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Promoting social cohesion and convergence

Narrowing the digital divide: Economic and social convergence in Europe's digital transformation

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Eurofound

European Foundation for the Improvement of Living and Working Conditions

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Executive summary

Introduction

This report assesses upward convergence trends in digitalisation and proposes actionable strategies to ensure that no one is left behind. Upward convergence takes place when EU Member States grow together in the same direction and disparities are reduced.

When Ursula von der Leyen, President of the European Commission, launched the twin (digital and green) transition in 2019, the commitment was to 'leave nobody behind'. In the complex scenario of digital competition on the global stage, the digital divide has both economic and social implications. In terms of economic implications, digitally excluded citizens and firms might be less equipped to engage in economic activities using digital means. This could translate into low productivity, lack of competitiveness and, consequently, low growth. Social implications arise because not having access to government or private services could lead to discontent and erode social cohesion.

Applying the lens of convergence to the evolution of digital indicators, this report investigates the digital divide and the long-term trends in digitalisation in Europe. It explores whether Member States, businesses, socioeconomic groups and regions have converged on their paths towards digitalisation.

Policy context

While digitalisation has been on the EU policy agenda since 2000 and significant progress has been made in this regard, the digital transformation is not yet complete. It has been reinforced with ambitious targets for 2030 – a 'Europe fit for the digital age' is now the priority. The second report on the Digital Decade, published in July 2024, called for additional investments in digital skills, high-quality connectivity and the uptake of artificial intelligence. The ambitious target of equipping 80 % of the EU population with basic digital skills is accompanied by EUR 250 billion in funding through NextGenerationEU and by a EUR 43 billion investment supporting the European Chips Act, which links with the European industrial strategy.

The digitalisation strategy is supported by regulations aiming to protect citizens and boost competitiveness in the market, such as:

- the Digital Services Act, setting out new standards for the accountability of online platforms regarding illegal content, disinformation and other societal risks;
- the Digital Markets Act, establishing a set of objective criteria for qualifying large online platforms as 'gatekeepers';
- the Artificial Intelligence (AI) Act, assigning applications of AI to three risk categories and prescribing mitigating and control actions;
- Directive (EU) 2024/2831 on improving working conditions in platform work;
- the European Chips Act, addressing semiconductor shortages and strengthening Europe's technological leadership;
- the European Data Act, establishing clear and fair rules for accessing and using data in the European data economy.

26 % of the Recovery and Resilience Facility (EUR 150 billion) is dedicated to digitalisation. The second report on the Digital Decade underlines progress made by Member States on digital key performance indicators in the areas of digital infrastructure, business transformation, skills and public services. It also highlights that progress has been uneven, in particular in the areas of digitalisation of small and medium-sized enterprises and digital skills. This Eurofound report explores these disparities and measures the extent to which convergence has been reached; it identifies socioeconomic groups, regions and businesses still affected by the digital divide.

Key findings

- Over the past two decades, great strides have been made in digitalisation. According to almost all indicators analysed, historically lower-performing Member States have been catching up with the digital leaders. However, significant regional and socioeconomic inequalities persist.
- When charting progress towards digitalisation, three levels of digital inclusion should be considered: access to infrastructure and devices, development of digital skills, and transformation of access and skills into tangible outcomes.
- Access is still an issue for vulnerable groups: low-income households, older individuals and those with lower levels of education. They are also more reliant on public services and may struggle in accessing e-government.
- Those with higher levels of education, those in the active workforce and those in the 25–44 age cohorts are better positioned, because they generally have access and the skills to harvest the advantages of using the internet and reap tangible benefits (social, economic and/or cultural).

- Upward convergence was also recorded in the digitalisation of Europe's businesses; once again, however, variable progress is being made by Member States.
- Larger firms and those located in urban areas have higher levels of digitalisation.
- The digital transition has important implications for Europe's competitiveness, as the use of advanced technologies in the private sector is associated with higher levels of labour productivity.
- The digitalisation that has taken place since 2008 has had significant links with the income convergence process across the EU-27.
- Across Member States, there are several examples of local initiatives that aim to bridge the digital divide, addressing specific socioeconomic groups and firms that need support.

These policies highlight the importance of committing to 'doing no harm' in the digital transition process and thus preventing the problem of exclusion.

Policy pointers

- Policymakers should adopt a commitment to doing no harm in the digital transition process, meaning that nobody should be excluded from accessing essential goods or services in the move towards a digital Europe. In practice, this may mean that analogue options remain for some public services, to facilitate continued service availability to the digitally excluded, including those who remain offline by choice.
- At the micro level, identifying pockets of digital exclusion in cities or neighbourhoods will facilitate a better understanding of the specific barriers to digitalisation, and the design of better targeted policies for inclusion.
- Local digital initiatives and local digital training should be customised based on an assessment of needs for the specific local community. Local communities could be involved through the co-creation of learning programmes.
- Those designing a digital inclusion initiative should consider the multifaceted needs that beneficiaries might have; this might mean tackling all three levels of digital exclusion: access (providing access and devices), use (providing skills) and outcomes (enabling the possibility of reaching tangible outcomes, be they social, economic or cultural).
- Digital upskilling programmes should not be narrowly focused on current technologies, but should foster competencies of learning to learn and be open to all sociodemographic groups.
- Training should also focus on helping people to develop critical thinking to deal with the challenges of digitalisation and to understand the processes at work behind generative AI, including the risk of biases and AI 'hallucinations'.
- Policymakers should ensure that smaller firms and those located outside large cities are given the support they need to adopt digital technologies.
- A lack of information and communication technology (ICT) skills among the population can pose an obstacle to economic growth. Firms should be supported in their efforts to upskill their workers in this area.

Introduction

When European Commission President Ursula von der Leyen launched the twin (digital and green) transition in 2019, the commitment was to 'leave nobody behind'. Leaving nobody behind is a challenging objective, but one with important social and economic implications. On the economic side, citizens and firms lacking skills and access might be less equipped to engage in economic activities using digital means. From the social perspective, a push to digitalisation could lead to discontent and reduced social cohesion if citizens are not appropriately equipped with digital access and skills to continue to access online services (Schou and Pors, 2019).

Using the lens of convergence, this report investigates the digital divide for countries, citizens and firms. It explores the long-term trends in digitalisation in Europe and whether indicators of digitalisation have converged.

At the EU level, the concept of upward convergence describes the collective progress of EU Member States towards better living and working conditions. When Member States achieve their policy targets, upward convergence should follow. The path towards digital convergence, as examined in this report, has been paved by the Lisbon Strategy and the eEurope 2002 action plan adopted at the beginning of the century. Therefore, convergence in the digital realm has been propelled by several strategies and action plans aiming to accelerate Member States' performance and, as stated in the Lisbon Strategy, make the EU 'the most competitive and dynamic knowledge-based economy in the world'. The latest demonstration of the political will to reinforce this performance is the commitment to create a 'Europe fit for the digital age'.

This report seeks to deepen our understanding of the evolution towards a 'digital Europe'. By applying the lens of convergence, the progress being made by Member States towards the EU's policy targets is analysed: where Member States are growing together and where digital gaps are growing. While the general trend is one of ever-increasing levels of digital access and skills, this report shines a light on the pockets of digital exclusion that exist and, in some cases, are expanding. This digital exclusion, which can leave certain groups of citizens – particularly the most vulnerable – behind, poses a threat to social cohesion and convergence. Moreover, digital exclusion also affects Europe's businesses, posing a potential threat to competitiveness and economic growth. Only by understanding where these gaps are emerging will it be possible to design policies that truly ensure that nobody is left behind on the path towards a digital Europe.

Measuring the digital divide

Back in 2001, the Organisation for Economic Co-operation and Development (OECD) defined the digital divide as 'the gap between individuals, households, businesses and geographic areas at different socio-economic levels with regard both to their opportunities to access information and communication technologies (ICTs) and to their use of the Internet for a wide variety of activities' (OECD, 2001, p. 5). Any analysis of the digital divide can therefore span a range of levels, from the international to the local, with different implications depending on the degree of aggregation. The digital divide concerns gaps in the digital skills of citizens and in the digitalisation of government services and private sector operations.

In this report, the digital divide is analysed mainly through the dimensions of the European Commission's Digital Economy and Society Index (DESI) and the EU survey on the use of ICT in households and by individuals (also known as the ICT Community Survey): specifically, digital infrastructure, digital skills, the digital transformation of businesses and the digitalisation of public services. Analysing specific indicators within the DESI allows us to understand if a catching-up process is taking place in the transition towards a digital Europe, and if disparities are increasing or decreasing among Member States. To assess the digital divide in the private sector, and its associated economic implications, firm-level data from the World Bank Enterprise Surveys are analysed.

As of 2025, despite impressive progress made at the EU level on the indicators used to measure the digital divide, digital exclusion persists. This has significant implications for economic equality, social inclusion and competitiveness. For example, the digitalisation of small and medium-sized enterprises (SMEs) is currently at half the level it needs to be to meet the targets for 2030. Another area where the EU is struggling to meet its targets is digital skills, with just over 55 % of EU citizens possessing basic digital skills (European Commission, 2024a). This Eurofound report, after illustrating convergence at the country level, goes beyond that level to identify socioeconomic groups, regions and businesses affected by the digital divide.

The interrelation between digital and social exclusion

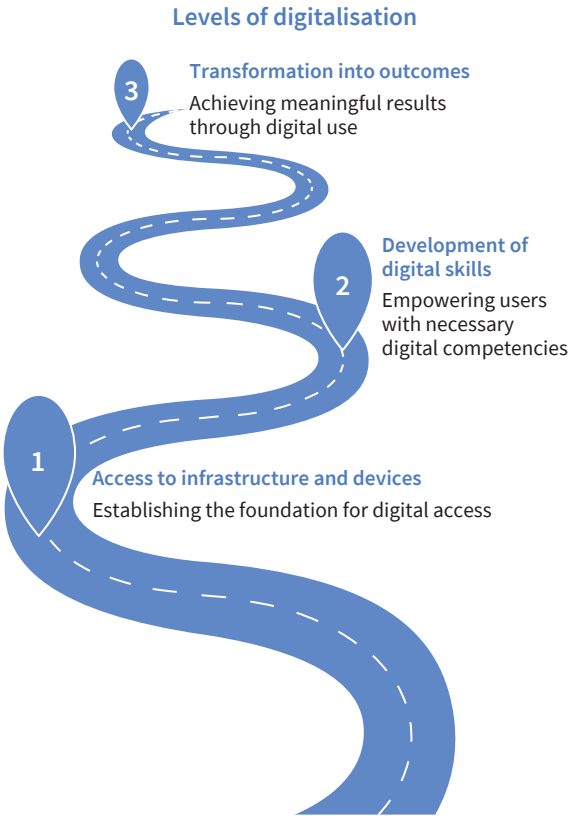
Digital exclusion is on policy agendas across Europe, but several key knowledge gaps need attention to inform more effective and sustainable solutions. Of particular importance is the intertwining of social and digital exclusion. The narrow definition of digital inclusion that focuses on access and use (the first and second levels of digital inclusion) needs to be expanded to incorporate a third level, namely the ability to derive tangible benefits from internet use (van Dijk and Hacker, 2003; Ragnedda, 2018).

The three levels of digital inclusion are presented in Figure 1. These three levels are shaped by an individual's 'digital capital', which Ragnedda (2018) defines as a form of social capital that combines access to digital resources with the ability to effectively utilise them. Digital capital influences access, skills development and the extent to which individuals can obtain 'tangible outcomes' from digital technologies (van Dijk, 2020; Ragnedda et al., 2022). At the same time, it is intertwined with other forms of capital (economic, social, cultural, personal and political), with each influencing and reinforcing the other in a reciprocal relationship. For example, a digital entrepreneur with a strong educational background, robust social networks and advanced digital skills can effectively leverage digital and non-digital capital to create meaningful opportunities, such as launching a successful online business or engaging in impactful digital advocacy. Conversely, a low-income individual with limited access to digital tools and few offline resources would be doubly disadvantaged, unable to translate either offline or online engagement into tangible outcomes. According to a systematic review of studies from around the globe, digital exclusion is thus most prevalent for low-income people, older adults, racial and ethnic minorities, newcomers/new immigrants and refugees, people with disabilities and women (Raihan et al., 2024). This is also true for the EU, but with a distinction in the women's category: older women, not all women, are likely to be digitally excluded. Ragnedda et al. (2022) highlight the intersectionality within these different types of digital and non-digital capital, which can be useful in classifying individuals according to their digitalisation level. Discussing digital exclusion in the light of digital capital thus highlights not just the material and technical aspects of digital engagement but also the social and cultural resources that enable individuals to transform digital tools into tangible benefits.

In the context of the move towards a digital Europe, the concept of digital capital helps explain why some individuals and regions are in a better position than others to thrive in the digital economy. For instance, individuals with higher levels of education and social capital are more likely to develop digital competencies and engage in practices that enhance their economic and social well-being. Conversely, those lacking such resources face compounded disadvantages, as limited digital capital intersects with other forms of social exclusion. Indeed, in an era when there is a trend towards the digital provision of some essential public services, those who need to access them most may find themselves restricted in their ability to do so. Nonetheless, the digitalisation of services can bring about important benefits. For example, digitalising social protection systems can help achieve transparency by providing new ways for people to access information and by simplifying application procedures (Spasova et al., 2023). However, digitalisation can also create new barriers for those with poor digital skills and for people with a hearing or visual impairment. As more services move online, it may be necessary to ensure the availability of physical spaces, as highlighted by national reports produced by the European Social Policy Network (Spasova et al., 2023; Eurofound, forthcoming).

When considering the sustainability of solutions, it is also necessary to think about the evolution of technology. A digital divide can emerge from the barriers posed by a lack of access to the internet, digital skills gaps, language barriers and internet costs (Raihan et al., 2024). While it is predicted that the

Figure 1: The three levels of digital inclusion



Source: *Authors, based on Ragnedda et al. (2022).*

hardware gap will close with the passing of time, continuous developments in technology could contribute to increasing the gap in digital skills (van Dijk and Hacker, 2003). There is, therefore, a need for widespread training. Indeed, ever-changing digital tools constitute both a benefit and a risk to EU citizens. While new digital technologies offer improved services and automation opportunities, they can also constitute a barrier, requiring up-to-date skills (van Dijk and Hacker, 2003) and confidence in using digital tools.

Continuous training and 'learning to learn' competencies are key to navigating digital tools, as emphasised in the European Commission's Digital Education Action Plan (2021–2027). It is also important to highlight that the recent phenomenon of generative artificial intelligence (AI) ([1]) has added an additional layer to how people understand and use information. As AI tools become increasingly ubiquitous, users need to be educated on the potential appearance of AI 'hallucinations' (which occur when a generative AI model produces incorrect or misleading information, often presented as if it were true), and to understand that AI is using a probability-based model in the answers it produces. While the answers may 'make sense' and are often correct, generative AI does not 'understand' the true meaning of what it is reporting to humans in natural language. The increase in AI applications in various fields, from research to cooking recipes and from customer service to legal interpretation, poses challenges not only to vulnerable groups but to the wider society. An extra level of awareness and validation is needed when these applications are utilised for public services. Following the ethics guidelines for trustworthy AI, human supervision should be ensured in producing any type of AI-generated content (Eurofound, 2023a). These guidelines were emphasised during the expert meeting to discuss scenarios around digital exclusion organised by Eurofound on 12 November 2024.

As noted above, the digital divide is most prevalent for groups including low-income people, older adults and other minorities (Raihan et al., 2024). Not only are these groups less likely to have access to digital technologies, they are also less likely to have the skills to use them. The digital divide highlights not just the material and technical aspects of digital engagement but also the social and cultural resources that enable individuals to transform digital tools into tangible benefits. Thus, it brings together the three levels of digital inclusion (Figure 1).

Throughout this report, the framework of the 'three levels of digital inclusion' is applied. The aims are to monitor access to infrastructure, identify the level of digital skills within the population and determine whether the digital transformation is translating into positive outcomes for the people and economies of Europe. How is the EU performing as a whole? According to which metrics is progress being made? Are the Member States of the EU converging in their progress towards a digital Europe? And how does this progress vary between socioeconomic groups and regions? The report shines a light on the role of digitalisation in economic convergence in the EU and considers the progress in and benefits of digitalisation for the EU's private sector.

This nuanced approach sheds light on how digitalisation impacts marginalised populations, exacerbates or mitigates regional disparities and interacts with community-specific challenges, offering actionable insights for targeted interventions and inclusive policy development.

Structure of the report

Chapter 1 of this report looks at the progress that Member States have made in moving towards a digital Europe. Using three of the four dimensions included in the DESI, it considers digital infrastructure and accessibility, the development of digital skills and the use of e-government services. It does so through the lens of convergence, asking if historically poorer-performing Member States have caught up with the digital leaders, and if disparities between Member States have decreased over time.

Chapter 2 goes beyond the aggregate Member State level and assesses progress at the regional level. It considers whether there are pockets of digital exclusion even within highly digital countries. Furthermore, it examines the digitalisation levels by socioeconomic group and asks whether these groups have converged among Member States. Convergence is calculated using selected indicators on internet access, internet use and internet outcomes, and the result shows if Member States have been able to improve the performance of vulnerable socioeconomic groups or if the divide has grown.

In Chapter 3, the focus moves from people to business. It looks at how digital indicators for businesses have evolved over time and, once again, applies the lens of convergence to assess the catching-up process and the evolution of disparities. Moreover, it uses microdata to paint a picture of how digital technologies are applied

([1]) Generative AI includes chatbots that have been trained on huge datasets and can interact with humans in natural language, that is, understanding instructions formulated as speech and not as code.

at the firm level and how their use is related to firm-level productivity. Within this chapter, the important link between digital technologies and economic convergence is explored.

Chapter 4 showcases case studies of regional and local initiatives supported by local authorities to improve digitalisation both for specific socioeconomic groups and for firms. The case studies come from five Member States: Germany, Greece, Poland, Romania and Sweden. These case studies present real-life examples of successful initiatives deployed to bridge the digital divide for the vulnerable socioeconomic groups highlighted in Chapter 2.

The final chapter of the report presents concluding remarks and policy pointers that are drawn from the overall analysis.

1 Convergence in digital indicators

Measuring upward convergence

Upward convergence has always been an EU aspiration; the implied hope behind the 1957 Treaty of Rome was that social convergence would follow economic harmonisation and growth. The concept of upward convergence was consolidated in 2017 and centred around the European Pillar of Social Rights (Eurofound, 2021). It combines two concepts: improving performance and reducing disparities. 'Improving performance' refers to Member States progressing in a desired policy direction (e.g. increasing broadband access or decreasing the number of internet non-users). Performance is generally measured by means of averages. Within the framework of convergence, the EU average is measured as the unweighted average of Member States. An improvement in performance that moves towards policy targets is referred to as an 'upward' trend; this means, for example, that a decreasing rate of internet non-users would be an upward trend, as this is considered an improvement in performance. 'Downward' trends, on the other hand, are those where performance declines (e.g. the rate of internet non-users rate goes up).

'Reducing disparities' refers to convergence. The opposite is divergence, that is, an increase in disparities. For example, if two Member States' employment rates become more similar, then the territories are said to have converged with regard to their employment rate. By the same logic, if the difference between the territories' performance has increased, then they have diverged.

In addition to upward convergence, three more scenarios can be observed based on the two concepts. Downward convergence occurs when performance worsens and disparities decrease. Upward divergence happens when performance improves and disparities increase. Finally, worsening performance and increasing disparities characterise downward divergence.

Convergence is measured in three ways in this report: beta-, sigma- and delta-convergence. Each of these measures allows for the capture of a slightly different perspective on convergence, which can give a more comprehensive picture of the convergence process. The methodology stems from previous Eurofound work, where Sala-i-Martin's approach is applied to social phenomena (Eurofound, 2018). The methodology behind each measure is explained below.

Beta-convergence

Beta-convergence is a process in which the poorest performers develop faster than the leading performers and therefore catch up to them. It is linked to the empirical definition of convergence postulated by growth models and is used to measure if initially low-performing regions develop faster than high-performing ones. Unconditional beta-convergence is estimated with the following regression model:

$$\Delta \ln y_{i,t} = \alpha + \beta \, ln\left(y_{i,t-1}\right) + \varepsilon_{i,t}$$

where $y_{i,t}$ is the value of indicator y in country i at time t; $\Delta y_{i,t}$ is the growth rate of indicator y in country i at time t; α and β are the parameters to be estimated; and $\varepsilon_{i,t}$ is the error term. This equation analyses the relationship between the growth of an indicator over a certain period and its initial value. Beta-convergence exists if the relationship is statistically significant and negative; thus, countries in which the initial level is higher see a slower pace of growth. The magnitude of parameter β indicates the speed of the convergence process.

Additionally, this report includes an analysis of conditional beta-convergence; Chapter 3 covers the relevant methodology and results.

Sigma-convergence

Sigma-convergence is characterised by an overall reduction in disparities among countries or regions over time. In this report, it is measured by the standard deviation and the coefficient of variation. The standard deviation is a measure of the dispersion of a set of data values. A low standard deviation for an indicator means that the values recorded by Member States are close to the EU mean, while for a high standard deviation they are spread out over a wider range. To have sigma-convergence, the standard deviation needs to have decreased. Where σ_t is sigma-convergence and $x_{i,t}$ is the value of indicator x in country i at time t, the average is:

$$\mu_t = \frac{1}{N}\sum_{i=1}^{n} x_{i,t}$$

and the standard deviation is:

$$\sigma_t = \sqrt{\frac{\sum_{i=1}^{n}(x_{i,t} - \mu_t)^2}{N}}$$

Sigma-convergence can also be assessed using the coefficient of variation. The coefficient of variation is defined as the ratio of the standard deviation to the mean. However, since the mean may fluctuate over the

years, using the coefficient of variation does not explain whether changes in disparities are driven by variations in the mean. From this perspective, the standard deviation is preferred, as it provides a more direct measure of changes in dispersion, independent of the mean.

Delta-convergence

The term 'delta-convergence' was coined by Heichel et al. (2005) to describe the analysis of countries' distance from an exemplary model, for example the best performer or a set of best performers. Delta-convergence is measured through the sum of the distances between values for the top performers and the other countries:

$$\delta_{i,t} = \sum_{i=1}^{N} \left(MAX(x_{i,t}) - x_{i,t} \right)$$

where $\delta_{i,t}$ is delta-convergence and $x_{i,t}$ is the value of indicator x in country i at time t. A reduction in the distance from the front runner over time implies convergence. If the sum of the distances decreases over time, delta-convergence can be identified, while an increase in the sum of the distances means that countries are diverging. Delta-convergence is a measure of how countries or other units are becoming similar to the top performer. While the presence of outliers can skew the data, it is a good quantitative measure of whether convergence towards a certain policy target has occurred.

Assessment of convergence in digital indicators

Digitalisation is one of the early challenges of the 21st century where the EU is competing with other nations to retain a leading position. For this effort to succeed, the ideal scenario is that Member States, and their regions, grow together towards the policy targets.

The following section outlines the convergence analysis and results of relevant digital indicators across the EU-27 at two different levels of analysis: individual and household. It uses a range of data sources but is largely taken from the EU survey on the use of ICT in households and by individuals ([2]). Indicators were chosen largely based on whether they had wide availability across time. Selection from that point was focused on indicators that could acutely incorporate the many components of digital inclusion and exclusion. The analysis is organised in three main categories: digital infrastructure and accessibility, digital skills, and e-government. Furthermore, indicators are assessed on the extent to which they have an impact on the three levels of digital inclusion (Figure 1): access, usage and outcomes. An outline of all indicators, their relevant Eurostat codes, the categories they fall under, the original source of the data and the period of time covered by the convergence analysis is presented for each dimension.

Digital infrastructure and accessibility

Digital infrastructure and accessibility is a key component to ensuring digital inclusivity. Access to broadband internet captures the access level, the extent to which internet infrastructure is present and accessible to households in the EU (Ragnedda, 2018). The unit of the analysis, therefore, is the household, as this indicator best demonstrates the extent of digital inclusivity both operationally and in the context of data coverage.

Household broadband access

'Households with broadband access' (isoc_r_broad_h) reports the proportion of those households that had broadband access from 2006 to 2021 as a percentage of the general population. Convergence can be observed in this measure, indicating that the EU has largely succeeded in overcoming the first level of digital exclusion.

In 2021, all EU countries had at least 80 % broadband coverage. The Member State with the lowest coverage was Bulgaria, which was still above 80 %, while the Netherlands had the highest coverage (almost 100 %). The unweighted average increased from 29 % in 2006 to 91 % in 2021. Denmark, the Netherlands and Sweden were early leaders in broadband access. Conversely, Greece and Romania were among the countries with the lowest levels of access, ranging from less than 5 % in Greece in 2006 to just around 30 % in Romania by 2011. Bulgaria subsequently held the lowest rate from 2013 to 2021.

Greece and Romania grew fastest from their initial starting points. While a catch-up effect can be observed in Bulgaria, its relatively low growth rate helps to explain why it had the lowest rate of broadband access in the EU from 2013 onwards. Disparities in broadband access between Member States decreased fourfold between 2006 and 2021; this reduction was most accentuated between 2007 and 2012. Lastly, the sum of distances from the best performer in 2021 was almost five times smaller than it was in 2006 (Figure 2).

([2]) This survey covers those households that have at least one member in the 16–74 age group.

