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COMMUNICATION FROM THE COMMISSION

establishing Union-level projected trajectories for the digital targets

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1. INTRODUCTION

This Communication accompanies and complements the Commission's first Report on the state of the Digital Decade. It presents the **Union-level projected trajectories** (hereinafter 'Digital Decade trajectories') for the attainment of each of the 2030 digital targets in compliance with Article 5(3) of Decision (EU) 2022/2481 ('the Decision') ([1]). The Digital Decade trajectories are projections of the yearly values of the key performance indicators (KPIs) set out in the Commission Implementing Decision ([2]), adopted by the Commission on 30 June 2023 (hereinafter the 'KPI Implementing Decision'), along the ideal path towards their 2030 target value, as set out in Article 4 of the Decision.

This Communication also presents the estimated trajectories based on the KPI historical data values (hereinafter 'baseline trajectories'). The baseline trajectories are projections of the KPI yearly values estimated by extrapolating available historical data. They describe the 'business as usual' scenario because, being based on past observed data, they only capture past investments and interventions, both private and public. The Commission uses baseline trajectories for illustrative purposes to assess and regularly monitor the gap between the estimated trend and the ideal one for each KPI defined in the 'KPI Implementing Decision'.

This Communication builds on the staff working document ([3]) that accompanied the proposal for a Decision of the European Parliament and of the Council establishing the Digital Decade Policy Programme 2030. It provides further developments and updates based on the latest observed data and trends.

In accordance with Article 5(3) of the Decision, the Union level projected trajectories can be updated, where necessary, in light of technical, economic or societal developments. A revision of the Union level projected trajectories as well as of the baseline trajectories may also be necessary because data availability in certain instances may be limited by the fact that the definition of the indicators used for monitoring purposes might vary over time. For indicators that capture rapidly changing phenomena, like the ones included in this monitoring process, variations may be needed to better reflect technological advances. Indicator's revisions are also driven by possible improvements in the statistical methodology or sampling strategy used to collect the indicators. These cases lead to breaks in the statistical time series that reduce comparability among values observed before and after the change occurred. If there are relevant breaks in data series, they will be taken into consideration when assessing deviations in the observed values from the projected trajectories.

Furthermore, the baseline trajectories for the KPI on connectivity are estimated projections for the achievement of the Digital Decade objectives based on historical data. Similar to

([1]) Decision (EU) 2022/2481 of the European Parliament and of the Council of 14 December 2022 establishing the Digital Decade Policy Programme 2030

([2]) Commission Implementing Decision (EU) 2023/1353 of 30 June 2023 setting out key performance indicators to measure the progress towards the digital targets established by Article 4(1) of Decision (EU) 2022/2481 of the European Parliament and of the Council

([3]) SWD (2021) 247: Commission staff working document accompanying the document: Proposal for a Decision of the European Parliament and of the Council establishing 2030 the Policy Programme 'Path to the Digital Decade', September 2021.

all the other baseline trajectories, they do not take account of the additional investments needed to roll out more advanced capability for the connectivity infrastructure of the future. The Commission consulted stakeholders on this in its consultation on the future of the electronic communications sector and its infrastructure ([4]).

2. PURPOSE OF THE DIGITAL DECADE TRAJECTORIES

The **Digital Decade trajectories** for the attainment of each of the digital targets presented in this Communication have been established by the Commission in close cooperation with Member States, notably by means of consultation with the Digital Decade Board ([5]).

In accordance with Article 5(3) of the Decision, the purpose of the Digital Decade trajectories is twofold. First, they serve as the basis for the Commission to monitor progress towards achieving the targets. Every year, as part of the Report on the State of the Digital Decade, the Commission intends to compare the observed KPI values for each target against the projected values along the Digital Decade trajectories.

Second, the Digital Decade trajectories serve to prepare the national Digital Decade strategic roadmaps ('national roadmaps'). In accordance with Article 7 of the Decision, each national roadmap must comprise national projected trajectories that help achieve the relevant digital targets. Member States should define their level of ambition and their national trajectories based on the Digital Decade trajectories at EU level, i.e., depending on the path that the indicators need to follow to reach the targets.

3. ESTIMATION OF UNION-LEVEL TRAJECTORIES TOWARDS 2030

3.1. Methodology for estimating the Digital Decade trajectories

The methodology for estimating the Digital Decade trajectories of each KPI must be theoretically solid, but at the same time simple and easy to use as reference point by Member States for the estimation of the national trajectories, also taking into account that some KPIs have data limitations.

The methodology for estimating the Digital Decade trajectories has been developed taking into consideration the KPI definition, the latest available data point, the 2030 target value and its theoretical functional form. To estimate the baseline trajectories, the availability of the KPI historical time series, its length and consistency have all be taken into consideration.

In more detail, the methodology consists of the following steps ([6]):

([4]) https://digital-strategy.ec.europa.eu/en/consultations/future-electronic-communications-sector-and-its-infrastructure

([5]) Commission Decision of 11 October 2022 setting up the group of experts 'the Digital Decade Board' - C(2022) 7141

([6]) Details on the methodology can be found in Torrecillas, J., Papazoglou, M., Cardona, M., Vázquez Prada-Baillet, M., Calza, E., Righi, R., Methodology to project Digital Decade trajectories towards 2030, López Cobo, M. and De Prato, G. editors, Publications Office of the European Union,

1. Choice of the functional form

According to the relevant academic literature, KPIs are classified into two different groups depending on their nature:

a. KPIs that describe a technology adoption process are projected using an 'S-shaped' functional form. This kind of model is appropriate for describing the typical behaviour of technology adoption. The S-shaped curve describes how, at the beginning of a technology life, there is usually a relatively small number of adopters until some tipping point is reached, when the performance increases significantly. Finally, at the end of a technology life, the marginal improvements become less and less distinguishable, with lower implementations by late individuals or firms – the so-called late adopters – and then they plateau.

   The S-shaped curve is characterised by three parameters: the timing of diffusion, the speed of diffusion and the saturation point. For the KPIs for which this functional form is adopted, the timing of diffusion is set so that the starting value of the trajectory is equal to the KPI's most recent observed data point. This allows for continuity between the historical time series and the projection. The speed of diffusion depends on the observed historical trend and the distance from the baseline to the predefined saturation level. Finally, the saturation point represents the maximum share of population or enterprises that will eventually adopt the technology (maximum ideal technology diffusion).

   The S-shaped functional form is chosen for the following KPIs: Gigabit network coverage; 5G coverage; Cloud computing take-up; Big data analysis take-up; AI take-up; Online service provisions for citizens and Online service provisions for businesses.

b. Linear projections are adopted for the KPIs that are expected to show a steady, regular increase.

   The linear functional form is chosen for the following KPIs: Basic digital skills, ICT specialists; Unicorns ([7]); Digital intensity of businesses; Electronic identification.

With the exception indicated above, the selected functional form is used to estimate the Digital Decade trajectory and the baseline trajectory for each KPI at EU level.

2. Estimation of the Digital Decade trajectory

The Digital Decade trajectory is a theoretical path of progression of each KPI value from the last available historical data point – that is the most recently observed KPI value – up to its 2030 target value.

The trajectory is computed so that the functional form adopted for the KPI reaches its target value by 2030 and it represents the ideal path the EU should follow towards the 2030 target for each KPI. In a nutshell, for both KPIs with linear functional forms and for KPIs with S-shaped functional forms, the trajectory is a line that connects the latest observed value with the 2030 target (dashed blue line in Figure 1).

Luxembourg, 2023, https://dx.doi.org/10.2760/442136,JRC133748. https://publications.jrc.ec.europa.eu/repository/handle/JRC133748

([7]) The linear form for the unicorns' trajectory is estimated after transforming the number of unicorns using the logarithmic function.

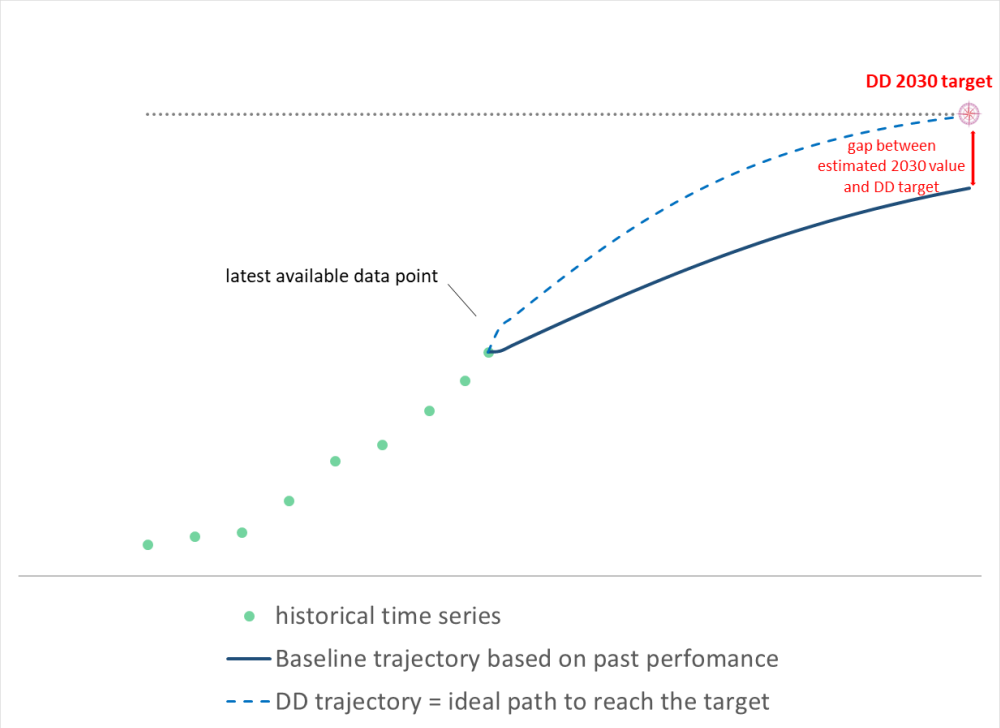
3. Estimation of the projected baseline trajectories

The baseline trajectory is the path that the KPI is assumed to follow towards 2030 in a 'business as usual' scenario, i.e., by extrapolating historical trends towards a plausible future while considering solely the impact of all the funding instruments, interventions and investments – both private and public – put in place during and before the period that spans the KPI's time series. For this reason, the 2030 value estimated along the baseline trajectory should be considered the conservative lower bound.

The first year and value of the baseline trajectory always coincides with the year and the value of the most recent data point available for each KPI.

Based solely on observed data, the baseline trajectory does not consider policy interventions or investment instruments that have been or will be implemented in the years after the last observed data point or have not impacted the KPI value yet. Based on newly available data, the Union-level baseline trajectories will be updated to dynamically capture the actual KPI path towards its 2030 target. In so doing, the baseline trajectories will dynamically take into account the impact of new investments, including Recovery and Resilience Facility and cohesion policy funds, on the different KPIs. Likewise, national baseline trajectories will be regularly updated to follow the effect of national investments on the Digital Decade KPIs.

Figure 1: Example of trajectories for a theoretical KPI with an S-shaped functional form: historical data points (dots), the Digital Decade (DD) trajectory towards the 2030 target (dashed line) and the baseline trajectory based on historical data (solid line)



3.2. EU projected trajectories by digital target

The following subsections describe the construction of the Union-level trajectories for each KPI in relation to each target. The KPI and target definitions are aligned with the 'KPI Implementing Decision' and the 'Decision' respectively.

3.2.1. *Basic digital skills*

Target: A digitally skilled population and highly skilled digital professionals, with the aim of achieving gender balance, where (a) **at least 80% of those aged 16-74 have at least basic digital skills;** (b) at least 20 million ICT specialists are employed within the Union, while promoting the access of women to this field and increasing the number of ICT graduates.

KPI definition (referring to part (a) of the target): At least basic digital skills, measured as percentage of individuals aged between 16 and 74 years old disaggregated by sex with "basic" or "above basic" digital skills in each of the following five dimensions: information, communication, problem solving, digital content creation and safety skills. It is measured based on the activities that individuals carried out during the previous three months[8]; and gender convergence, measured as the percentage of women and men among those individuals with "basic" or "above basic" digital skills.

Source: Eurostat, European Union survey on ICT usage in households and by individuals.

Available data points: 2015, 2016, 2017, 2019, 2021 (with a break in series in 2021).

Baseline value (latest available historical data point): (2021) 54%.

Context, assumptions, model functional form and latest developments

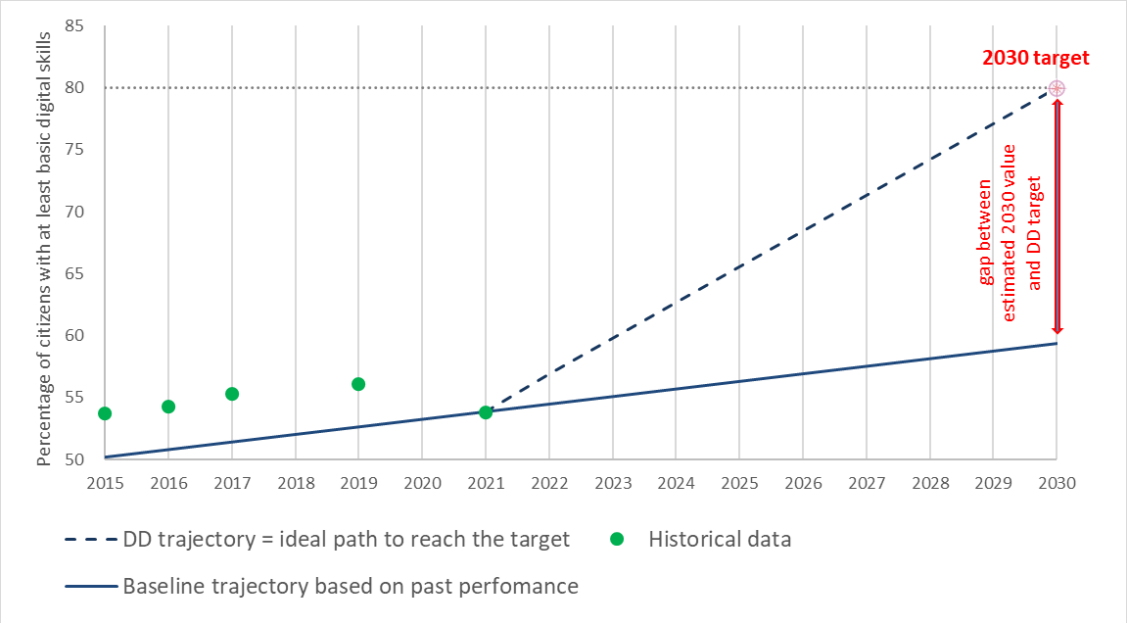
Digital skills are a key asset that enables people to use the emerging opportunities created by digital technologies and fully benefit from them. The KPI to monitor this target measures the ability of people to perform certain activities on the internet, using digital tools and software. As defined by Eurostat, the digital skills indicator is a composite indicator based on selected activities performed by individuals on the internet in specific areas: until 2019, these included information, communication, problem solving and digital content creation, and from 2021 onwards an additional area, safety, was added.

