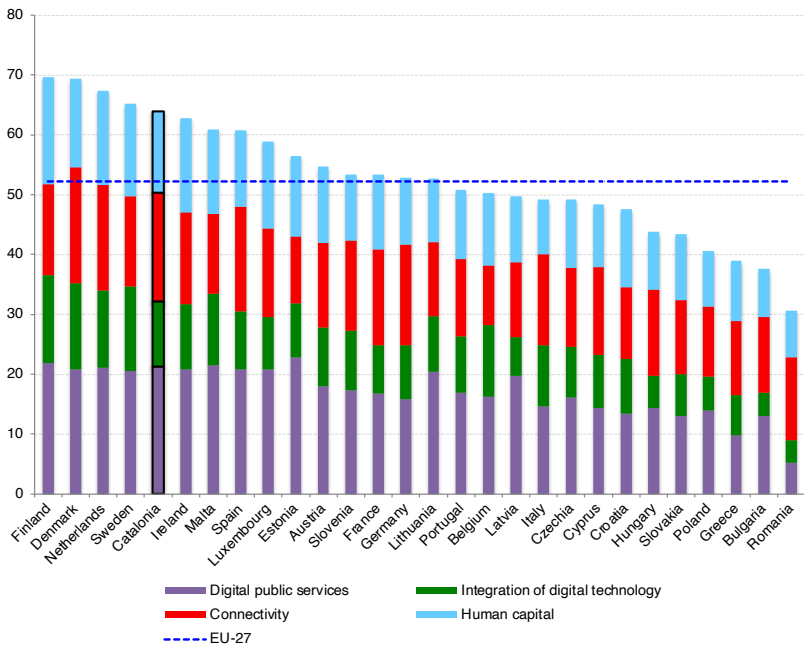
2. DIGITALIZATION IN CATALONIA 2022

2.1 DESI Index 2022

The DESI index makes it possible to measure the level of digitization of the economy and society of a territory. In 2022, Catalonia reached 63.96%, putting it in fifth place in the ranking that groups the states of the EU-27. The mean value of these states is 52.27%.

As can be seen in Graph 1, which shows the DESI value of each state broken down into the four dimensions, the leading state is Finland (69.59%), followed by Denmark (69.33%), the Netherlands (67, 37%) and Sweden (65.22%). Catalonia is, along with Ireland (62.74%), among the leading states.

Graph 1: DESI 2022 (%)



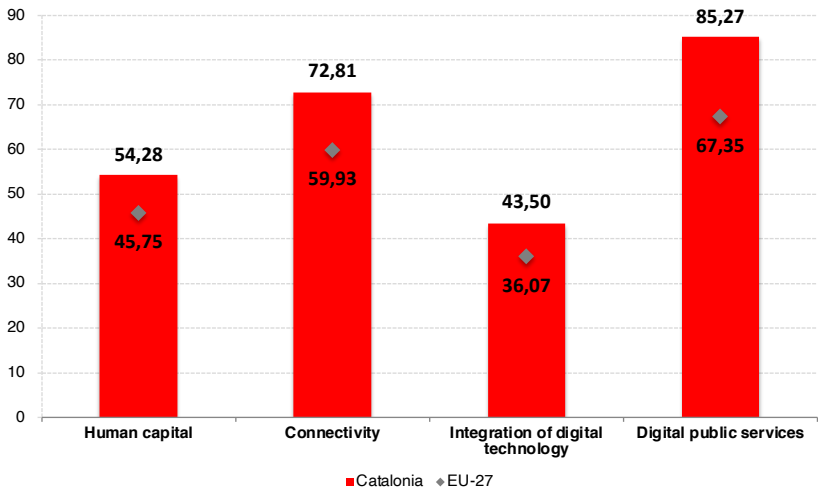
Source: EUROSTAT ¹, IDESCAT, CNMC, SETID, Own questionnaires

¹Refers to data from the EU-27 states. Applies to all graphs and tables in the document.

2.2 Dimensions

Graph 2 shows the DESI dimensions based on the score in each section as it related to the EU-27 average. Catalonia is very well positioned, and, as in previous years, it maintains levels that exceed the EU-27 average in all four dimensions. The convergence towards the leading countries is well established, especially in Connectivity and Digital Public Services, and with quite positive results in Human Capital and Integration of Digital Technology in companies.

Graph 2: Dimensions DESI 2022 Catalonia (%)



Source: EUROSTAT, IDESCAT, CNMC, SETID, Own questionnaires

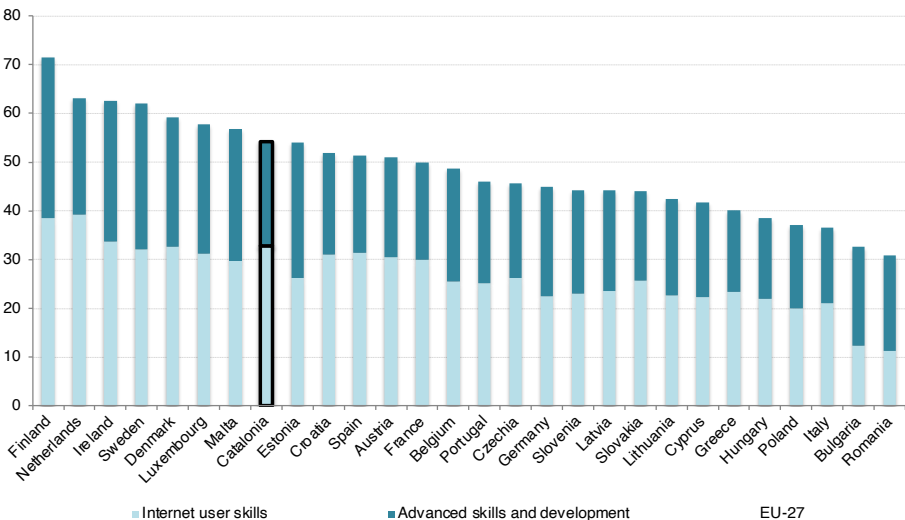
The following section details the results of the four dimensions along with those of their respective sub-dimensions, considering the states as a whole and placing Catalonia in its corresponding position in the ranking. The average value of the EU-27 of each dimension is also included.

2.2.1 Human capital

This dimension includes two sub-dimensions: Internet user skills and Advanced skills and development. The first sub-dimension refers to the ability of citizens to use digital products and services, while the second one is related to the ability to produce these products and services. Catalonia holds the eighth position here, and despite having obtained better results than in previous years, its relative position has fallen one place.

Catalonia has obtained a score of 54.28% in Human capital for digitization, a dimension in which Finland (71.39%), the Netherlands (63.13%), Ireland (62.64%) and Sweden (61.98%) hold the top positions.

Graph 3: Human capital (%)

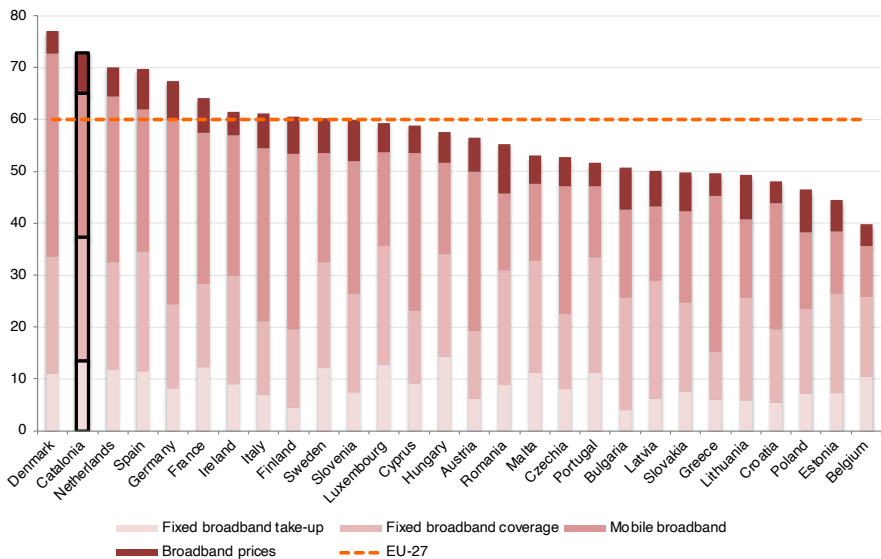


Source: EUROSTAT, IDESCAT

2.2.2 Connectivity

This dimension¹ includes four sub-dimensions: Fixed broadband take-up, Fixed broadband coverage, Mobile broadband and Broadband prices. This is the dimension where Catalonia gets its highest rank holding the second position among the States of the UE-27, with a score of 72.80%, just below Denmark (77.09%) and above the Netherlands (70.09%). Therefore, Catalonia maintains high levels of connectivity in relation to the group of EU states.