Figure 2: Convergence summary – infrastructure and access indicators

Indicator	Households with broadband access
Period	2006–2021
Average change	
Average change towards expected policy target (%)	
Change in disparities	
Sigma-convergence	
Beta-convergence	Convergence
Distance from front runner	

Note: *The 'Average change towards expected policy target' row displays the difference between the two averages at the beginning and end of the period. An increase is desirable in this case because it means that more households have internet access. The unit for this row is the difference between two percentages.*
Source: *Eurofound.*

The literature suggests that, in the early stages of digital infrastructure development and set-up, the catching-up process of countries such as Romania and Bulgaria resulted from ICT investment alongside market competition, which played a significant role in boosting access to broadband (Vicente and López, 2010). It is important to note, however, that market competition does not necessarily deliver access equally to both rural and urban areas (Lehtonen, 2020; Eurofound, 2023b). Evidence from a Greek case study suggests that effective market competition provides a significant boost to broadband access, but the authors highlight the fact that other factors such as consumer income and demographic effects are also important (Moutafides and Economides, 2011). In 2023, the next step pursued by the Digital Decade priority was to increase the availability of very high capacity networks in order to cater for the higher capacity required by new technological developments (European Commission, 2024b).

Digital skills

Digital skills are a critical component in the process of digital inclusion. Although access to internet services is a prerequisite step towards being digitally included, an individual's usage once they have access is necessarily limited by their level of digital skills, even if they have a high-speed and high-quality internet connection. Operationally, therefore, digital skills are a significant indicator of the extent to which Member States have achieved the second and third levels of digital inclusion. In addition, simply possessing these digital skills may not be enough to allow individuals to obtain benefits. To achieve the third level of digital inclusion and avoid divides in outcomes, individuals must know how to use these skills to generate alternative forms of capital such as economic and social capital (Ragnedda, 2018). This section examines a variety of indicators related to frequency of use, everyday skills, tasks that allow for tangible economic benefits and aggregate measures of individuals who have used their digital skills for economic empowerment (e.g. the proportion of employed ICT specialists). The following indicators, summarised in Table 1, are therefore effective benchmarks for monitoring the success of Member States in overcoming the second and third levels of digital exclusion.

Table 1: Indicators used in convergence analysis – digital skills

Indicator	Indicator code (Eurostat)	Data source	Period of time covered by the analysis
Individuals who used the internet and the frequency of that use (daily, weekly or never)	[isoc_r_iuse_i]	Survey on the use of ICT in households and by individuals	2006–2023
Individuals using the internet for internet banking	[tin00099]	Survey on the use of ICT in households and by individuals	2012–2023
Individuals using the internet for telephoning and video calls	[isoc_ci_ac_i]	Survey on the use of ICT in households and by individuals	2008–2023
Employment of ICT specialists	[isoc_skslf]	EU Labour Force Survey (EU-LFS)	2005–2023
Individuals selling goods and services online	[isoc_ci_ac_i]	Survey on the use of ICT in households and by individuals	2005–2023
Individuals ordering goods and services online	[isoc_r_blt12_i]	Survey on the use of ICT in households and by individuals	2006–2023

Individuals who use the internet daily

The first indicator examined in this category is the number of individuals using the internet between 2006 and 2023. Frequency of use is a measure that goes beyond individuals just simply having access. It demonstrates that they have chosen to use it as part of their daily life, a key component of the second level of digital inclusion. The EU unweighted average for daily internet users more than doubled from 32 % to 87 % between 2006 and 2023. **Overall, all convergence measures indicate that the countries with lower proportions of daily internet users have caught up with leading countries, ultimately achieving convergence** ([3]).

Over time, Sweden, Luxembourg, Denmark and, as of 2023, the Netherlands have had the largest proportions of individuals who report using the internet daily; this peaked in the Netherlands at almost 100 %. Romania and Bulgaria have had the lowest proportions of daily internet users over time. In 2006, only 10 % of Romanians used the internet daily, compared with 60 % of Danes or 80 % of Swedes in that same year. In 2023, the country with the lowest proportion of daily internet users was Bulgaria with just above 75 %.

Countries that in 2006 had lower proportions of regular internet users daily were able to significantly catch up. Denmark, Finland, the Netherlands and Sweden started from the strongest positions, and each of these countries saw growth in line with their initial positions. While Bulgaria and Greece caught up fast, the country with the highest growth rate over time was Romania. Between 2006 and 2023, the proportion of daily internet users grew by 13 % in Romania, five times higher than the rate of growth in Denmark. Disparities fell substantially between 2006 and 2023, with 2022 seeing the largest drop in disparities in a single year, although such disparities marginally rebounded in 2023. By 2023, disparities were three times lower than in 2006. Over time, the distance from the best performer has reduced. It fell gradually until 2015, but at a much faster rate from 2016 onwards.

Individuals who never use the internet

This indicator measures the proportion of individuals reported as having never used the internet from 2006 to 2023. This indicator also reflects the extent of the second level of digital inclusion, but for the inverse portion of the population: those who have not made use of the internet despite having physical access. The second level of digital inclusion has become increasingly important in the context of socioeconomic characteristics, notably age demographics. When speaking about digital engagement, there is also a group of individuals, 'the disconnected', who choose not to be connected and refuse the 'always-on' approach, 'preferring to choose to experience social relations entirely away from technology' (Hardey and Atkinson, 2018). The evidence about the disconnected is mostly collated through qualitative analysis, and quantitative estimates of the reasons why they do not use the internet are not available. This scarcity of research stems from the fact that the disconnected belong to the 'hard-to-reach' groups, since they require traditional ways of contact such as postal or telephone interaction (Hardey and Atkinson, 2018). What is known, though, is that the disconnected are at the very least a subset of the 6 % of Europeans aged 16–74 who have never used the internet.

The number of individuals who have never used the internet has fallen over time; the EU unweighted average was over seven times smaller than it was in 2006. Over time, Sweden, Denmark and Luxembourg have had the smallest proportions of individuals who reported never using the internet, with Luxembourg having no respondents who indicated that they had never used the internet in 2023. Despite a decrease in the averages and in disparities among Member States, there was no catching-up process overall.

As of 2023, Romania, had the highest proportions of respondents who claim to never use the internet, followed by Bulgaria, Greece and Croatia. In 2006, over 70 % of Romanians had never used the internet, while in that same year only 10 % of Swedes claimed they had never used it. By comparison, the country with the highest proportion of individuals who had never used the internet in 2023, Croatia, had a share of just above 13 %, which is 3 percentage points lower than in 2006.

Despite its strong starting position, Luxembourg improved the fastest (i.e. had the fastest negative growth rate) in this indicator, followed by Denmark and the Netherlands. Sweden and Finland, although they performed well, had decreasing rates that were slightly

([3]) The average number of weekly internet users also increased over time at a similar rate, and the convergence measures are similar.

slower than the average. In all other Member States, the share of people who never used the internet decreased slower, with one third of Member States having a decreasing rate of under 10 % every year. Czechia, France, Spain and especially Romania performed quite well with high decreasing rates given their starting position, which indicates that they caught up significantly. However, divergence occurred over time, since most Member States did not improve enough relative to their performance in 2006. Conversely, disparities between countries and distance from the best performer decreased over time. Disparities between countries were four times lower and the distance from the best performer was seven times less in 2023 than in 2006, indicating that a substantial number of countries have begun to report fewer individuals who have never used the internet.

Changes in internet use can be partly explained both by demography but also by the necessity of using the internet for accessing social, health and socioeconomic resources (König and Seifert, 2020). Given that such resources are becoming inextricably related to internet usage, young and, in part, older generations are incentivised to go online, often on a daily or at least weekly basis, as demonstrated in this analysis. Although these resources are often easily accessible to younger people, the growing need to use them online often restricts access for members of older generations who normally would be classified as never having used the internet, which as indicated through this analysis puts them in a minority. To promote their inclusion, König and Seifert (2020) recommend interventions that promote internet use (e.g. skills training) and these should focus on people's life courses, social networks and country characteristics.

Individuals using the internet for internet banking

Usage of internet banking is a key indicator of possessing digital skills. With many banks having moved their services online, individuals have had to leverage digital skills to keep pace with this transition. Moreover, this indicator also measures the success of individuals in using digital skills to achieve additional forms of capital (in this instance, economic capital) and therefore, partly, achieving the third level of digital inclusion. This indicator only accounts for the individuals who had used the internet for banking within the three months prior to the survey. From an operational perspective, internet banking includes performing electronic transactions with a bank to make payments or to look up account information. The indicator covers the period from 2012 to 2023, and the EU unweighted average increased from 41 % in 2012 to 69 % in 2023. All convergence metrics indicate that, from 2012 to 2023, convergence among Member States occurred.

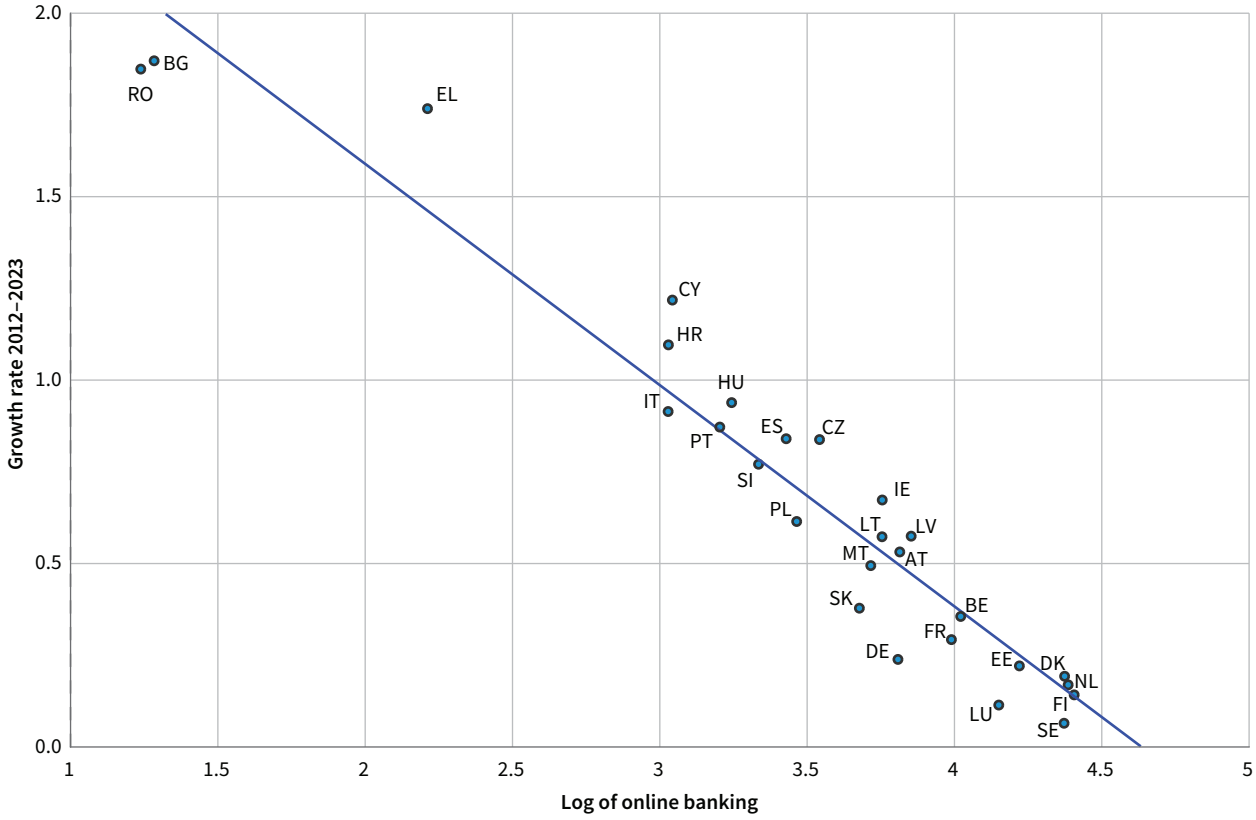
Over time, Denmark and Finland have been the most prominent leaders in the proportion of individuals using the internet for internet banking; this peaked with 95 % of individuals in Denmark in 2023. Bulgaria and Romania have had the lowest proportions of individuals who used internet banking; in 2012, just about 5 % of Romanians used internet banking, compared with over 80 % of individuals in Finland in that same year.

Countries that started with a lower proportion of individuals using the internet for banking in 2012 were able to significantly catch up by 2023. Three Member States (Bulgaria, Greece and Romania) caught up significantly (upper left of Figure 3). Greece started with a higher proportion of individuals using online banking services in 2012 than Bulgaria or Romania, but grew at a very fast rate, to above the EU-27 average. Although Bulgaria and Romania had the fastest growth rates in the EU-27 – almost 17 times faster than Member States such as Sweden – they still did not reach the average. Other Member States that caught up significantly were Croatia, Cyprus and Hungary. The countries that had growth rates lower than average were largely those that started off with higher proportions, such as Luxembourg and Sweden (bottom right of Figure 3). Countries in the middle, which started off relatively strong but not as leaders, generally caught up at a rate above average.

Although disparities grew between 2012 and 2017, they have declined since: by just under 20 % when comparing 2012 with 2023. These results would indicate that countries have been converging over time. Furthermore, the sum of the distances decreased gradually over time, with the largest decline occurring between 2017 and 2019, when it fell by over 10 %.

Grigorescu et al. (2023) note that uptake of internet banking across the EU is indeed rapidly growing, but this convergence is not equal across sociodemographic groups. Convergence is more limited among older populations and those with lower levels of education. Grigorescu et al. (2023) also do not rule out that, due to digitisation, the economic environment has become much more attractive and has led to investment and innovation in all areas. This in turn has led to better ease of access, convenience and attractiveness to consumers, which in turn has reinforced the use and uptake of online banking. Such assessments support the conclusion that, at the country level, digital inclusion has reached the first two levels and has made inroads on the third level, effectively utilising these digital tools for the development of digital capital.

Figure 3: Beta-convergence of individuals who used the internet for online banking, 2012–2023



Source: *Authors' calculations, based on Eurostat [tin00099].*

Telephoning and video calls

The telephoning and video calls ('online communication' from now on) indicator considers the proportion of individuals who used the internet for telephoning or making video calls in the previous 12 months, between 2008 and 2023. As communication networks have increasingly shifted to online platforms, understanding and being equipped to use these platforms has become essential in avoiding social exclusion, and is therefore a significant measure of the second level of digital inclusion. The unweighted EU-27 average was over four times higher in 2023 (71 %) than in 2008 (17 %).

Since 2015, the strongest performing Member States have been Cyprus, Denmark and the Netherlands. This peaked in 2023 with 87.5 % of individuals in Cyprus. Between 2008 and 2017, the poorest performers were Croatia, followed by Romania and Italy. However, since then, a range of countries have taken the poorest performer's spot: France (which was the best performer in 2008), Portugal, Slovenia, Germany and Poland (in both 2022 and 2023). In 2008, the strongest performer, France, reported over 30 % of individuals using the internet for telephoning and video calls, compared with under 10 % in Croatia. In 2023, just over 55 % of Poles used the internet for telephoning and video calls, substantially lower than the top performer, Cyprus (87.5 %).

A catching-up process took place between 2008 and 2023; Cyprus had the highest growth rate, followed by Greece, Italy, Croatia and Romania. Italy and Croatia performed slightly below the average; however, both Member States still achieved a high level of growth. In a minority of cases, countries that had higher values in 2008 (but were not best performers) did not achieve particularly impressive growth. These cases included Germany, Poland and Slovenia. France and Slovakia had the lowest growth rates, but both started in stronger positions in 2008.

Disparities increased between 2008 and 2023. It is important to note that disparities were at their lowest in 2008, which is most likely due to technological unavailability rather than a proactive attempt to keep disparities low among Member States. Disparities grew by 45 % between 2008 and 2016, but fell by 20 % between 2016 and 2023. Overall, disparities still grew by over 15 % over time. This indicates that, while the share of individuals using the internet for online communication increased, this was not at an equal rate across the EU-27. While the distance from the best performer grew between 2008 and the peak of this growth in 2014, increasing by around 50 %, this figure did fall over time, reaching a low in 2022 that was 17 % lower than in 2008. However, an increase in 2023 put it over the 2008 figure.

Figure 4: Increase in share of online communication, 2008–2023 (%)

Note: *The figure shows that online communication increased to be over the 50 % threshold in all Member States from 2020 onwards.*
Source: *Authors' calculations, based on Eurostat [isoc_ci_ifp_iu].*

The literature around internet use for online communication has rapidly expanded since the onset of the COVID-19 pandemic. First, the improved performance among EU countries in 2020 is testament to the increased use of online video platforms for speaking to family members and working during lockdown restrictions. This growth is shown in Figure 4, where it is immediately noticeable that usage increased in all countries.

However, this does not fully explain how countries have not converged to a state comparable to 2008 or why we see growing divergence. The factors behind the slowing growth in online communication, specifically among older generations, could be 'perceived self-efficacy and fear, the culture of online communication, absence of social capital and physical functioning' (Wilson-Menzfeld et al., 2023, p. 222). These factors are particularly common among older people, limiting their ability to use and adapt to new methods of online communication. They may also be exacerbating exclusion and in turn harming progress towards the second level of digital inclusion.

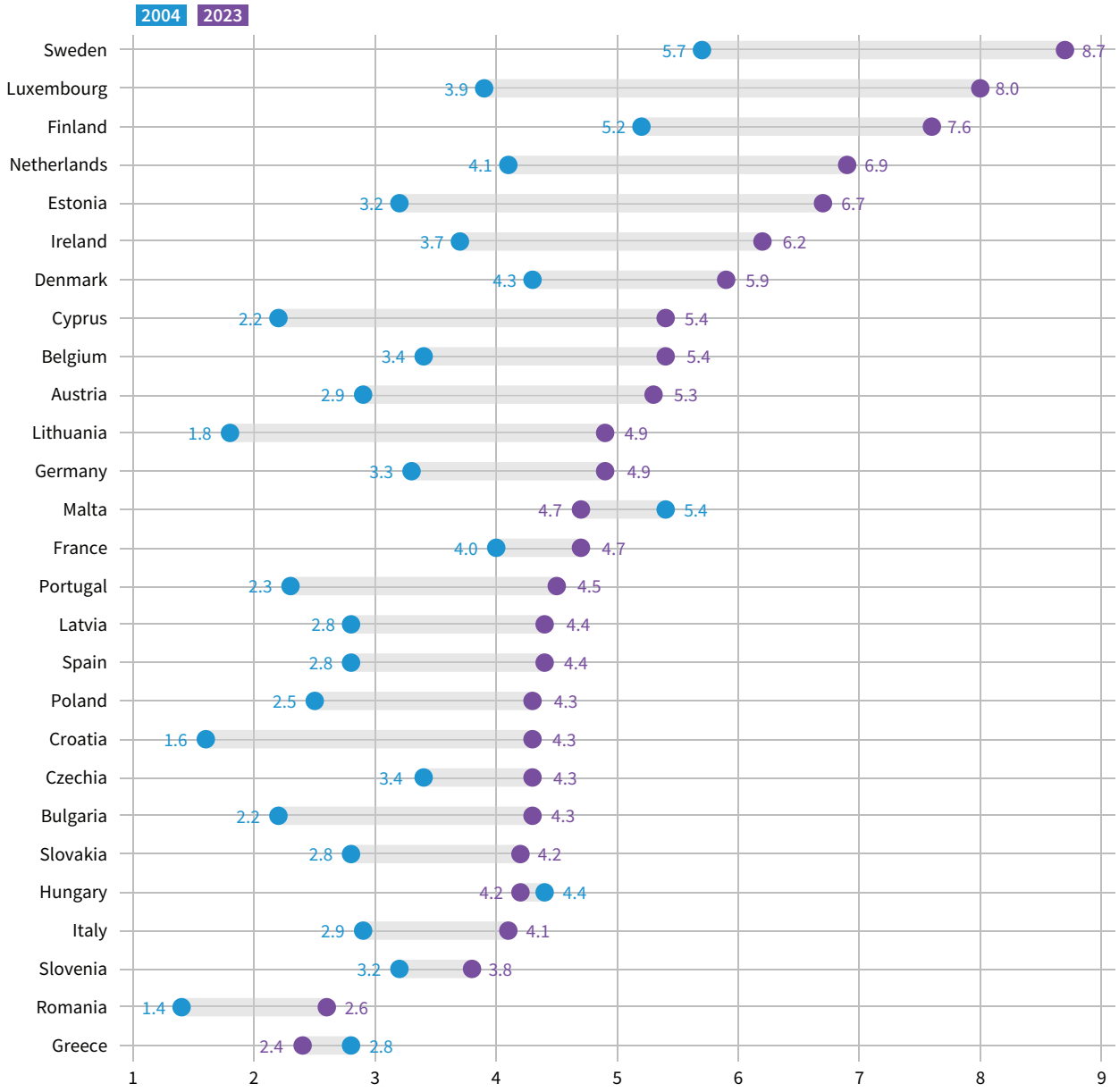
The divergence observed above may be accounted for by studies on some of the difficulties individuals have faced in adapting to the new landscape of online work, including challenges such as 'the difficulty in maintaining social interactions' and 'the absence of cues and emotional intelligence' in online work (Lal et al., 2023, p. 1333). 'Videoconference fatigue' has arisen, due in part to 'work practices and technologies designed with assumptions of steady states and taken-for-granted balances between task and social dimensions of work relationships' (Bergmann et al., 2023, p. 347). It is plausible that, upon reopening after COVID-19 pandemic lockdowns, the demand for online communication, particularly in countries in which the proportion of the population using the services was converging, has opted towards more physical and offline forms of communication. This is not to say that the number of people using such services has fallen dramatically. There are several ways in which hybrid work can be implemented, and Eurofound has surveyed 'multiple options for addressing the interaction of the physical, temporal, social and virtual elements of hybrid work' in previous research (Eurofound, 2023c, p. 33). Therefore, it is not that work activities have decreased, but rather that the rate of growth that was experienced up to and throughout the COVID-19 pandemic has now reduced.

Employment of ICT specialists

Eurostat defines ICT specialists as 'workers who have the ability to develop, operate and maintain ICT systems, and for whom ICT constitute the main part of their job' [4]. This indicator captures the total number of individuals employed with ICT specialist skills as a percentage of the entire population. While it is an accurate measure of a very high level of digital skills, it is also a significant measure of how individuals have been able to achieve economic outcomes (employment) through their utilisation of digital skills. Over time, the EU-27 unweighted average has slowly increased, rising from 3.3 % in 2004 to 5.1 % in 2023. Overall, poor performers have caught up to the best-performing countries.

The top performers over time were Finland and Sweden (Figure 5). Their performance has improved significantly since 2020, with Sweden being the top performer in three out of the last four years. The overall poorest

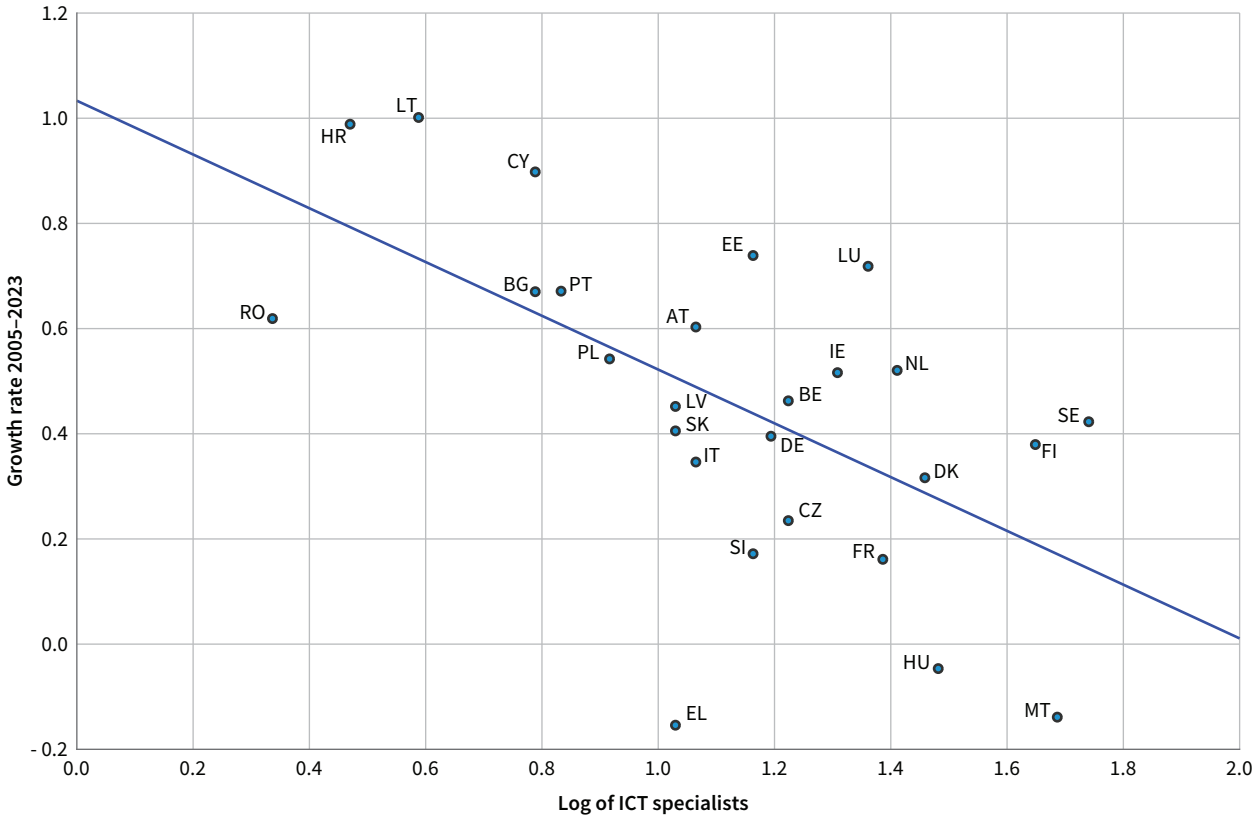
Figure 5: Increase in share of ICT specialists, 2004–2023 (%)



Source: *Eurostat [isoc_skslf].*

(4) See https://ec.europa.eu/eurostat/cache/metadata/en/isoc_skslf_esms.htm for information about the classification of ICT specialists in the International Standard Classification of Occupations (ISCO). The EU-LFS results cover the total population usually residing in the Member State, except for people living in collective or institutional households. While demographic data are gathered for all age groups, questions relating to labour market status are restricted to people aged 15 years or older. The EU-LFS covers all industries and occupations.