The baseline trajectory is based on the linear functional form. The assumption is that the indicator will follow a linear trend, with a constant growth rate until 2030. Between 2019 and 2021, a revision of the methodology to measure this indicator caused a break in the

([8]) Defined based on the Eurostat methodology reflecting the revised Digital Competence Framework (DIGCOMP 2.0), as also set out in Commission Implementing Regulation (EU) 2022/1399 of 1 August 2022 specifying the technical items of the data set, establishing the technical formats for transmission of information and specifying the arrangements and content of the quality reports on the organisation of a sample survey in the use of information and communication technologies domain for the reference year 2023 in accordance with Regulation (EU) 2019/1700 of the European Parliament and of the Council.

series ([9]). For this reason, the baseline trajectory is first estimated based on the historical time series until 2019 (included) and then adjusted to correct for the break in series. The adjustment for the break in series consists of computing the regression line's intercept by imposing that the starting value of the baseline trajectory coincides with the latest observed data point. Figure 2 shows the available historical data, and the Digital Decade and baseline trajectories of the KPI indicator. The forecast trend shows that the target will not be met without policy interventions and associated investments (the 2030 forecast projected along the baseline trajectory is 59% of those aged 16-74 would have at least basic digital skills).

Figure 2: At least basic digital skills in the EU. Historical data, Digital Decade (DD) trajectory and baseline trajectory towards 2030



In 2021, only 54% of EU citizens had at least basic digital skills, which is 26 percentage points below the target, with major differences among Member States. Achieving the target will require an average annual growth of over 4.5% over 10 years, implying the need for

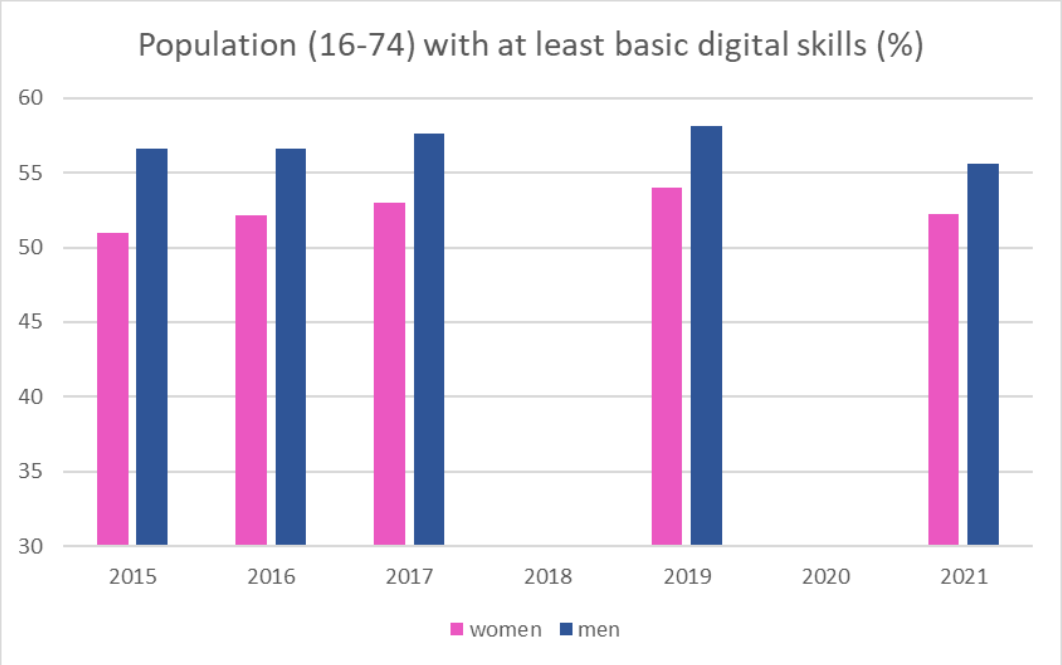
([9]) The methodological revision that took place between 2019 and 2020 aims to better capture the rapid technological changes of the ICT landscape. A new Digital Skills Indicator (DSI) was introduced in 2022 based on the Commission's Digital Competence Framework 2.0. The methodology was updated by the Commission's Joint Research Centre and the Information Society Statistics Working Group with Member State representatives. The changes include variation in the mode of data collection due to the COVID-19 pandemic, from face-to-face to telephone or online interviews; changes in the sampling of some countries and the inclusion of a fifth dimension of digital skills on safety (the DSI now measures: information and data literacy skills, communication and collaboration skills, digital content creation skills, safety skills and problem-solving skills). More info:

- Vuorikari, R., Jerzak, N., Karpinski, Z., Pokropek, A. and Tudek, J., Measuring Digital Skills across the EU: Digital Skills Indicator 2.0, EUR 31193 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-55856-9, doi:10.2760/897803, JRC13034.
- Vuorikari, R., Kluzer, S. and Punie, Y., DigComp 2.2: The Digital Competence Framework for Citizens – With new examples of knowledge, skills and attitudes, EUR 31006 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-48883-5, doi:10.2760/490274, JRC128415

immediate and considerable efforts to address existing gaps in at least basic digital skills. In addition, the level of digital skills is influenced by several socio-demographic factors such as age, level of education, employment status and place of residence, with a gap in general between rural and urban areas. Member States need to put in place integrated actions, targeting formal and non-formal education, lifelong learning and policy measures aimed at reducing the disadvantages of vulnerable groups.

There is no significant difference in the share of people with at least basic digital skills between sexes but on average men tend to have better digital skills than women (see Figure 3). The gap between men and women (as a percentage) has been decreasing in recent years, with the difference between men and women with at least basic skills dropping from 5.6 points in 2015 to 3.4 points in 2021. This will be supported by ad hoc policy interventions.

Figure 3: Percentage of individuals aged 16-74 with at least basic skills in the EU by sex (from 2015 to 2021).



3.2.2. *ICT specialists (and gender gap in ICT)*

Target (same as previous): A digitally skilled population and highly skilled digital professionals, with the aim of achieving gender balance, where (a) at least 80% of those aged 16-74 have at least basic digital skills; (b) **at least 20 million ICT specialists are employed within the Union, while promoting the access of women to this field and increasing the number of ICT graduates.**

KPI definition (referring to the part (b) of the target): ICT specialists, measured as the number of individuals aged 15-74 who are employed as ICT specialists; and gender convergence, measured as the percentage of women and men among those individuals employed as ICT specialists. In accordance with the ISCO-08 ([10]) code classification, ICT

([10]) International Standard Classification of Occupations 2008.

specialists are workers who have the ability to develop, operate and maintain ICT systems, and for whom ICT constitutes the main part of their job, including but not limited to ICT service managers, ICT professionals, ICT technicians, ICT installers and servicers.

The gender gap in ICT specialists in employment is computed as the share of female ICT specialists in the total ICT specialists in employment. Whilst the promotion of the access of women to this field is mentioned in the target, the Decision does not establish a specific and quantitative target for gender convergence. As a result, this part of the target is not treated as a separate KPI.

Source: Eurostat – Labour Force Survey.

Available data points: from 2011 to 2022.

Baseline value (latest available historical data point): Total ICT specialists in 2022 = 9.37 million; share of female ICT specialists = 18.9%.

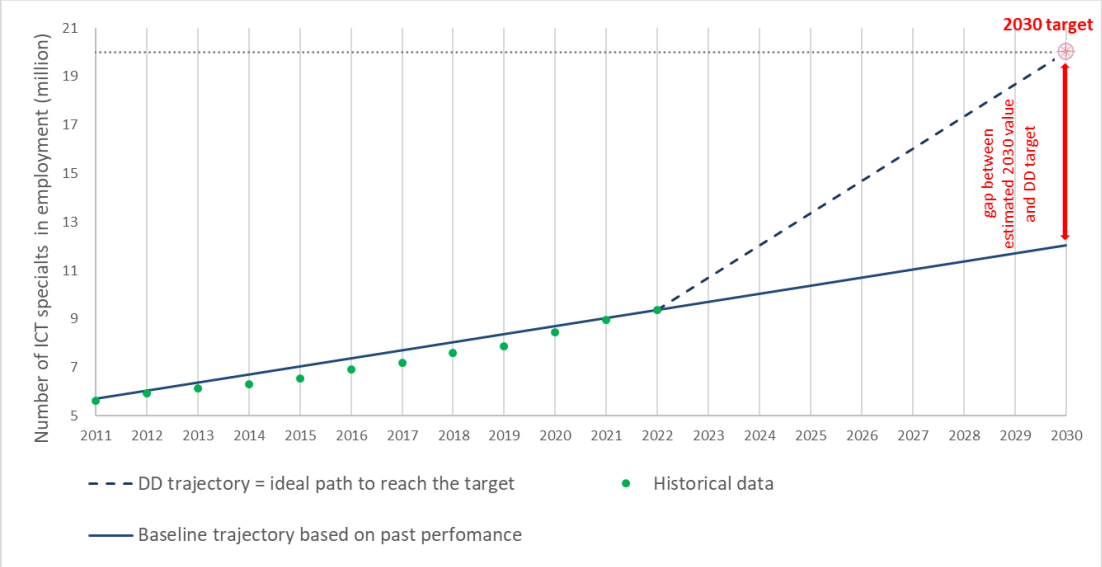
Context, assumptions, model functional form and latest developments

A workforce with ICT specialist skills, having the potential to maintain and grow the digital economy, is a key element for successful digital transformation. The target aims to expand the number of people working as ICT specialists in the EU and overcome the critical shortages currently faced in the EU. The indicator to monitor this target refers to ICT specialists as 'workers who have the ability to develop, operate and maintain ICT systems, and for whom ICT constitutes the main part of their job.' ([11])

The Digital Decade trajectory is a straight line that connects the 2022 value (the most recent available data point) with the 2030 target. The baseline trajectory is based on the linear functional form, which is based on the historical data (all available years included). The assumption is that the KPI follows an increasing trend with a constant rate over the whole period. The Digital Decade trajectory is shown in Figure 4 together with the historical data and the baseline trajectory. In the 'business as usual' scenario, the EU is not expected to meet the target because the 2030 forecast projected along the baseline trajectory is 12 million.

([11]) Eurostat definition operationalised through the International Standard Classification of Occupations (ISCO).

Figure 4: ICT specialists in the EU. Historical data, Digital Decade (DD) trajectory and baseline trajectory towards 2030

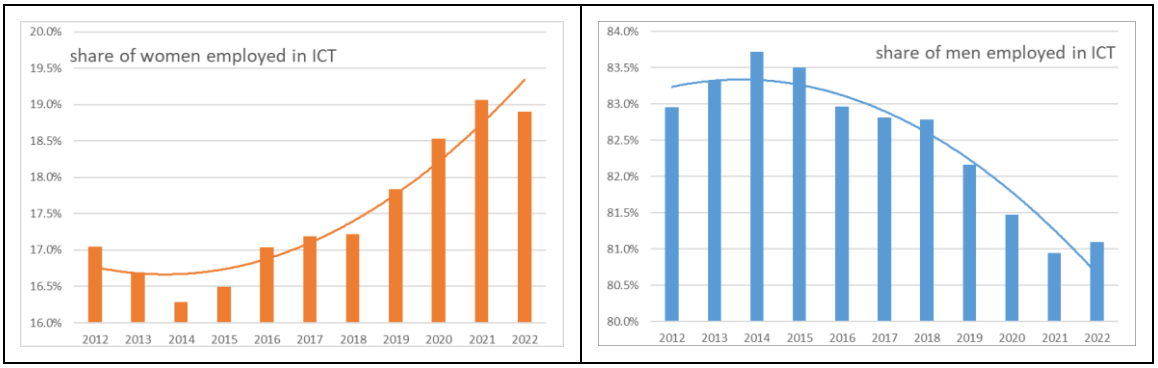


Despite sustained growth over the last 10 years, there were 9.37 million ICT specialists in employment in 2022, corresponding to 4.6% of total employment and slightly less than 11 million below the 2030 target.

In the last 2 years, the trend in the number of ICT specialists has accelerated, with higher average annual growth than in the previous decade (6.0% between 2020 and 2022, and 4.2% between 2011 and 2019). To achieve the Digital Decade target, the positive trend recorded in the last 2 years should be further accelerated.

In 2022, slightly less than 19% of the total ICT specialists in employment was made up of women. In the past decade, the percentage of men steadily remained some 60 percentage points above the percentage of women, with the women's percentage between 16% and 19% and the men's one between 81% and 84% (Figure 5). Despite a small dip between 2013 and 2015, the percentage of women employed in ICT specialists' occupation has steadily risen albeit at a slow pace since 2012 (Figure 5, left). On the other hand, the percentage of men employed as ICT specialists has decreased since its peak in 2014-2015 but remains significantly higher than the percentage of women in ICT occupations, more than four times higher (Figure 5, right). To increase the number of women employed in ICT jobs, all Member States should take action to promote employment of ICT specialists. To reach this goal, it is essential that more women enrol in tertiary education programmes related to ICT. This will increase the number of women available for ICT jobs.