Graph 4: Connectivity (%)



Source: EUROSTAT, IDESCAT, CNMC, SETID

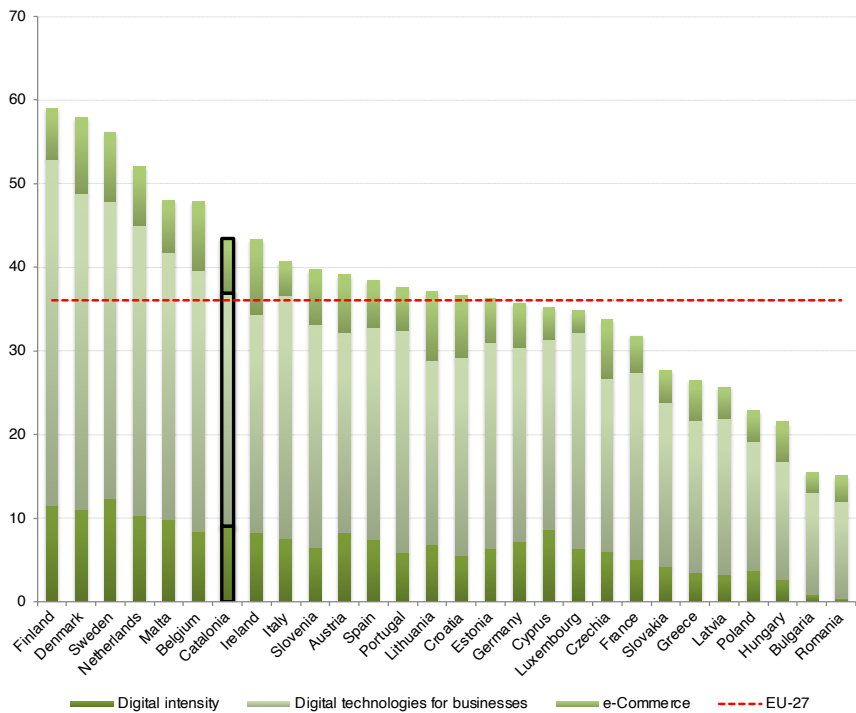
¹ In DESI 2022, in the Connectivity dimension, an indicator (4G Coverage) has been eliminated and a new one has been added (Fibre to the premises coverage (FTTP)). The rest of the indicators remain the same as in DESI 2021. For more detailed information, see the methodological note.

2.2.3 Integration of digital technology

This dimension includes three sub-dimensions: Digital Intensity, Digital technologies for businesses and e-Commerce. The first sub-dimension refers to the number of technologies adopted by the SMEs; the second one considers the acquisition of a series of technologies by companies (Big Data, Cloud, AI...); and the third sub-dimension is related to online sales from SMEs.

In relation to the Integration of digital technology in companies, Catalonia obtained a value of 43.50%, coming in seventh position and with a clear advantage over the European average, which has a value of 36.07%. Finland (59.09%), Denmark (57.99%), Sweden (56.07%), Netherlands (52.07%), Malta (48.07%), Belgium (47.99%), Ireland (43.50%), Italy (40.07%), Slovenia (39.99%), Austria (39.07%), Spain (38.99%), Portugal (37.99%), Lithuania (37.07%), Croatia (36.99%), Estonia (36.99%), Germany (35.99%), Cyprus (35.07%), Luxembourg (34.99%), Czechia (33.99%), France (32.99%), Slovakia (28.07%), Greece (26.99%), Latvia (25.99%), Poland (23.99%), Hungary (21.99%), Bulgaria (15.99%), Romania (15.07%).

Graph 5: Integration of digital technology(%)



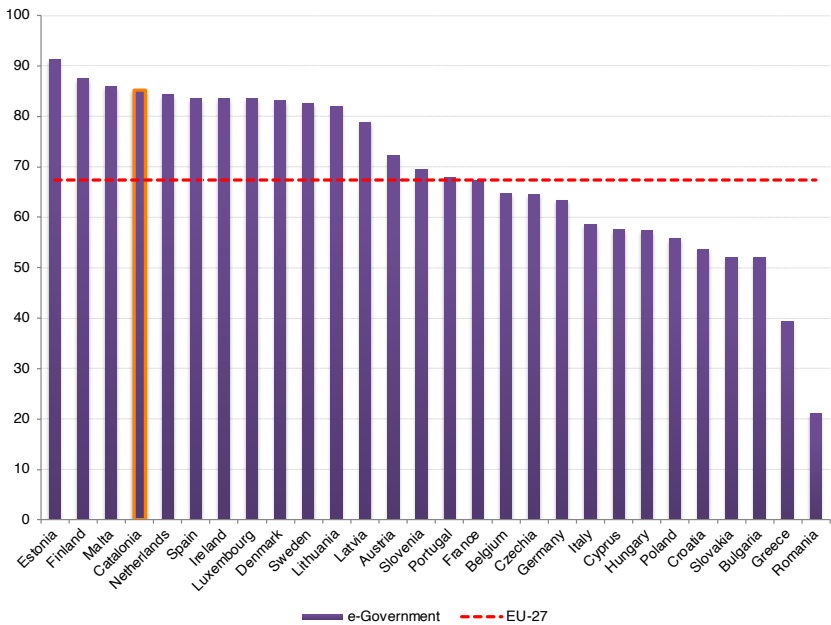
Source: EUROSTAT, IDESCAT, Own questionnaires

2.2.4 Digital Public Services

The digitization of Public Administrations considers a single sub-dimension, related to e-Government. This is the second dimension, alongside the Connectivity dimension, where Catalonia reaches a more prominent position.

Overall, digital public services in Catalonia achieve high marks (85.27%) compared to the EU-27 average (67.34%), which places it in fourth position. The leading states are Estonia (91.18%), Finland (87.36%) and Malta (85.80%).

Graph 6: Digital public services (%)



Source: EUROSTAT, IDESCAT, Own questionnaires

2.3 Sub-dimensions and indicators

The following sections present the sub-dimensions and indicators of each of the dimensions. The analysis includes both the value of the sub-dimension or indicator for Catalonia and the position it currently holds, as well as the corresponding values for Spain, the state with the best result, and the EU-27 average.

2.3.1 Human capital

The following sections present the sub-dimensions and indicators of each of the dimensions. The analysis includes both the value of the sub-dimension or indicator for Catalonia and the position it occupies, as well as the corresponding values for Spain, the state with the best result, and the EU-27 average.

Table 1: Comparison of sub-dimension of Human capital (%)

Dimension 1 Human capital	Catalonia		Spain	Leader	UE-27
	Score	Position	Score	Score	Score
1a Internet user skills	65.80	4	62.67	78.53	50.70
1b Advanced skills and development	42.75	11	39.97	65.65	34.29

Source: EUROSTAT, IDESCAT

Both sub-dimensions include various indicators that measure, on the one hand, the digital skills of citizens in general and, on the other, those of the labor force. Catalonia obtains better results in Internet user skills than in Advanced skills and development, ranking above the EU-27 average in both cases. Table 2 shows the results of the Human capital indicators.