Figure 6: Beta-convergence of employed ICT specialists, 2005–2023



Source: *Authors' calculations, based on Eurostat [isoc_skslf].*

performers over time were Greece and Romania, although Lithuania was the poorest performer briefly between 2006 and 2010. The number of employed specialists in each country increased over time except in the cases of Greece, Hungary and Malta, where it decreased. In terms of EU achievements, the EU is making progress in its 2030 target set in the Digital Decade programme, and the catching-up process is under way for most countries. Lithuania grew the fastest, while Croatia and Cyprus both grew at a faster speed than other countries given their starting positions (see Figure 6). Romania's speed also increased, but not enough to be above average. Countries such as Denmark, Finland and Sweden maintained their performance; these countries started in 2005 with a much higher proportion of employed ICT specialists and also grew faster than average. Overall, disparities are increasing within the EU-27, with countries with high proportions of ICT specialists growing faster than those with lower shares of ICT specialists. Furthermore, the sum of distances of Member States from the best performer increased by nearly 50 %.

In the case of Lithuania, the country that caught up the fastest between 2005 and 2023, the availability of ICT specialists appears to be a result of strategic government plans for ICT development and future digitalisation (Lithuanian Innovation Centre, 2020).

As part of its Vision 2030 roadmap, Lithuania details a variety of measures, such as increasing the number of digital specialists and enhancing learning opportunities at all levels, to increase Lithuania's growth as a tech hub within the EU and to make it into an industry leader in the Baltic states.

Individuals selling goods and services online

The 'individuals selling goods and services online' indicator captures the proportion of individuals who sold goods and services online, specifically within the previous three months, between 2005 and 2023. The unweighted average increased fivefold in this period, rising from 4 % to 21 %. Overall, a catching-up process took place, with poorest-performing Member States catching up with best performers; however, both disparities and the sum of distances from the leading countries increased.

Over time, Denmark, the Netherlands and Slovenia have had the highest shares of individuals selling goods and services online. The countries with the consistently lowest proportions of individuals selling goods and services online were Cyprus and Greece.

Slovakia caught up at the fastest rate given its starting position. Other countries that grew at a fast rate given their original relative position were Hungary, Ireland,

Lithuania and Malta. Although they grew at a fast rate, Bulgaria, Cyprus, Portugal and Romania grew at a slower rate than average. Countries such as Finland, the Netherlands and Sweden started from stronger positions, grew at a fast rate and maintained this strong position. Finally, Germany and Slovenia, although starting from stronger positions, did not grow as fast. In fact, Germany experienced a negative growth rate over time. Due to these dynamics, disparities among countries were twice as high in 2023 as they were in 2005. Furthermore, countries did not reduce the sum of distances from the best performer over time.

While it cannot be definitively determined why divergence has occurred, in her analysis of consumer-to-consumer e-commerce, Vicente (2015) finds that a variety of factors determine who is most likely to be an individual online seller, as opposed to a buyer. Although this analysis does not take into account sellers and buyers for collective analysis, which would allow for comparison, this indicator demonstrates how selling goods and services online requires a digital skills base; therefore, it can be indicative of the extent to which a population is digitally equipped. She finds that, in 2012, 'those who just sell tend to have a low educational attainment, are unemployed, live in low-income regions and display a narrow use of the internet'. Therefore, Member States in which these factors are more prevalent are likely to also fall or diverge from a developed consumer-to-consumer e-commerce market. This helps to explain why countries with higher standards of education and employment such as Germany and Slovenia have seen drop-offs in this regard, and to explain rapid growth in eastern Member States. These results indicate that traversing the different levels of digital inclusion is an ongoing challenge that warrants consideration. While individuals may possess the skills to make use of digital resources, this does not mean that all such individuals will be able to maximise these skills so that they can acquire tangible benefits and outcomes (Ragnedda, 2018).

Individuals ordering goods and services online

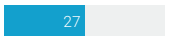
This indicator relates to people who bought or ordered goods or services over the internet during the previous year (12 months). Online shopping has become increasingly more prevalent, and, with many goods and services not being offered offline, individuals' ability to use the internet for such purposes has become an essential skill in the context of the second level of digital inclusion. The unweighted average for the EU-27 increased more than threefold from 2006 to 2023, rising from 20 % of individuals to 70 % of individuals. Overall, convergence can be observed in all measures across the EU-27.

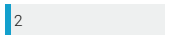
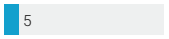
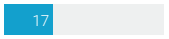
Over time, Denmark, the Netherlands and Sweden have been leaders in this indicator, with online ordering peaking in the Netherlands in 2023 at over 90 %. The countries with the consistently lowest proportions of individuals ordering goods and services online were Romania and Bulgaria. In comparison, while around 55 % of Danes had ordered goods and services online within the 12 months prior to being asked in 2006, the corresponding proportion in Romania was approximately 1–2 % of individuals.

Romania caught up the fastest, followed by Bulgaria; however, the latter grew slightly below average given its original position. In most cases, countries were able to grow at a rate above the average. Those with the lowest growth rates were those that started from the strongest positions (beta-convergence). Although disparities increased between 2006 and 2012, from then onwards disparities fell gradually until 2018 and then fell dramatically. By 2023, disparities had fallen by 46 % overall compared with 2006. By 2023, the sum of distances was 60 % lower than in 2006.

The convergence observed within the EU-27 can be largely explained by the emergence of the COVID-19 pandemic. While there had been a gradual trend towards online shopping since the late 2010s, the onset of the COVID-19 pandemic spurred on these behavioural changes. This was largely a case of necessity, as countries faced lockdowns and individuals often found it challenging to access essential and non-essential services (Scutariu et al., 2022). Figure 7 summarises the convergence in the digital skills indicators discussed in this section.

Figure 7: Convergence summary – digital skills indicators

Indicator	Individuals who used the internet daily	Individuals who never use the internet	Individuals using the internet for internet banking	Individuals using the internet for telephoning and video calls
Period	2006–2023	2006–2023	2012–2023	2008–2023
Average change				
Average change towards expected policy target (%)				
Change in disparities				
Sigma-convergence				
Beta-convergence	Convergence	Divergence	Convergence	Convergence
Distance from front runner				
Delta-convergence	Convergence	Convergence	Convergence	Divergence

Indicator	Employment of ICT specialists	Individuals who ordered goods and services online	Individuals who sold goods and services online
Period	2004–2023	2006–2023	2005–2023
Average change			
Average change towards expected policy target (%)			
Change in disparities			
Sigma-convergence			
Beta-convergence	Convergence	Convergence	Convergence
Distance from front runner			
Delta-convergence	Divergence	Convergence	Divergence

E-government

E-government is an ever-growing area of digitalisation. Digital services relevant to state and public services are increasingly going online and are therefore important in the context of digital inclusion. The challenge now is to offer a faster service while making sure that access is still granted to all service users. The further development of the use of AI in the provision of public services holds significant promise in terms of efficiency and making services more accessible. Nonetheless, challenges in terms of biases of algorithms and potential data privacy concerns remain, and measures should be taken to address these challenges (European Economic and Social Committee, 2024).

Furthermore, the ability of individuals to access state and public services online, from the point of view of both governments and citizens, is a key indicator of improvements made in efficiency and social capital (see Table 2). Given this, advances in e-government are critical in the context of the third level of digital inclusion.

Individuals who used the internet for interaction with public authorities

This indicator considers the proportion of the population that used the internet for interacting with public authorities, specifically within the previous 12 months in the period between 2008 and 2021. Higher proportions of individuals using the internet for interacting with public authorities can be seen as an achievement with regard to the third level of digital inclusion, as it contributes to enhanced social outcomes as a result of a more digitally equipped society. The EU unweighted average doubled from 32 % in 2008 to 65 % in 2021.

Although a majority of Member States have caught up with top performers, there is evidence of an increase in disparities. While the sum of distances has fallen overall, this has only happened as of 2019.

Over time, Denmark has been the most prominent leader, peaking at over 90 % in 2021. Romania has had the lowest proportions of individuals using the internet for interacting with public authorities over time: less than 10 % of Romanians used the internet for interacting with public authorities in 2008, compared with 62.5 % of Finns (leaders in that same year). Nor has the proportion of Romanians using the internet drastically improved over time, with an increase of less than 7 percentage points as of 2021 ([5]).

A catching-up process took place, although some countries that started with lower proportions of individuals using the internet for interacting with public authorities in 2008 did not fully catch up to the high performers and the leaders grew at a below-average rate. Given its starting position, Greece was able to significantly catch up with the highest growth rate (11 %) among the EU-27. Other countries that caught up significantly were Croatia, Cyprus, Czechia and Latvia. However, the countries with the lowest proportions of individuals using the internet for interaction with public authorities in 2008, Romania and Bulgaria, grew rapidly but they did not manage to catch up with the average. Most countries that were leaders in 2008 had growth rates below the average but still maintained their leading position; examples include Finland, Luxembourg, the Netherlands and Sweden. The country with the lowest growth rate overall was Germany, despite having the eighth highest proportion in 2008.

Although disparities dropped between 2010 and 2012, they have grown since. The increase was about 20 % between 2008 and 2021, indicating divergence. The sum of the distances from the best performer increased by over 30 % between 2008 and 2013; however, this figure has since come down to below 2008 levels, albeit it is not substantially lower (approximately 8 %).

Table 2: Indicators used in convergence analysis – e-government

Indicator	Indicator code (Eurostat)	Data source	Period of time covered by the analysis
Individuals who used the internet for interaction with public authorities	[isoc_r_gov_i]	Survey on the use of ICT in households and by individuals	2008–2021
Individuals who requested benefits or entitlements (previous 12 months)	[isoc_ciegi_ac]	Survey on the use of ICT in households and by individuals	2022–2024
Digital public services for citizens	[desi_dps_cit]	DESI	2017–2023

Source: *Authors.*

([5]) The lowest performer for every year was Romania, other than in 2012 when Italy was the lowest performer. However, it reported a figure of 19 %, which Romania has not come close to achieving except in 2021; this is more indicative of inaccurate or missing data rather than Romania actually improving drastically in that year and subsequently half the reported proportion declined the following year.

Individuals who requested benefits or entitlements online

Since 2022, data have been available on the share of people who use the internet to request benefits and entitlements through government websites. While it is not meaningful to look at patterns of convergence in this short period, it is still worth examining geographical variation across Europe in this indicator. Considering the data for 2024, important differences can be seen between Member States. For example, in Greece, the proportion of internet users who, within the previous 12-month period, requested benefits or entitlements online was 29 %. In contrast, in Romania, only 2.3 % of internet users reported having done so. In four Member States – Romania, Bulgaria, Czechia and Germany (ordered from lowest to highest) – fewer than 10 % of internet users requested benefits or entitlements through government websites in the previous year. In contrast, in three Member States – France, Finland and Greece (ordered from highest to lowest) – more than one third of internet users reported having done so. On average across the EU-27, 19 % of internet users requested benefits or entitlements through government websites, according to data for 2023. In general, there is substantial variation in this indicator across the regions of Europe, with no strong geographical patterns emerging. However, the prevalence of internet use to request benefits or entitlements does tend to be below average in eastern Member States.

Digital public services for citizens

The 'digital public services for citizens' indicator measures the share of administrative steps for major life events (e.g. birth of a child, new residence) that citizens could complete online between 2017 and 2023. This is another important measure of enhanced social capital stemming from increased digitalisation, whereby those left behind by under-digitalised public services risk being excluded from the tangible benefits, irrespective of their level of physical access to the internet or their level of digital skills. The EU-27 unweighted average increased from 72 % in 2017 to 79 % in 2023. The majority of Member States have caught up with the top performers, and disparities have decreased.

Over time, Malta has been the definitive leader in terms of digital public services for citizens; since 2015, 100 % of public services have been digitalised for citizens. The Maltese government outlines that, while in previous years the focus was on 'increasing the number of services provided online and accessible 24/7, that focus has now shifted to improving service delivery' (Government of Malta, 2021, p. 11). This includes the 'once-only' principle, which implies that service users provide data only once and these can then be reused by administrative bodies, in respect of data privacy (Government of Malta, 2022). The lowest performer from 2017 to 2023 was Romania.

An overall catching-up process took place; the countries with the highest growth rates (Bulgaria, Greece and Hungary) had lower starting points. Generally, countries with lower growth rates started from stronger positions in 2017; the only exception was Romania, which had a slower growth rate.

Although disparities grew marginally between 2020 and 2021, they fell by more than 4 percentage points in the period considered and the distance from the best performer also decreased.

The number of public services being digitalised and made available online in Member States is increasing, and Member States are converging in this regard (see Figure 8). However, these results should be put in context with the actual number of citizens who are availing themselves of these services. There are a number of barriers that prevent citizens from engaging with these public services, even if they are placed online on a more convenient platform (Ragnedda and Kreitem, 2018). First, engagement with these platforms has been shown to be limited, especially for those with lower levels of education and for older age groups. Moreover, even if these services are available, quality and usability differ a lot among countries (Eurofound, 2024a).

Figure 8: Convergence summary – e-government indicators

Indicator	Individuals who used the internet for interaction with public authorities	Digital public services for citizens
Period	2008–2021	2017–2023
Average change		
Average change towards expected policy target (%)		
Change in disparities		
Sigma-convergence		
Beta-convergence	Convergence	Convergence
Distance from front runner		
Delta-convergence	Convergence	Convergence

This can limit the potential goals of the EU to achieve convergence among Member States in the area of digitalising public services, while also exacerbating divides in the outcomes of digitalisation. Even with record investment in digital services, improved access to those services are important steps additional to digital literacy and general education.

Summary

The overall result from the convergence analysis is that digitalisation indicators moved upwards in great strides and that, except for the share of people who never used the internet, low performers have caught up with best performers. This is not surprising: in the past 20 years, digitalisation policies at both the European and national levels have driven implementation in the Member States, allowing for convergence. Most of the individual indicators across the various dimensions – infrastructure and access, digital skills, and experience of e-government – point towards convergence among Member States. It is important to highlight, however, that convergence has not been entirely consistent. The convergence effect is heavily dependent on the dimension the indicator comes from, but also the Member State under consideration.

In the **infrastructure and access dimension**, northern European countries have generally performed better over time, while south-eastern European countries have fared worse. But convergence is evident throughout this dimension, with the south-eastern European countries experiencing high growth rates over the period examined. Romania has shown considerable improvement over time across this dimension, while the extent of convergence has been more moderate in other poorly performing countries like Bulgaria and Greece. Overall, Member States do not appear to be facing overt difficulties with regard to the first level of digital inclusion, with most Member States possessing optimal access and lower-performing Member States showing positive indicators that they are catching up to this steady state.

With regard to **digital skills**, similar trends emerge from the data. Northern European countries tended to perform better, with lower growth rates given their stronger relative positions, and south-eastern European countries are generally converging. A policy objective often cited, the increase in ICT specialists, is also visible in the convergence analysis. The share of employed ICT specialists increased over time, except in the case of Greece, Hungary and Malta, where the proportion of the employed population with ICT specialist skills had decreased in 2023 compared with 2005. This result is positive in terms of the expected outcomes for individuals of increased digitalisation. However, there are notable exceptions on both sides. Although Romania was generally the country with the highest growth rate in the EU-27, it rarely tended to grow above the average given its relative starting position. Member States such as Greece, Croatia, Lithuania and Cyprus, although not growing at as fast a rate, grew at a higher relative rate given their starting position. Furthermore, stronger relative positions should also not be taken for granted. For example, although France was initially a leading country in terms of individuals using the internet for telephoning and video calls, by 2018 it was one of the worst-performing countries. Such observed instances are evidence that digital skills require active learning, development and refinement. Divergence in the proportion of individuals who have never used the internet is also a concern in this regard.

Likewise, while indicators such as individuals using the internet for internet banking and individuals ordering goods and services online have seen convergence (a positive sign for enhanced ability to use digital skills and to achieve outcomes), the indicator for individuals selling goods and services online has seen divergence. The first and second instances follow the trends in other indicators (Bulgaria and Romania were the lowest performers, while Denmark, Finland and Sweden were the leaders). In the third instance, the countries that caught up the most were more varied, including Ireland, Lithuania and Slovakia. Germany, even with a strong initial position, reported negative growth. While the extent of digitalisation certainly plays a role here, the influence of evolving consumer preferences on shopping online or at bricks-and-mortar shops should not be ignored.

In the case of **e-government**, the struggle of the poorest-performing countries is perhaps more evident. While some initially poor-performing countries have caught up significantly – such as Croatia, Greece, Slovakia and Latvia – others, such as Bulgaria and especially Romania, have not been as successful. Once again, despite not having an incredibly strong initial position, Germany has also demonstrated negligible growth. While convergence can be observed in e-government indicators, notable outliers, both previously high-performing and lower-performing countries, warrant considerable attention so as to avoid gaps in the outcomes of digitalisation from increasing further across the EU. In the next chapter, the analysis focuses on sociodemographic groups and on regions. In addition to this analysis, further information on the digitalisation of social protection is available in two Eurofound reports: *Digitalisation in social protection: Trends, risks and opportunities* (forthcoming) and S*ocial protection 2.0: Unemployment and minimum income benefits* (2024a).

2 Digital convergence beyond national aggregates

The national-level analysis in Chapter 1 should be complemented by an analysis of how different groups of citizens are faring, given that digitalisation does not affect all parts of society equally, as the literature suggests. Economic, social, political, personal and cultural capital heavily shape an individual's digital capital – defined as the accumulation of digital competencies and technologies. Digital capital thus comprises all levels of digital inclusion, namely access to digital resources (first level), the use of digital resources (second level) and the benefits derived from them (third level). Consequently, socially excluded groups such as older people, individuals with lower levels of education, unemployed people, people with disabilities, minorities and, in some cases, women are more at risk of becoming digitally excluded (Ragnedda, 2018; Raihan et al., 2024). Because other forms of capital can be converted into digital capital – and digital capital's tangible benefits can, in turn, be converted back into other types of capital – social and digital exclusion are likely to reinforce each other (Ragnedda, 2018; Ragnedda et al., 2022; Raihan et al., 2024). The following paragraphs provide a description of the main socioeconomic groups that pertain to this analysis.

Retired, that is, mainly older people, unemployed people and people with lower levels of education often lack digital skills and high-quality hardware. This is not only keeping them from engaging in digital activities but also excludes them from 'digital by default' initiatives in countries with high levels of digitalisation (Schou and Pors, 2019; Mubarak and Suomi, 2022).

Among those who have never used the internet, age is a factor. Both at the EU and Member State levels, individuals aged 55–64 years and those over 65 years represent the highest proportion of non-users. The share of people above the age of 65 in this category ranges from 10 % in Czechia to more than 30 % of the population in Italy, Portugal, Bulgaria and Croatia; in Ireland and Luxembourg, the figure is 20 %. Overall, this group amounts to more than one fifth of the EU population, corresponding to almost 96 million individuals.

The importance of addressing specific barriers and improving digital inclusion among older adults is highlighted in the literature. Socioeconomic factors such as changes in income and occupation, health, living situation and family status (e.g. partnership and distance to children) are all considerations, as are country-specific features, that determine the take-up of and drop-off from online activities among older adults (König and Seifert, 2020). Evidence suggests that tailored interventions that build confidence, provide education on online communication norms and offer face-to-face assistance with technology can enhance older people's engagement with social technologies. If inclusive digital strategies are designed to consider the unique challenges they face, older adults can experience the social benefits these tools offer, leading to improved well-being and reduced social isolation (Schreurs et al., 2017; Wilson-Menzfeld et al., 2023), ensuring they are not left behind in an increasingly digital world. The case study for Greece presented in Annex 3 is of particular interest here, as it concerns the digital financial literacy of this group.

Given the interconnected nature of digital exclusion and social exclusion, the share of **people at risk of poverty or social exclusion** is another important statistic to consider. In 2023, more than 20 % of the EU population, or around 95 million people, were reported to be at risk of poverty, suffering from severe material and social deprivation, or living in a household with very low work intensity. This inequality was clearly exemplified during the COVID-19 pandemic by the lack of devices in low-income households, which was reflected in the difficulties that some children had in accessing online lessons. Despite international statistics placing the average European (not EU) share of households with a device (e.g. computer, laptop or tablet) at around 70 %, the pandemic will have impacted those households where there was no device or limited access to those devices for concurrent use. For example, in Romania, where the share of people at risk of poverty and social exclusion is particularly high, 66 % of people with internet access only used their phones to access the internet (Cibian et al., 2022). Moreover, in Italy, in 2019, 24.1 % of households only had a smartphone as a device to connect with, which could not guarantee the same operational ease as a laptop for work or learning activities (Censis, 2020).

The group of **people with lower levels of education**, which is highly correlated with low income, is one of the groups most exposed to digital exclusion, exhibiting generally lower levels of digital engagement (Lutz, 2019; van Dijk, 2020; Weßner et al., 2024). Individuals in this group are generally lower-skilled, increasing their exposure to risks of unemployment and poverty. They are also less likely to attend training. The share of individuals with lower levels of education in the working-age population – those with at most lower secondary education – decreased between 2007 and

2023 in the EU. The countries with the highest shares of people with lower levels of education are Portugal, Spain and Italy. Among the countries with the lowest shares of people with lower levels of education in 2023 were the Baltic states, which have halved their shares since 2007.

In the case of **people with severe disabilities**, the 2024 Belgian Presidency (Belgian Presidency of the Council of the European Union, 2024) drew attention to the fact that, while digital developments such as telework, digital support and assistive technologies have improved accessibility for people with disabilities, algorithms can introduce discriminatory bias. People with severe disabilities accounted for 8.7 % of the EU population above the age of 16 in 2023, but data related to the level of digital literacy in this group are not available in the EU survey on the use of ICT in households and by individuals and can thus not be considered in the following analysis.

Convergence in digitalisation indicators for different socioeconomic groups

A selection of indicators allows us to capture the three different levels of digital inclusion illustrated in the introduction: access, use and outcomes. These three levels are applied to the socioeconomic groups mentioned in the previous section, to analyse gaps and convergence, as far as the data allow. While age and educational attainment can directly reflect the older citizens group and the people with lower levels of education group, employment status supplies an intersectional perspective that covers multiple characteristics; for example, the retired and inactive group partially overlaps with the older adults group. The digital access level is captured by the level of internet access for low-income households. The use level is explored through above basic digital skills, online learning and activity on social networks. The outcomes level is captured by online banking and by requesting benefits and entitlements from public authorities. The following paragraphs provide a brief description of the indicators (summarised in Table 3) and their importance in measuring digital inclusion among various socioeconomic groups in line with the literature – namely, different age groups and groups differentiated by educational attainment and employment status.