Figure 5: Percentage of individuals employed in ICT specialists' occupations in the EU by sex (2012-2022). The solid line shows the time trend since 2012. Left-hand side: percentage of women in total ICT specialists; right-hand side: percentage of men in total ICT specialists. The range of values is different in the two charts.



Policy interventions on human capital (the skills and brainpower of workers) interact with a variety of factors. There is the need for sustained and integrated action to strengthen the advanced digital skills supply and, importantly, to promote gender balance. This target should be also considered in conjunction with the targets on the adoption of digital technologies by enterprises which might prompt an acceleration in the demand for specialised ICT skills.

3.2.3. *Connectivity*

Target: Secure, resilient, performant and sustainable digital infrastructures where all end users at a fixed location are covered by a gigabit network up to the network termination point, and all populated areas are covered by next-generation wireless high-speed networks with performance at least equivalent to that of 5G, in accordance with the principle of technology neutrality.

KPI definition:

- Gigabit connectivity, measured by the percentage of households covered by fixed Very High-Capacity Networks (VHCN). The technologies considered are those currently able to deliver gigabit connectivity, namely Fibre to the Premises (FTTP) and Cable DOCSIS ([12]) 3.1. The evolution of the FTTP coverage will also be monitored separately and taken into consideration when interpreting VHCN coverage data.
- 5G coverage, measured as the percentage of populated areas covered by at least one 5G network regardless of the spectrum band used.

Source: Broadband coverage in Europe studies for the European Commission by Omdia and Point Topic ([13]).

Available data points: Gigabit: from 2013 to 2022; 5G: from 2020 to 2022

([12]) Data Over Cable Service Interface Specification.

([13]) Broadband coverage in Europe 2022, Omdia and Point Topic for the European Commission

Baseline value (latest available historical data point): 2022: VHCN = 73%; 5G coverage = 81.2%.

Context, assumptions, model functional form and latest trends

The availability of gigabit connectivity services and 5G mobile coverage are essential enablers of the digital transformation. Household behaviours and the uptake of new technologies such as virtual and augmented reality, AI applications, automated driving, logistics and manufacturing processes will further drive demand.

This target is related to two KPIs:

- Availability to all European households of fixed connections able to deliver very high-speed and reliable connectivity services (measured with the VHCN indicator).

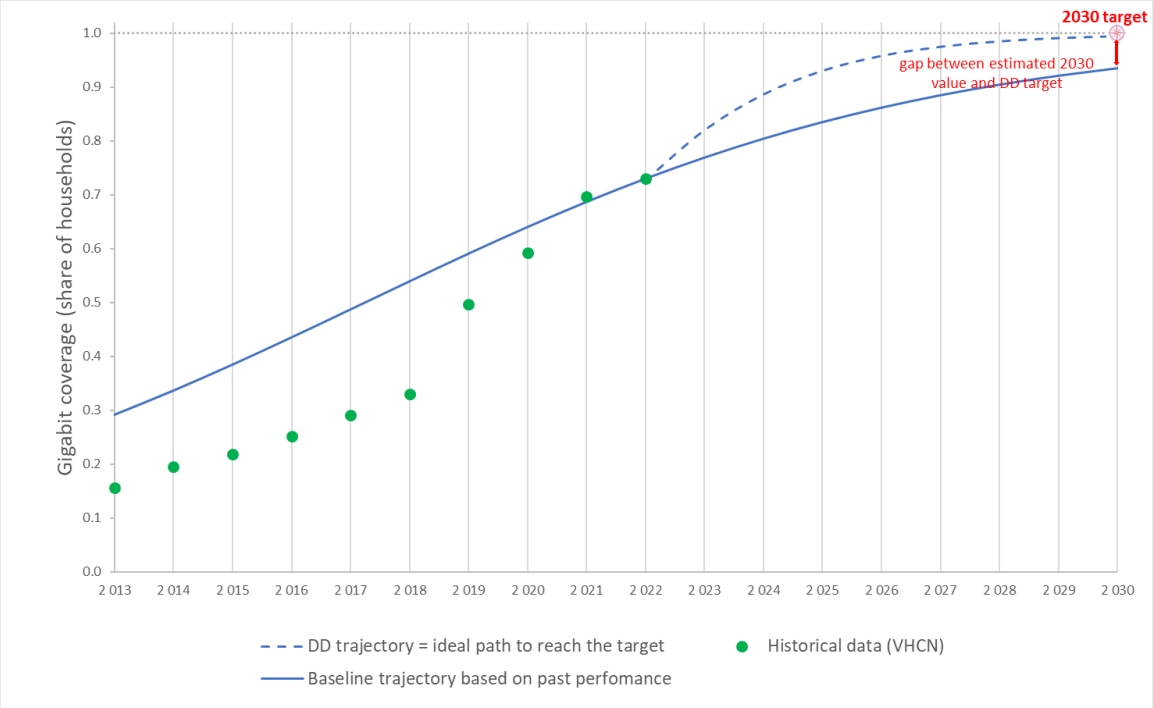
- Availability in all populated areas of a 5G mobile network regardless of the spectrum band used.

Gigabit: The VHCN trajectory is the reference one for tracking the gigabit target. Based on the 'KPI Implementing Decision', the VHCN trajectory is complemented by the FTTP one.

The available historical data on the VHCN indicator show an S-shaped trend that is adopted for this KPI for both the Digital Decade and the baseline trajectory (Figure 6). This is in line with the conceptual model assumed for this measure, where typically the additional deployments of optical fibre-based infrastructure start in areas with reasonable investment costs as well as in dense urban areas where existing cable networks are being upgraded and exercise a competitive constraint. Conversely, the persistent investment gap affects households in the more cost-intensive suburban, semi-rural and rural areas.

The speed of diffusion of the VHCN baseline trajectory is based on the FTTP historical data. This better reflects the expected investment costs of deploying optical fibre infrastructure, assuming that the future gigabit roll-out will depend solely on FTTP infrastructure. Figure 6 shows the baseline trajectory for the fixed VHCN indicator.

Figure 6: Fixed VHCN coverage in the EU. Historical data, Digital Decade (DD) trajectory and baseline trajectory towards 2030



The current indicator for fixed VHCN, based on the current Digital Economy and Society Index indicator, covers networks currently able to deliver gigabit connectivity. However, this may include networks that do not currently deliver gigabit connectivity, not least at peak time conditions. This is for instance the case for DOCSIS 3.1 networks that do not have fibre deployed sufficiently close to the end user. However, it is not currently possible to appropriately map and therefore exclude such networks from measurements. As a result, the measured values and the forecast of the baseline trajectory may be higher than the actual coverage. Moreover, upgrading DOCSIS 3.0 networks, which currently cover 11% of homes, will have a very limited impact on rural connectivity. Lastly, not all FTTP networks are sufficiently dimensioned to provide gigabit speeds at peak time. More investments are therefore needed in the access network, but also in the core and backhaul parts of the network to sustain the exponential growth in data transmission needs expected in 2030 and beyond. Further investments in hardware and software will be needed beyond upgrading the access networks to fibre ([14]). In light of the above, additional work will be undertaken to agree a common methodology for a KPI to measure gigabit connectivity. This will allow a comparison of data at EU level on the quality of service of VHCN infrastructures capable of delivering 1 Gbps under peak time conditions.

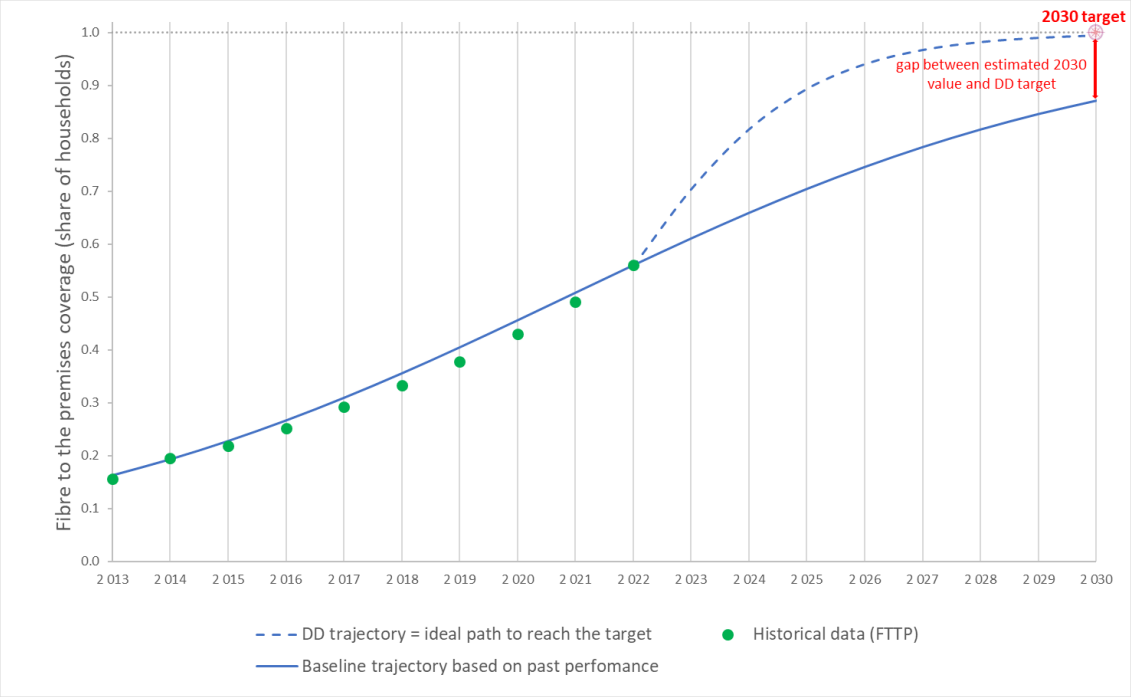
Against this background of the methodological limits of the KPI, it can be noted that, based on the currently available data, fixed VHCN having the capability of offering gigabit connectivity covered 73% of EU households in 2022, up from 70% a year earlier, and is expected to reach 94% by the end of the projection period. This growth has been driven by the deployment of optical fibre networks (FTTP), which covered 56% of EU households

([14]) IT development and procurement strategy choices will be subject to pre-approval by the European Commission Information Technology and Cybersecurity Board.

in 2022. The remaining 27% of households still not covered by VHCN will be reached mainly through further FTTP deployments, which will require sustained efforts. It should not be ruled out that a significant share of rural areas will have to be reached by 5G Fixed Wireless Access networks. Gaps in rural regions continue to be a prevailing issue, as 55% of households in these areas still lack coverage by VHCN. This factor poses additional hurdles for the expansion of services until complete coverage is attained. The marginal cost of connecting a household substantially increases when reaching rural areas.

To track the progress of FTTP coverage, as outlined in the 'KPI Implementing Decision', and to better interpret VHCN coverage data, a Union-level trajectory is also established for this indicator (Figure 7). According to estimates along the baseline trajectory, FTTP is projected to reach 87% of households in the EU by 2030.

Figure 7: FTTP coverage in the EU. Historical data, Digital Decade (DD) trajectory and baseline trajectory towards 2030



5G coverage: The mobile network connectivity target set out in Article 4(1), point (2)(a) of the Decision aims to ensure that all populated areas are covered by a next-generation wireless high-speed network with at least 5G equivalent performance in accordance with the principle of technology neutrality. The corresponding KPI included in the 'KPI Implementing Decision' measures the percentage of populated areas covered by at least one 5G network regardless of the spectrum band used([15]).

Over the past few years, based on the available data, there appears to have been a significant increase in 5G coverage, with the EU value for this KPI reaching 81.2% in 2022. Some Member States have even reported values close to 100% or reaching 100%. It should nevertheless be noted that this expansion has been made possible mainly by using

([15]) While the 700 MHz, the 3.4-3.8 GHz and the 26 GHz spectrum bands are considered the three primary 5G pioneer bands, there is significant deployment in other EU-harmonised 5G-ready bands, in particular in Member States where the use of 5G pioneer bands is not yet permitted.

dynamic spectrum sharing (DSS), which employs non-5G pioneer bands such as the legacy 1.8 GHz and/or 2.1 GHz bands. This enables demand-based sharing between 4G and 5G. As a consequence of the spectrum sharing with 4G, and in particular the bandwidth limitations, the actual 5G performance delivered to the end user may be significantly lower than what can be achieved over dedicated 5G bands.

To determine the expected progress of this KPI to 2030, available data from the years 2020 to 2022 have been analysed. Based on this analysis, the forecast along the baseline trajectory predicts that by 2024, close to 100% of populated areas in the EU will be covered by 5G networks overall. Therefore, no Digital Decade trajectory is displayed in Figure 8.

However, it should be noted that also for the current KPI for the 5G target there are methodological limits, as it does not take into account the quality of service provided under peak time conditions. The current baseline trajectory is therefore not representative of the actual path that Europe needs to undertake to truly attain the 5G connectivity target. To ensure that the quality of service underlying this target is provided in all populated areas by 2030 further significant investments will be needed, primarily in the radio access network (i.e., building new base stations, interconnecting existing and new base stations). The use of more spectrum in the medium and high bands will be needed to gradually improve the quality of service on 5G networks and enable the deployment of 5G for Industry 5.0 ([16]). A key challenge will be to ensure that the deployed networks support key industry sectors and critical applications that benefit consumers and businesses in all sectors.

To measure Member States' readiness to overcome this challenge, further examination is required to improve and broaden the measurement framework for 5G. The objective is to establish a quantifiable KPI that captures the actual quality of service as experienced under peak time conditions and encompasses other "next-generation wireless high-speed networks" with performance equivalent to or surpassing 5G.

([16]) Industry 5.0 complements and extends Industry 4.0. It emphasises aspects that will be deciding factors, not just economic or technological, for the place of industry in the future European society.

Figure 8: 5G roll-out in the EU, historical data and baseline trajectory towards 2030.

3.2.4. *Semiconductors*

Target: Secure, resilient, performant and sustainable digital infrastructures where the production, in accordance with Union law on environmental sustainability, of cutting-edge semiconductors in the Union is at least 20% of world production in value.

KPI definition: Semiconductors, measured as value generated, in terms of revenues, by semiconductor activities in the Union, in all stages of the value chain, with respect to the global market value. For the first year, reporting will be done on the basis of those activities in Europe.