The first two indicators of Internet user skills refer to different levels (at least basic and above basic), in digital skills related to information, communication, problem solving, the use of software to create content and security. The third indicator refers to the skills specifically related to the use of software for the creation of digital content, and considers a basic or above basic level.

Catalonia is above the EU-27 average in all three indicators and holds the fourth position in digital skills above the basic level. In the other two indicators, it takes the fifth position. The indicator that refers to at least basic level digital skills has twice the weight of the other two for the purpose of weighing their contribution to the sub-dimension.

Regarding the four Advanced Skills and Development indicators, Catalonia obtains its lowest positions. In contrast, Catalonia has much better results in the employed population specializing in ICT, where Catalonia holds the ninth position. In the other three indicators of this sub-dimension, Catalonia occupies positions quite far behind the leading states. In any case, Catalonia's results are above the EU-27 average.

In this sub-dimension, the indicators ICT specialists and female ICT specialists weigh twice as much as the other two.

Table 2: Comparison of indicators of Human capital (%)

Dimension 1 Human capital	Catalonia		Spain	Leader	UE-27
	Score	Position	Score	Score	Score
1a1 At least basic digital skills	67,09	5	64,16	79,18	53,92
1a2 Above basic digital skills	39,00	4	38,06	51,76	26,46
1a3 At least basic content creation skills	77,45	5	73,52	83,34	66,16
1b1 ICT specialists	4,93	9	4,10	8,00	4,50
1b2 Female ICT specialists	19,17	19	19,40	28,2	19,10
1b3 Enterprises providing ICT training	20,75	15	20,12	37,67	19,68
1b4 ICT graduates	4,00	18	4,00	8,60	3,90

Source: EUROSTAT, IDESCAT

2.3.2 Connectivity

Three of the four Connectivity sub-dimensions contain indicators of coverage and implementation of different broadband technologies, both fixed and mobile. The fourth sub-dimension, Broadband prices, measures the prices of a series of packages offered for fixed, mobile broadband and both.

Table 3 presents the scores and positions of each of the sub-dimensions of the dimension related to Connectivity.

Table 3: Comparison of the sub-dimensions of Connectivity (%)

Dimension 2 Connectivity	Catalonia		Spain	Leader	UE-27
	Score	Position	Score	Score	Score
2a Fixed broadband take-up	53,70	2	45,89	57,23	37,15
2b Fixed broadband coverage	95,49	1	92,28	95,49	69,30
2c Mobile Broadband	55,61	10	54,93	78,26	53,93
2d Broadband prices	77,04	6	77,04	95,35	63,53

Source: EUROSTAT, IDESCAT, CNMC, SETID

Catalonia has above-average results in all sub-dimensions. In fixed broadband it holds a advanced position, in both take-up and in coverage, where it is the leader. In mobile broadband it ranks tenth, and in broadband prices sixth.

The weight of each of the sub-dimensions to the dimension is as follows : 25%, 25%, 40% and 10%.

Table 4 shows the results of the indicators for the four sub-dimensions within Connectivity¹.

1 To obtain the indicator At least 100 Mbps fixed broadband take-up (2a2), estimates have been made based on data from Spain (National Commission of Markets and Competition by its Spanish initials: CNMC). For the indicators of fixed broadband take-up of at least 1 Gbps (2a3), 5G spectrum (2c1), and the Broadband Price Index (2d1), Spain's scores have been applied. For more information, see the methodological note.

Table 4: Comparison of indicators of Connectivity (%)

Dimension 2 Connectivity	Catalonia		Spain	Leader	UE-27
	Score	Position	Score	Score	Score
2a1. Overall fixed broadband take-up	86.92	5	82.92	96.97	77.83
2a2. At least 100 Mbps fixed broadband take-up	87.25	1	71.80	87.25	40.60
2a3. At least 1 Gbps take-up	0.01	22	0.01	26.75	7.58
2b1. Fast broadband coverage (NGA)	96.95	8	94.39	100	90.13
2b2. Fixed very high capacity network (VHCN) coverage	96.06	2	93.84	100	70.20
2b3. Fibre to Premises (FTTP) coverage	93.89	1	88.92	93.89	49.95
2c1. 5G spectrum	65.00	12	65.00	100	56.07
2c2. 5G coverage	59.57	11	58.89	99.72	65.78
2c3. Mobile broadband take-up	95.46	5	93.89	98.39	86.53
1d1. Broadband price index	82.78	6	82.78	96.52	72.65

Source: EUROSTAT, IDESCAT, CNMC, SETID

Catalonia has scores higher than the EU-27 average in all the indicators related to the Connectivity dimension, except for Fixed broadband take-up of at least 1 Gbps and 5G coverage. Its leadership in Fixed Broadband take-up of at least 100 Mbps and Fibre to premises coverage (FTTP) stands out, as well as its second position in Fixed Very High Capacity Network Coverage (VHCN).

All the indicators have the same weight in the respective sub-dimension, except Fixed Very High Capacity Network (VHCN) Coverage and 5G Coverage, which weigh twice as much.

2.3.3 Integration of digital technology

The dimension of Integration of digital technology in companies is broken down into three sub-dimensions, one relative to the number of technologies adopted by SMEs, another that refers to the current degree of digitalization existing in companies and the third on e-commerce of SMEs.

The first sub-dimension has a single indicator, and has a weight of 15%; the second has seven indicators, three of them with twice the weight of the other four, and a relative weight over the dimension of 70%. The third is made up of three indicators, with the same weight, and contributes 15%.

Table 5 shows the scores and position of Catalonia in each of these sub-dimensions.

Table 5: Comparison of sub-dimensions de Integration of digital technology(%)

Dimension 3 Integration of Digital Technology	Catalonia		Spain	Leader	UE-27
	Score	Position	Score	Score	Score
3a Digital intensity	60,56	6	49,60	82,57	43,57
3b Digital technologies for businesses	39,85	8	36,24	59,10	34,55
3c e-Commerce	43,46	11	38,21	61,63	35,70

Source: EUROSTAT, IDESCAT, Own questionnaires

The most noteworthy position of Catalonia in Integration of digital technology in companies is the one referring to the digital intensity of SMEs, where it ranks sixth. The result in business digitization is also quite remarkable, obtaining eighth place in the ranking. As for the e-commerce of Catalan SMEs, despite not being in a clearly leading position, it does exceed the EU average.

Table 6 shows the results of the indicators.

Table 6: Comparison of indicators of Integration of digital technology(%)

Dimension 3 Integration of Digital Technology	Catalonia		Spain	Leader	UE-27
	Score	Position	Score	Score	Score
3a1 SMEs with at least a basic level of digital intensity	68,45	6	59.68	86.06	54.86
3b1 Electronic information sharing	53.29	2	49.09	57.22	38.09
3b2 Social media	47.64	4	39.28	50.69	29.34
3b3 Big data	10.89	13	8.97	30.05	14.22
3b4 Cloud	35.70	13	27.02	69.17	33.99
3b5 AI	7.97	13	7.66	23.89	7.91
3b6 ICT for environmental sustainability	65.50	14	76.06	85.53	65.89
3b7 e-Invoices	34.07	8	32.84	94.88	32.17
3c1 SMEs selling online	28.04	7	25.40	37.58	18.47
3c2 e-Commerce turnover	10.43	15	9.13	22.28	11.64
3c3 Selling online cross-border	10.68	11	9.04	16.22	8.73

Source: EUROSTAT, IDESCAT, Own questionnaires

The analysis of the indicators of Integration of digital technology in companies shows that Catalonia is above the EU-27 average in all of them, except in Big Data and in ICT for environmental sustainability. It holds the second position in the ranking of electronic information sharing. Despite holding the seventh position in SMEs that sell online, in e-commerce turnover it still has a long way to go, enjoying a slightly better position in electronic cross-border sales.