Access

Level of internet access by household income

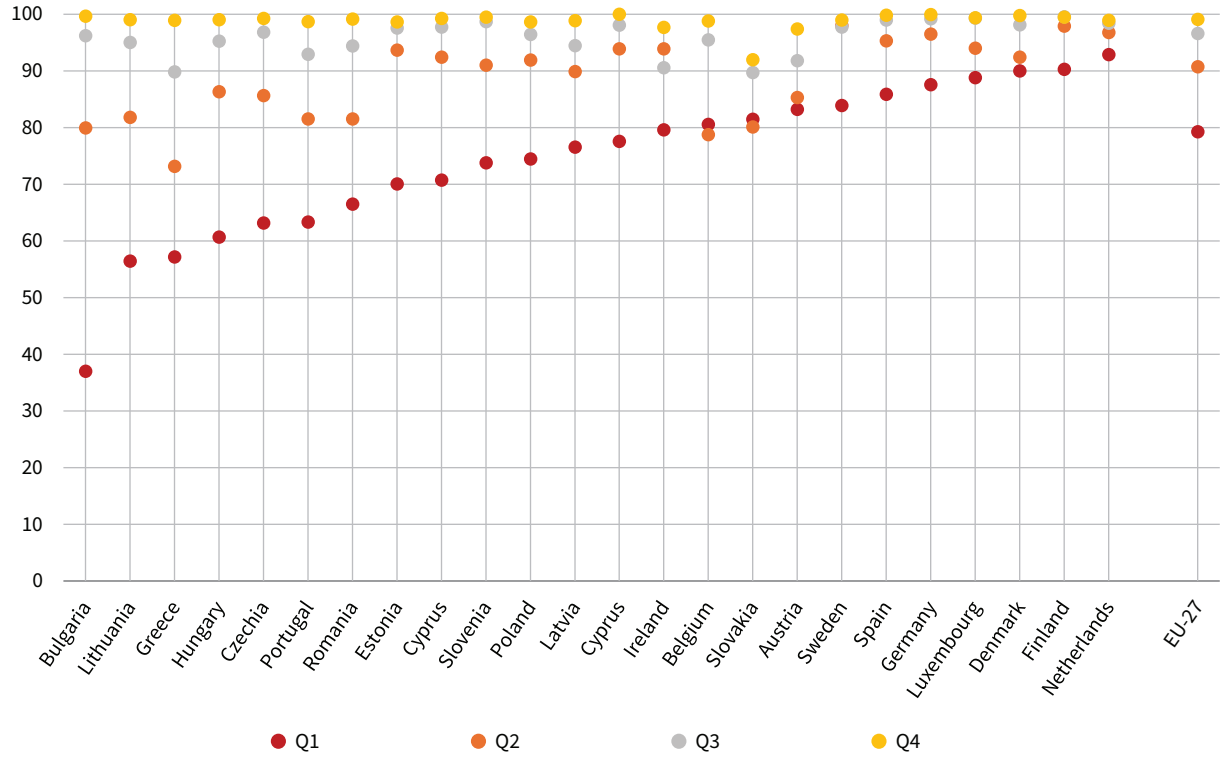
This indicator captures the level of internet access by household income across the EU. The period covered for this indicator ranges from 2011 to 2020. The EU unweighted average increased from 71 % in 2011 to 89 % in 2020. This indicates that, as of 2020, the differences in access among households with different levels of income persisted, reflecting the findings in the literature that social exclusion and digital exclusion are deeply linked. In most countries, the lowest-income households (the red dots in Figure 9) record the lowest levels of access to the internet. In 2020, the Netherlands was the Member State with the lowest difference in shares of internet access by household income level, with just 6 percentage points separating the lowest-income and highest-income households. At the other extreme,

Table 3: Indicators used in convergence analysis of the socioeconomic groups – internet use

Digital indicator	Indicator code (Eurostat source)	Groups breakdown	Access/use/outcome
Level of internet access per household (first quartile of income)	[isoc_ci_in_h] [HHI_Q1]	Income quartile	Access
Individual with above basic digital skills	[I_DSK2_AB] (individuals with above basic digital skills) (all five component indicators are at above basic level)	Education, age, employment status	Use
Use of social networks	[I_IUSNET]	Education, age, employment status	Use
Online learning	[I_IUOANY] (any of the three activities I_IUOLC (doing an online course), I_IUOLM (online learning materials) and I_IUOCIS (communicating with instructors or students))	Education, age, employment status	Use
Internet banking	[I_IUBK]	Education, age, employment status	Outcome
E-government	[I_IGOV12FM]	Education, age, employment status	Outcome

Source: *Authors.*

Figure 9: Internet access by household income, 2020 (%)

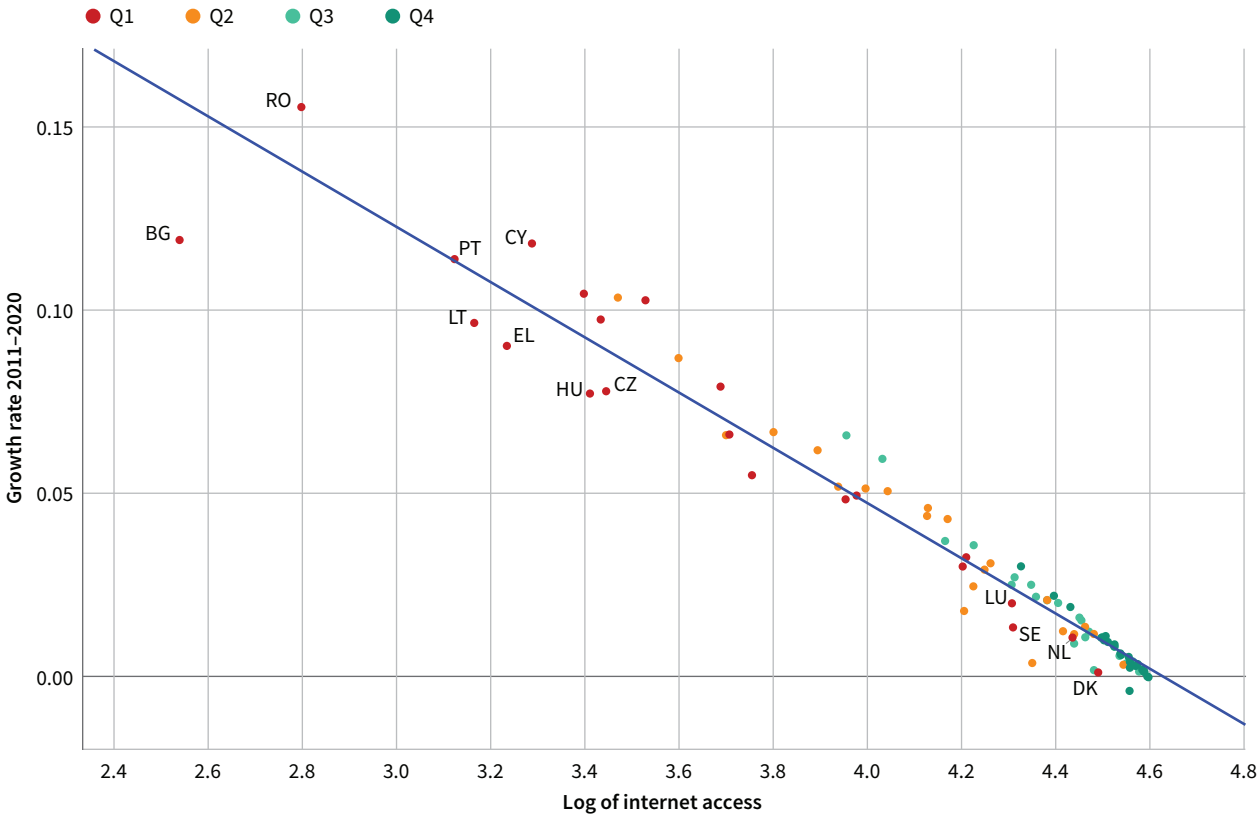


Note: *Data are missing for France, Italy and Malta. Q1 is the quartile of lowest-income households and Q4 the highest-income.*
Source: *Eurostat [isoc_ci_in_h].*

more than 60 percentage points separate Bulgarian low-income households (at 37 %) from high-income households, which are close to 100 % coverage. In 2011, the coverage among low-income households was lowest in Bulgaria (12.3 %), followed by Romania, Portugal and Lithuania (all below 25 %). In 2020, Bulgaria was followed by Lithuania (56.5 %) and Greece (57.2 %).

Despite persisting inequalities in access to the internet, a catching-up process took place; low-income households improved their coverage share, while high-income households have reached a steady state and have not decreased. Disparities halved between 2011 and 2020, and the gap between the poorest performer and the best performer also narrowed (as seen in the top left part of Figure 10), where the group catching up from a lower share of internet access is exclusively composed of low-income households. However, as seen in Figure 10, many of the low-income households grew slower than the average (below the trend line), especially those in Bulgaria, Greece, Hungary, Lithuania and Portugal.

Figure 10: Beta-convergence of internet access by household income, 2011–2020



Note: *Data are missing for France, Italy and Malta. Q1 is the quartile of lowest-income households and Q4 the highest-income.*
Source: *Authors' calculations, based on Eurostat [isoc_ci_in_h].*

Use

Individuals with above basic digital skills

The first indicator for evaluating internet use is the assessment of digital skills – specifically, the share of people with above basic digital skills. An individual is said to have above basic digital skills if they exhibit above basic levels of skill in five specific areas: information and data literacy, communication and collaboration, digital content creation, safety, and problem-solving. Unlike other indicators, data on digital skills are only available for 2021 and 2023; therefore, the time series is not long enough for a meaningful convergence analysis. However, breakdowns are available by educational attainment, employment status and age and can help us gain an understanding of how digital abilities were distributed throughout society in 2023.

In terms of age group (Figure 11), the oldest cohort, aged 55–74, exhibited the lowest share of above basic digital skills across all Member States in 2023. The highest level of digital skills for those aged 55–74 was around 40 % in the Netherlands, and the lowest levels were in Romania and Bulgaria (around 2 %). For the 2023 EU-27 average, around 14 % of individuals aged 55–74 exhibited above basic digital skills. This stands in stark contrast to an average of 35.2 % of people with above basic skills among the 16–24 age group, a share of almost 50 % among the groups aged 25–34 and 35–44, and 42 % in the cohort aged 45–54. In the top performers – Finland, Malta and the Netherlands – up to 60 % or even 70 % of the two youngest cohorts possess above basic digital skills. Differences between the 55- to 74-year-old cohort and the rest of the cohorts are least pronounced in the Netherlands.

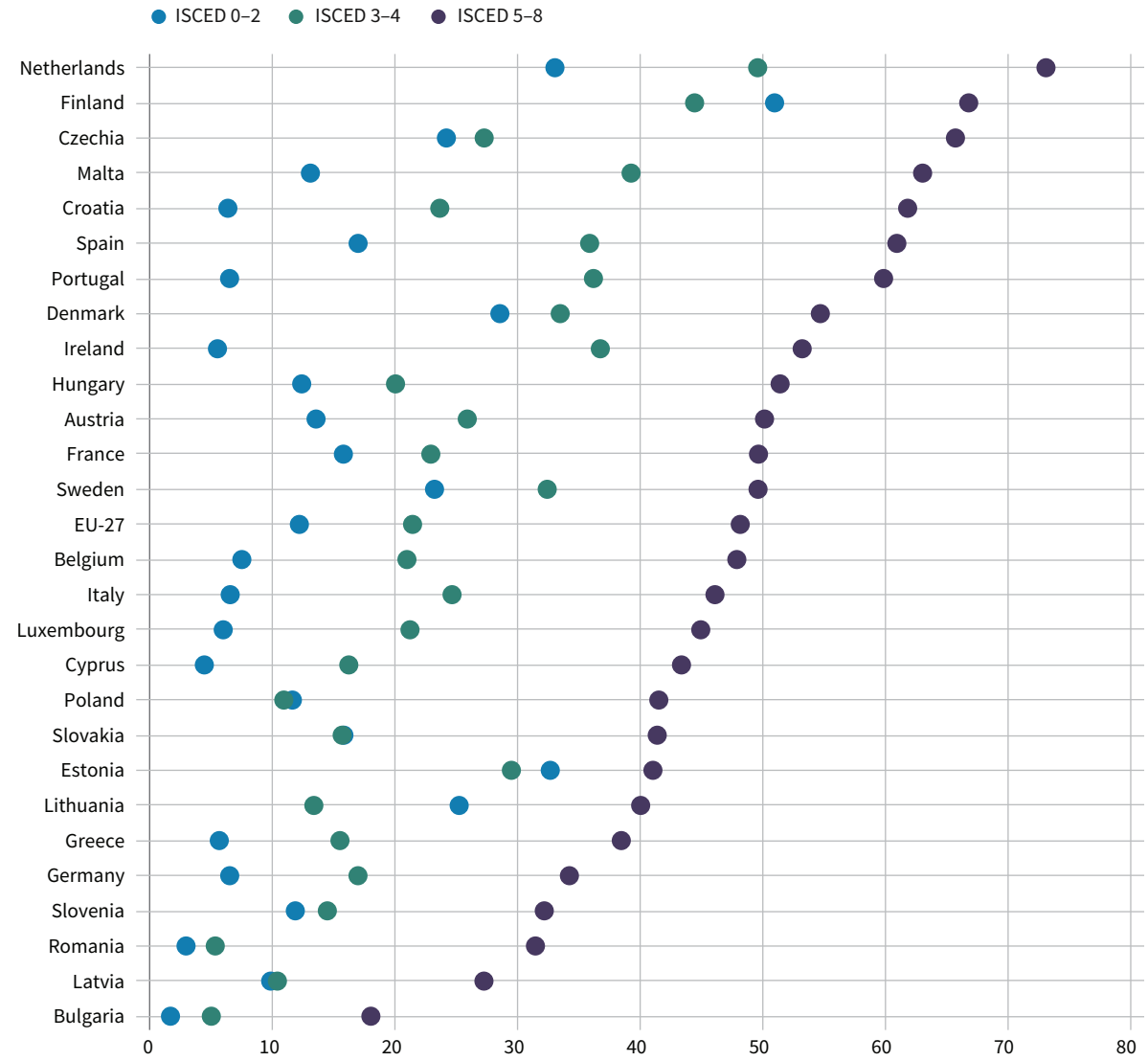
Figure 11: Individuals with above basic digital skills by age group, 2023 (%)

Source: *Eurostat [I_DSK2_AB].*

Differentiating by levels of educational attainment, the picture is even clearer. Figure 12 shows that a higher level of education is clearly correlated with higher levels of digital skills, but to varying extents across the Member States. Looking at the EU average, 20 % of the population with low levels of education, 35 % of the population with medium levels of education and almost 60 % of the population with high levels of educational attainment had above basic digital skills in 2023. In every Member State, the level of digital skills of the group with the highest level of education largely exceeds the two other groups. The Netherlands and Finland exhibit the highest share of highly educated individuals with above basic digital skills, with around 70 %, followed by Czechia. The overall lowest shares of digitally skilled people are found among people with low levels of education in Romania and Bulgaria, with 3 % and 1.7 % respectively. Interestingly, in Finland, Estonia and Lithuania, the level of above basic digital skills of the population with lower levels of education exceeds the digital skills of the population with medium-level educational attainment.

When assessing digital skills by employment status, the economically inactive and retired cohort has the lowest share of above basic digital skills across all Member

Figure 12: Individuals with above basic digital skills by educational attainment, 2023 (%)

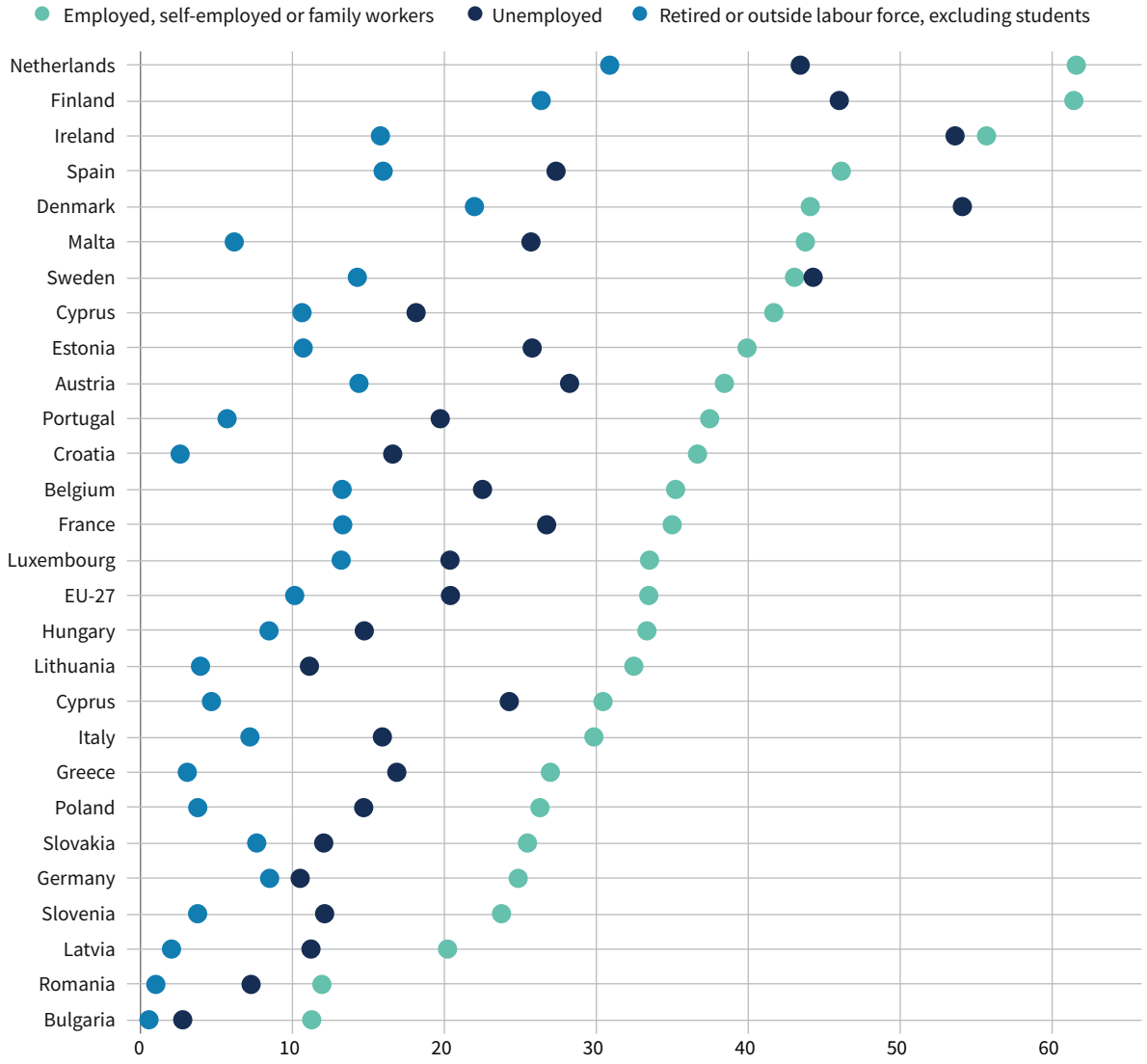


Note: *ISCED, International Standard Classification of Education. The various ISCED levels are classified as follows: ISCED 0 = early childhood education ('less than primary' for educational attainment); ISCED 1 = primary education; ISCED 2 = lower secondary education; ISCED 3 = upper secondary education; ISCED 4 = post-secondary non-tertiary education; ISCED 5 = short-cycle tertiary education; ISCED 6 = bachelor's or equivalent level; ISCED 7 = master's or equivalent level; ISCED 8 = doctoral or equivalent level.*
Source: *Eurostat [I_DSK2_AB].*

States (Figure 13). Once again, the share among the lowest-performing group is highest in the Netherlands and Finland (around 25 %), and lowest in Romania (1 %) and Bulgaria (0.5 %). In terms of the EU-27 average for 2020, about 10 % of the retired group have above basic digital skills. This share is twice as large among unemployed people, and three times as large among the employed population. In all countries except Denmark and Sweden, employed individuals have the largest share of digital skills, followed by unemployed and economically inactive individuals. In Ireland, the discrepancy between the economically active groups is remarkably small. In all other Member States, the working population clearly exhibits larger shares, with more than 60 % of working individuals displaying above basic digital skills in the top-performing countries – the Netherlands and Finland – compared with about 45 % of unemployed individuals displaying the same skills. In the lowest-performing countries – Romania and Bulgaria – only slightly above 10 % of the working population have above basic digital skills.

These figures support the findings in the literature that socially vulnerable groups might be more prone to digital exclusion beyond mere physical access; digital exclusion includes the skills to use digital technologies. Most of the policy initiatives presented in Chapter 4 are therefore targeted towards older people, unemployed people or individuals who are socially excluded in other ways.

Figure 13: Individuals with above basic digital skills by employment status, 2023 (%)



Source: *Eurostat [I_DSK2_AB].*

Use of social networks

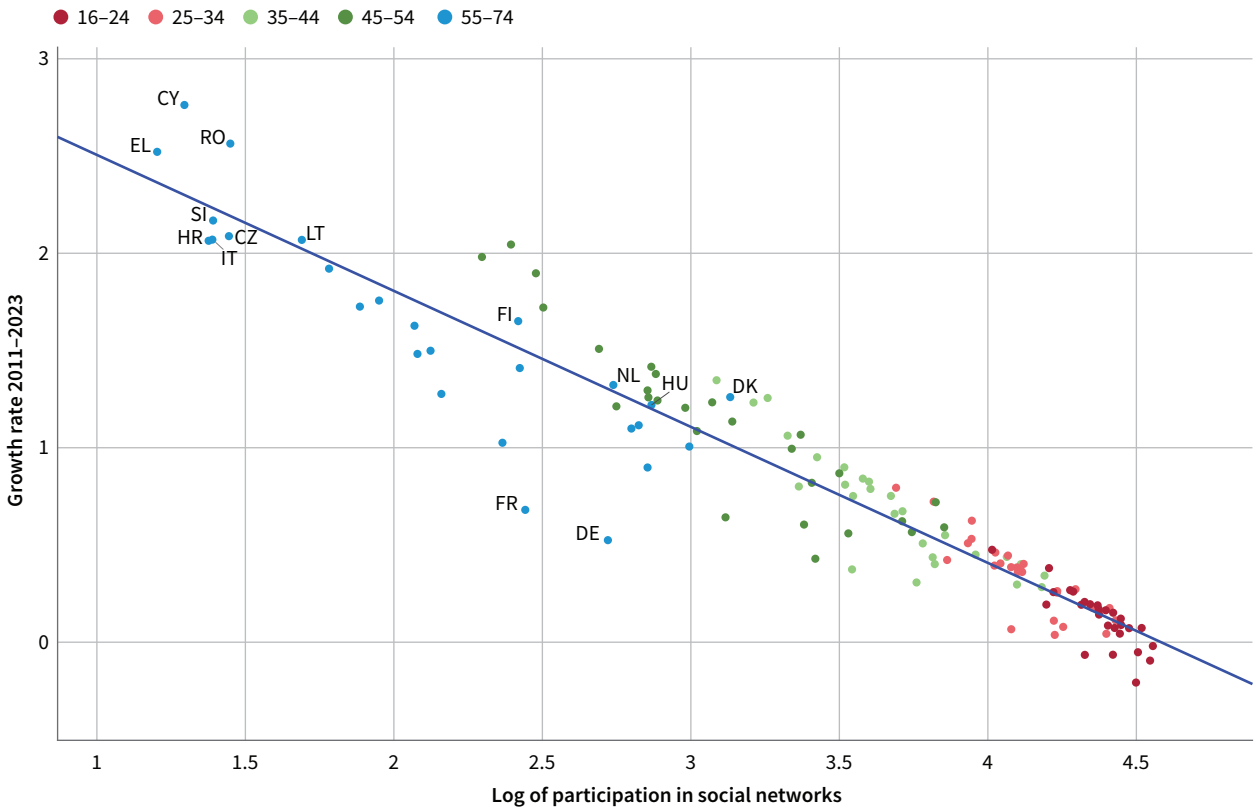
A prominent form of internet use is participating in social networks by creating user profiles, messaging and/or posting. This indicates a basic level of digital literacy. It reflects an individual's ability to navigate digital platforms, communicate online and participate in virtual communities. Therefore, it helps gauge the foundational digital skills of a population.

While it is generally debatable whether increased use of social media should be a generalisable social goal, it may have benefits for vulnerable groups; for instance, social media could counteract isolation among older people. Hence, social networks might provide an alternative medium for (intergenerational) interactions with existing connections, allowing individuals to maintain their relationships as mobility decreases, as well as the possibility of building new social ties.

Earlier studies suggest that the use of social networks might differ by socioeconomic characteristics. The use of professional networks such as LinkedIn is associated with higher levels of income and self-reported skill levels, while use of other networks is associated with gender and age (Blank and Lutz, 2017). While the medium itself influences whether a platform is used for recreational purposes or can be used for professional activities, education impacts how people use these networks (Karaoglu et al., 2022).

Since 2011, social networks have become more popular, especially in countries and groups where they were initially less used. Notably, the largest increase happened for the groups aged 35–44 and 45–54, particularly in Cyprus, where usage by the 45–54 age group increased by 75 percentage points. Women are slightly more likely to use social networking sites than men, but this is reversed in the 55–74 age group, with significantly more men (54 %, versus 47 % of women) using social networks in 2023.

Figure 14: Beta-convergence of participation in social networks by age groups across Member States, 2011–2023



Source: *Authors' calculations, based on Eurostat [I_IUSNET].*

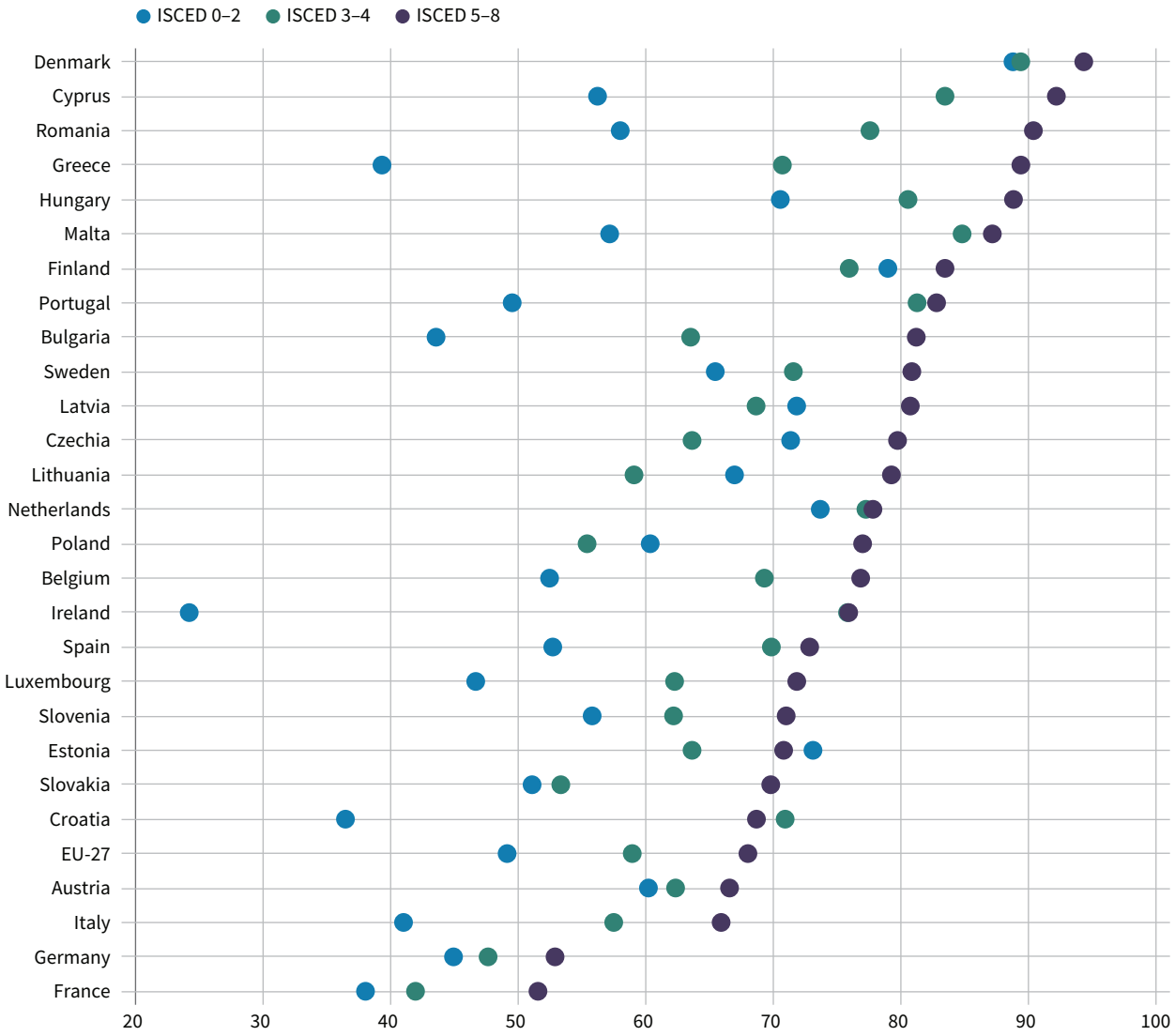
Social network use by age in 2023 seems to indicate a 'grey divide' across the Member States. With the exception of Denmark, where more than two thirds of people aged 55–74 use social networks, this cohort generally tends to be much less active than other age groups. The lowest use of social networks was found among the 55–74 age group in France and Germany (25 %), but overall social network use was lower than in the rest of the EU.