Source: Study in progress by the International Data Corporation.

No available data point.

Baseline value (latest available historical data point): Around 10% of the global market share by value in 2022.

Semiconductors are at the centre of strong geostrategic interests and the global technology race. They are essential building blocks of digital and digitised products. From smartphones and cars through to critical applications and infrastructure for healthcare, energy, defence, communications and industrial automation, chips are central to the modern digital economy. In terms of revenues across the semiconductor value chain, the US is currently the market leader, followed by South Korea, Taiwan, Japan and the EU, whose revenues are approximately 10% of the global market by value according to the

current estimation. The Digital Decade sets the target that the EU's market share should reach 20% by value by 2030.

Table 1: Semiconductor value chain segments with EU market share (2022)

Stage of supply chain	Added value	EU share
Material and silicon wafers	7%	14%
Manufacturing Equipment	17%	21%
Design Tools and IP	3%	2%
Chip Design	30%	8%
Semiconductor Manufacturing	34%	7%
Assembly, Test and Packaging	10%	5%
Supply chain	100%	9.9%

Note: Data in column 2 show the added value of that segment in the value chain (from AT Kearney, CSET, IC insights, WSTS, SEMI). Data in column 3 show the EU share of the global market in that segment by value in 2022.

Table 1 shows the baseline values for the EU trajectories. No (baseline or Digital Decade) trajectory is available yet, as a third-party study by International Data Corporation ([17]) is on-going with the purpose of understanding the evolution and future values of the EU market share up to 2030.

As the digital transition accelerates, worldwide demand for chips will grow rapidly and is expected to exceed USD 1 trillion by 2030, essentially doubling its value over this decade. This means that the EU's revenues in semiconductors should quadruple by 2030, making it particularly challenging to estimate this target.

In April 2023, a political agreement was reached between the European Parliament and the Council on the Chips Act. The proposed Act was formally approved by the Parliament and the Council in July 2023 ([18]). It will build on Europe's strengths and address outstanding weaknesses, developing a thriving semiconductor ecosystem and resilient supply chain. It is a key step towards EU technological sovereignty and will help Europe achieve the relevant Digital Decade target and the Green Deal objectives. Thanks to the European

([17]) https://www.idc.com/about/

([18]) Chips Act: Council gives its final approval - Consilium (europa.eu)

Chips Act, the EU aims to reach its target of doubling its current global market share to 20% in 2030.

3.2.5. *Edge nodes*

Target: Secure, resilient, performant and sustainable digital infrastructures where at least 10 000 climate-neutral highly secure edge nodes are deployed in the Union, distributed in a way that guarantees access to data services with low latency (i.e., a few milliseconds) wherever businesses are located.

KPI definition: Edge nodes, measured as the number of compute nodes providing latencies below 20 milliseconds; such as an individual server or other set of connected computing resources, operated as part of an edge computing infrastructure, typically residing within an edge data centre operating at the infrastructure edge, and therefore physically closer to its intended users than a cloud node in a centralised data centre.

Source: Edge Observatory([19])

No available data point

Baseline value (latest available historical data point): 0 in 2022.

Context, assumptions, model functional form and latest trends

Edge computing enables the supply of data processing services from decentralised compute nodes and infrastructures at the network's edge, minimising the transmission of unnecessary data over the network and improving cloud computing's overall performance. The deployment of edge nodes supports the development of low-latency data processing services. When combined with a variety of technologies such as 5G deployment, algorithms, sensors and the Internet of Things, data, AI, machine learning, virtual reality and robotics, the deployment of edge nodes has the potential to produce significant benefits to businesses impacts as well as support the advancement of the digital transformation of multiple sectors of the economy.

The deployment of highly secure and climate-neutral edge nodes is estimated to evolve into a standardised S-curve of technology and innovation adoption.

The baseline for 2022 is accounted as '0'. The methodology needed to quantify the deployment of edge nodes and their localisation is still being developed.

Current business analysis information is sparse and focuses only on anticipated spending on edge computing infrastructure, software and services (UNLOCK-CEI project, 2023 ([20])), which does not allow for a direct assimilation into existing edge node deployment. Accordingly, information from the European Telecommunications Network Operators'

([19]) https://digital-strategy.ec.europa.eu/en/policies/edge-observatory

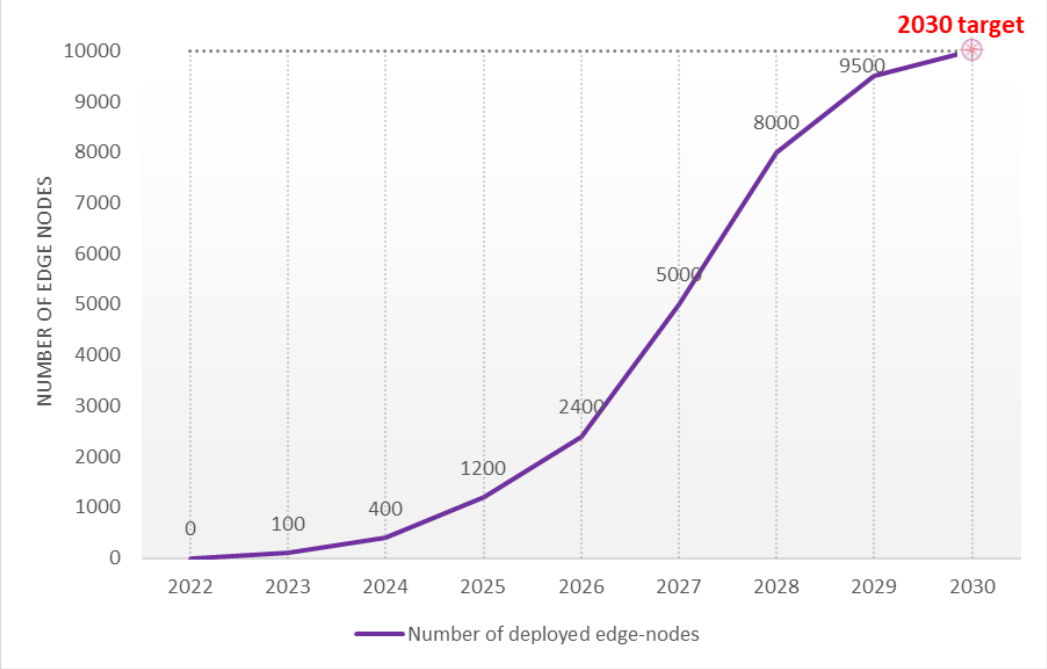
([20]) UNLOCK-CEI, Cloud-Edge-IoT Demand Landscape (April 2023).

Association describes three commercial edge computing services across Europe ([21]) but does not provide enough information to determine the location or size of edge deployment.

The limited number of available data sources all agree that edge computing continues to be in its infancy in Europe in 2023, with the majority of interested organisations still in the awareness-raising and educational stages, along with some organisations implementing small-scale pilot projects (UNLOCK-CEI project, 2023). This drives the anticipated relatively small uptake of edge node deployment in the years to come, between 2023 and 2026. During the 2025-2027 period, the investments under the IPCEI-CIS (Important Project of Common European Interest on Next Generation Cloud Infrastructure and Services) are expected to make edge computing technologies and solutions commercially available to the market. This will boost adoption across Europe, enabling the exponential expansion of edge node deployment to meet the target by 2030.

In this context, Figure 9 provides a preliminary indication of the path towards the achievement of the Digital Decade target, whilst no baseline trajectory can be yet established.

Figure 9: Expected number of deployed edge nodes (EU projection to 2030)



Note: The edge node trajectory is based solely on an assessment by experts.

The above estimation will be revised and a Digital Decade trajectory established on the basis of the Edge Observatory study ([22]), which aims to provide qualitative and quantitative information on actual and expected market developments as well as relevant initiatives and actions taken by private, public and mixed schemes of stakeholders in the area of edge computing in order to provide the necessary information for monitoring the evolution of

([21]) European Telecommunications Network Operators' Association, The State of Digital Communications 2023, February 2023.

([22]) Study not published yet.

the edge nodes target over time and across EU countries. At the time of adoption of this Communication, the Edge Observatory has yet to produce its first edge deployment data collection exercise, which is ongoing and will be available in two phases between October 2023 and the end of July 2024. The initial phase will include data collection for Germany, France, Spain, Italy, the Netherlands and Sweden. This data will be completed in phase 2 by gathering edge deployment data from all EU countries for 2023.

3.2.6. *Quantum computing*

Target: Secure, resilient, performant and sustainable digital infrastructures where the Union has, by 2025, its first computer with quantum acceleration, paving the way for the Union to be at the cutting edge of quantum capabilities by 2030.

KPI definition: Quantum computing, measured as the number of operational quantum computers or quantum simulators, including accelerators of High Performance Computing supercomputers, deployed and accessible to the user communities.

Source: Quantum Flagship study ([23])

No available data point

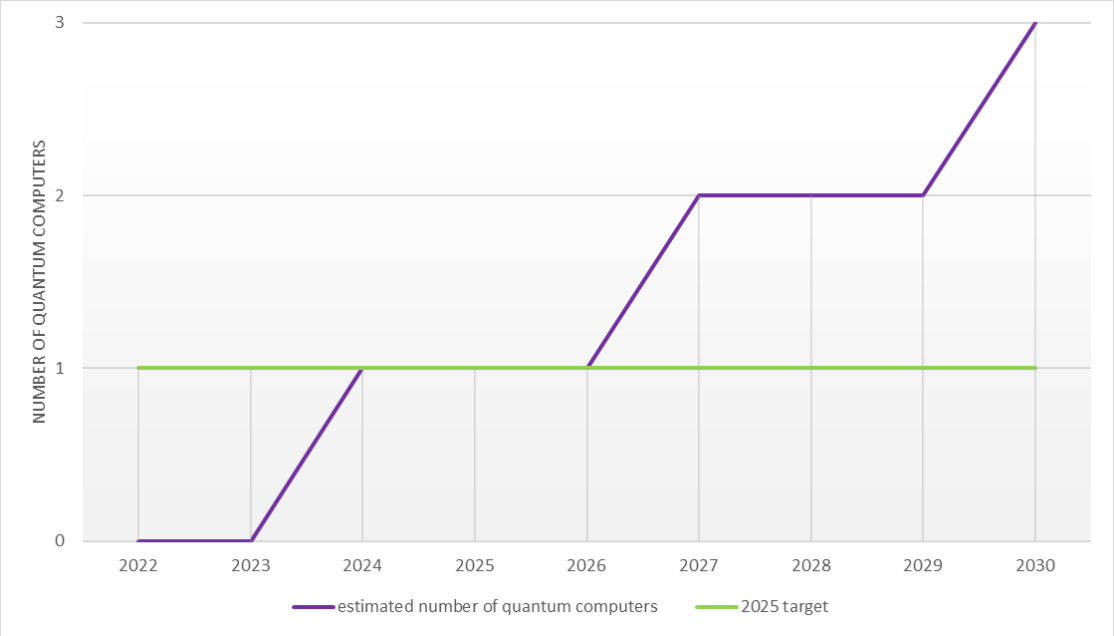
Baseline value (latest available historical data point): 0 in 2022.

Quantum computing is a fast developing field with significant potential for enhancing Europe's competitiveness and productivity in a wide range of sectors. Quantum computers will be able to perform calculations much faster, while consuming much less energy, than today's highest performance computers. They will be able, for instance, to enable much faster and more efficient development of new medicines, find solutions to highly complex logistics and scheduling problem, and develop new materials. Given the foundational role of quantum computing for Europe's digital transition, and its far-reaching economic and societal impact, this is a highly strategic field for the EU, and its geopolitical significance will only increase in the coming years. Given the specificity of this target, EU achievements in this area depend on the successful implementation of joint, multi-country commitments.

The starting value for this KPI is 0 in 2022. t is expected that at least one operational quantum computer will be deployed by 2024, ahead of the target timeline, followed by a second in 2027 and at least 3 by 2030 (Figure 10). Due to the specificity of this target, no baseline trajectory is established.

([23]) Quantum Technologies Flagship

Figure 10: Number of quantum computers in the EU. Trajectory towards 2030



Note: The quantum computing trajectory is based solely on an assessment by experts.

3.2.7. *Take-up of digital technologies*

Target: The digital transformation of businesses, where at least 75% of Union enterprises having taken up one or more of the following, in line with their business operations: (i) cloud computing services; (ii) big data; (iii) artificial intelligence.

KPI definition ([24]):

(i) Cloud computing, measured as the percentage of enterprises using at least one of the following cloud computing services: finance or accounting software applications, enterprise resource planning (ERP) software applications, customer relationship management (CRM) software applications, security software applications, hosting the enterprise's database(s), and computing platform providing a hosted environment for application development, testing or deployment.

(ii) Big data, measured as the percentage of enterprises analysing big data from any data source (internal or external). As of the 2024 report, big data will be measured by the percentage of enterprises performing data analytics (internally or externally).

(iii) Artificial intelligence, measured as the percentage of enterprises using at least one artificial intelligence technology.

Source: Eurostat – European Union survey on ICT usage and e-commerce in enterprises.

([24]) Further details on these KPI's definition are set out in the 'KPI Implementing Decision'.

Available data points: Cloud: 2014, 2016, 2018, 2020 and 2021 (break in series in 2021); Big data: 2016, 2018, 2020; AI: 2021.

Baseline value (latest available historical data point): 2021 Cloud computing = 34%; 2020 Big data = 14%; 2021 AI = 8%.

Context, assumptions, model functional form and latest developments

This target refers to the uptake by EU enterprises of three different digital technologies that play a key role in supporting competitiveness, improving the ability to store, extract and process data, improving services and products or creating new ones. The measurement of the target is supported by three indicators that look at the share of EU enterprises which:

- Use sophisticated or intermediate cloud computing services.
- Use of big data analytics, which in turn refers to the use of technologies, techniques or software tools (such as data or text mining, machine learning) for analysing big data extracted from the enterprise's own data sources or other data sources.
- Use at least one artificial intelligence (AI) technology, such as 1. text mining, 2. speech recognition, 3. natural language generation, 4. image recognition and processing, 5. machine learning (e.g., deep learning) for data analysis, 6. AI based software robotic process automation, 7. autonomous robots, self-driving vehicles, autonomous drones.