2.3.4 Digital public services

This dimension includes a single sub-dimension, related to certain services offered digitally by Public Administrations. It is made up of five indicators, two of them with twice the weight of the rest: Digital public services for citizens and for businesses.

Table 7 shows the scores and positions of Catalonia in this sub-dimension.

Table 7: Comparison of sub-dimension of Digital public services (%)

Dimension 4 Digital Public Services	Catalonia		Spain	Leader	EU-27
	Score	Position	Score	Score	Score
4a e-Government	85.27	4	83.52	91.18	67.35

Source: EUROSTAT, IDESCAT, Own questionnaires

Regarding e-Government, public administration in Catalonia is seated in a very good position, especially with regards to digital public services for citizens and businesses with levels of digitalization clearly above the European average except for the Open data indicator. Below, Table 8 details the e-Government indicators.

Table 8: Comparison of digital public services indicators (%)

Dimension 4 Digital Public Services	Catalonia		Spain	Leader	UE-27
	Score	Position	Score	Score	Score
4a1 e-Government users	73.67	15	72.71	93.27	64.84
4a2 Pre-filled forms	81.85	8	78.24	94.32	64.49
4a3 Digital public services for citizens	90.78	4	87.07	99.64	74.63
4a4 Digital public services for businesses	96.80	4	93.63	100	81.71
4a5 Open data	79.83	18	94.73	97.50	81.12

Source: EUROSTAT, IDESCAT, Own questionnaires

2.4 Analysis of results

In DESI 2022, Catalonia maintains the fifth place within the group of EU-27 states, a position it has already obtained in the three previous editions, with a wide margin compared to the EU average. Thus, it can be affirmed that the leading position of Catalonia is well established in the level of digitization of its society and economy.

With regards to Human capital, Catalonia's eighth position is the result, above all, of some notable scores in the Internet user skills sub-dimension, while in Advanced skills and development the results are less noteworthy. While in both sub-dimensions it scores above the EU-27 average, the presence of women ICT specialists in the labor market, enterprises that offer ICT training to their workers, and the number of ICT graduates are in clear need of improvement.

In Connectivity, Catalonia hold the second position, obtaining positive results in almost all its sub-dimensions and indicators, especially in the take-up and coverage of fixed broadband. On the other hand, the take-up of fixed broadband of at least 1Gbps and the assigned 5G spectrum are the ones that obtain the worst results. It should be noted that the scores for these two indicators for Catalonia come from the same scores for Spain, due to the impossibility of obtaining the disaggregated data for Catalonia.

The integration of digital technology in Catalan companies is notable, achieving the seventh position. The good results in digital intensity of SMEs should be highlighted, as well as the adoption of digital technologies in companies in general.

Finally, with regards to Digital Public Services, the digitization of public services in Catalonia allows Public Administrations to achieve a fourth position and presents results above the EU-27 average. The development of e-government stands out, especially with regard to the availability of digital services for citizens and businesses, where Catalonia comes in fourth place in the ranking of the EU-27.

3. EVOLUTION OF DESI CATALONIA 2020-2022

The following section analyzes the temporal evolution of the DESI and its components over the last three years. In order to compare all of the indicators, a work of homogenization has been carried out, for both the methodology applied and the sources consulted. Specifically, the methodological changes incorporated into the DESI of this edition make it necessary to recalculate the scores from previous editions, so that the final scores presented in the following table do not coincide with those obtained last year.

Below are the results of the DESI of Catalonia of the last three editions, both at the level of scores and positions and their respective variations.

Table 9: Comparative Analysis DESI (2020-2022)

	Value					Position				
	2020	2021	2022	Δ 2020-21	Δ 2021-22	2020	2021	2022	Δ 2020-21	Δ 2021-22
DESI	52.81	58.27	63.96	5.46	5.69	5	5	0	0	0
Dimension 1 - Human Capital	53.59	53.77	54.28	0.18	0.51	7	7	8	0	-1
Subdimension 1a - Internet user skills	NP	NP	65.80	NP	NP	NP	NP	4	NP	NP
1a1 - At least basic digital skills	NP	NP	67.09	NP	NP	NP	NP	5	NP	NP
1a2 - Above basic digital skills	NP	NP	39.00	NP	NP	NP	NP	4	NP	NP
1a3 - At least basic digital content creation skills	NP	NP	77.45	NP	NP	NP	NP	5	NP	NP
Subdimension 1b - Advanced skills and development	43.67	43.28	42.75	-0.39	-0.53	8	8	11	0	-3
1b1 - ICT specialists	4.34	4.80	4.93	0.46	0.13	10	9	9	1	0
1b2 - Female ICT specialists	21.94	21.38	19.17	-0.56	-2.21	6	9	19	-3	-10
1b3 - Enterprises providing ICT training	24.26	20.71	20.75	-3.55	0.04	12	15	15	-3	0
1b4 - ICT graduates	3.90	3.68	3.98	-0.22	0.30	15	20	18	-5	2
Dimension 2 - Connectivity	48.30	59.17	72.80	10.87	13.63	1	3	2	-2	1
Subdimension 2a - Fixed broadband take-up	43.83	49.93	53.70	6.10	3.77	4	1	2	3	-1
2a1 - Overall fixed broadband take-up	82.05	86.10	86.92	4.05	0.82	10	6	5	4	1
2a2 - At least 100 Mbps fixed broadband take-up	67.40	77.62	87.25	10.22	9.63	1	1	1	0	0
2a3 - At least 1 Gbps fixed broadband take-up	0.00	0.01	0.01	0.01	0.00	15	18	22	-3	-4
Subdimension 2b - Fixed broadband coverage	90.24	92.26	95.49	2.02	3.23	1	1	1	0	0
2b1 - Fast broadband (NGA) coverage	93.62	94.46	96.95	0.84	2.49	8	9	8	-1	1
2b2 - Fixed very high capacity network (VHCN) coverage	91.11	93.37	96.06	2.26	2.69	4	4	2	0	2
2b3 - Fibre to the premises (FTTP) coverage	87.23	89.70	93.89	2.47	4.19	2	1	1	1	0
Subdimension 2c - Mobile broadband	22.24	34.44	55.61	12.20	21.17	6	6	10	0	-4
2c1 - 5G spectrum	30.00	30.00	65.00	0.00	35.00	10	11	12	-1	-1
2c2 - 5G coverage	NP	12.52	59.57	NP	47.05	NP	7	11	NP	-4
2c3 - Mobile broadband take-up	86.63	86.63	95.46	0.00	8.82	7	7	5	0	2
Subdimension 2d - Broadband prices	35.68	64.03	77.05	28.35	13.02	22	13	6	9	7
2d1 - Broadband price index	51.76	73.03	82.78	21.27	9.75	22	13	6	9	7
Dimension 3 - Integration of digital technology	35.83	39.95	43.50	4.12	3.55	8	8	7	0	1
Subdimension 3a - Digital intensity	NP	NP	60.56	NP	NP	NP	NP	6	NP	NP
3a1 - SMEs with at least a basic level of digital intensity	NP	NP	68.45	NP	NP	NP	NP	6	NP	NP
Subdimension 3b - Digital technologies for businesses	33.87	36.39	39.85	2.52	3.46	8	9	8	-1	1
3b1 - Electronic information sharing	52.37	52.37	53.29	0.00	0.92	2	2	2	0	0
3b2 - Social media	37.01	47.11	47.64	10.10	0.53	6	1	4	5	-3
3b3 - Big data	9.95	7.22	10.89	-2.73	3.67	18	22	13	-4	9
3b4 - Cloud	NP	NP	35.70	NP	NP	NP	NP	13	NP	NP
3b5 - AI	NP	NP	7.97	NP	NP	NP	NP	13	NP	NP
3b6 - ICT for environmental sustainability	NP	65.50	65.50	NP	0.00	NP	14	14	NP	0
3b7 - e-invoices	36.25	34.07	34.07	-2.18	0.00	5	8	8	-3	0
Subdimension 3c - e-Commerce	35.96	43.25	43.46	7.29	0.21	14	9	11	5	-2
3c1 - SMEs selling online	21.06	25.96	28.04	4.90	2.08	10	7	7	3	0
3c2 - e-Commerce turnover	10.47	19.38	19.43	-0.09	0.05	14	14	15	0	-1
3c3 - Selling online cross-border	8.51	11.60	10.68	3.09	-0.92	15	8	11	7	-3
Dimension 4 - Digital public services	73.52	80.18	85.27	6.66	5.09	5	4	4	1	0
Subdimension 4a - e-Government	73.52	80.18	85.27	6.66	5.09	5	4	4	1	0
4a1 - e-Government users	59.46	72.25	73.67	12.79	1.42	20	9	15	11	-6
4a2 - Pre-filled forms	NP	NP	81.85	NP	NP	NP	NP	8	NP	NP
4a3 - Digital public services for citizens	NP	NP	90.78	NP	NP	NP	NP	4	NP	NP
4a4 - Digital public services for businesses	NP	NP	96.80	NP	NP	NP	NP	4	NP	NP
4a5 - Open data	NP	NP	79.83	NP	NP	NP	NP	18	NP	NP