The use of social networks is converging, meaning that average use has increased over the last decade, while discrepancies between the different age groups across Member States have simultaneously decreased. This can be seen in Figure 14, where age groups with low social network use grew more than those with already high levels between 2011 and 2023.

The 16–24 age group is a significant outlier in Germany (less than 75 % use social networks), France, Latvia, Luxembourg, Slovakia and Sweden, which have high overall levels, but have reduced their use of social networks since 2011. Notably, the group aged 55–74 years in Cyprus and Greece, previously exhibiting infrequent use of social networks, has exhibited above-average growth of more than 50 percentage points since 2011, suggesting that they are catching up, unlike in France and Germany where this group is showing below-average growth.

In terms of **education**, social network use among people with high levels of education largely exceeds the other educational levels in most countries (Figure 15). Again, the highest level of use in 2023 among the population with lower levels of education is found in Denmark (80 %), and the lowest level of use is found in Ireland (25 %). Only in Estonia is the highest level of social media use found among those with the lowest level of education. Differences between the groups with different education levels are smallest in Finland and the Netherlands, and most pronounced in Austria, Belgium, Greece, Hungary and Romania. Looking at developments since 2011, all groups in all countries, except for people with lower levels of education in Germany, Ireland, Luxembourg and Slovakia, increased their usage of social networks.

Figure 15: Participation in social networks by educational attainment, 2023 (%)



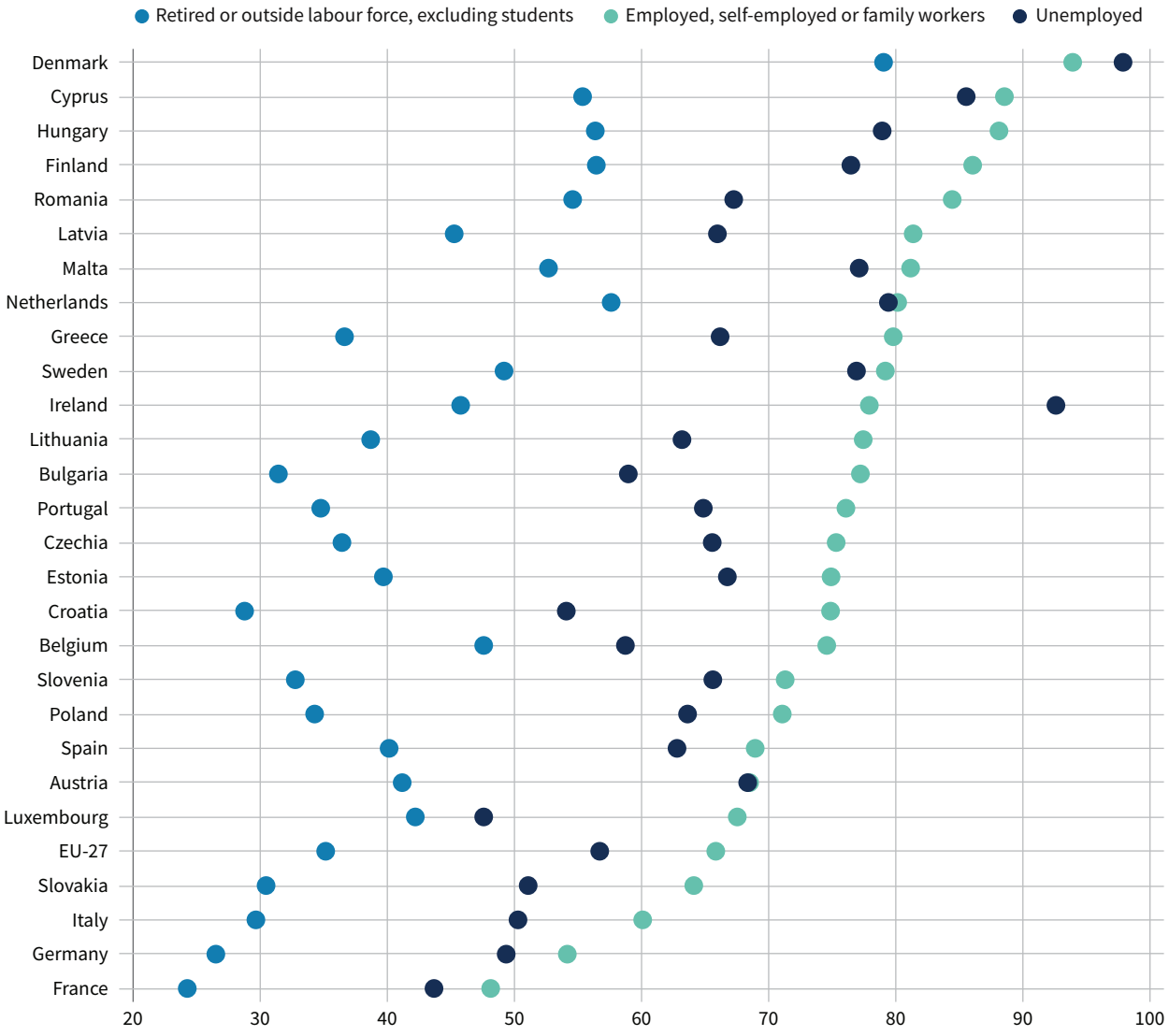
Note: *ISCED, International Standard Classification of Education.*
Source: *Eurostat [I_IUSNET].*

Generally, the smallest increases in social network use between 2011 and 2023 for all educational groups happened in Germany and Slovakia, as well as in France for individuals with medium and high levels of education. At the EU level, more than 70 % of highly educated women, in contrast to 64 % of highly educated men, use social networks. Among the people with a medium level of education, the gendered difference amounts only to 3 percentage points, and this is reversed for those with lower levels of education.

Most of the groups with above- and below-average growth are those with the lowest level of educational attainment. These groups are catching up in Bulgaria, Greece, Romania and Slovakia, that is, the countries where these groups are lagging furthest behind. Here, the largest overall increase in social network use (around 50 percentage points) is detected for those with a medium level of education. The largest increase for the group with lower levels of education was a 40-percentage-point increase in Hungary. As overall discrepancies between groups across Member States increased, social network use is not converging in terms of education, even though the average uptake has grown since 2011. The groups with lower levels of education who use social networks in higher proportions are found in Demark, Finland, Latvia, Czechia, the Netherlands and Estonia.

The same is true when differentiating social network use by employment. Retired and inactive people are the least likely to use social networks in all countries. Two thirds of this vulnerable group use social networks in Denmark, followed by around 55 % in the Netherlands and Finland, in contrast to 25 % of this group in Germany and France (Figure 16). Interestingly, the same is not true of unemployed people, who show the highest use of social networks in Denmark, at almost 100 %, and

Figure 16: Participation in social networks by employment status, 2023 (%)



Source: *Eurostat [I_IUSNET].*

in Ireland, at around 90 %, compared with only 75 % of employed people. In all other countries, the highest use of social networks is among employed people, with the largest difference in Croatia, where 75 % of employed people but only around 55 % of unemployed people use social networks.

The convergence analysis shows that in Romania, Greece and Lithuania, in particular, the inactive and retired populations, which have very low levels of social network use, have managed to catch up in terms of growth since 2014. In Cyprus and Romania, participation in social networks grew for all groups but increased the most for unemployed people. The highest overall increase is detected in Ireland, where the unemployed population increased their use of social networks by 50 percentage points. The average use of social networks by employment status has increased since 2014, but so have the discrepancies across Member States.

Overall, the use of social networks has increased across society, but not to the same extent for all groups. On the one hand, while they still lag behind in terms of use in 2023, unemployed people, older adults and people with lower levels of education are starting to catch up in lower-performing countries such as Bulgaria, Cyprus, Greece and Romania. On the other hand, the same groups show below-average growth rates in France, Germany and Luxembourg, while lagging far behind

other age and education cohorts. It is noteworthy that overall only differences between age groups have narrowed since 2014 while disparities between groups by educational attainment and employment status have widened across Member States. These findings suggest that particularly vulnerable groups are using social networks less and might become more prone to exclusion, including in more digitalised countries, underlining the importance of projects particularly targeting older and unemployed people. Two examples of such projects are presented in the case studies. These are the 'Digital ambassadors' project in Rhineland-Palatinate in Germany (Chapter 4), and the Podkarpackie digital inclusion programme in Poland (discussed in Annex 3).

Online learning

Online learning is another indicator of internet use. In the framework used in this report, this would be in the realm of second-level digital inclusion. Online learning is a pillar of lifelong learning, enabling individuals to acquire new skills and adapt to the evolving demands of the labour market. The use of online platforms for education signals the readiness of a population to engage in continuous skills development, which is crucial for economic competitiveness and personal growth. Digital learning platforms make education accessible to a wider audience, particularly to individuals in remote or underserved regions who may lack access to traditional educational institutions. High rates of online learning use indicate progress towards more inclusive education systems, in line with EU objectives to reduce educational inequalities.

Online learning activities gained significant importance during the COVID-19 pandemic. However, the general uptake may not have reached all parts of society equally, and socioeconomic inequalities may persist or even be exacerbated. The EU survey on the use of ICT in households and by individuals includes an index to gauge if a person has used online learning materials, communicated with teachers or students on educational websites, or taken online courses in the previous three months.

The cohort of people aged 55–74 years, people with low educational attainment and economically inactive individuals are the least likely to use the internet for online learning. In Romania, Cyprus, Bulgaria and Greece, fewer than 5 % of this cohort use online learning activities. In Cyprus and Romania, the gap between the oldest cohort and the rest of the population is also very large, both in absolute terms and in the extent of the change since 2015, as it decreased in Romania in contrast to the general trend. In general, in all countries, there are large differences between the youngest cohort, who tend to use online learning activities most, and the middle-aged groups, except in Denmark, where the 25–34 age group is almost on a par with the 16- to 24-year-old group (Figure 17). In Ireland, the 16–24 age group uses online learning much less (around 45 %) than those aged 25–34 (70 %), 35–44 (60 %) and 45–54 (over 50 %). In the Netherlands, where online learning is most popular, use among the oldest cohort is around 30 %; however, the share among 16- to 24-year-olds is three times higher. While online learning increased for all groups at the strongest rate in Ireland and the Netherlands, this trend did not affect the oldest group to the same extent. Thus, while online learning became increasingly popular on average, this does not mean that there was convergence, as disparities between the groups increased as well. This may be related to the fact that learning activities, both digital and analogue, decline with age. According to the EU Labour Force Survey (EU-LFS), participation in education and training diminishes significantly with age.

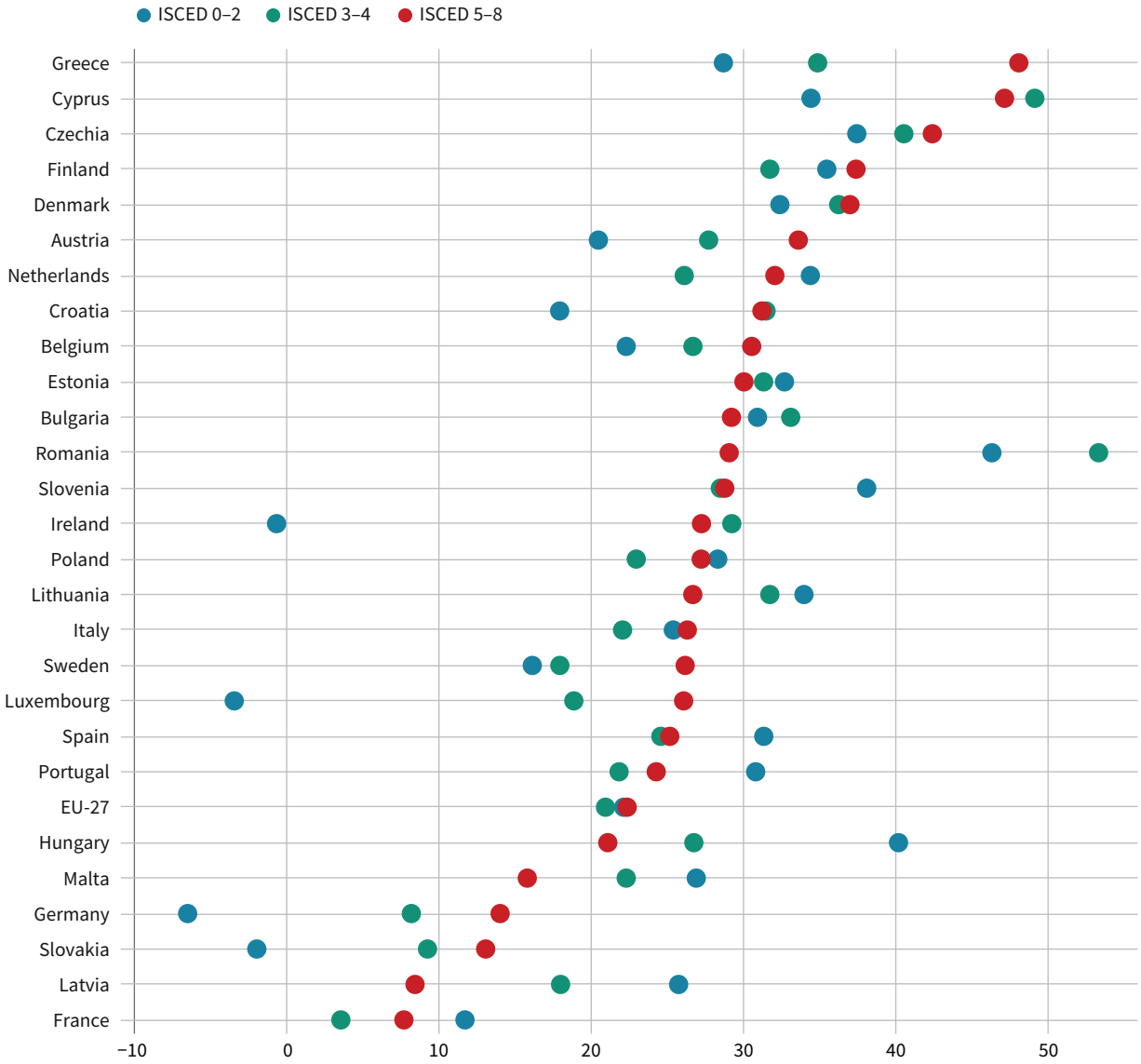
Having increased their use of online learning resources more than men in the same age cohort, 60 % of women aged 25–34 used these resources, exceeding their male counterparts. In 2017, the share of online learning among men was higher than among women in all age cohorts above 25 years. However, in 2023, because the share of women increased more substantially, their use of online learning exceeded use among men in all age groups except for the 55–74 age group.

Figure 17: Use of online learning activities by age group, 2023 (%)

Source: *Eurostat [I_IUOANY].*

However, this result does not necessarily mean that online learning is less popular among all other vulnerable groups; in Finland, for example, 60 % of the group with the lowest educational attainment used the internet for online learning, exceeding the share among those with high levels of education. Figure 18 presents the changes between 2017 and 2023 by educational attainment. In Finland and in the Netherlands, people with lower levels of education also increased their online learning after 2017 by around 25 percentage points, which is the largest increase within this group. Broken down by gender, women with high and medium levels of educational attainment use online learning activities on average slightly more than their male counterparts. The opposite is true of individuals with lower levels of education.

Figure 18: Differences in the use of online learning activities by educational attainment, 2017–2023 (percentage points)



Note: *ISCED, International Standard Classification of Education.*
Source: *Eurostat [I_IUOANY].*

In all countries, the people with the highest levels of education are most likely to use online learning activities, especially in Ireland, Portugal and Spain. People with high levels of education increased their online learning most in Ireland and the Netherlands, by around 40 percentage points. In some countries, the differences in educational attainment are very pronounced, particularly in southern European countries, where there was a clear increase in online learning with increasing educational attainment in 2023. Online learning increased for almost all groups in all countries except Romania, where the share of online learners decreased for all groups after 2017, particularly among people with high levels of education. In Luxembourg, the share of people with low levels of education engaged in online learning decreased by 10 percentage points after 2017, while the proportion of people with high levels of education who used online learning increased by 20 percentage points. In all countries but Romania and Spain, the increase was most pronounced for individuals with a tertiary-level degree. In Greece, where people with low levels of education use online learning substantially less, above-average growth rates imply a catching-up process. People with less education in Germany, Luxembourg and Romania, on the other hand, are increasingly falling behind. Overall, this means that uptake of online learning is not equal for all and thus disparities are increasing. That online learning activities are used far less by people with a low level of education need not be solely a reflection of the fact that the learning activities are taking place online. Instead,

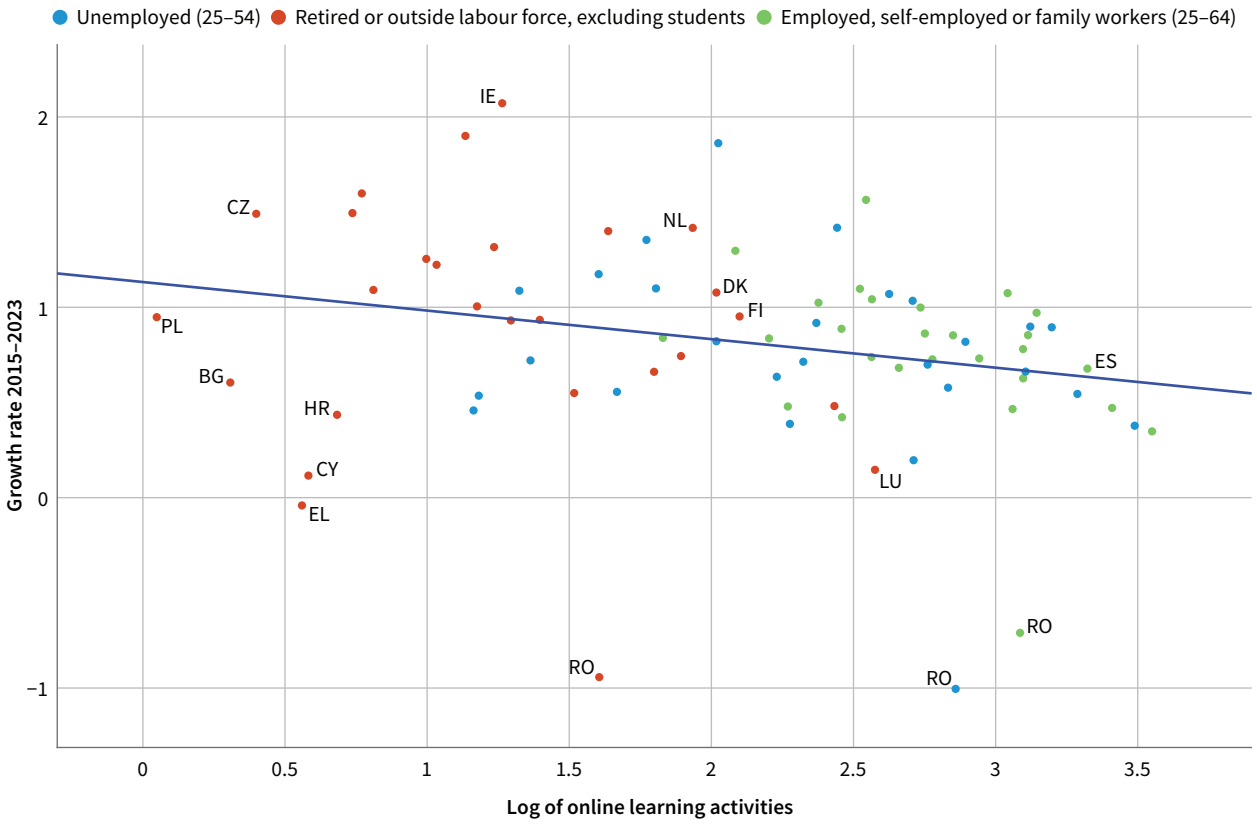
it may further be connected to the general finding that this group's participation in lifelong learning generally lags far behind those with other levels of education (Cedefop, 2023).

While economically inactive individuals are, by far, the group using online learning materials the least, when differentiated by employment status, working individuals exhibit the highest share of online learning in most Member States; the exceptions are Austria and Luxembourg, where unemployed people account for the highest share. Among the working population, Bulgaria and Romania exhibit the lowest levels of engagement with online learning, with less than 5 % of online learners in 2023. In the Netherlands, Finland and Ireland, on the other hand, more than 60 % of the working population participated in online learning. In the Netherlands, the unemployed population was almost on a par with the working population; both in the Netherlands and in Ireland, their online learning has increased by around 40 percentage points or more since 2015. While Ireland and Malta have managed to boost online learning for the more vulnerable groups, namely unemployed, retired and inactive people since 2015, these groups fell increasingly behind in Cyprus, Greece, Luxembourg and Romania, suggesting that inequalities in this dimension of internet use also increased (Figure 19).

Notably, for all groups, the level of online learning in Romania decreased between 2014 and 2023, in contrast to the general development in the rest of the Member States. Barriers to online learning might be rooted in structural problems in Romania (Manu et al., 2021). First, many rural schools lack basic facilities – nearly 40 % lacked running water or sewage in 2019 (European Commission, 2019a) and many of them are poorly equipped with digital infrastructure (Manu et al., 2021). Second, 66 % of internet users rely solely on phones for access, which limits their ability to fully engage in online education (Cibian et al., 2022). Furthermore, rising inflation from 5.1 % in 2021 to 13.8 % in 2022 (World Bank, 2024) is likely to have made updating or purchasing digital devices unaffordable for many, further contributing to the decline in online learning participation.

Between 2017 and 2023, online learning activities increased across most socioeconomic groups in all Member States. This was particularly the case for groups that had previously shown lower levels of engagement in such activities, suggesting a catching-up process. Specifically, these were people aged 55–74 in Czechia, Hungary, Ireland, Malta and Slovakia; those with lower levels of education in Greece; and retired, inactive and unemployed people in Ireland and Malta.

Figure 19: Beta-convergence of online learning activities by employment status, 2015–2023



Source: *Eurostat [I_IUOANY].*

Their above-average growth between 2017 and 2023 suggests that they are catching up. However, because this is not the case for all vulnerable groups in all Member States, differences between the socioeconomic groups across the countries have increased overall. In Romania, in particular, all groups have decreased their use of online learning activities. Instances of falling behind can be observed, as indicated by the below-average increase in online learning for the oldest age cohort in Bulgaria, Croatia, Cyprus, Finland and Luxembourg; for the cohort with the lowest level of education in Germany and Luxembourg; and for people who are inactive, retired and unemployed in Cyprus, Greece and Luxembourg. Thus, while online learning has become increasingly popular on average, disparities between socioeconomic groups across the Member States have widened, with vulnerable groups not participating to the same extent as other parts of society. The fact that, overall, less educated, older and unemployed individuals tend to use online learning activities the least is not surprising given that these groups generally have lower levels of participation in lifelong learning. This may point towards a need for policy intervention to ensure that technology can combat rather than reinforce educational inequalities (Marcus-Quinn, 2022; McCoy and Siedschlag, 2025). One example of an initiative that encourages adults in long-term unemployment to engage with e-learning is the DIAS.komm project (see Annex 3).

Outcomes

Internet banking

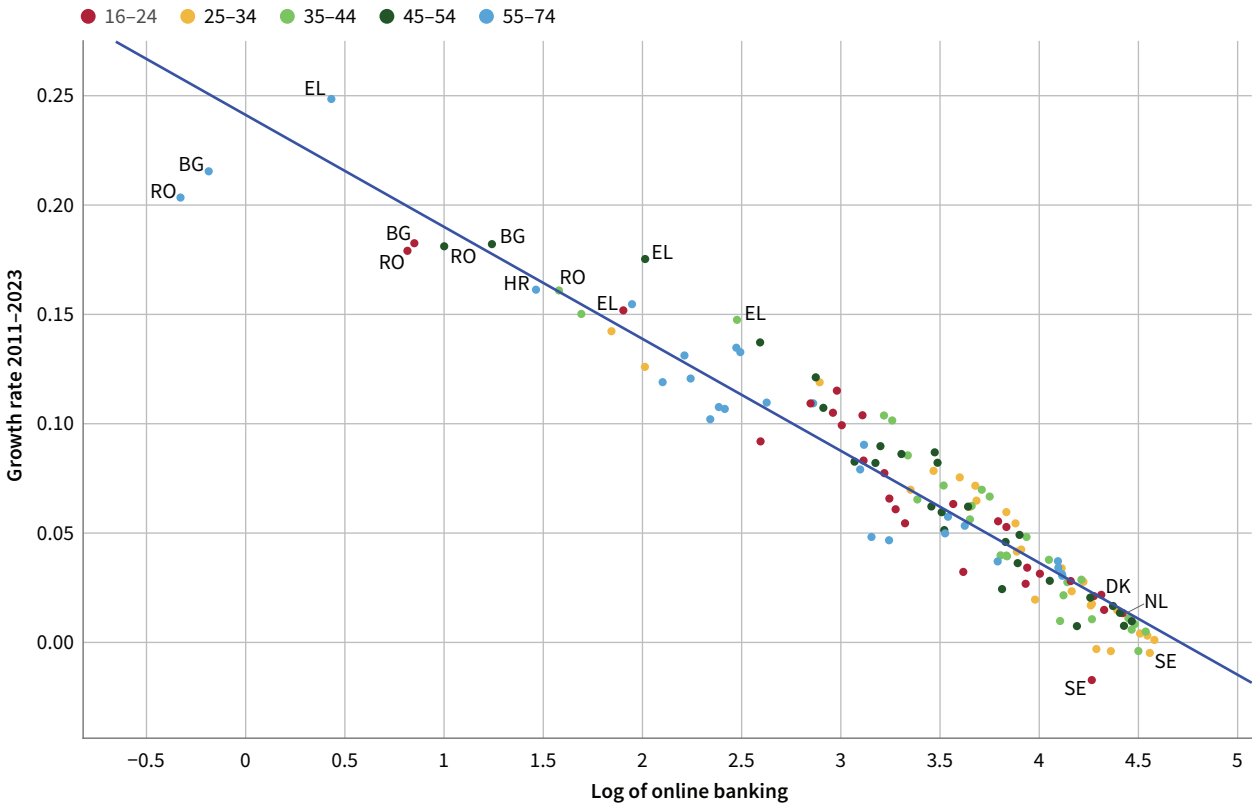
Online banking is one of the long-standing indicators concerning the use of the internet; it serves as a proxy for understanding both the adoption of digital services and the level of digital skills among citizens. Using online banking requires a certain level of digital literacy, such as the ability to navigate digital interfaces, ensure secure transactions and manage personal finances online. By tracking the percentage of individuals who engage in online banking, the DESI also measures higher-order digital competencies. Countries with higher usage rates for online banking tend to have populations with stronger digital skills and populations that are integrating digital tools into their daily lives, supporting more efficient financial transactions and reducing dependency on physical infrastructure. Online banking is an example of **advanced digital service adoption**. Unlike simpler activities such as social media use or general web browsing, online banking involves tasks that require trust in digital platforms, familiarity with online tools and an understanding of financial management. Analysing online banking usage breakdowns by different socioeconomic groups reveals information not only about the usage but also about how digitally and financially skilled people are.