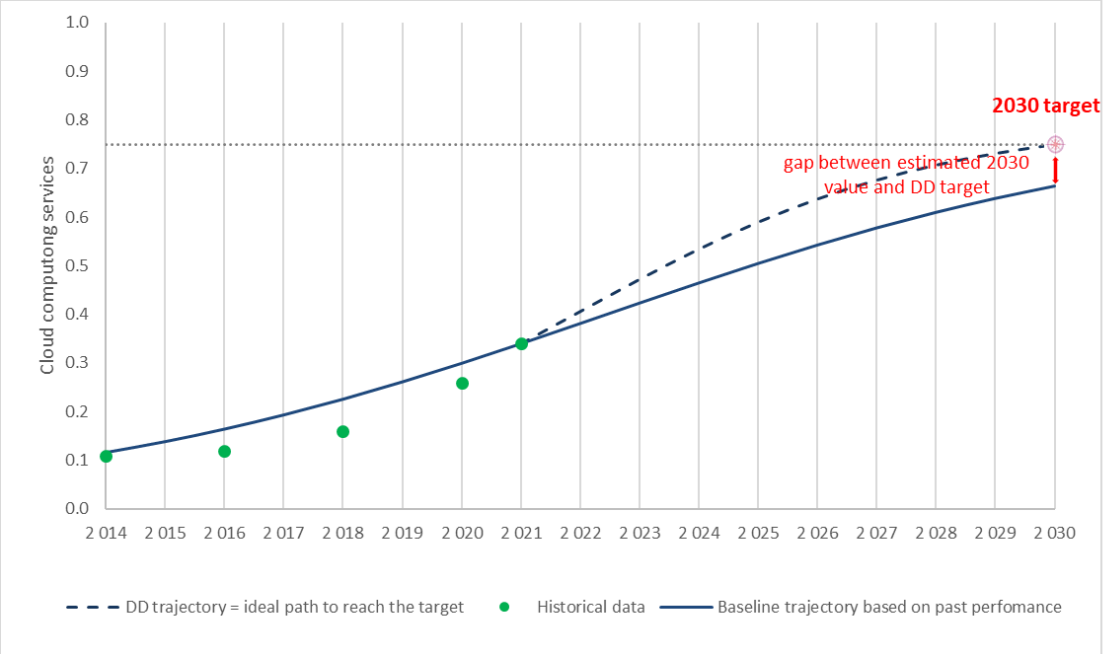
The corresponding trajectories are described below.

Cloud: According to the relevant literature, an S-shaped adoption curve is the most appropriate approach for estimating the evolution of enterprise cloud computing (take-up of intermediate and sophisticated services). The adoption of this technology might still present some economic (e.g., limited choice), security and technical challenges (e.g. vendor lock-in) associated with the lack of advanced skills across enterprises, in particular among small and medium-sized enterprises (SMEs). This might delay full adoption, in particular of sophisticated cloud services, leading to a flatter growth rate near to the saturation point of the curve. The functional form adopted for this KPI is therefore the S-shaped one, typically used to describe this type of technological diffusion process.

The market saturation point is set at 80% for both the Digital Decade and the baseline trajectories. The saturation point is assumed to be slightly above the 2030 target of 75% to allow for a further increase in the cloud technology adoption levels after the target has been reached. The speed of diffusion parameter for the Digital Decade trajectory is set so that the 75% target is reached by 2030, while the speed of diffusion for the baseline trajectory is based on the data before the break in series (2014-2020). As for all the other S-shaped functional forms, the timing of diffusion is computed to make the baseline trajectory start at the last observed data point (the 2021 value for cloud).

Figure 11 shows the Digital Decade and baseline trajectories for the share of firms using sophisticated or intermediate cloud services. The estimated 2030 value in the 'business as usual' scenario falls short of the 2030 target value by approximately 10 percentage points if no additional investments are implemented (66% is the 2030 forecast projected along the baseline trajectory).

Figure 11: Share of enterprises using cloud services in the EU. Historical data, Digital Decade (DD) trajectory and baseline trajectory towards 2030 ([25])

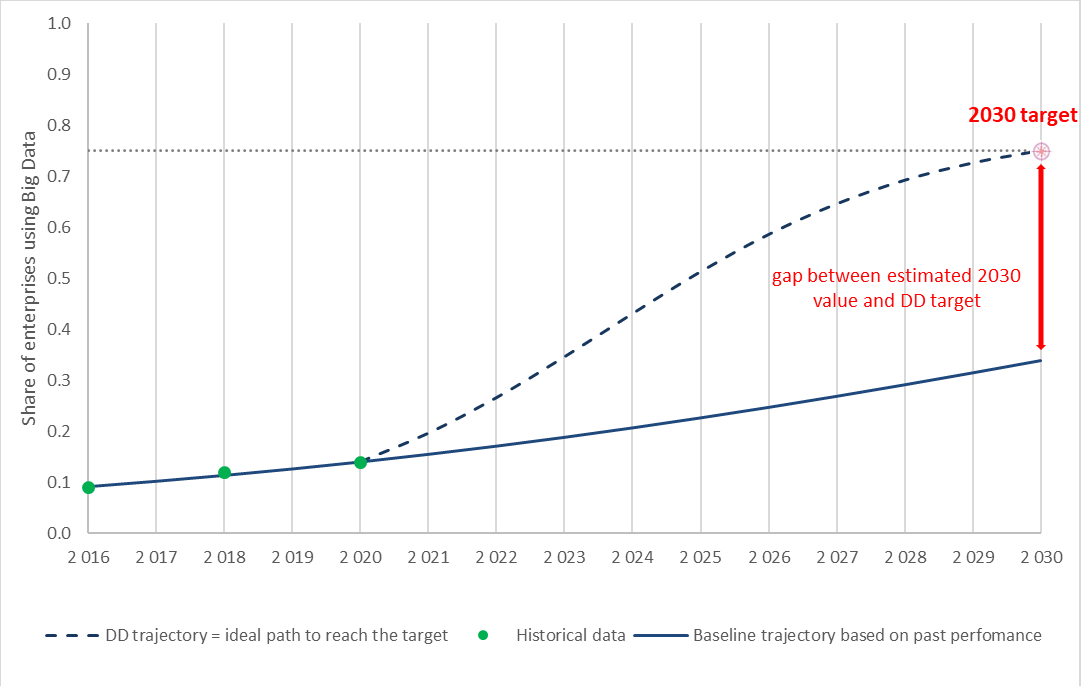


Big data: The technology adoption rationale described by an S-shaped curve applies here too. Big data analysis take-up is expected to be slow in the beginning, accelerating after a while to reach a slower final uptake. This will probably be driven by very small firms that may have less incentive to adopt big data technologies. Also in this case, the market saturation point is set at 80%, above the target of 75%, to allow for a further increase after the target has been reached. The speed of diffusion parameter is set so that the 75% target is reached by 2030 in the Digital Decade trajectory.

Figure 12 shows the Digital Decade and baseline trajectories for the share of firms using big data analysis. The estimated 2030 value in the 'business as usual' scenario is far below the 2030 target (34% is the 2030 forecast projected along the baseline trajectory).

([25]) Eurostat's indicator 'Enterprises purchasing at least one of the following cloud computing (CC) services: hosting of the enterprise's database, accounting software applications, customer relationship management software, computing power' (code E_CC_GE_ME) is used for the period 2014-2020. A break in series occurred in 2021 when the indicator 'Enterprises buying sophisticated or intermediate CC Services' was used. This indicator includes different CC services: Accounting software (CC_PFACC); ERP software (CC_PERP); CRM software (CC_PCRM); Security software (CC_PSEC); Database hosting (CC_PDB) and Hosting environment for application development (CC_PDEV).

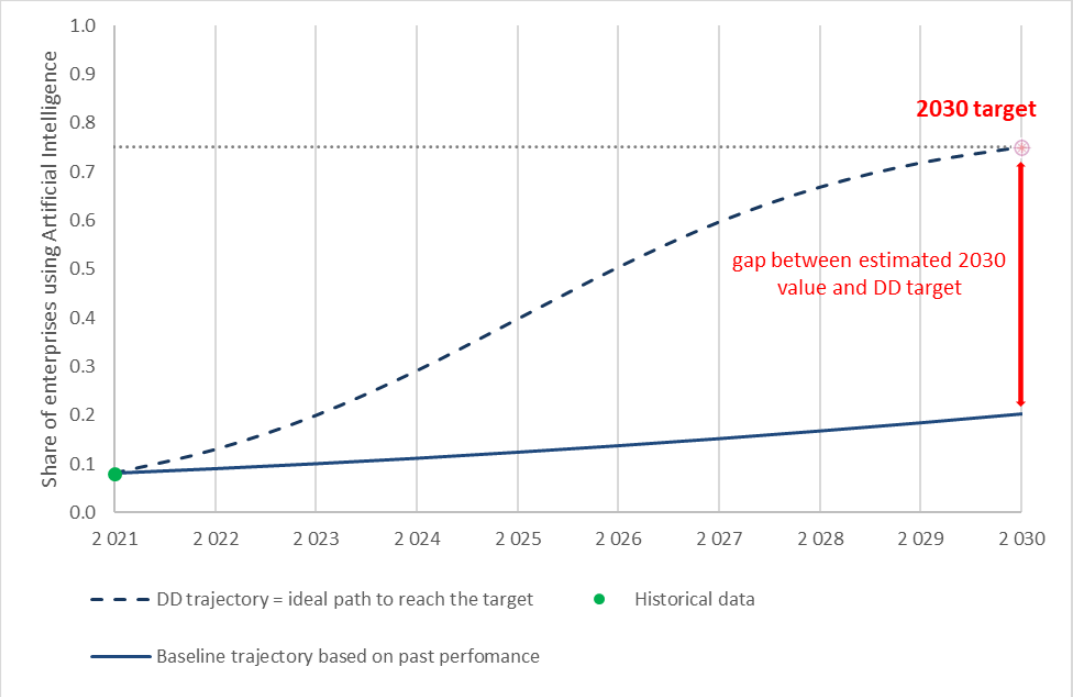
Figure 12: Share of enterprises using big data analysis in the EU. Historical data, Digital Decade (DD) trajectory and baseline trajectory towards 2030



Artificial intelligence: The lack of time series data for AI adoption does not allow a baseline trajectory to be built based on data. The literature on technology adoption clearly recommends using an S-shaped curve for this KPI as well. AI adoption is usually a process that complements big data adoption because AI methodologies are for example very much suited to exploiting the full potential of big data. To overcome the lack of AI data points, the baseline trajectory for AI uses the same speed of diffusion parameter as the one estimated for the big data baseline trajectory. As for all the other KPIs, the timing of diffusion is instead computed by imposing that the baseline trajectory starting point coincides with the (unique) observed data point.

Figure 13 shows the Digital Decade and baseline trajectories for the share of firms using AI. Also in this case, the estimated 2030 value in the 'business as usual' scenario is far below the 2030 target (20% is the 2030 forecast projected along the baseline trajectory).

Figure 13: Share of enterprises using AI in the EU. Historical data, Digital Decade (DD) trajectory and baseline trajectory towards 2030 (same speed of diffusion parameter as in the big data baseline trajectory)



Overall, it can be observed that the adoption of digital technologies by enterprises remains uneven. It varies depending on the technology used, with sharp differences among Member States and economic sectors. The use of cloud computing services experienced significant growth in recent years, reaching 34% of firms in the EU in 2021 (60% among large companies and 33% among SMEs). The uptake of big data analytics and AI technologies remains much more limited, used by only 14% and 8% of EU enterprises respectively. Reaching the Digital Decade targets will require substantial efforts by Member States through comprehensive and integrated policies aimed at boosting uptake and addressing obstacles that hinder progress (including the lack of specialised skills and technical expertise, obstacles to the use of data). Without additional targeted actions, the uptake of big data and AI in particular will significantly fall short of the set targets.

3.2.8. *Basis level of digital intensity*

Target: The digital transformation of businesses, where more than 90% of the Union SMEs reach at least a basic level of digital intensity ([26]).

KPI definition: SMEs with at least a basic level of digital intensity, measured as the percentage of SMEs using at least 4 of 12 selected digital technologies.

([26]) As defined in Commission Implementing Regulation (EU) 2021/1190 of 15 July 2021 laying down the technical specifications of data requirements for the topic 'ICT usage and e-commerce' for the reference year 2022, and subsequent implementing regulations pursuant to Regulation (EU) 2019/2152 of the European Parliament and of the Council (Text with EEA relevance), in particular Article 7(1) and Article 17(6).

Source: Eurostat – European Union survey on ICT usage and e-commerce in enterprises (code: ISOC_E_DII ([27])).

Available data points: from 2015 to 2022 (break in series every year).

Baseline value (latest available historical data point): 69% in 2022.

Context, assumptions, model functional form and latest developments

'Digital intensity' is an aggregate value based on the number of technologies a business uses, against a scoreboard of various technologies, in line with the Digital Economy and Society Index. This target refers to a wide uptake of digital technologies among SMEs([28]) in the EU, the businesses that employed almost two thirds of the active population in the EU's non-financial economy in 2020.

Digital Intensity is measured via the Digital Intensity Index (DII), which measures how many of 12 selected technologies are used by firms. A basic level of digital intensity means that an enterprise uses at least 4 of the 12 selected digital technologies.

Every year, the index covers a broad range of technologies, from basic to more sophisticated ones, and aims to measure the level of digitalisation of SMEs in the EU. The 2022 survey included the following 12 technologies and/or criteria: "*1. Enterprises where more than 50% of the persons employed had access to the internet for business purposes; 2. Employ ICT specialists; 3.The maximum contracted download speed of the fastest fixed line internet connection is at least 30 Mb/s ([29]); 4.Enterprises which conduct remote meetings; 5. Enterprises make persons employed aware of their obligations in ICT security related issues; 6. Any type of training provided to develop ICT related skills of the persons employed, during 2021; 7. Use at least three ICT security measures; 8. Enterprise with document(s) on measures, practices or procedures on ICT security; 9. Any of the persons employed having remote access to any of the following: e-mail, documents, business apps; 10. Use industrial or service robots; 11. Used any computer networks for sales (at least 1%); 12. Enterprises where web sales are more than 1% of the total turnover and Business-to-Customer (B2C) web sales more than 10% of the web sales ([30])*".