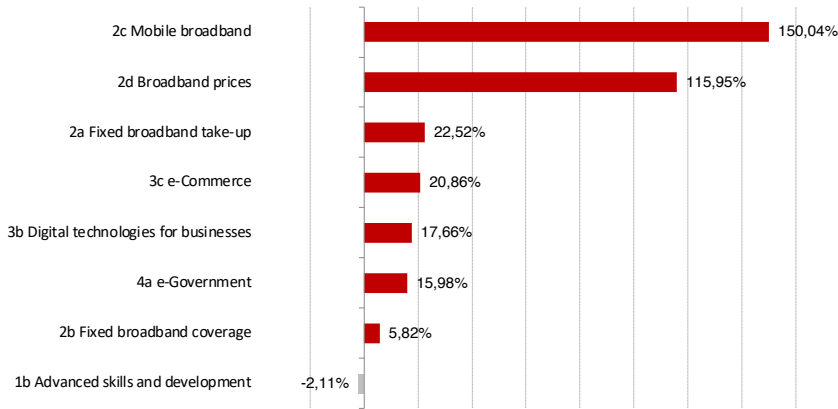
Source: Own elaboration

As can be seen in Table 9, in the DESI 2022 there are some indicators¹ for which the score of previous years is not available and, therefore, its evolution cannot be analyzed. This is due to changes in the DESI methodology, and applies to all EU-27 states.

In DESI 2022, Catalonia has improved its result in the four dimensions compared to DESI 2020. However, this improvement does not always result in a change in positional terms, since position is relative to the results of the EU-27 states. Thus, the position of Catalonia in Human capital and Connectivity has fallen one position compared to DESI 2020; while in Integration of digital technology and Digital public services it has gained a position.

The following Graph presents the sub-dimensions² with their corresponding increase or decrease in the 2020-2022 period.

Graph 7: Evolution of sub-dimensions (2020-2022)



Source: Own elaboration

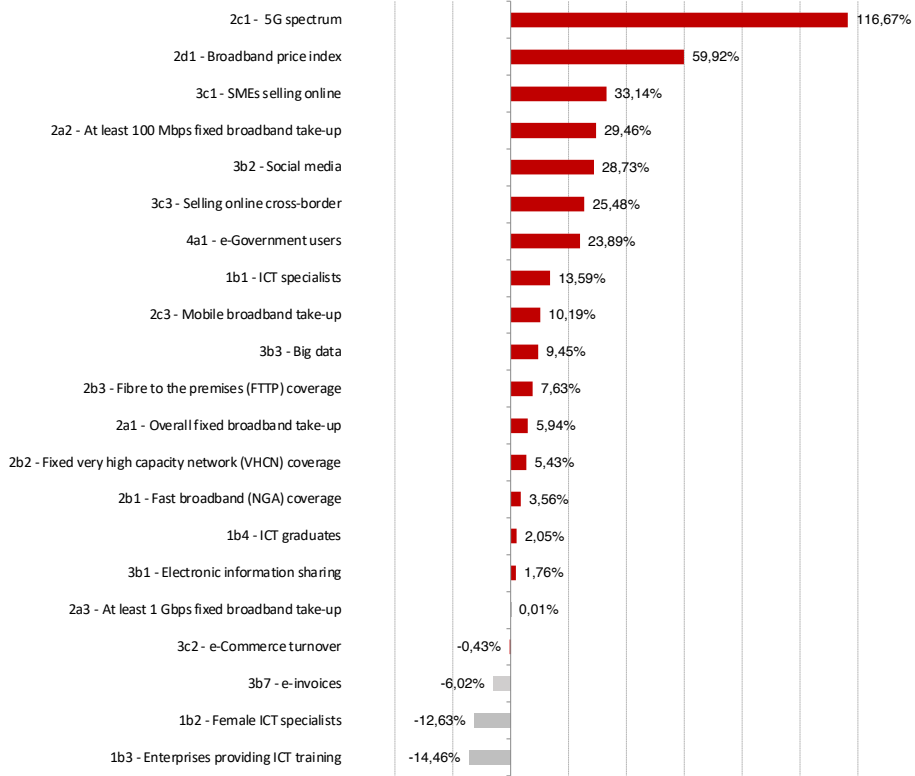
¹ At least basic digital skills; Above basic digital skills; At least basic digital content creation skills; SMEs with at least a the basic level digital intensity, Cloud; AI; ICT for environmental sustainability; Pre-filled forms; Digital public services for citizens; Digital public services for businesses; and Open Data.

² The Internet user skills and Digital intensity sub-dimensions cannot be analyzed as their respective indicators are not available for previous years.

As can be seen, the most notable growth corresponds to the Mobile broadband sub-dimension, followed by Broadband prices. Overall, it is worth noting the fact that there is no sub-dimension that decreases in 2022, except for Advanced skills and development with -2.11%.

Graph 8 lays out the evolution of the indicators for which the scores of previous years are available, and it can be seen how most of the indicators grow in 2022 compared to 2020. Those that decrease the most are those related to the presence of women specialists in ICT and enterprises that provide ICT Training for their workers. At the other extreme, 5G spectrum allocation and the Broadband Price Index show very strong growth.

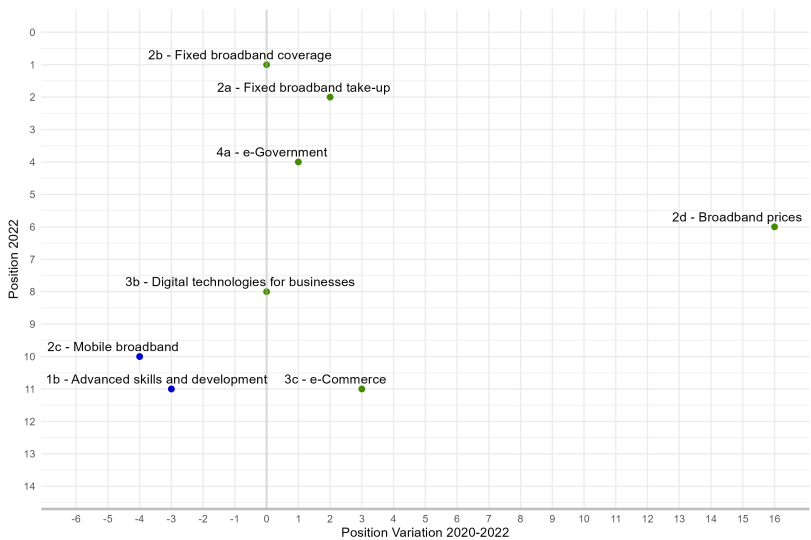
Graph 8: Evolution of indicators (2020-2022)



Source: Own elaboration

Graph 9 analyzes the position of the sub-dimensions, comparing that of 2022 and its evolution with respect to 2020. The horizontal axis represents the increase, decrease or maintenance of positions while the current position is represented on the vertical axis.