As seen in Chapter 1, the overall unweighted average for this indicator increased, and a catching-up process and reduction in disparities took place among Member States. Examining online banking usage breakdown from 2011 to 2023 by socioeconomic group allows us to confirm if convergence took place at a more granular level. In 2023, people in the 25- to 44-year-old age range were more likely to use online banking than people aged 55–74; they were also more likely to use it than the younger cohort of 16- to 24-year-olds. The only groups where the share of people using online banking declined were 25- to 34-year-olds in Germany, Luxembourg and Sweden, and also 16- to 24-year-olds and 35- to 44-year-olds in Sweden. The unweighted average grew by 30 percentage points between 2011 and 2023 to 71 %. The leading age cohort has been the Finnish group aged 35–44, except for 2020, when it was the same cohort but in Denmark. The poorest-performing age cohort has been those aged 55–74 in Romania, except for 2012–2013 and 2016–2019, when it was 55- to 74-year-olds in Bulgaria. Both genders increased their use of online banking across the EU between 2017 and 2023. Women aged 16–24, 25–34 and 35–44 used online banking services more frequently than men in the same age cohorts. The largest gender differences in 2017 existed among the 55- to 74-year-old cohort, among which 30 % of women and 38 % of men used online banking. While remaining the largest difference, the discrepancy has slightly decreased, as women in that age group increased their uptake by almost 17 percentage points to 47 % and men increased theirs to 54 %.

Figure 20 shows that online banking use among those in the 55- to 74-year-old age bracket in Bulgaria, Croatia, France, Italy, Poland, Portugal, Romania and Slovenia grew at a slower rate (light-blue data points in the top left to middle of Figure 20, below the trend line). The youngest cohort, 16- to 24-year-olds, experienced slow growth in Bulgaria, while the 45- to 54-year-old cohort in Romania also struggled to reach the average.

Usage by education indicates that individuals with higher levels of education are the most likely to use internet banking in all Member States. However, in countries such as Denmark, Estonia, Finland and the Netherlands, the gap with those who have lower levels of education is below 15 percentage points, while it grows wider, above 60 percentage points, for those in Croatia, Cyprus, Greece, Ireland and Poland. The unweighted average for these groups also grew by 25 percentage points between 2011 and 2023, from 41 % to 66 %. The established leading group from 2011 to 2023 consisted of people with higher levels of education from Finland; this group was overtaken by people with higher levels of education from the Netherlands in 2023. A catching-up process took place, but the groups with lower levels of education in Bulgaria and Romania increased their usage more slowly than

Figure 20: Beta-convergence of online banking by age group, 2011–2023



Source: *Authors' calculations, based on Eurostat [I_IUBK].*

average, while Greeks with higher levels of education increased theirs more. The groups with lower levels of education in Denmark and Sweden perform as well as the groups with higher levels of education when it comes to use of online banking. Men of all educational levels tend to use online banking more than women, with the difference decreasing with higher levels of educational attainment.

In relation to employment status and online banking usage in 2023, employed people generally account for the highest share of usage. Ireland bucks this trend: the figures stand at 98 % of unemployed people compared with 92 % of employed people. The Irish exception could be explained by the fact that several benefits and allowances can be paid online, and also by the 2023 wave of tech sector dismissals (Burke-Kennedy, 2023). For the retired and inactive group, the share of online banking usage has decreased since 2011, but a country pattern similar to those noted in the age and education analyses emerges; in Demark, Finland, the Netherlands and Sweden, the usage gap between those in the active workforce and those who are unemployed is far smaller than the usage gap in Croatia, Czechia and Slovenia. Croatia, Greece and Lithuania register bigger gaps than other countries between online banking usage among the active workforce and among the retired and inactive group. From 2012 to 2023, the EU-27 unweighted average grew by 24 percentage points to 62 %.

A catching-up process took place between the lowest-performing groups and the best performers, and a reduction in disparities meant that differences among groups generally declined. The distance from the best performer, the unemployed group in Ireland, decreased. In the previous years, the best-performing group was the Finnish unemployed group in 2022, and between 2012 and 2021 employed individuals in Finland were the top users of online banking. The retired and inactive group, the one with the lowest starting usage share, grew slower than average in approximately two thirds of the Member States, the exceptions being Austria, Belgium, Cyprus, Czechia, Denmark, Greece, Ireland, Italy, Latvia and Spain.

The ability to turn access and skills into outcomes for the online banking indicator emerges mainly among the less vulnerable socioeconomic groups such as those with higher levels of education, the age cohort ranging from 25 to 44 years, and those in the active workforce. Older adults aged from 55 to 74 and the 16- to 24-year-old cohort register the lowest levels of online banking, especially in Bulgaria and Romania, while in Greece these groups have been catching up. In the Nordic countries, the same age groups are generally catching up faster and with shares closer to the average. In terms of education, a divide can be observed between people with higher levels of education and people with medium and lower levels of education across all Member States,

but again in countries like Finland, where social inequalities are smaller, the gap in usage of online banking is also smaller. A similar pattern is observed for those in the active workforce compared with those who are unemployed and those who are retired and inactive. The Greek case study presented in Chapter 4 targets this gap by introducing older people to the safe use of online banking and payments.

Online interaction with public authorities

This indicator measures the penetration and adoption of e-government services among citizens. The ability to interact with public authorities online is a hallmark of a modern, digitalised public administration system. Digital interactions with public authorities offer citizens a faster, more efficient alternative to traditional in-person or paper-based processes. The indicator serves as a proxy for digital inclusion. High levels of engagement with e-government services suggest that citizens have the necessary digital skills and internet access to benefit from public digital offerings. Conversely, low levels of engagement can highlight gaps in digital inclusion, particularly among disadvantaged or digitally excluded groups.

As described in Chapter 1, the overall EU unweighted average for this indicator doubled from 2008 to 2023. By age groups among Member States, the time series is shorter, ranging from 2009 to 2019, and the unweighted average is 36.6 %, up from 25.7 % in 2009. In 2019, the youngest (16–24 years old) and oldest (55–74 years old) groups had the lowest user shares compared with the central age cohorts of 25–34 and 35–44 years old. In 2019, the leading Member State for all age cohorts, with a share above 74 % in each group, was Finland. The poorest-performing groups, with under 10 % of users, are Romanians in all age groups and Bulgarians, Latvians and Portuguese aged 55–74. The 25–34 age group in Finland has been the top group since 2009, except for 2018, when the 35- to 44-year-old group was first. The 55- to 74-year-old cohort in Romania has been the poorest-performing group since 2009.

A catching-up process can be observed from 2009 to 2019 for the share of individuals interacting with public authorities online. This was especially noticeable for 55- to 74-year-olds in Croatia, Greece, Lithuania and Spain. But the shares in Austria, Cyprus, Denmark, Estonia, Finland, Hungary, Ireland, the Netherlands and Sweden grew faster than average. The 16- to 24-year-old group caught up quickly with the other groups in Bulgaria, Croatia, Cyprus, Czechia and Greece, but struggled to catch up in Italy, Latvia, Portugal and Romania. In fact, disparities increased and so did the distance from the best performer.

In terms of educational attainment, the groups that are better able to reap the benefits of online interaction with public authorities are the groups with the higher levels of educational attainment, followed by the groups with medium and lower levels of education (Figure 21). For this indicator, like online banking, education makes a difference. In 2019, Finland (59.2 %), the Netherlands (36 %) and Luxembourg (26.3 %) were the best performers for the share of groups with lower levels of education engaging with authorities online. The shares of groups with less education in Bulgaria, Croatia, Greece, Poland and Romania did not exceed 5 % (they were around 1–2 % in 2009). The increase in averages meant that some catching-up did take place, although this was not enough to close the gaps between groups with lower, medium and higher levels of education.

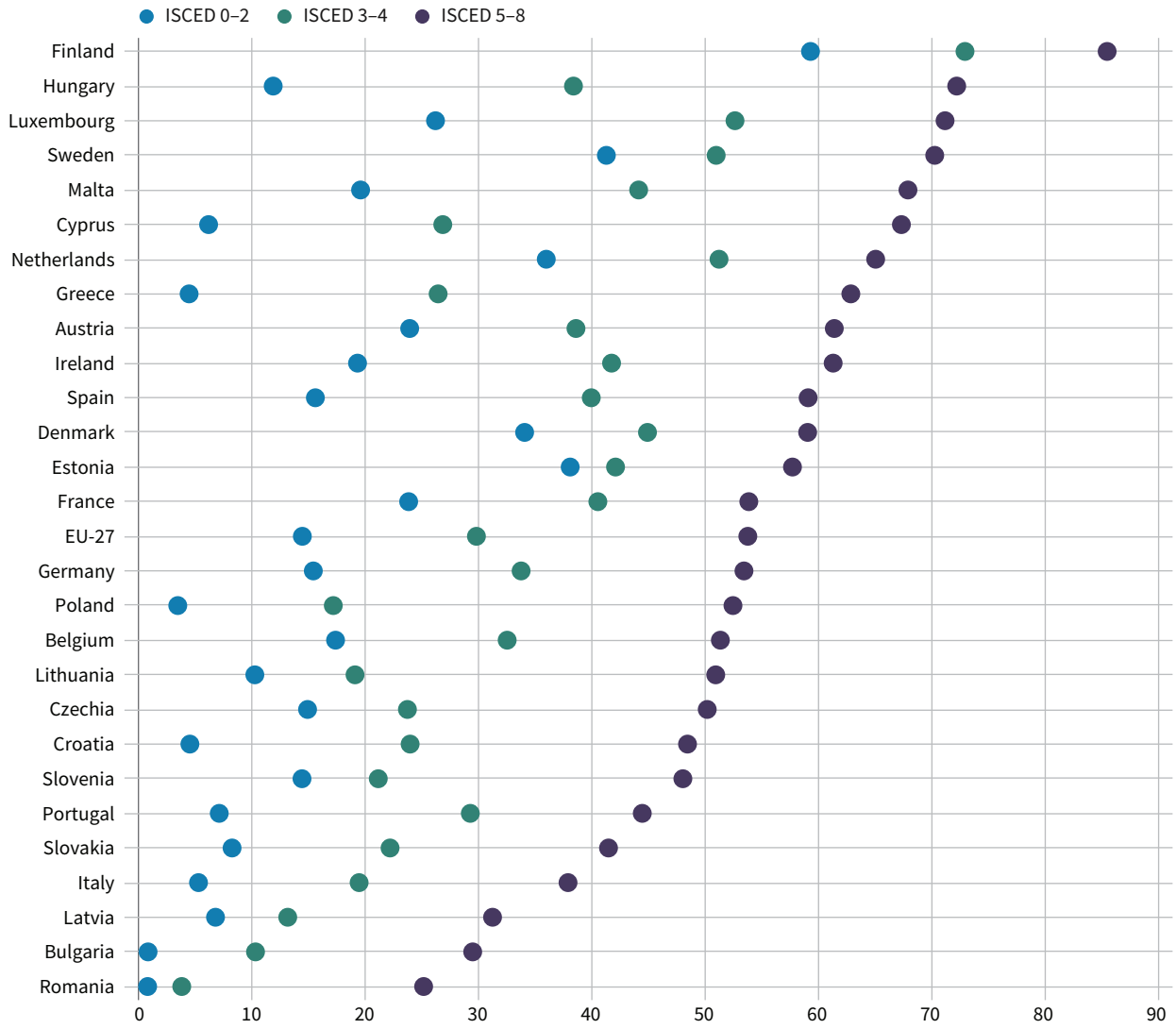
From the point of view of employment status, people in the active workforce in all Member States register higher shares of interaction with the public authorities than unemployed people or retired and inactive people. As in the case of the other indicators examined, Finland and the Netherlands are among the best performers for all the age cohorts. Hungary (74.9 %) is a very good performer for the active members of the workforce, on a par with Finland (77.6 %), but not so for unemployed or retired people, for which Hungary has the greatest difference among the groups, followed by Finland. The retired group caught up with the higher-performing groups of unemployed individuals and individuals in the active workforce. This was not sufficient to eliminate disparities among these groups, and the distance from the best performer did not decrease.

Online interaction with public authorities is another digitalisation indicator for which less vulnerable groups tend to have better outcomes. Age, education and employment status can make a difference in the share of individuals who interact with public officials online. Finland is again the leading Member State in terms of the share of users across all the socioeconomic groups. A catching-up process took place in Croatia, Greece, Lithuania and Spain for the 55–74 age group. But the youngest cohorts in Italy, Latvia, Portugal and Romania did not grow as their counterparts did in other countries. In terms of education level, the shares of groups with lower levels of education in Bulgaria, Croatia, Poland, Romania and Slovakia did not reach above 5 % usage in 2019. Nevertheless, the catching-up process was led by the increase in the averages, but did not eliminate the disparities among groups with higher levels of education and the other groups. A similar overall pattern can be observed for those in the active workforce and the other groups.

Internet use to request benefits or entitlements (e-government activity)

The third level of digital inclusion comprises individuals' ability to derive 'tangible outcomes' from digital activities. Closely connected to the mere interaction with public authorities discussed above is another indicator implying whether individuals derive – quite literally – benefits from e-government websites, such as pensions, unemployment benefits or child allowances,

Figure 21: Online interaction with public authorities by educational attainment level, 2019 (%)



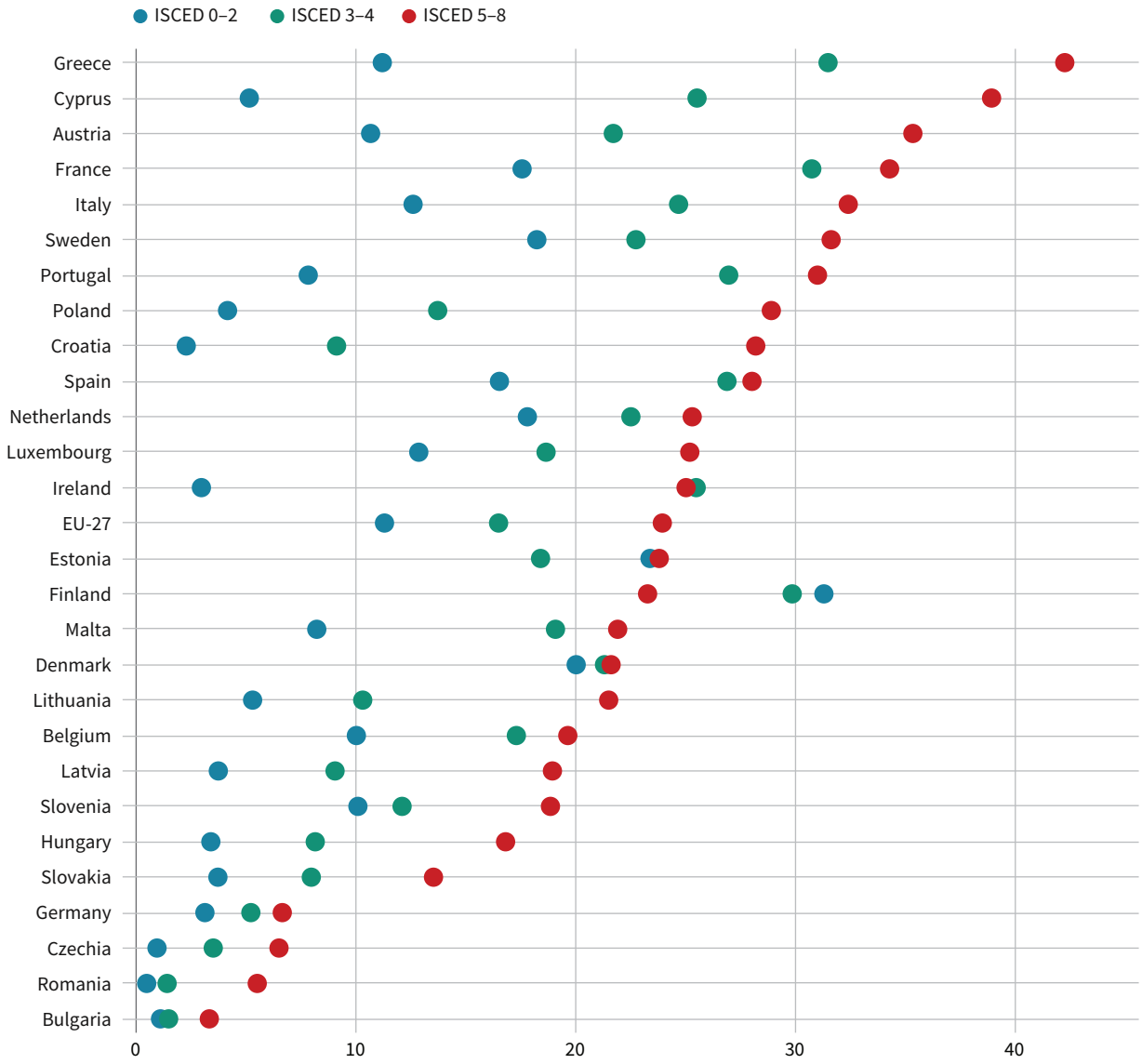
Note: *ISCED, International Standard Classification of Education.*
Source: *Eurostat [I_IGOV12FM].*

or use these websites to enrol in schools and universities online. Because data are only available for 2022–2024, the scope for measuring differences over time and conducting a meaningful convergence analysis is limited. The 2023 analysis reveals disparities among and within Member States for different socioeconomic groups.

With a few exceptions, the groups with the highest levels of education were the most likely to derive benefits from digital public interaction in all countries (Figure 22). In Finland, less than one quarter of highly educated individuals used the internet to request benefits or entitlements, but about 30 % of those with medium and lower levels of education did so. In Ireland, about one quarter of people with medium and high levels of education, but less than 5 % of people with lower levels of education, sought benefits online in 2023. The highest share of public interaction was exhibited among highly educated individuals in Greece and Cyprus (around 40 %), followed by Austria, France and Italy. Interestingly, this is in contrast to a very low share among the population with low educational attainment (around 10 % in Greece and Austria, and 5 % in Cyprus). Overall, with less than 5 % in all educational groups in Bulgaria and more than 5 % only for the group with higher levels of education in Romania, these two countries are the lowest performers. Moreover, in Czechia and Germany, only 3 % of the group with low educational attainment and 6 % of the group with high educational attainment reported having requested benefits and entitlements online. Similarly, for all age groups, the lowest shares are again detected in Bulgaria, Romania, Czechia and Germany; the highest shares, almost 45 %, were found among those aged 16–24 in Finland and Portugal and 35–44 in Greece, Cyprus and Poland. Similarly to other indicators, the lowest participation is among the oldest cohort aged 55–74, particularly in Bulgaria, Hungary, Poland and Romania.

Importantly, whether benefits relevant to an individual's socioeconomic position can be requested online depends not only on their own digital capital, but

Figure 22: Internet use to request benefits and entitlements by educational attainment, 2023 (%)



Note: *ISCED, International Standard Classification of Education.*
Source: *Eurostat [I_IGOVBE].*

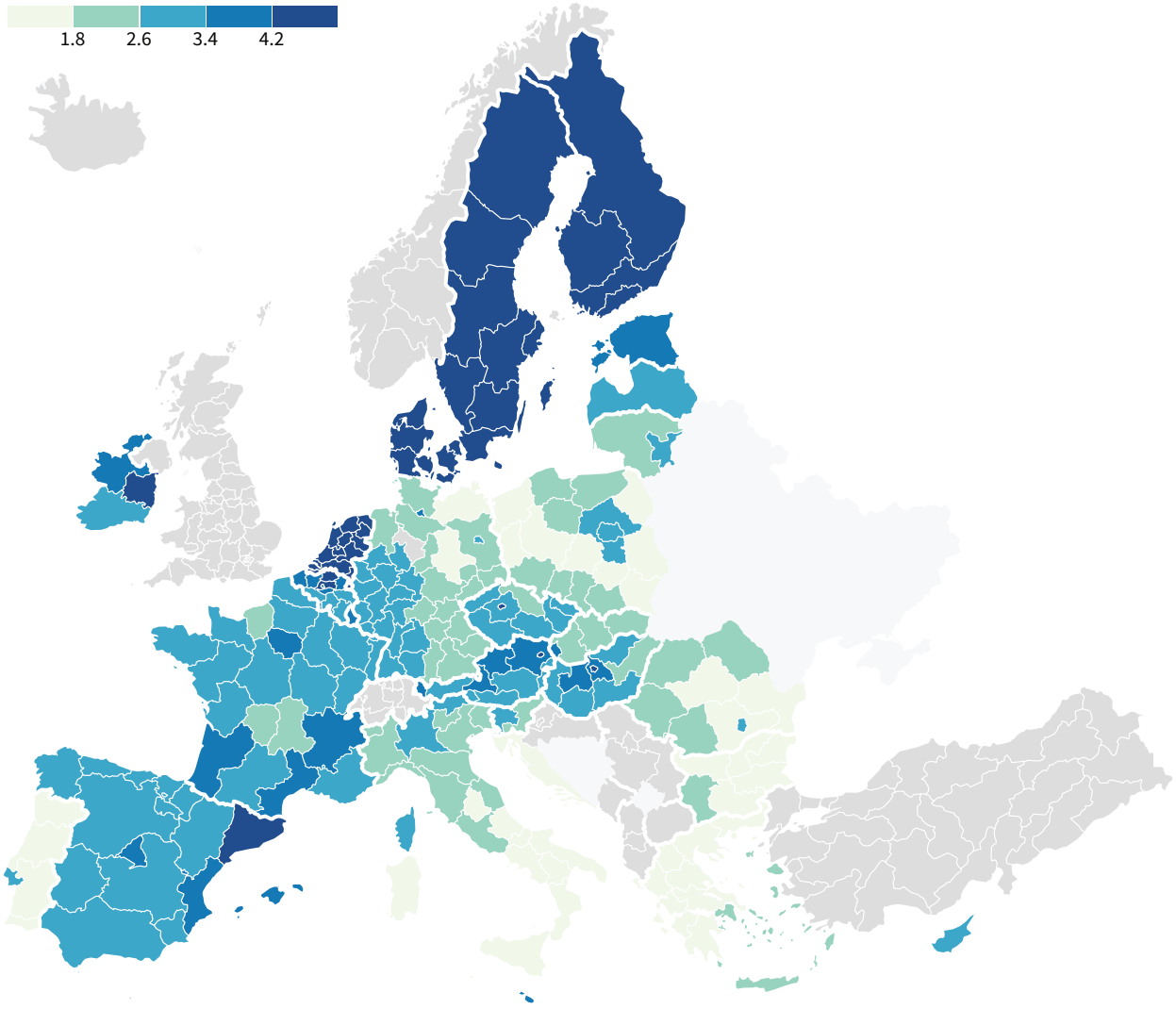
also on whether appropriate digital infrastructure for specific purposes exists. Online enrolment in universities or schools becomes less important with age, while pensions become increasingly important. Depending on which services are provided online, internet usage for e-governance might vary substantially.

Comparing the Member States' e-government maturity, indicating the availability of public online services (European Commission, 2024c), with the share of individuals applying for benefits online shows a clear overlap between these two indicators. The overall lowest e-government maturity is exhibited in Romania, Cyprus, Italy, Slovakia, Germany, Hungary, Greece and Czechia. The best performers are Malta, Estonia, Luxembourg, Finland, Lithuania, Denmark and the Netherlands. Disparities between the different socioeconomic groups could thus also be caused to some extent by differences in the provision of e-government services at the national level (a detalied mapping of front- and back-office processes will be available in a forthcoming Eurofound report (Eurofound, forthcoming)). However, the examples of Cyprus and Greece show that, despite the generally low level of e-government maturity, younger people and people with higher levels of education use existing services to such an extent that the average take-up at the national level is among the highest in the EU. In both countries, the divide between more vulnerable and less vulnerable groups is particularly pronounced. This underlines the importance of designing policy interventions to meet the needs of these vulnerable groups. The digital exclusion project in Helsingborg in Sweden is an example of an initiative targeting users of social and labour services to help them access these services online. The other Swedish project specifically assists older people with – among other things – e government activities, while the initiative focuses on women in rural areas.