Having a flexible definition enables the indicator to be adapted to technological change and develop, as skills or technologies that are considered advanced today might become basic in the future. However, due to the change in the composition of the indicator to include more recent technologies, the indicator has shown little progress over the last few years and even dropped in some years.

([27]) The KPI is computed as the complement to 100 of the percentage of SMEs with a very low digital intensity index (sub-category E_DI4_VLO).

([28]) Enterprises having between 10 and 249 number of employees and self-employed persons are considered for the DII estimation (data for micro enterprises missing for almost all the MSs)

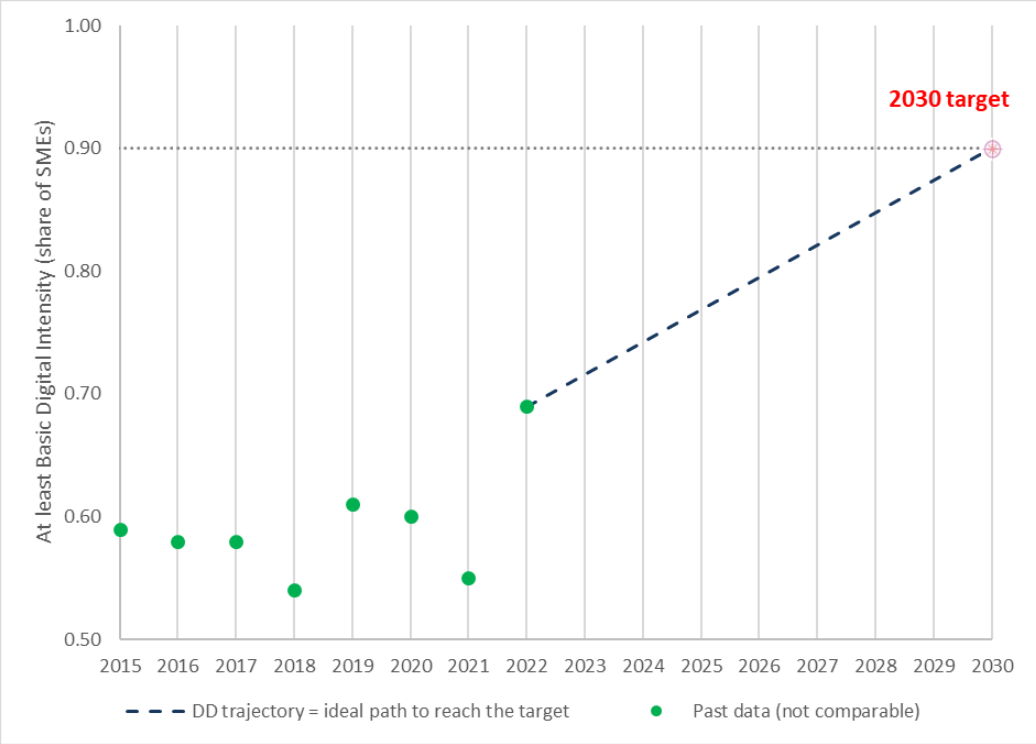
([29]) With the Gigabit Infrastructure Act the Commission has proposed to upgrade the reference speed for to 1 Gbps.

([30]) The Enterprise survey questions used for the definition of the Digital Intensity Index vary every year. The list used by year is provided by Eurostat.

The unavailability of comparable historical data made it not possible to establish a baseline trajectory. To enable better monitoring, the Commission is working on a consistent definition every 2 years, starting from 2021. As a result, the 2021 figures will be comparable with those of 2023, 2025, 2027 and 2029, while the 2022 figures will be comparable with those of 2024, 2026, 2028 and 2030.

The Digital Decade trajectory is based on a linear functional form as the assumption is that the KPI will follow an increasing trend, although with fluctuations year on year, reaching the target in 2030 (Figure 14).

Figure 14: Digital Intensity Index. Historical data and the Digital Decade (DD) trajectory towards 2030



3.2.9. *Innovative businesses/scale-ups (unicorns)*

Target: The digital transformation of businesses, where the Union facilitates the growth of its innovative scale-ups and improves their access to finance, leading to at least doubling the number of unicorns.

KPI definition: Unicorns are measured as the sum of unicorns referred to in Article 2, point (11)(a), of the Decision and those referred to in Article 2, point (11)(b), of that Decision.

Source: Dealroom platform ([31]).

Available data points: from 2008 to 2022.

([31]) https://dealroom.co/guides/guide-to-unicorns

Baseline value (latest available historical data point): 249 in 2022 ([32]).

The 2030 target for this KPI requires a definition of the reference data point. This Communication takes the number of unicorns recorded in 2022 in the EU (249) as the reference point and considers 500 as the 2030 target.

As noted by experts ([33]), unstable macroeconomic trends in the last year suggest that growth levels in recent years are not likely to be sustained in the near term, and possibly not even in the longer term. This new reality was already evident in the last two quarters of 2022, when investments in start-ups fell and most leading tech companies (large caps and unicorns) laid off staff. High inflation, rising interest rates and geopolitical crises, such as the war in Ukraine, all contributed to the recent decline in the number of new unicorns. This suggests that the high growth levels observed in the EU in recent years may not be replicable in the medium term.

Newly released data ([34]) indicates that the number of new unicorns in the EU was relatively low in the first quarter of 2023, with only four recorded, compared to around 20 in the corresponding period in 2021 and 2022 (22 and 20 respectively). Four new unicorns were founded in Q1-2020. The 'birth rate' of unicorns in the EU seems therefore to have declined to pre-COVID levels.

Even with its recent upward trend, the EU lags behind other regions such as the US, China and the UK, where most unicorns are concentrated, either because they are founded there or move there after they have been founded ([35]). Creating strong and supportive systems and exploiting the full potential of the EU Single Market are important factors in boosting the number of unicorns or attracting them from all over the world.

The baseline trajectory relies on the historical data of unicorns covering the period 2008-2022. The functional form chosen in this case is the exponential one and fits well the historical data (Figure 15). No Digital Decade trajectory is shown due to the recent/current instability of trends.

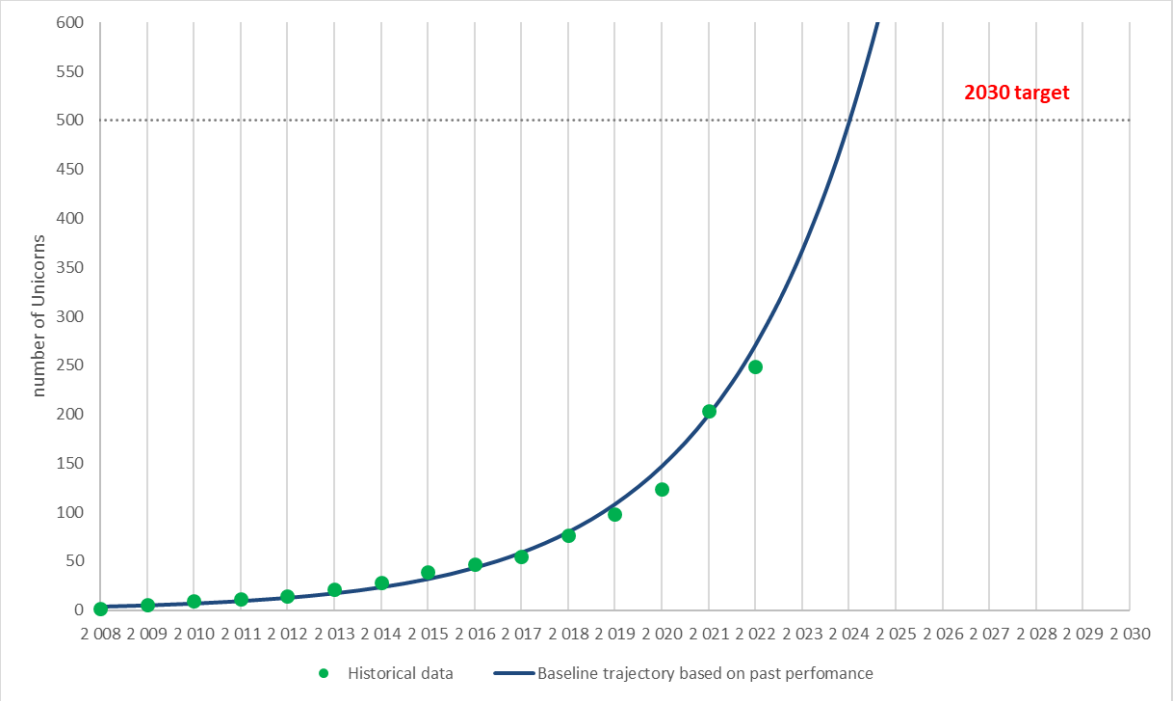
([32]) The Dealroom platform regularly updates the number of unicorns. The number of unicorns in the EU on 09/01/2023 was 249, as downloaded from Dealroom. The UK is always excluded from the statistics shown in this document.

([33]) CBINSIGHTS' Research Brief (https://www.cbinsights.com/research/unicorn-company-slowdown/) and 2022 Atomico State of European Tech report (https://stateofeuropeantech.com/1.european-teach-a-new-reality).

([34]) Dealroom (https://tinyurl.com/EU-unicorns-Q1-2023)

([35]) Dealroom (https://tinyurl.com/unicorns-totals-non-EU)

Figure 15: Number of unicorns in the EU. Historical data and baseline trajectory



3.2.10. *Digitalisation of public services*

Target: The digitalisation of public services, where there is 100% online accessible provision of key public services and, where relevant, it is possible for citizens and businesses in the Union to interact online with public administrations.

KPI definition:

- **Citizens**: Online provision of key public services for citizens, measured as the share of administrative steps that can be done fully online for major life events. The following life events are considered: moving; transport; starting a small claims procedure; family; career; studying; and health.

- **Businesses**: Online provision of key public services for businesses, measured as the share of administrative steps needed to start a business and conduct regular business operations, which can be done fully online.

Source: e-Government benchmark([36]).

Available data points: from 2013 to 2022 (break in series as of 2020).

Baseline value (latest available historical data point): 2022: Citizens = 77 (on a 0-100 scale); Businesses = 84 (on a 0-100 scale).

([36]) e-Government Benchmark 2023, Capgemini, Sogeti, IDC and Politecnico di Milano for the European Commission

Context, assumptions, model functional form and latest trends

The provision of digital public services has become a fundamental tool for the public sector. Public authorities can increase their efficiency and improve their relationship with the public through e-Government, where technology is used to improve and facilitate government services, for example to request birth certificates or submit tax returns online. Wider and easier access to public services ultimately increases their transparency and accountability, while at the same time reducing red tape. This target aims to ensure wide and easy access to public services online, measured through the online availability of key public services for both citizens – for example to make or reschedule an appointment at the hospital or appeal against a court decision – and businesses, for example when starting a business or conducting regular business operations.

The KPIs used for trajectory estimations are:

- For citizens, the target is monitored via the share of administrative steps that can be carried out online for major life events (moving; transport; starting a small claims procedure; family; career; studying; health) for citizens.

- For businesses, the target is monitored via the share of public services needed for starting a business and for conducting regular business operations that are available online for domestic as well as for foreign users.

The eGovernment data collection is organised around the life events that are packages of government services usually provided by multiple government agencies. For each life event, all relevant interactions with government that an individual or business might seek are measured by the eGovernment benchmark. Both KPIs include a cross-border dimension, i.e., the extent to which information services and transaction services and information on these services are provided online for users from other EU countries.

According to the relevant literature, the evolution of the provision of digital public services is assumed to follow an S-shaped curve for both citizen and business services. Two main reasons support this choice. First, some services might be more expensive to provide online. They will therefore be left at the end of the digitalisation process with slower growth as the process reaches the saturation point. Second, services in rural or remote areas, where there is less digital infrastructure, might be more difficult to digitalise because digital infrastructure tends to be less diffuse in these areas. The saturation point is set to 100% and describes the situation when all key public services are fully available online. This assumption is confirmed by the fact that some EU countries already reached the maximum value in either the citizen or business KPI in 2021, and hence achieved the Digital Decade target, as reported by the latest eGovernment benchmark report.

The methodology used by the eGovernment benchmark was revised in 2020, leading to a break in the series for both indicators ([37]). To adapt to the break in series, the following approach is adopted to estimate the speed of diffusion:

1. The speed of diffusion parameter for the baseline trajectory is estimated using the data points before the break in series only (2013-2019).