Graph 9: Evolution de sub-dimensions (2020-2022)

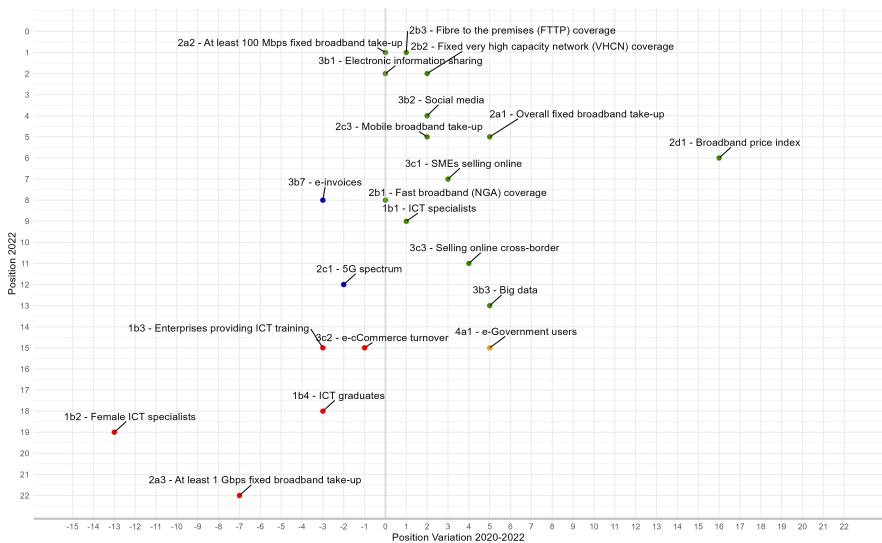


Source: Own elaboration

In this analysis, two groups are differentiated; firstly, in the upper half of the Graph is the group of sub-dimensions with advanced ranking positions (in green) that are maintained (Fixed broadband coverage) or improved (Fixed broadband take-up, e-Government and Broadband prices). In the lower half is the group of sub-dimensions with lower positions that maintain or gain positions (in green, Digital technologies for businesses and Electronic commerce) or that lose positions (in blue, Mobile broadband and Advanced skills and development).

Below in Graph 10 shows the equivalent for indicators.

Graph 10: Evolution of Indicators(2020-2022)

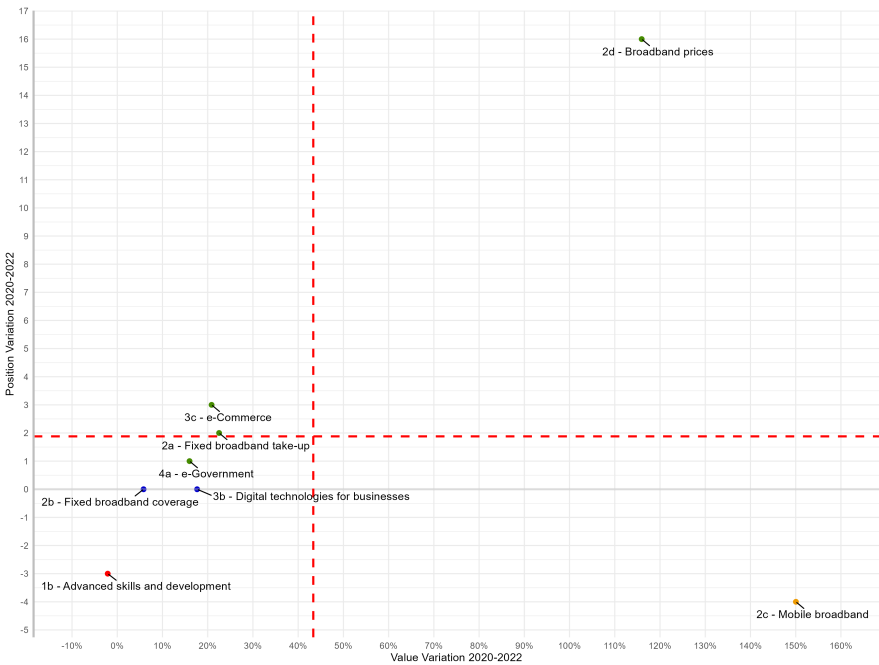


Source: Own elaboration

Regarding the indicators, the differentiation by groups is similar to that of the sub-dimensions but in this case with four groups. On the one hand, there is a first group of indicators with prominent positions that, in addition, improve compared to 2020 (for example, Overall fixed broadband take-up, in green). A second group is made up of the indicators that, despite maintaining advanced positions, fall back in 2022 (as is the case of electronic invoicing, in blue). The third group corresponds to the indicators with more modest positions but that have advanced compared to 2020 (e-Government users, in yellow). The fourth group is made up of the indicators with the lowest position and losing positions (Enterprises that provide ICT training, in red). The indicator that has the most gains in its position is the Broadband Price Index (16) and the one that loses the most, Female ICT specialists (13).

Graph 11 combines the evolution of the score and the position of the sub-dimensions. On the horizontal axis the variation of the sub-dimensions is represented and on the vertical axis the improvement or regression of positions. The horizontal dotted line indicates the average variation of the position of the sub-dimensions (1.85) and the vertical axis, the average variation of the score (43.34%).

Graph 11: Comparison of the evolution of the sub-dimensions and their position (2020-2022)

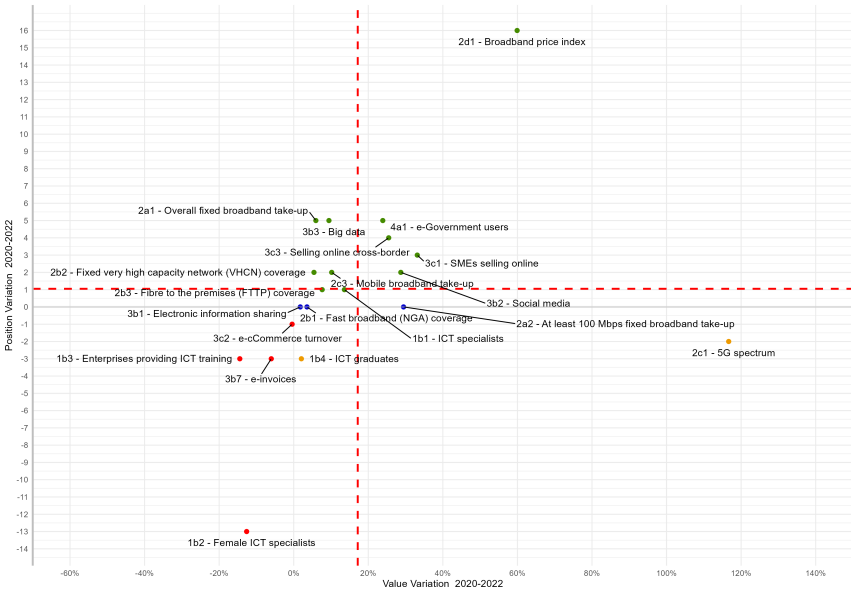


Source: Own elaboration

In green, the sub-dimensions that have increased their score and have improved their position are shown, as is the case of the Broadband prices or Electronic Commerce; in blue are those that maintain the position with respect to 2020 and have grown in score (Digital technologies for businesses), in yellow are those that despite having grown in score regress in position (Mobile broadband) and in red those that regress in position as well as in score (Advanced Skills and Development).