Convergence in digitalisation at the regional level

Differences among geographical areas are also present at the regional and local levels, pointing to the need to strengthen regional approaches to digitalisation concurrently with achieving national objectives. Furthermore, many of the challenges that the digitalisation process poses are difficult to address with a top-down, vertical approach. Regarding digitalisation, local municipalities and regions have highly variable issues, needs and preferences, requiring a more tailored strategy on the part of the EU and its Member States. At the individual level, regional differences can be critical with regard to the extent of digital divides that exist in society, whether this is the extent of access available, the possession of digital skills or the economic and social opportunities that a person can exploit in the digital sphere (Ragnedda, 2018). An overview of digitalisation in EU regions shows that, while regions in the Nordic countries and in the Netherlands register very high scores on digital indicators for individuals, southern Italian regions, Portugal (with the exception of Lisbon), Greece, Bulgaria, Romania (with the exception of Bucharest) and the north-eastern region of Województwo Mazowieckie in Poland register lower scores (Figure 23). Furthermore, it should be highlighted that, even in regions where scores are high, there might be pockets at the city or neighbourhood level where digitalisation is an issue and should be tackled at the local level. One example is the city of Siegen, Germany (see the DIAS.komm case study in Annex 3).

Figure 23: Regional digital index for individuals, 2023 (NUTS 2)



Note: *The map represents the index's ranking of the following indicators for 2023: internet access at home, internet access daily, never uses the internet, internet banking, access to social networks, online interaction with public authorities (2021), ordering goods and services online, and selling goods and services online. The darker the colour, the better the performance. Data for Germany and Poland are at nomenclature of territorial units for statistics (NUTS) level 1; data for all other Member States are at NUTS 2 level.*
Source: *Authors' calculations, based on Eurostat data on regional statistics on ICT usage in households and by individuals [reg_isoc_i].*

Table 4: Indicators used in regional-level convergence analysis

Indicator	Indicator code (Eurostat)	Category	Data source	Period of time covered by the analysis
Households with broadband access	[isoc_r_broad_h]	Digital infrastructure and access	Survey on the use of ICT in households and by individuals	2008–2021
Individuals ordering goods and services	[isoc_r_blt12_i]	Digital skills	Survey on the use of ICT in households and by individuals	2012–2023 2018–2023
Individuals who used the internet for interaction with public authorities	[isoc_r_gov_i]	E-government	Survey on the use of ICT in households and by individuals	2011–2021 2018–2021

Source: *Authors.*

The analysis presented in Chapter 1 demonstrated the aspects of the digital transformation process where Member States had been making progress and achieving convergence, and where progress was lacking. While data at the Member State level allow for a broad analysis at the aggregate level, they may mask disparities that exist within the Member States. For this reason, this section utilises more disaggregated data for a subset of indicators to investigate the convergence process using regional data.

Previous research by Eurofound (2023b) has highlighted the existence of a rural–urban divide in terms of both broadband access and quality of internet connectivity, as well as broadband skills. These disparities among regions are confirmed when we consider progress through the lens of convergence.

The indicators under consideration in this section are listed in Table 4.

Households with broadband access

Regions in Finland, the Netherlands, Spain and Sweden were the strongest performers over time, while the unweighted average across all regions almost doubled between 2008 and 2021, from 46 % of households with broadband access to 91 %. Almost all regions grew above or slightly below the average. The regions with the highest rates of growth were regions in Romania and one in Bulgaria (Severozapaden). Disparities were four times lower in 2021 than in 2008, and the sum of distances was almost four times lower in 2021 than in 2008. Utilising data just from 2014 to 2021 (which facilitates analysis of household access to broadband in additional regions where data are not available prior to 2014), convergence can be observed in all three indicators. However, despite the catching-up process, several regions are still underperforming, specifically the French island of Corsica and two regions in Sweden: West Sweden (Västsverige) and Upper Norrland (Övre Norrland). Notably, West Sweden and Upper Norrland were the only regions in the EU-27 with a lower average in 2021 than in 2014.

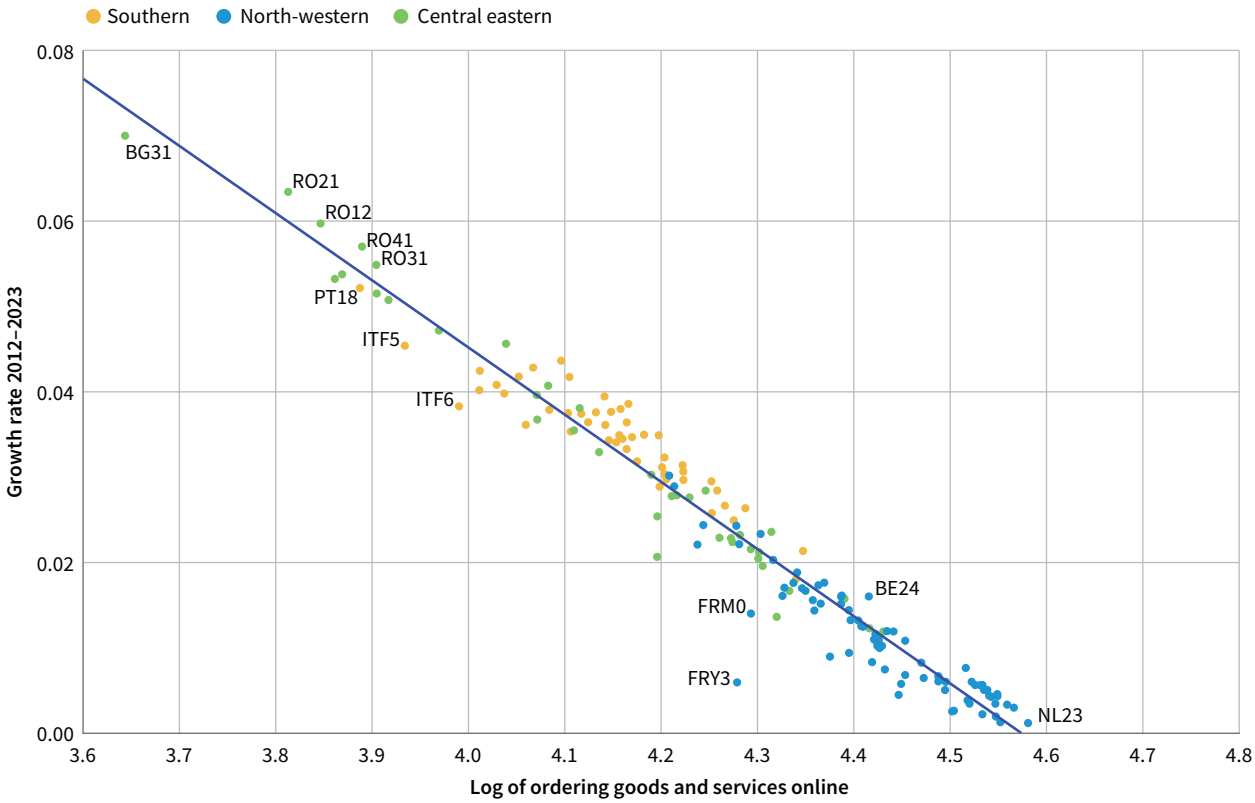
In explaining the underperformance of regions that have lower connectivity levels, Salemink et al. (2017) highlight specifically the role of lower levels of education and lower skills levels in rural areas. Even if rural areas have the ICT infrastructure, prior research finds that residents in rural areas often lack the skills and knowledge to fully gain access to the internet in these areas and truly overcome this second level of the digital divide (Ragnedda, 2018). However, the above analysis shows that this concerns only minority of cases, with the unweighted average of household internet access in 2023 being above 90 %.

Individuals ordering goods and services online

The period of time covered for the regional analysis extends from 2012 to 2023. The unweighted average increased from 73 % to 93 % between 2012 and 2023. At the regional level, regions in the Netherlands, Spain and Sweden have been the top performers. The Severozapaden region of Bulgaria was the lowest performer over time according to this indicator. The proportions of individuals ordering goods over the internet declined moderately in five regions between 2018 and 2023: one in France (Corsica), three in the Netherlands (Groningen, Gelderland and South Holland) and one in Sweden (East-Central Sweden).

Regions with the highest level of growth were generally those with lower proportions of individuals ordering goods and services over the internet in 2012, indicating a catching-up process. These regions also tended to be concentrated in central eastern Europe (indicated by the green points in Figure 24). Examples include Bulgarian and Romanian regions, specifically the region of Severozapaden in Bulgaria, which had the highest growth rate in the EU-27 (7 %). This was over seven times higher than regions in France, such as Corsica, which had the lowest growth from 2018 to 2023, performing far below the average rate of growth.

Figure 24: Beta-convergence of individuals ordering goods and services online, 2012–2023 (NUTS 2)



Source: *Authors' calculations, based on Eurostat [isoc_r_blt12_i].*

Individuals who used the internet for interaction with public authorities

Regions in Denmark and Sweden have been the strongest performers in terms of the proportion of individuals using the internet for interaction with public authorities. Swedish regions achieved over 80 % in usage rates from 2018 onwards. Romanian regions continued to have usage rates below 10 % as of 2021 data. To compare, while over 65 % of Danes in the region of Hovedstaden used the internet for interaction with public authorities in 2011, the corresponding figure for Romanians in the Sud-Est region was less than 2 %. The unweighted average over time increased twofold, from 23 % to 46 %. Only in one region, Yugoiztochen in Bulgaria, was the proportion of individuals using the internet for interaction with public authorities lower in 2021 than in 2011. When examining convergence from 2018 to 2021, one region each in Bulgaria, Romania, Spain and Sweden, as well as five regions in Denmark, declined as of 2021 relative to 2018.

Romanian regions were the most diverse, in both the extent to which they used the internet to interact with public authorities initially in 2011 and the extent to which they grew over time. Romanian regions that had lower proportions in 2011 generally grew faster; however, only one region grew above the average. Bulgarian regions generally did poorer, with Yugoiztochen (Bulgaria) performing the worst and attaining a negative growth rate. The Spanish region of Ciudad de Melilla had the highest growth rate of any EU-27 region. Although it is highly dependent upon the region, and some regions definitively struggled to catch up, these results indicate that convergence was ultimately achieved among EU-27 regions as of 2021, compared with results from 2011. The results are similar when replicated with additional regions between 2018 and 2021.

Disparities between EU regions saw a gradual decline between 2011 and 2021, with moderate rebound increases in 2016 and 2017. With an overall decrease of 21 %, however, this would indicate convergence. When replicating results with additional regions for 2018–2021, disparities grew. Delta-convergence analysis demonstrates that, despite upward rebounds, the sum of distances between Member States and the top performer gradually declined between 2011 and 2021. Between 2018 and 2021, these results are also similar.

A variety of factors affect the usage of e-government resources; in particular, education level is the most significant indicator of whether a person engages with e-government (Horobet et al., 2023). There is a negative correlation between internet use and e-government indicators, which suggests that levels of access to the internet are not a sufficient explanation of the extent of use of the internet for interaction with public authorities (Horobet et al., 2023). Improvements in education and

digital literacy are more likely to boost the adoption of e-government initiatives; the potential efficiency and economic growth associated with digitalisation is therefore limited to the extent that governments can tailor such services to the needs and digital capabilities of their populations, and this often needs a localised approach at the regional level. Only by tackling the different levels of the digital divide at the local level can Member States hope to further the digitalisation of public (and other) services.

Summary

The analysis of the socioeconomic groups presented above highlights that disparities exist for all the selected indicators. Disparities seem to be more marked in Member States where the progress made in digitalisation is less advanced relative to other Member States, and where the literature reports that there is a greater degree of social exclusion, which is in turn reflected in greater gaps among the groups. The link between social exclusion and digital exclusion found in the literature is confirmed by this analysis.

The gaps in access, use and outcomes register a catching-up process in all indicators, but disparities between groups across Member States only decreased for the use of social networks by age group.

In the other cases, the catching-up process is not enough to reduce disparities between all groups and Member States. This suggests that, even with rising digitalisation at the national level, support should be maintained for those who are aged 55–74, for people with lower levels of education, for unemployed people, and for retired or economically inactive people. Several case studies of such support programmes, many of which target older people as well as unemployed and inactive individuals, together with lessons learned for the digital inclusion of these groups, are presented in Chapter 4.

EU digitalisation trends reveal convergence across indicators, with regions in Bulgaria and Romania often showing the highest growth, while regions in Denmark and Sweden consistently performed best. However, some Swedish regions underperformed in specific metrics.

Top-performing regions in the Netherlands, Spain and Sweden achieved near-universal access by 2016. Bulgaria and Romania excelled in growth (Severozapaden in Bulgaria saw the highest level of growth) while Calabria (Italy) and Mellersta Norrland (Sweden) lagged. Disparities fell sixfold between 2008 and 2023. Corsica and some Dutch and Swedish regions (e.g. Östra Mellansverige) underperformed in the same period.

In terms of ordering goods online, the top regions were in Denmark and Sweden (with usage rates exceeding 80 % by 2018), while Romanian regions lagged (< 10 %). Yugoiztochen (Bulgaria) performed worst, with Ciudad de Melilla (Spain) showing the highest level of growth. Disparities halved between 2011 and 2021, but rebounded slightly from 2018 to 2021.

Overall, Sweden, despite leading in some areas, saw underperforming regions in others, while Romanian and Bulgarian regions demonstrated significant growth starting from low positions. Persistent challenges remain in rural and disadvantaged areas across Europe.

3 Digitalisation and economic outcomes

In this chapter, the link between digitalisation and economic growth is analysed along three distinct dimensions. First, given the need to move towards a digital Europe to improve the region's competitiveness, we assess how Europe's businesses have become increasingly digitalised over time and ask whether there has been convergence in the process of digitalisation across the EU-27. Second, we exploit the availability of firm-level data from a number of EU countries to explore in more detail the ways in which businesses are employing digital and advanced technologies, and we explore how this links to productivity. Finally, we examine the potential role that digitalisation has played in economic convergence across Member States.

Advancing the digitalisation of the EU's business sector is seen as key to improving economic competitiveness. Reflecting this, in 2021, the digitalisation of the private sector was set out as one of the four cardinal points of the EU's Digital Compass ([6]). According to some metrics, the state of digital uptake looks quite good. For example, the most recent data from the DESI show that almost 94 % of enterprises with 10 or more employees used a fixed broadband connection to access the internet in 2023. As of the same year, more than three quarters of enterprises in the EU had a website (Eurostat, 2024a). However, the 2024 *State of the Digital Decade* report (European Commission, 2024a) highlights some key challenges: in particular, the limited advancements that businesses are making with regard to the use of more advanced technologies, including cloud computing and the adoption of AI. The report also notes the slow and uneven progress of SMEs in reaching digital targets and the concentration of progress in large cities.

Uneven progress in digitalisation at the firm level is also evident in the Eurostat Digital Intensity Index (DII). The DII shows that, while 91 % of large enterprises had reached at least a basic level of digital intensity by 2023, only 58 % of SMEs had (Eurostat, 2024b). This puts SMEs a long way off the 90 % target set for 2030 as part of the EU's Digital Decade plans.

The most recent edition of the European Company Survey (ECS) shows that, as of 2019, 28 % of firms in the EU were classified as 'highly digitalised'. This classification is characterised by high levels of use of computers, robots, data analytics and e-commerce, as well as purchases of specialised software (Eurofound and Cedefop, 2020). At the other end of the spectrum, 27 % of companies were deemed to have a low level of digitalisation. Comparing the situation across Member States, the report shows that highly digitalised firms were most prevalent in Denmark and Malta and least prevalent in Latvia and Lithuania. This may, in part, reflect the underlying composition of economic activity, with some sectors (e.g. financial services) much more likely to be highly digitalised than others (e.g. construction). Going beyond patterns of digitalisation, the ECS data also highlight that highly digitalised establishments score better in terms of performance and that workplace well-being is higher in establishments with high levels of computer use.

While digitalisation is high on the policy agenda, in the academic literature the positive impact of digital technologies on productivity has not always been taken as a given. Indeed, back in the 1980s Robert Solow stated that 'you can see the computer age everywhere but in the productivity statistics' (Triplett, 1999, p. 1), in reference to the fact that the United States was investing heavily in computers in the 1970s and 1980s but without a corresponding increase in output. Growth then accelerated in the 1990s, but a subsequent 'productivity paradox' was seen when productivity growth slowed again in the mid-2000s (Borowiecki et al., 2021). However, more recent literature supports the idea that digitalisation and the adoption of new technologies hold enormous potential to advance progress and prosperity, albeit with risks of increasing inequality (Brynjolfsson and McAfee, 2014).

Firm characteristics are likely to influence whether digitalisation and new technology adoption result in enhanced productivity. For example, research by the OECD (2001) finds that managerial practices play an important role in ensuring the productivity gains of ICT investments. Haller and Siedschlag (2011) find that certain firms are more successful in utilising ICT to improve performance. These include those that are larger, are younger, are expanding quickly, have highly skilled workers, are engaged in exports and are located in capital city regions. The same research also shows positive productivity spillovers for other firms in the

([6]) For more information on the 2030 targets for Europe's Digital Decade, see https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/europes-digital-decade-digital-targets-2030_en.

same industry and region. Gal et al. (2019) find that 'frontier firms', which are already the most productive, benefit more from ICT investments, and the productivity benefits also depend upon firm size. Importantly, Gal et al. (2019) also show that the potential positive benefits of technology adoption can be cancelled by labour and skills shortages. Indeed, according to Taştan and Gönel (2020), the productivity enhancements potentially brought about by technology may hinge upon the skills level of workers. These authors also find that firms must also invest in ICT-skilled labour to reap the benefits of investments in software.

The benefits of technology adoption may extend beyond improved productivity. Gopalan et al. (2022) show that the adoption of ICT by firms increases participation in global value chains. This matters, as the benefits of increased participation in global value chains include increased productivity growth, opportunities to connect with leading firms, improved access to knowledge and technical know-how, and access to larger markets.

Beyond benefits to the firm, there may also be positive implications for employees when firms adopt digital technologies. Previous evidence from 32 European countries shows that innovation at the firm level is associated with better job quality and improved work–life balance for employees (Grande et al., 2020). Grande et al.'s results also point to the importance of industrial relations, as unions play an important role in ensuring that innovation translates to improved job quality.

The important role that social partners will play in the digital transition has also been highlighted by other studies. For example, the International Labour Organization (ILO) has investigated the effects of generative AI on job quality and quantity, and it has stressed that governments and social partners should play an active role in ensuring an orderly and fair adoption of these new technologies (Gmyrek et al., 2023). And research by Eurofound (2023a) highlights the need for digitalisation to be more fully incorporated into collective bargaining agreements, in particular when it comes to the ethical considerations of digitalisation. While this chapter focuses on the economic benefits of digitalisation for firms, other considerations at the firm level, including the protection of employees' personal data, the right to disconnect and the psychological ramifications of increasingly digitalised workplaces, are of utmost importance but beyond the scope of the current analysis.

Convergence in digital indicators for businesses

Three metrics of digitalisation are considered when examining the progress made towards the digitalisation of Europe's private sector through the lens of convergence. These metrics are presented in Table 5.

Internet access

As a measure of access, we use the percentage of firms with 10 or more employees where at least 50 % of those employees have access to the internet for business purposes. Examining this indicator in detail presents a mixed picture. The data show that, from 2013 to 2023, lower-performing countries did not generally succeed in catching up to country leaders. Portugal, however, is an exception, expanding access at an above-average rate.

In the 10 years following 2013, the unweighted EU average of enterprises where at least 50 % of employees had access to the internet increased from 35 % to 53 %. The countries with the highest levels of access have consistently been Denmark and Sweden. While Portugal was the lowest performer from 2013 to 2014, Romania has been the lowest performer since.

Analysis of the catching-up process shows that, already in 2013, most countries had sizeable numbers of enterprises with workforces that had access to the internet. However, it also shows that some countries have struggled to maintain levels of growth in line with the rest of the EU. Such countries include Bulgaria, Greece and Romania. Leaders like Denmark and Sweden have maintained high growth rates. Only one country improved substantially from a relatively poor position in terms of internet access of enterprises: Portugal. Indeed, Portugal's growth rate was eight times higher than that of Denmark, indicating that Portugal is moving towards convergence.

Table 5: Indicators used in convergence analysis – digitalisation of business

Indicator	Indicator code (Eurostat)	Data source	Period of time covered by the analysis
Internet access by size and class of enterprise	[isoc_ci_in_es]	Survey on ICT usage and e-commerce in enterprises	2013–2023
E-commerce sales of enterprises	[isoc_ec_eseln2]	Survey on ICT usage and e-commerce in enterprises	2005–2023
Digital public services for businesses	[desi_dps_biz]	Digital Economy and Society Index (DESI)	2013–2020

While there have been periods in which disparities between Member States have fallen (e.g. in 2015 and 2021), the general pattern over time has been one of increasing disparities in terms of enterprises with internet access. Disparities were slightly higher in 2023 than they were in 2013, indicating divergence. Finally, the distances between the leading country and the other Member States in terms of the proportion of enterprises with internet access were decreasing until 2018, but the pattern reversed in 2019, when the sum of distances significantly increased. Overall, the analysis would indicate that countries have diverged over time in the proportion of enterprises with internet access. Although it can be difficult to determine why such divergences have taken place, an analysis undertaken by Oliveira and Martins (2010) on e-business adoption demonstrates that certain factors, namely technology readiness, competitive pressure and trading partner collaboration, were highly influential in determining the extent to which businesses chose to engage with the internet as a core part of their business. These factors, specifically related to technology readiness, will have influenced the extent to which low-performing countries could catch up to leading countries. Box 1 presents an exploration of regional and sector-level connectivity in enterprises.

E-commerce sales of enterprises

The indicator on e-commerce sales of enterprises measures the proportion of enterprises that recorded e-commerce sales. As such, according to the framework of the three levels of digitalisation (Figure 1), it is an indicator of internet use. The survey population consists of enterprises with 10 or more employees and self-employed people, and the data cover the decade from 2013 to 2023. Overall, convergence analysis reveals that there has been some degree of catching-up on average, but Member States have, in large part, failed to reduce the distance between the lower-performing and the best-performing Member States in terms of the prevalence of e-commerce.

Over the past decade, the EU-27 unweighted average increased from 17 % to 25 %, seeing continuous high growth until a plateau was reached between 2022 and 2023, with almost negligible growth in the proportion of enterprises using e-commerce in the EU since then. Denmark, Ireland and, as of 2023, Lithuania have been leaders in the proportion of enterprises with e-commerce sales. Greece and especially Bulgaria and Romania were the lowest performers between 2013 and 2023. The lowest performer in 2023 was Romania, which recorded just 13 % of businesses registering sales via e-commerce. This may reflect lower levels of internet access overall in the country; where fewer people have access to broadband connections, fewer businesses have incentives to use it. In general,

Box 1: Internet access by sector and region

The statistics highlighted above summarise the evolution of connectivity at the broad Member State level. However, within Member States, there is likely to be a degree of heterogeneity – both between regions and between sectors – in terms of firms' connectivity to the internet. Here we look at the situation as of 2023 across sector groups and regions.

Generally, access to the internet among enterprises across EU-27 regions varies greatly by sector and by region. Considering access across all sectors, the five poorest-performing regions were all located in Romania. In each region, in fewer than 20 % of firms with 10 or more employees did more than half the workforce have access to the internet for business purposes. The region with the lowest proportion of enterprises with access to the internet was Sud-Vest Oltenia, in Romania. In this region, only in 7.7 % of firms did more than 50 % of employees have access to the internet.

In terms of the best performers across all sectors, the three regions with the highest rates of firm-level connectivity were all located in Denmark: Syddanmark (71 %), Sjælland (74 %) and Midtjylland (79 %).

Turning to the breakdown by sector of activity, connectivity across the regions was lowest in the manufacturing and construction sectors (28 % and 30 %, respectively). However, there is a large degree of heterogeneity across regions within this sector. For example, in the Sud-Est region in Romania, only 2 % of manufacturing firms had internet access according to the measure being used, while in Midtjylland in Denmark, 68 % of manufacturing firms had access. Unsurprisingly, the best-connected sector across all regions was the information and communications sector: in this sector, 94 % of firms across the EU-27 regions had internet access for more than 50 % of employees and connectivity rates of 100 % were recorded in several regions.

Overall, the large degree of heterogeneity across regions and sectors highlights important access gaps that can be missed when aggregate data are analysed.

broadband infrastructure is lagging, particularly in the rural areas of Romania (Stoica and Ilas, 2013), but recent investments are trying to bridge this gap (European Commission, 2019b).

Beta-convergence analysis demonstrates that, while some low-performing countries did catch up with top performers, not all countries have caught up at the same rate. Countries that started at low levels include Bulgaria, Cyprus and Italy. The latter two performed notably well, catching up substantially with top performers. Bulgaria was also able to catch up with other countries, but at a rate slightly below the average considering its starting position. Belgium, Finland, Ireland, Lithuania, Spain and Sweden all started with very high levels of enterprises using e-commerce for sales and all experienced high levels of growth.

Conversely, many Member States recorded quite weak growth, often irrespective of their starting points. Romania's starting point was similar to Greece's; however, its catch-up rate was less than half of Greece's rate. Other countries such as France and Portugal started from a relatively strong position, but did not experience very high growth in this metric, failing to catch up to the best performers.

Sigma-convergence analysis indicates that disparities between countries have increased over time: by over 20 percentage points from 2013 to 2022. This is despite the fact that disparities significantly reduced in 2022–2023. The total sum of distances from the best performer (delta-convergence) has grown over time, and it was particularly marked between 2016 and 2019, although a significant reduction was observed in 2023. The sum of distances decreased slightly during the COVID-19 pandemic, but rose once again in 2022. This suggests that some of the enterprises that transitioned to e-commerce during the pandemic returned to regular business operations after it. While clear benefits of the rise of e-commerce have been noted, the ability of all Member States to catch up with such technological advancements has been limited, particularly in the mid-2010s. Bădîrcea et al. (2022) emphasise the role of several factors that determine e-commerce's development within the EU, including consumers' education levels and the availability of internet banking.