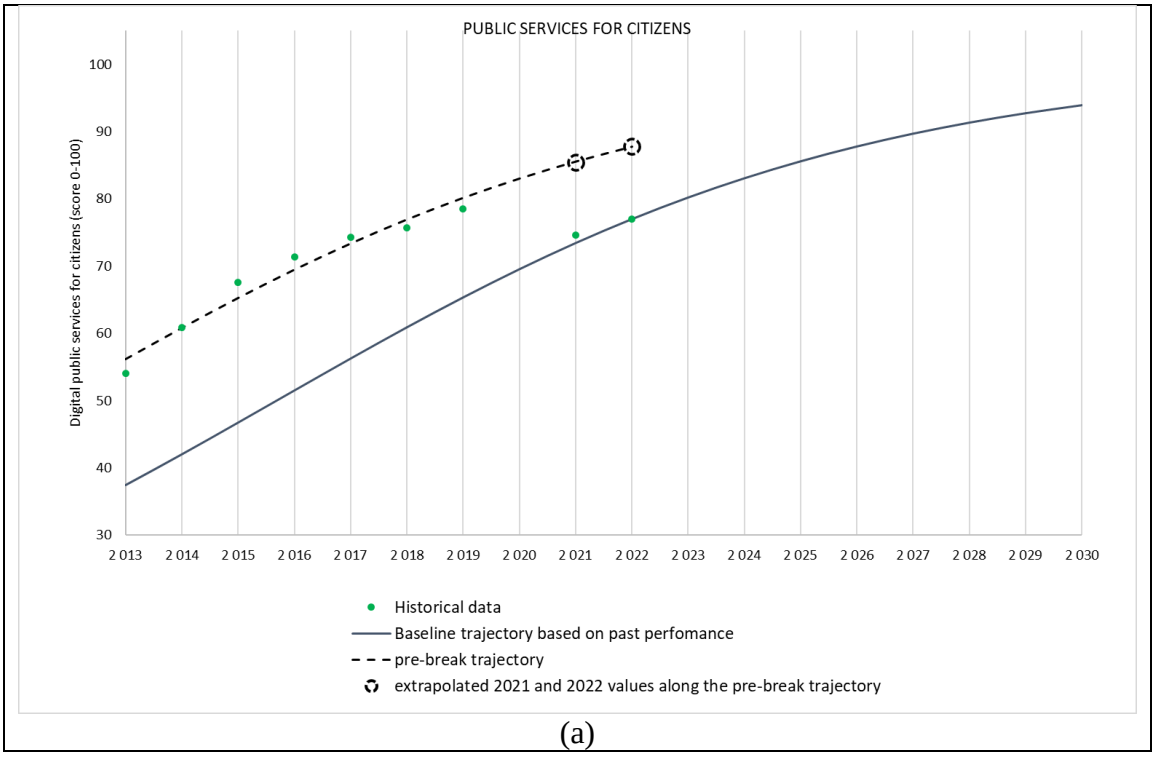
([37]) During the methodology update, the number of services per life event was reduced and the Transparency of Public Organisations indicator was replaced with the Transparency of Service Design indicator. Full details on the revision and the new method in the eGovernment Benchmark Method Paper 2020-2023.

2. A first estimate of the speed of diffusion is computed using pre-break data points only ('pre-break trajectory'); the two post-break data points for 2021 and 2022 are extrapolated along the pre-break trajectory; the average break in series effect is estimated as the average difference between the extrapolated and observed data points for 2021 and 2022; the post-break data points are adjusted for the average break in series effect and the speed of diffusion is estimated again using the whole time series, including the pre-break and adjusted post-break data points.

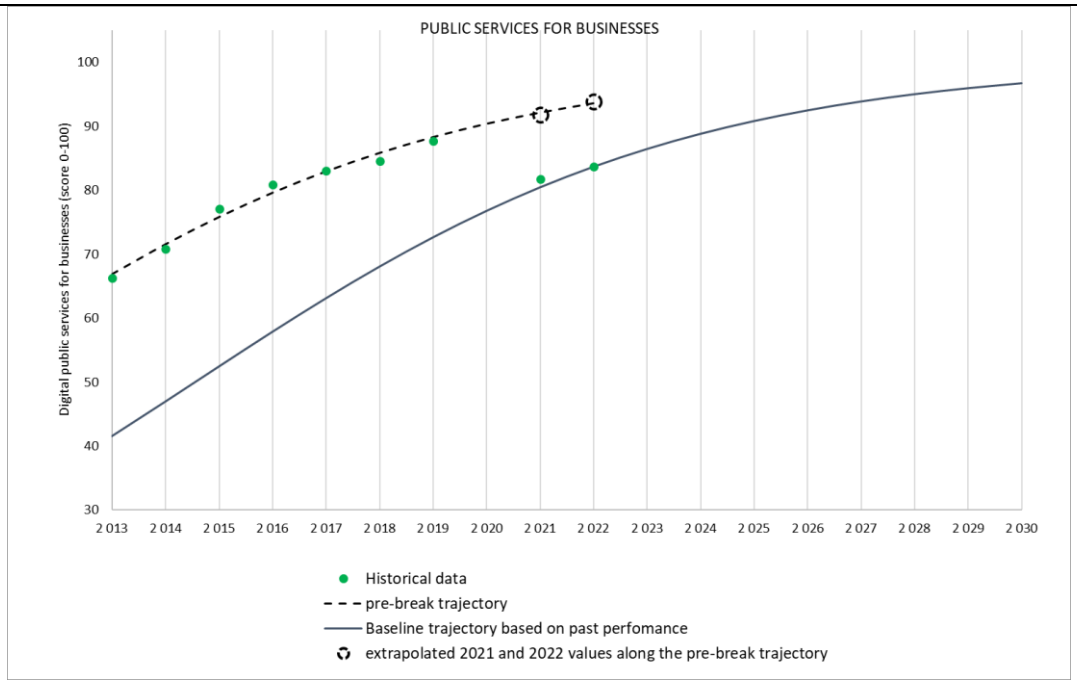
As for all the other KPIs, the timing of diffusion parameter is set so that the starting value of the trajectory is equal to the most recent observed value, the 2022 one. Figure 16: citizens (a) and businesses (b) show the resulting baseline trajectories for both KPIs.

For both KPIs, the 2021 and 2022 observed data points are in line with the speed of diffusion estimated with the pre-break time series.

Figure 16: Estimation of the baseline trajectory based on both pre- and post-break data points: digital public services for citizens (a) and for businesses (b)



(a)

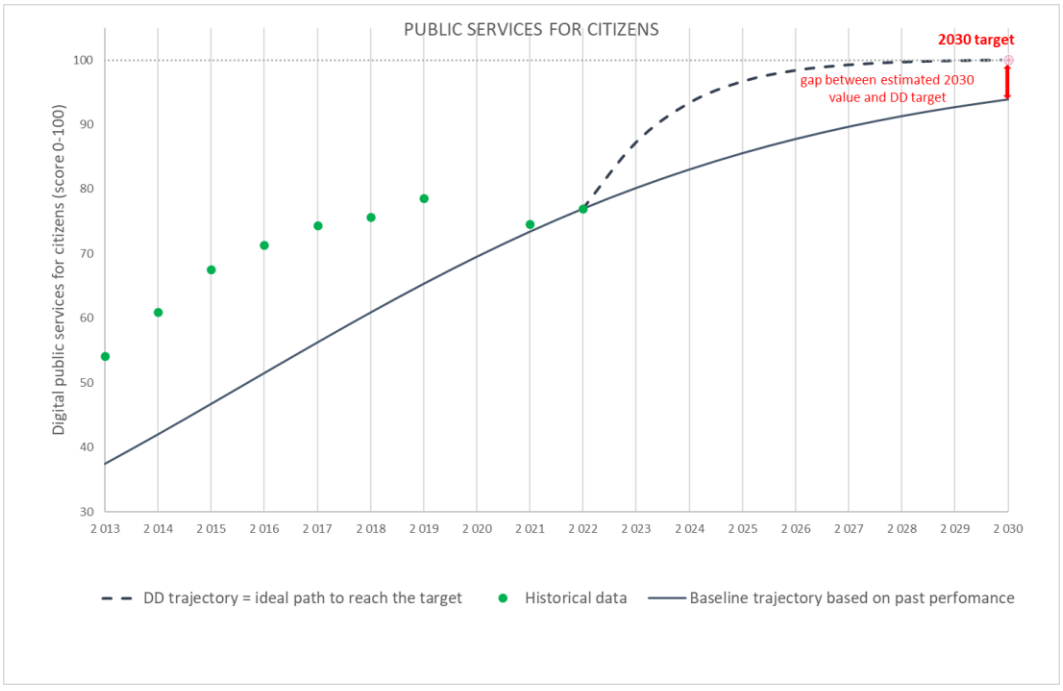


(b)

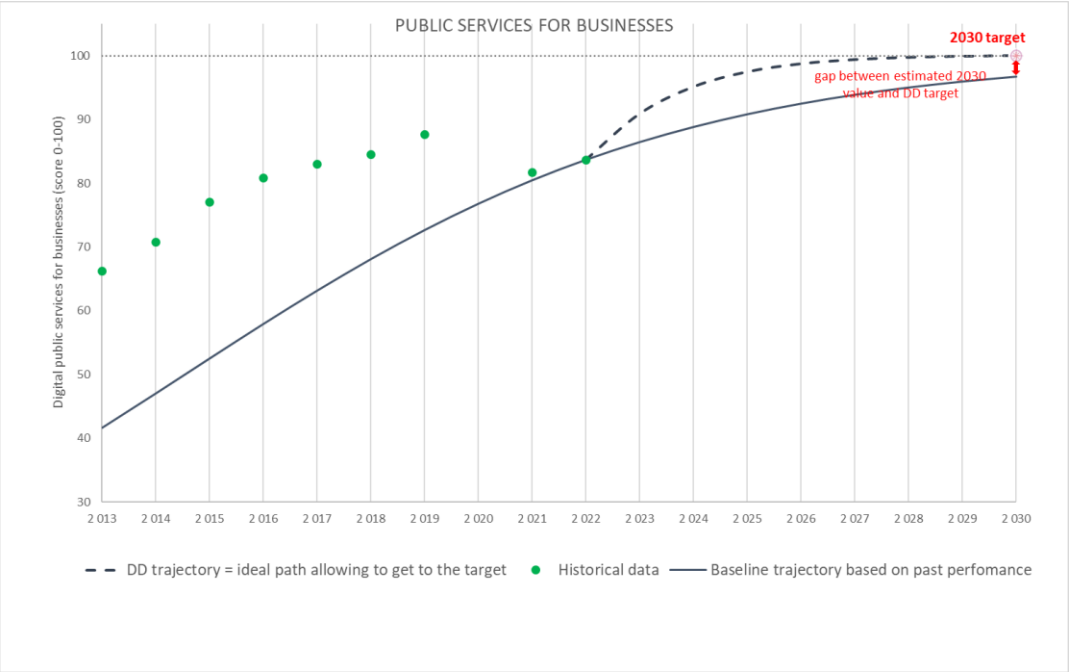
Historical data, the Digital Decade trajectory and the baseline trajectory are shown in Figure 17 (a) for the citizen KPI and Figure 17 (b) for the business KPI.

Figure 17: Online service provision for citizens (top chart) and businesses (bottom chart). Historical data, Digital Decade (DD) trajectory and baseline trajectory towards 2030

(a) Share of administrative steps that can be done online for major life events for citizens nationals and foreigners (0 = no steps can be done online; 100 = the whole process can be done online). Historical data, Digital Decade and baseline trajectory



(b) Share of public services needed to start a business and conduct regular business operations that are available online for national as well as for foreign users (0 = no steps can be done online; 100 = the whole process can be done online). Historical data, Digital Decade and baseline trajectory



In 2022, the availability of digital public services for citizens and businesses scored 77 and 84 out of the maximum value of 100 respectively. Some Member States are already close to or have achieved the 100-point target. Nevertheless, progress is uneven across and within Member States. In particular, there is ample room for improvement in the availability of cross-border digital public services, which will be in particular achieved by the further implementation of the Single Digital Gateway ([38]).

The 2030 forecast projected along the baseline trajectory is 94/100 for the citizen indicator and 97/100 for the business indicator.

3.2.11. *Electronic health record*

Target: The digitalisation of public services, where 100% of Union citizens have access to their electronic health records.

KPI definition: Access to e-health records, measured as: (i) the nationwide availability of online access services for citizens to their electronic health records data (via a patient portal, or a patient mobile app) with additional measures in place that enable certain categories of people (e.g. guardians for children, people with disabilities, elderly) to also access their data, and (ii) the percentage of individuals that have the ability to obtain or make use of their own minimum set of health-related data currently stored in public and private electronic health-record (EHR) systems.

([38]) https://single-market-economy.ec.europa.eu/single-market/single-digital-gateway_en

Source: Empirica GmbH and PredictBy.

No available data point

Baseline value (latest available historical data point): 2022 = 72 (0-100 score).

The conceptual framework of the e-Health indicator is focused on the availability of electronic medical data for European citizens and does not measure their actual usage of online health services. The framework consists of four thematic dimensions, each including indicators that measure key aspects of the availability of online access to electronic health record data. There are 12 indicators in total at country level that describe:

1. the nationwide availability of online access to electronic health data;
2. the categories of accessible health data;
3. the availability of authentication schemes, type of front-end solutions and coverage;
4. accessibility for certain categories of people, like vulnerable groups.

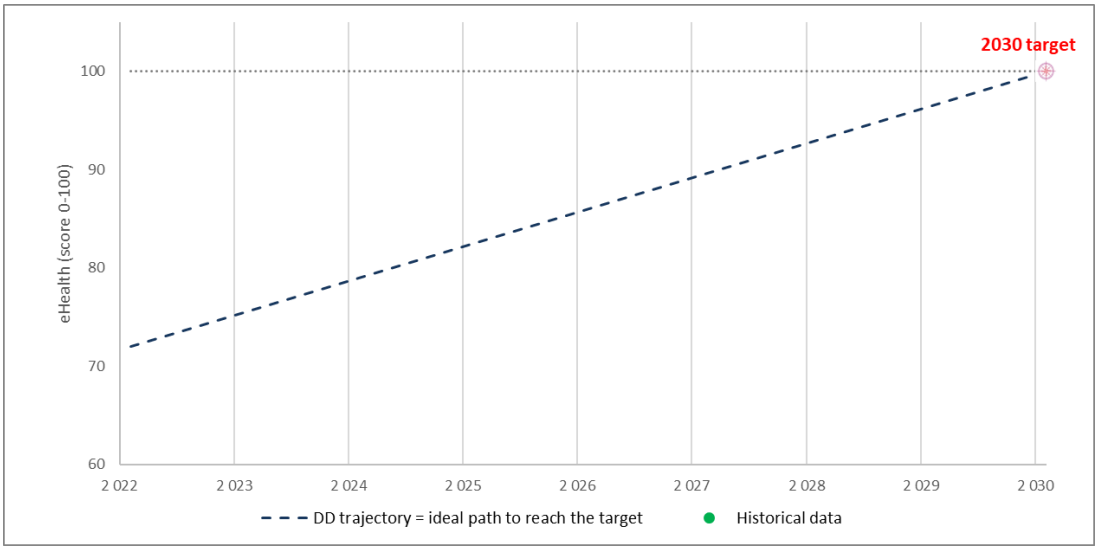
The e-Health indicator is an aggregate measure of the scores of each thematic dimension weighted differently according to the number of indicators included in the dimension.
In 2022, the EU scored 72 on a scale of 0-100.