Graph 12 presents the same comparison at the indicator level.

Graph 12: Comparison of the evolution of indicators and their position (2020-2022)



Source: Own elaboration

The analysis of the indicators shows that, in general, most of the indicators that grow in score also improve in position. Of the 22 indicators analyzed, among the 6 that fell in position, there are 4 that also decreased in score; while among the 16 indicators that present positive growth, 11 advance in position, 3 maintain it and 2 regress.

The indicator that grows the most is the 5G spectrum indicator, but it loses two positions. The most important positional improvement corresponds to the Broadband Price Index, with very notable growth as well. On the other hand, the indicator that decreases the most is that of enterprises that provide training in ICT; losing three positions.

With regards to variation with respect to the average score, 7 indicators grow above the average score for all of these (17.16%). The average variation in terms of positions is 1.05.

4. CONCLUSIONS

For the fourth consecutive year, Catalonia maintains the fifth position of digitization in its economy and society, in this edition with an overall score of 63.96%. This outstanding position is supported, especially, by Connectivity and Digital Public Services. Catalonia is ranked a very short distance from the pioneer states in digitization, the so-called "Nordic group" made up of Finland, Denmark, the Netherlands and Sweden. Analyzing the overall performance in the DESI index, it can be seen that Catalonia continues to have a development above the European average in all dimensions, thus consolidating the digital strength of its society and economy.

In DESI 2022, Catalonia has improved in all dimensions, although this increase does not always translate into obtaining a better relative position in all the EU-27 states. Regarding DESI 2021, Catalonia loses one position in Human capital (from seventh to eighth), gains one position in Connectivity and another in Integration of digital technology in companies (in both cases, from eighth to seventh), and maintains fourth position in Digital Public Services.

Thus, Connectivity continues to be a strong point and the basis of the digitalization of Catalonia, and it is the dimension in which it obtains the best position, specifically second, behind Denmark and ahead of the Netherlands. It is worth highlighting the result of fixed broadband, which leads the ranking of EU states, and that of the fixed broadband take up, which wins second position, behind Hungary.

In the Human capital dimension, the digital skills of internet users indicators stand out positively, while the data related to ICT training and employment (especially among women), despite being slightly above the European average, still have a long way to go when compared with the EU-27 states.

Regarding the integration of digital technology, Catalan companies generally show a good level of digitization. All in all, the percentage of billing coming from e-Commerce in small and medium-sized companies seems to have stagnated, both nationally and internationally.

On the other hand, the degree of digitization of the Public Administration in Catalonia has improved year after year. However, in comparison with the other EU-27 states, the users of electronic administration and open data in Catalonia do not hold the top positions.

Ultimately, the analysis of the results of DESI 2022 shows that, in general, Catalonia is progressing in the digital transformation of its society and economy, showing outstanding levels of digitization in all dimensions. However, it is necessary to improve in aspects such as ICT talent and the close the gender gap as well as improvement in the use of certain digital technologies by companies, the volume of business of e-Commerce of SMEs, the use of online procedures by citizens, and open data by the public administration.

5. METODOLOGICAL NOTE

The DESI 2022 methodology (*Digital Economy and Society Index (DESI) 2022. Methodological note*¹) presents some changes compared to DESI 2021. The same four dimensions and ten sub-dimensions are maintained, but some indicators have been modified.

Dimension 1, Human capital, has two sub-dimensions. The three indicators of the first sub-dimension, Internet user skills, come from the *Survey on equipment and use of information and communication technologies in homes*² (Idescat, 2021 data), whose calculation methodology³ has been modified in the DESI 2022. Regarding the second sub-dimension, Advanced skills and development, for the calculation of ICT Specialists (1b1) and Female ICT specialists (1b2), Idescat has calculated the scores, based on data from the active population survey from the INE. Indicator 1b3, Enterprises that provide ICT training, comes from the *Survey on the use of ICT and electronic commerce in companies*⁴ (Idescat, 2020-2021 data). Finally, the source of the data on ICT graduates (1b4) is from *the Population Studies Statistics*⁵, from Idescat.

Dimension 2 is Connectivity and has four sub-dimensions: Fixed broadband take-up, Fixed broadband coverage, Mobile broadband, and Broadband price index. Various sources have been used to obtain the indicators (one has been eliminated and another has been added). The indicators 2a1 Overall fixed broadband take-up and 2c3 Mobile broadband take-up come from the *Survey on equipment and use of information and communication technologies in homes*² (Idescat, 2021 data). The indicator 2a2 At least 100 Mbps fixed broadband take-up has been partially estimated based on 2021 data from *the National Commission for Markets and Competition (CNMC)*⁶. Specifically, the percentage of lines in homes and the percentage of lines of at least 100 Mbps out of the total number of lines have been estimated. On the other hand, the NGA, VHCN, FTTP and 5G coverage data (2b1, 2b2, 2b3 and 2c2 respectively) have been provided by the Secretary of State for

¹ <https://ec.europa.eu/digital-single-market/en/desi>

² <https://www.idescat.cat/estad/ticl>

³ https://ec.europa.eu/eurostat/cache/metadata/en/isoc_sk_dskl_i2l_esmsip2.htm

⁴ <https://www.idescat.cat/estad/eticce>

⁵ <https://www.idescat.cat/pub/?id=eep>

⁶ <http://data.cnmc.es/datagraph/>

Telecommunications and Digital Infrastructures (SETID) for the year 2021. Finally, there are three indicators whose scores are the same as for Spain: At least 1 Gbps take-up (2a3), 5G Spectrum (2c1), and Broadband Price Index (2d1), since it has not been possible to obtain the disaggregated data to calculate them reliably at the level of Catalonia.

Dimension 3, Integration of digital technology, has three sub-dimensions. The first is Digital Intensity and it has a single indicator: (3a1) SMEs with at least a basic level of digital intensity. The score of which has been calculated by Idescat based on data from the Survey on the use of information technologies and communication and electronic commerce in companies and is based on the new DESI 2022 methodology. The second sub-dimension, Digital Technologies for businesses, has seven indicators. One of them (3b6 ICT for environmental sustainability) comes from the survey carried out *ad hoc* with the same methodology and takes questions from the European study from which the data for the member states of the EU-27¹. The rest of the indicators of this sub-dimension come from the same Idescat survey indicated above, which is also the source of the indicators of the third subdimension, e-Commerce.

Finally, dimension 4, Digital public services, has five indicators grouped into a single sub-dimension, e-Government. The data for indicator (4a1), e-Government users, come from Idescat, based on the *Survey on equipment and use of information and communication technologies in homes*. The indicators Pre-filled forms (4a2), Digital public services for citizens (4a3) and Digital public services for businesses (4a4) are based on the methodology included in the eGovernment Benchmark 20202 of the European Commission. An evaluation of various services offered by the different Public Administrations in Catalonia has been made, using the Mystery Shopping technique. The Open Data indicator (4a5) has been obtained through the questionnaire collected in the European Data Portal³, and has been completed by the General Directorate of Transparency and Open Data of the Generalitat de Catalunya.

¹ European enterprise survey on the use of technologies based on artificial intelligence by Ipsos and iCite; Survey of businesses on the use of digital technologies by Ipsos and iCite .