Due to the lack of comparable and consistent data on this target, a specific study was carried out to develop a monitoring framework to measure citizens' online access to electronic health data in the EU ([39]). Data was collected via an online survey among the Member State authorities responsible for e-health. The survey methodology and set of questions were validated with the help of the country representatives in the European eHealth Network to ensure the quality of data collected. Data was collected in February-March 2023. All EU Member States responded to the survey.

In the absence of historical data, the baseline trajectory could not be estimated, whilst for establisging the Digital Decade trajctory it is assumed that the ideal path towards 100% of EU citizens having online access to health data by 2030 will follow a linear trajectory from 72 in 2022 to 100 at the end of the decade (Figure 18).

([39]) Digital Decade e-Health indicators development, Empirica GmbH and PredictBy study for the European Commission

Figure 18: e-Health composite indicator. Historical data and DD trajectory



3.2.12. *Electronic identification (eID)*

Target: The digitalisation of public services where 100% of Union citizens have access to secure electronic identification (eID) means that are recognised throughout the Union, enabling them to have full control over identity transactions and shared personal data.

KPI definition: Access to eID is measured by two KPIs: (1) the number of Member States that have notified at least one national eID scheme in accordance with Regulation (EU) No 910/2014; and (2) as the number of Member States that have provided access to secure privacy-enhancing eID via the European Digital Identity Wallet in accordance with the Proposal for a Regulation of the European Parliament and of the Council amending Regulation (EU) No 910/2014 as regards establishing a framework for a European Digital Identity[40]).

Source: The European Digital Identity Framework.

No available data point

Baseline value (latest available historical data point): 21/27 national eID scheme notified in accordance with Regulation (EU) No 910/2014.

The Digital Decade target on electronic identification provides for 100% of citizens having access to secure, privacy-enhancing eID by 2030.

The target will be tracked by two KPIs. The first one is the number of Member States that have notified at least one national eID scheme to the Commission in accordance with Regulation (EU) No 910/2014. By the time of adoption of this Communication, a total of 21 EU countries have notified at least one eID scheme.

The second KPI uses as a benchmark the proposal that the Commission put forward in June 2021 for a European Digital Identity Framework, revising the existing European electronic

([40]) COM/2021/281 final.

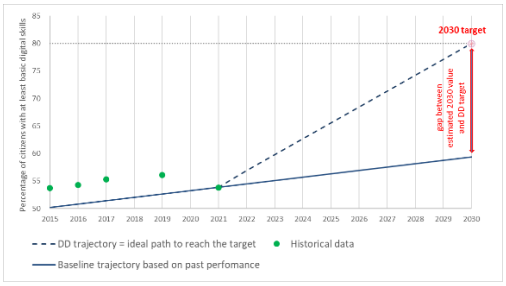
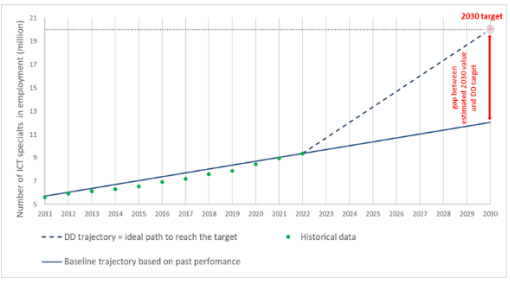
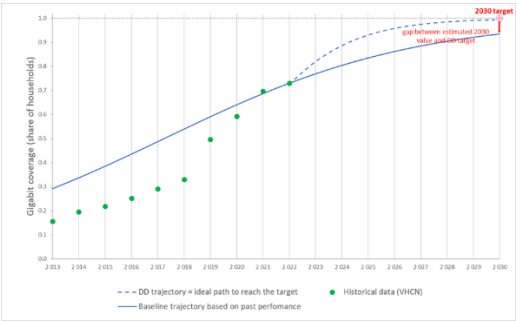
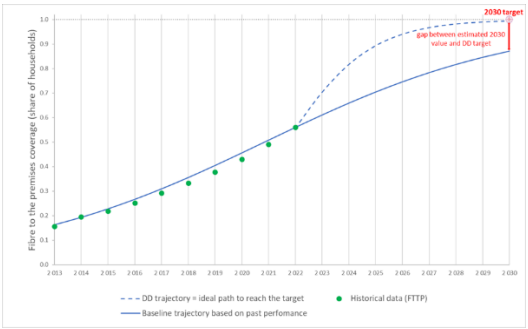
identification and trust services initiative (eIDAS Regulation). The proposed new framework aims to amend the 2014 eIDAS Regulation and ensure that by 2030, in line with the target set in the Digital Decade Policy Programme, 100% of EU citizens have access to a secure eID scheme recognised throughout the EU, giving users full control over identity transactions and shared personal data. The proposal includes a personal digital wallet to allow citizens to prove their identity and share identity-related attributes and electronic documents in a secure and convenient way. The European Digital Identity wallets will enable people to choose which aspects of their identity, data and certificates they share with third parties and keep track of sharing. User control ensures that only information that needs to be shared will be shared. Use of the European Digital Identity wallet will always be at the choice of the user.

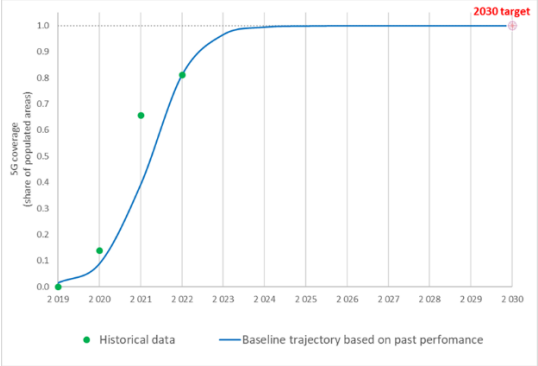
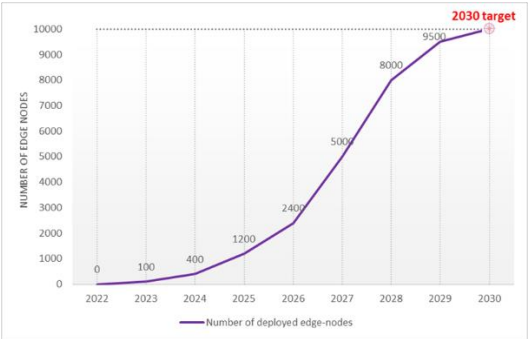
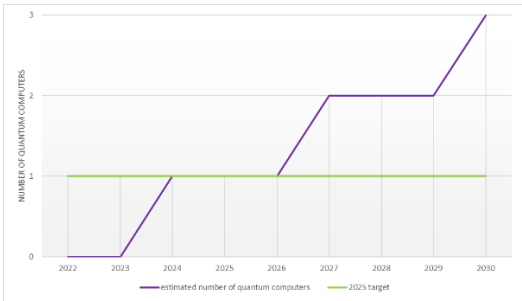
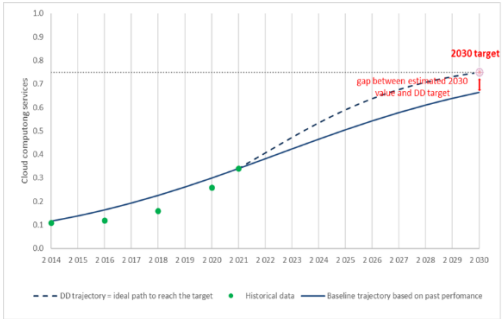
The proposal which is at the time of publication of this Communication expected to be adopted soon, will require EU Member States to provide access to a digital wallet built on common technical standards. To set up the necessary technical architecture, speed up implementation of the revised regulation, provide guidelines to Member States and avoid fragmentation, the proposal was accompanied by a recommendation for the development of a common EU toolbox defining harmonised technical specifications for the wallet.

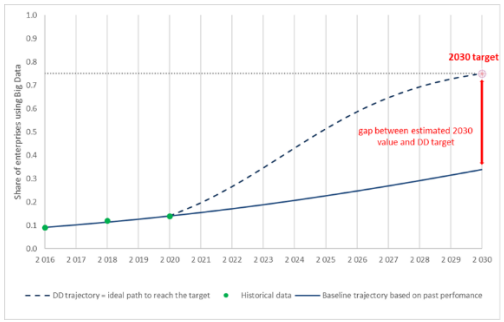
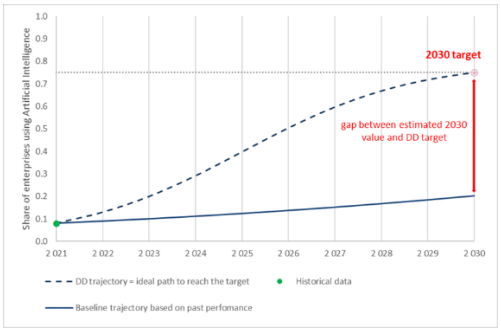
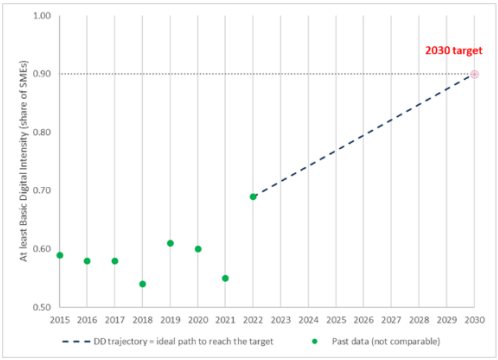
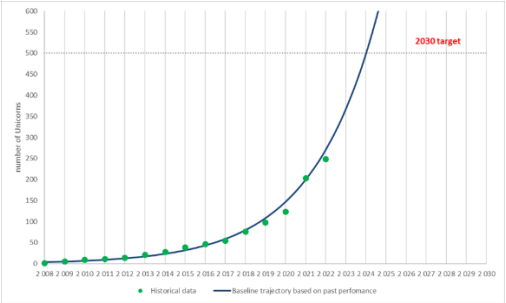
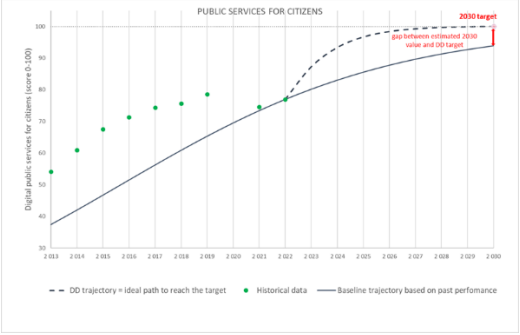
The evolution of this target is conditioned by the implementation of the European Digital Identity Framework by the Member States. The trajectories of this target will be established based on the deadline set by the co-legislators for provision of the European Digital Identity Wallet by Member States.

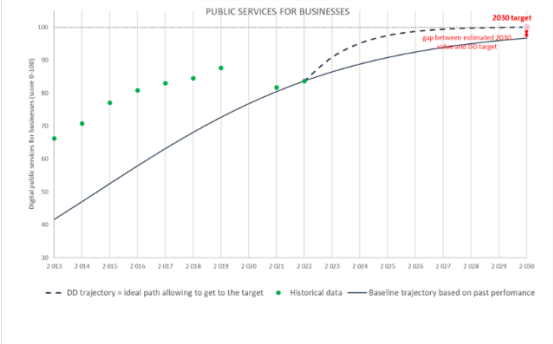
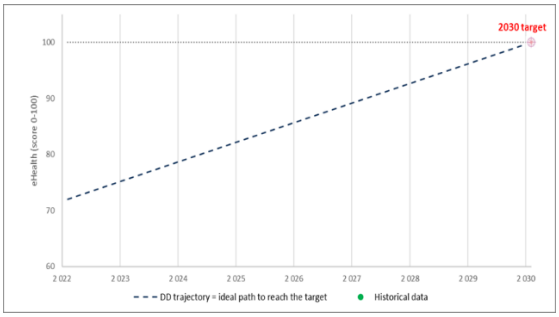
In the context of the review of the digital targets that the Commission should undertake by June 2026 where necessary, the 2030 target for access to secure, privacy-enhancing eID may be reviewed taking into account the adoption and implementation stages of the European Digital Identity Framework.

4. ANNEX: BIRD'S EYE VIEW OF THE TRAJECTORIES OF THE DIGITAL DECADE POLICY PROGRAMME

At least basic digital skills 2021 value: 54% 2030 value: • target: 80% • projected: 59%	
ICT specialists in employment 2022 value: 9.37 million 2030 value: • target: 20 million • projected: 12.0 million	
Very High-Capacity Network (gigabit) 2022 value: 73% 2030 value: • target: 100% • projected: 94%	
Fibre To the Premises (FTTP) 2022 value: 56% 2030 value: • target: 100% • projected: 87%	

Overall 5G coverage 2022: 81% 2030 value: • target: 100% • projected: 100%	
Semiconductors 2022: approximately 10% of global market 2030 value: • target: 20% • projected: N/A	N/A
Edge nodes 2022 value: 0 2030 value: • target: 10 000 • projected: N/A	
Number of quantum computers 2022 value: 0 2030 value: • target: 'the cutting edge of quantum capabilities' • projected: 3	
Take-up of cloud services by businesses 2021: 34% 2030 value: • target: 75% • projected: 66%	

Take-up of big data by businesses 2020: 14% 2030 value: • target: 75% • projected: 34%	
Take-up of AI by businesses 2021: 8% 2030 value: • target: 75% • projected: 20%	
SMEs with at least basic digital intensity 2022 value: 69% 2030 value: • target: 90% • projected: N/A	
Number of unicorns 2022 value: 249 2030 value: • target: 500 • projected: >500	
Digitalisation of public services for citizens 2022: 77/100 2030 value: • target: 100/100 • projected: 94/100	

Digitalisation of public services for businesses 2022: 84/100 2030 value: • target: 100/100 • projected: 97/100	
eHealth composite indicator on the availability of electronic medical data 2022: 72 (score 0-100) 2030 value: • target: 100/100 • projected: N/A	
eID 2023: 21 countries with eID schemes notified **eWallet** The KPI follows the European Digital Identity Framework.	N/A