² <https://ec.europa.eu/digital-single-market/en/news/egovernment-benchmark-2020-egovernment-works-people>

³ <https://www.europeandataportal.eu/es/dashboard/2020>

5. APPENDIX

1. DESI indicators and definitions

Dimension	Subdimension	Indicator code	Indicator	Description	Breakdown	Unit	Source and Year
1 Human capital	1a Internet user skills	1a1	At least basic digital skills	Individuals with 'basic' or 'above basic' digital skills in each of the following five dimensions: information, communication, problem solving and software for content creation and safety	All Individuals (aged 16-74)	% individuals	DESCAT (2021)
		1a2	Above basic digital skills	Individuals with 'above basic' digital skills in each of the following five dimensions: information, communication, problem solving and software for content creation and safety	All Individuals (aged 16-74)	% individuals	DESCAT (2021)
		1a3	At least basic digital content creation skills	Individuals with at least a basic level in using software for digital content creation	All Individuals (aged 16-74)	% individuals	DESCAT (2021)
	1b Advanced skills and development	1b1	ICT specialists	Employed ICT specialists, ICT professionals, ICT technicians, ICT installers and services.	Total number of Persons in employment	% employed people (16-74)	DESCAT (2021)
		1b2	Female ICT specialists	Employed female ICT specialists. Broad definition based on the ISCO-08 classification and including jobs like ICT service managers, ICT professionals, ICT technicians, ICT installers and services.	Total number of Persons in employment	% employed females (16-74)	DESCAT (2021)
		1b3	Enterprises providing ICT training	Enterprises who provided training in ICT to their personnel	All enterprises, without financial sector (10 persons employed or more)	% enterprises	DESCAT (2021)
		1b4	ICT graduates	Individuals with a degree in ICT	Total graduates	% graduates	DESCAT (2021)

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Dimension	Subdimension	Indicator code	Indicator	Description	Breakdown	Unit	Source and Year
2. Connectivity	2a. Fixed broadband take-up	2a1	Overall fixed broadband take-up	% of households subscribing to fixed broadband	All households, with at least one individual aged 16-74	% households	IDESCAT (2021)
		2a2	At least 100 Mbps fixed broadband take-up	% of households subscribing to fixed broadband of at least 100 Mbps	All households with at least one individual aged 16-75	% households	CNMC (2021) IDESCAT (2021)
		2a3	At least 1 Gbps take-up	% of households subscribing to fixed broadband of at least 1 Gbps	All households with at least one individual aged 16-76	% households	COCOM (CE and Eurostat) (2021)
		2a1	Fast broadband (NGA) coverage	% of households covered by fixed broadband of at least 30 Mbps download. The technologies considered are FTTH, FTTB, Cable Docsis 3.0 and VDSL	All households	% households	SETID (2021)
	2b. Fixed broadband coverage	2b2	Fixed Very High Capacity Network (VHON) coverage	% of households covered by any fixed VHON. The technologies considered are FTTH and FTTB for 2015-2018 and FTTH, FTTB and Cable Docsis 3.1 for 2019 onwards	All households	% households	SETID (2021)
		2b3	Fibre to the Premises (FTTP) coverage	% of households covered by FTTH and FTTB	All households	% households	SETID (2021)
		2c1	5G spectrum	The amount of spectrum assigned and ready for 5G use within the so-called 5G pioneer bands. These bands are 700 MHz (703-733 MHz and 758-788 MHz), 3.6 GHz (3400-3600 MHz) and 26 GHz (1000 MHz within 24250-27500 MHz). All three spectrum bands have an equal weight	5G pioneer bands	Assigned spectrum as a % of total harmonised 5G spectrum	COCOM (2022)
	2c. Mobile broadband	2c2	5G coverage	% of populated areas with coverage by 5G	All households	% populated areas	SETID (2021)
		2c3	Mobile broadband take-up	Individuals who used the internet on a mobile device	All individuals (aged 16-74)	% individuals	IDESCAT (2021)
	2d. Broadband prices	2d1	Broadband price index	The broadband price index measures the prices of representative baskets of fixed, mobile and converged broadband offers	Broadband price index	Score (0-100)	CE (2021)

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Dimension	Subdimension	Indicator code	Indicator	Description	Breakdown	Unit	Source and Year
3 Integration of digital technology	3a Digital intensity	3a1	SMEs with at least a basic level of digital intensity	The digital intensity score is based on counting how many one of 12 selected technologies are used by enterprises. A basic level requires usage of at least 4 technologies.	SMEs (10-249 persons employed), without financial sector	% SMEs	IDESCAT (2021)
		3a1	Electronic information sharing	Enterprises who have in use an ERP (enterprise resource planning) software package to share information between different functional areas (e.g. accounting, planning, production, marketing)	All enterprises, without financial sector (10 persons employed or more)	% enterprises	IDESCAT (2021)
		3a2	Social media	Enterprises using two or more of the following social media: social networks, enterprise's blog or microblog, multimedia content sharing websites, wik-based knowledge sharing tools. Using social media means that the enterprise has a user profile, an account or a user license depending on the requirements and the type of the social media.	All enterprises, without financial sector (10 persons employed or more)	% enterprises	IDESCAT (2021)
	3b Digital technologies for businesses	3b3	Big data	Enterprises analysing big data from any data source	All enterprises, without financial sector (10 persons employed or more)	% enterprises	IDESCAT (2020)
		3b4	Cloud	Enterprises buying sophisticated or intermediate cloud computing services	All enterprises, without financial sector (10 persons employed or more)	% enterprises	IDESCAT (2021)
		3b5	AI	Enterprises using any AI technology	All enterprises, without financial sector (10 persons employed or more)	% enterprises	IDESCAT (2021)
	3c e-Commerce	3b6	ICT for environmental sustainability	The indicator measures the level of support that adopted ICT technologies offered to enterprises to engage in more environmentally-friendly actions. The level of intensity is measured based on the number of environmental actions (maximum 10) reported by enterprises to have been facilitated by the use of ICT. The following categorisation was achieved: low intensity (0 to 4 actions), medium intensity (5 to 7 actions) and high intensity (8 to 10 actions).	All enterprises, without financial sector (10 persons employed or more)	% enterprises having medium/high intensity of green action through ICT	Ad hoc survey (2021)
		3b7	e-Invoices	Enterprises sending e-invoices, suitable for automated processing	All enterprises, without financial sector (10 persons employed or more)	% enterprises	IDESCAT (2020)
		3c1	SMEs selling online	SMEs selling online (at least 1% of turnover)	SMEs (10-249 persons employed), without financial sector	% SMEs	IDESCAT (2021)
		3c2	e-Commerce turnover	SMEs' total turnover from e-commerce	SMEs (10-249 persons employed), without financial sector	% SME turnover	IDESCAT (2021)
		3c3	Selling online cross-border	SMEs that carried out electronic sales to other EU countries	SMEs (10-249 persons employed), without financial sector	% SMEs	IDESCAT (2021)

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1. DESI indicators and definitions

Dimension	Subdimension	Indicator code	Indicator	Description	Breakdown	Unit	Source and Year
4. Digital public services	4a e-Government	4a.1	e-Government users	Individuals who used the Internet, in the last 12 months, for interaction with public authorities	All individuals (aged 16+)	% internet users	IDESCAT (2021)
		4a.2	Pre-filled forms	Amount of data that is pre-filled in public service online forms	All Life Events	Score (0 to 100)	e-Government Benchmark adapted to Catalonia
		4a.3	Digital public services for citizens	The share of administrative steps that can be done online for major life events (birth of a child, new residence, etc.) for citizens	All Life Events	Score (0 to 100)	e-Government Benchmark adapted to Catalonia
		4a.4	Digital public services for businesses	The indicator broadly reflects the share of public services needed for starting a business and conducting regular business operations that are available online for domestic as well as foreign users. Services provided through a portal receive a higher score, services which provide only information (but have to be completed offline) receive a more limited score. Score (0 to 100) e-Government Benchmark	All Life Events	Score (0 to 100)	e-Government Benchmark adapted to Catalonia
		4a.5	Open data	This composite indicator measures to what extent countries have an open data policy in place (including the transposition of the revised PSI Directive), the estimated political, social and economic impact of open data and the characteristics (functionalities, data availability and usage) of the national data portal.	Total	% maximum score	Directori General de Transparència i Dades Obertes de la Generalitat de Catalunya

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