Other challenges to cross-border e-commerce that persist at the EU level include issues relating to logistics and delivery, language and location, laws and tax regulations, and geo-blocking (Kalinić et al., 2018). Consequently, European shoppers often continue to opt to purchase from a domestic e-commerce market as opposed to alternative EU markets. This limits the extent of e-commerce's development across national borders. Lastly, even though some convergence did take place during the COVID-19 pandemic in response to global shutdowns, disparities grew once such restrictions were removed. Studies have shown that the emergent success and survival of e-commerce is significantly dependent on the economy, cultural peculiarities and other socioeconomic factors in each Member State. Differences in these factors led to significant differences in how Member States adapted to the rapid changes in business models (Scutariu et al., 2022). Overall, these phenomena assist in explaining elements of divergence that have been observed in the development of e-commerce throughout the EU-27.

Digital public services for businesses

The digital public services for businesses indicator reflects the share of public services needed to start a business and to conduct regular business operations that are available online for domestic and foreign users. The online availability of these services may lead to efficiency gains for the private sector and could be considered as an outcome within the framework of the three levels of digitalisation. Over the period analysed here (2013–2020), the EU-27 unweighted average increased from 66.1 % to 84.4 %. While a majority of Member States have caught up with top performers, several Member States are falling behind.

Over the past decade, Denmark, Estonia and Ireland have been the leaders in the provision of digital public services for businesses, with between 99 % and 100 % of public services being available online since 2015. The lowest-performing country was Greece from 2013 to 2014 and Romania from 2015 onwards. The gap between the best and worst performers has narrowed over time, but in 2020 the gap remained notable, with Ireland at a rate of 100 % and Romania at a rate of just under 50 %.

The country with the highest growth rate was Greece – the lowest-performing country in 2013. The only country that may be considered to have fallen behind is Poland, which, although not starting from a very strong initial position, had a substantially low growth rate of around 1 %.

Disparities fell dramatically from 2015 until 2018, when they began to marginally increase. Still, disparities were 22 percentage points lower in 2020 than in 2013. Such results would indicate evidence of weak upward convergence. The distance from the best performer gradually decreased from 2013 to 2020, albeit with a small increase in 2018–2020.

The convergence process of the three indicators discussed in this section (access, e-commerce and digital public services) is summarised in Figure 25.

Figure 25: Convergence summary – digital indicators for businesses

Indicator	Internet access by size and class of enterprise	E-commerce sales of enterprises	Digital public services for businesses
Period	2013–2023	2010–2023	2013–2020
Average change			
Average change towards expected policy target (%)			
Change in disparities			
Sigma-convergence			
Beta-convergence	Convergence	Convergence	Convergence
Distance from front runner			
Delta-convergence	Divergence	Divergence	Convergence

Note: *The 'Average change towards expected policy target' row displays the difference between the two averages at the beginning and end of the period. An increase is desirable in this case because it means that more households have internet access. The unit for this row is the difference between two percentages.*
Source: *Eurofound.*

Patterns of digitalisation – evidence from the firm level

While the previous section explored patterns of digitalisation in the private sector using aggregate data across the EU, we next turn to the application of firm-level data to provide a micro perspective on digitalisation. Using data from the World Bank Enterprise Surveys, collected in 10 Member States from the end of 2019 through to the summer of 2022 ([7]), the analysis investigates these questions: what kind of firms adopted more technologically advanced processes? Do these firms enjoy a productivity advantage? Are working conditions better in more technologically advanced firms?

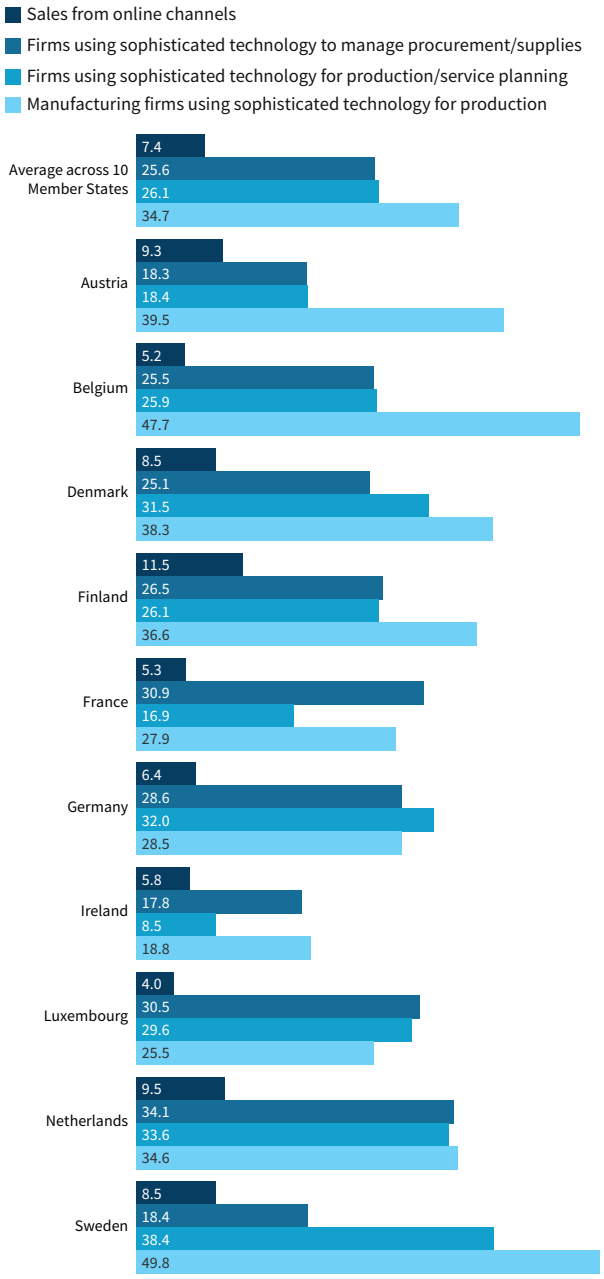
Considering the digital practices adopted at the firm level, there are some interesting differences between the Member States for which data are available (Figure 26).

Looking first at the proportion of sales from online channels, across the 10 countries surveyed, online sales represented a minority of sales, accounting for only 7.4 %. In contrast, direct sales at establishments' premises accounted for, on average, 37.6 % of total sales. The average percentage of firms' sales that came from online channels was highest in Finland (11.5 %) and lowest in Luxembourg (4.0 %). This could, in part, reflect the timing of the surveys in each country; firms that were surveyed later in 2020 and in 2021 would have had more time to adapt their sales modality to the COVID-19 crisis and thus seen a higher proportion of sales online. Likewise, firms that were surveyed after lockdown measures had eased may have been less reliant on online sales ([8]).

([7]) While the Enterprise Surveys have been carried out in all Member States in the past number of years, the specific questions on technology adoption that are utilised in this chapter were only asked in the 10 countries presented in Figure 26. The World Bank Enterprise Surveys can be found at https://www.enterprisesurveys.org/. We thank the Enterprise Analysis Unit of the Development Economics Global Indicators Department of the World Bank for the data.

([8]) Across the sample, online sales averaged 6.9 % in 2020, 8.1 % in 2021 and 4.3 % in 2022. Data were available for only 18 firms in 2019.

Figure 26: Technology use across 10 Member States (%)



Note: *Data collected in 2020 and 2021.*
Source: *World Bank, 2025.*

Moving beyond sales, and turning to the use of specific advanced technologies, 25.6 % of firms surveyed indicated that they used the two most sophisticated technologies – supplier relation management (SRM) software or e-procurement – to manage procurement and supply. This ranged from 18.8 % of firms in Ireland to 34.6 % of firms in the Netherlands.

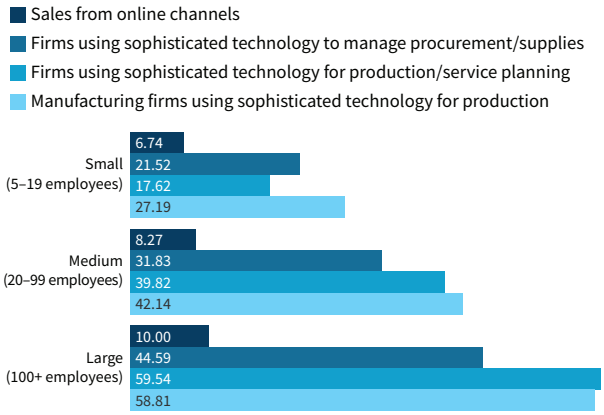
There is further variation in the proportion of firms using sophisticated technologies to plan production or service provision across the Member States surveyed.

Here, 'sophisticated technologies' refers to the use of specialised software for demand forecasting or demand planning and enterprise resource planning (ERP) or equivalent software integrated with other back office functions. The average proportion of firms using these technologies is 26.1 % across the 10 countries. This ranges from average use rates of 8.5 % in Ireland to 38.4 % in Sweden.

In general, the use of sophisticated technologies for production among manufacturing firms is quite high as, on average, 34.7 % of manufacturing firms surveyed indicated the use of sophisticated production technologies. Here, 'sophisticated technologies' means the use of machines controlled by computers or computer numerically controlled machines (CNC), robots, additive manufacturing or other advanced manufacturing processes. Firms located in Sweden lead the way here again, with approximately 50 % of manufacturing firms surveyed indicating they use these technologies.

Patterns of technology adoption across countries may reflect underlying differences in the industrial structure, including the size of firms (as it may be more economically viable for larger firms to adopt sophisticated technologies due to economies of scale) and sectoral composition. Considering the adoption of sophisticated technologies across firm size (Figure 27) and sector (Figure 28), notable differences emerge. Large firms are the most likely to be digitalised. This is particularly notable in their use of sophisticated technologies for production and service delivery planning, as well as in their use of advanced manufacturing technologies. While approximately 18 % of firms with fewer than 20 employees use sophisticated technologies for production or service planning, close to 60 % of firms with 100 or more employees do so.

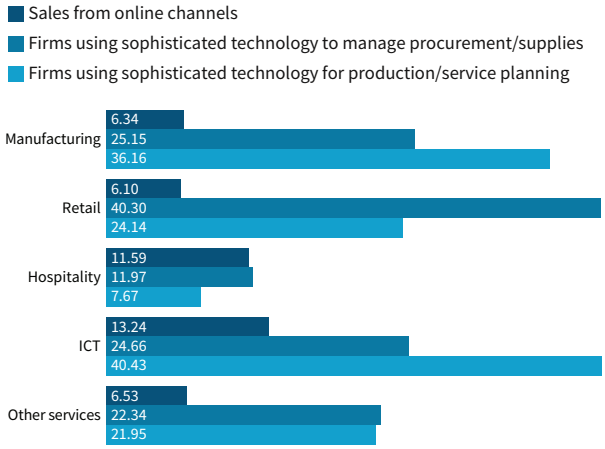
Figure 27: Technology use by firm size (%)



Note: *Data collected in 2020 and 2021.*
Source: *World Bank, 2025.*

Notable differences also emerge by sector (Figure 28). Firms operating in the ICT sector record the largest percentage of sales from online channels, although the figure remains relatively modest at just over 13 %. ICT firms are also most likely to use sophisticated technology for production or service delivery planning (40 %), followed closely by manufacturing firms (36 %). Retail firms are most likely to use sophisticated technology to manage procurement or supplies.

Figure 28: Technology use across sectors (%)



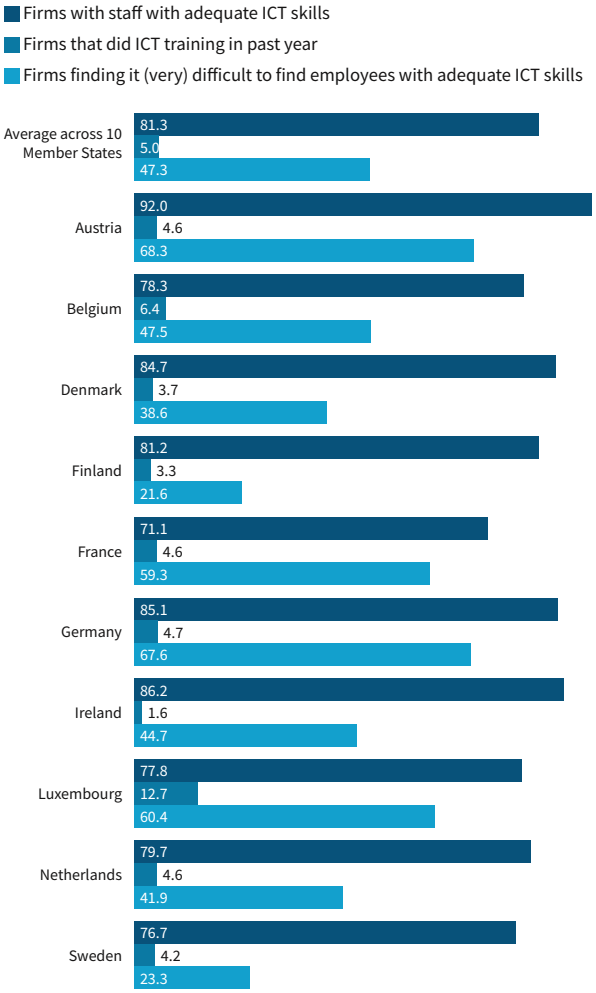
Note: *Data collected in 2020 and 2021.*
Source: *World Bank, 2025.*

Patterns also emerge when considering ICT skills at the firm level (Figure 29). Across the Member States surveyed, most firms (81.3 %) feel that the ICT skills of their employees are at or above what is required. Firms in Austria appear most satisfied with the ICT skills level of their employees; 92 % of surveyed firms there say that these skills are at or above what is required. The percentage is lowest in France, at 71 %.

Perhaps related to these high levels of satisfaction, relatively few firms (only 5 %) across the 10 Member States conduct formal training programmes in ICT or computer skills. Firms in Luxembourg are most likely to have undertaken this form of training (12.7 %), while firms in Ireland are least likely to have done so (1.6 %).

An interesting alternative indicator of the prevalence or shortage of skilled ICT workers is the proportion of firms with vacancies over the previous two years that reported that it was difficult or very difficult to find employees with an adequate level of ICT skills. On average across the 10 Member States, 47.3 % of firms that had vacancies in the previous two years reported that it was difficult or very difficult to find employees with adequate skills in this domain. This ranges from 21.6 % of firms in Finland to 68.3 % of firms in Austria. The shortage of ICT skills among prospective employees in Austria is in contrast to the high level of satisfaction that firms have with the level of ICT skills of their current

Figure 29: ICT skills and training at the firm level across 10 Member States (%)

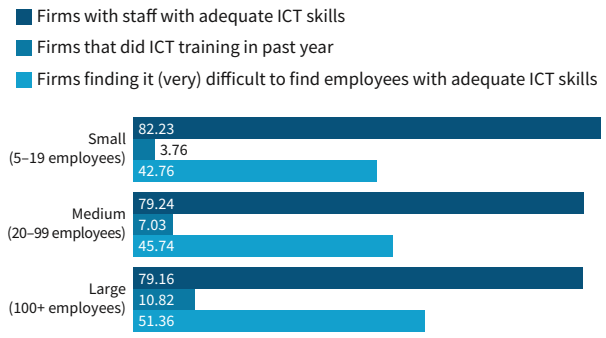


Note: *Data collected in 2020 and 2021.*
Source: *World Bank, 2025.*

staff. It suggests that, while the average firm may be happy with the skills of its current staff, those firms that are expanding are facing shortages of skilled workers. Overall, considering the current tight labour market conditions, it should not be surprising that firms face skills shortages. A study from 2024 shows that, across the EU, 80 % of employers struggle to hire workers with the right skills (Eurofound, 2024b).

Considering ICT skills and training across firm sizes and sectors (Figures 30 and 31), the survey results show that skills shortages are felt somewhat more acutely by large firms. Firms with 100 or more employees are slightly less likely to report that their staff are adequately skilled (although at 79 % they are still largely satisfied), and they are most likely to report having conducted formal training programmes in ICT or computer skills in the past year. Finally, among firms that have had vacancies in the past two years, large firms are most likely to report that they struggled to find employees with adequate ICT skills.

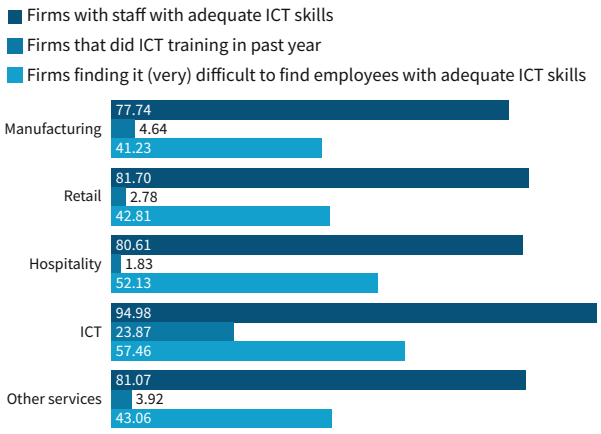
Figure 30: ICT skills and training by firm size (%)



Note: *Data collected in 2020 and 2021.*
Source: *World Bank, 2025.*

Considering these statistics across sectors, firms operating in the ICT sector are most likely to report that their current employees have adequate ICT skills. However, they clearly exhibit a demand for more skills in this area, as they are noticeably more likely to run formal ICT-focused training programmes and most likely to report difficulties finding prospective employees with adequate ICT skills.

Figure 31: ICT skills and training by sector (%)



Note: *Data collected in 2020 and 2021.*
Source: *World Bank, 2025.*

Digitalisation and firm-level productivity

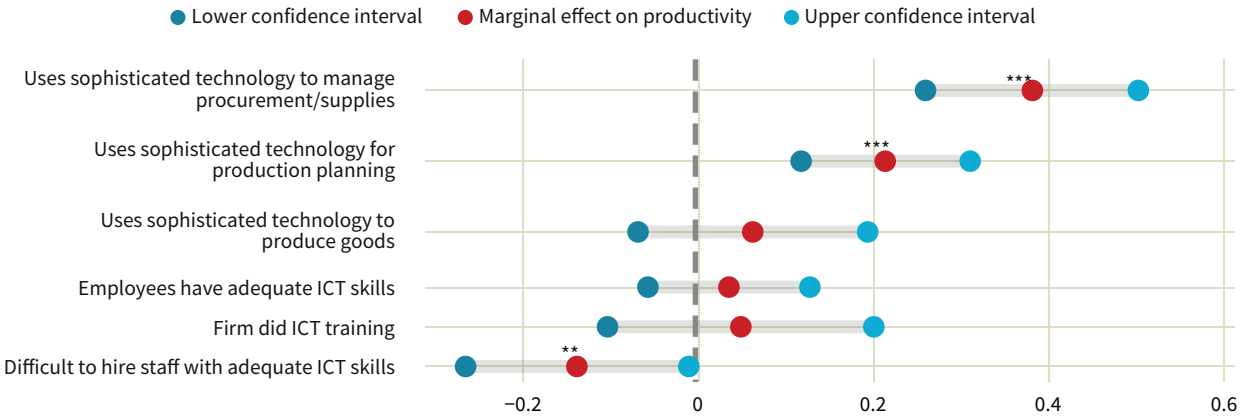
Analysis of these firm-level data suggests a positive and significant correlation between the use of digital and advanced technologies and the average level of turnover per worker – a proxy for labour productivity. Figure 32 shows that labour productivity is significantly higher in firms that use sophisticated technologies to manage procurement or supplies (the first line of Figure 32) and in firms that use sophisticated technologies to plan production or service provision (the second line of Figure 32) ([9]). These results hold after accounting for the sector of activity, the firm size and whether the firm is located in a country's main business city, as well as country and survey year fixed effects. On the other hand, there is no evidence of a significant correlation between the use of sophisticated production technologies and labour productivity among manufacturing firms ([10]).

Lines 4 to 6 of Figure 32 explore the relationship between the ICT and computer skills of employees and the average labour productivity of the firm. The results in lines 4 and 5 show that firms that are satisfied with the ICT skills of their employees are not more productive, nor is there a productivity bonus associated with conducting formal training programmes in ICT or computer skills. On the other hand, among the subsample of firms that had job vacancies in the previous two years, labour productivity levels are lower in firms that struggled to find employees with adequate ICT skills. While the results in Figure 32 do not show a significant correlation between ICT training and labour productivity on average, engaging in these forms of upskilling of employees may be important in the current fast-moving pace of digital progress. Chapter 4 presents an example of an ICT training initiative in Romania that seeks not only to upskill employees based on current requirements for digital skills, but also to anticipate future needs for digital skills in the workforce. This could be important in ensuring that firms and workers are not left behind in the move towards a digital Europe.

([9]) If both variables are included in a single regression, the coefficient on each remains positive and statistically significant.

([10]) This question is only relevant to, and therefore only asked of, manufacturing firms.

Figure 32: Firm-level digitalisation and productivity



Notes: *The graph shows the estimated coefficients from six different models, with each line representing a different model. In each case, the outcome variable in the regression is the log of sales (turnover) per worker, which is used as a proxy for labour productivity. The model is run on 10 Member States for which data are available: Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Luxembourg, the Netherlands and Sweden. Regressions also control for the sector of operation, the firm size category (small, medium or large), country, whether the firm is located in the main business city and the year of survey. Survey weights are applied. Asterisks highlight the coefficients that are statistically significant: *** indicates p < 0.01 and ** indicates p < 0.05.*
Source: *Authors' calculations, based on World Bank, 2025.*

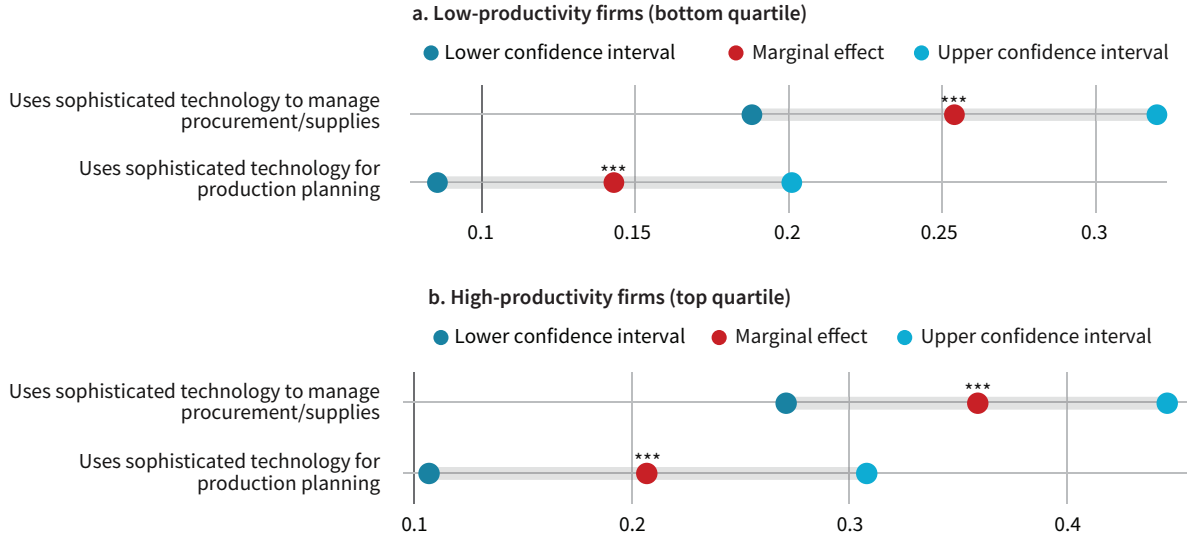
The results displayed in Figure 32 show that, for the average firm, increased use of technologically sophisticated processes for managing procurement and supply chains, and for planning production or service delivery, is associated with higher levels of productivity. But what about firms that are more or less productive to begin with? It could be possible that these results reflect the relationship between technology and productivity for highly productive 'frontier firms' operating at the top of the productivity distribution. Research shows that frontier firms display different characteristics from other firms. They tend to be larger, more profitable and younger; they are also more resilient to the productivity slowdowns that affect other firms (Andrews et al., 2015). Moreover, Andrews et al. (2015) show that the technologies that are developed by frontier firms diffuse slowly to other firms in an economy. On the other hand, it is possible that the results we see for the average firms are driven by the fact that they give a competitive boost to otherwise less productive firms. Indeed, research from the Netherlands shows that the productivity benefits of software investment are strong for low-productivity firms (Borowiecki et al., 2021).

To test the relationship between technology and productivity at different points on the productivity distribution, quantile regressions have been performed on the data. Specifically, Figure 33 shows the relationship between technology use and productivity based on firms in the bottom quartile (low-productivity firms, panel a) and the top quartile (high-productivity firms, panel b) of the productivity distribution. The positive and significant coefficients suggest that there are positive productivity benefits associated with technology adoption for high- and low-productivity firms, albeit with coefficients slightly larger in magnitude for high-productivity firms.

Other findings from the literature suggest that more digitalised firms are more likely to be engaged in international trade and integrated into global supply chains. Estimates for the 10 Member States represented in the data confirm that firms that use more sophisticated digital technologies in their operations are more likely to be engaged in exporting and importing activity and are more likely to have a foreign stake in their ownership ([11]). These correlations hold even after accounting for the link between digital technologies and productivity (as shown in Figures 32 and 33). However, it is likely that the causality between the use of more sophisticated digital technologies and engagement in global value chains can run in either direction, with internationally orientated firms being more likely to have access to and to use more digitally advanced technologies. The results in Figure 32 and Figure 33 suggest that there are positive benefits to

([11]) Results are not presented here for brevity, but are available from the authors upon request.

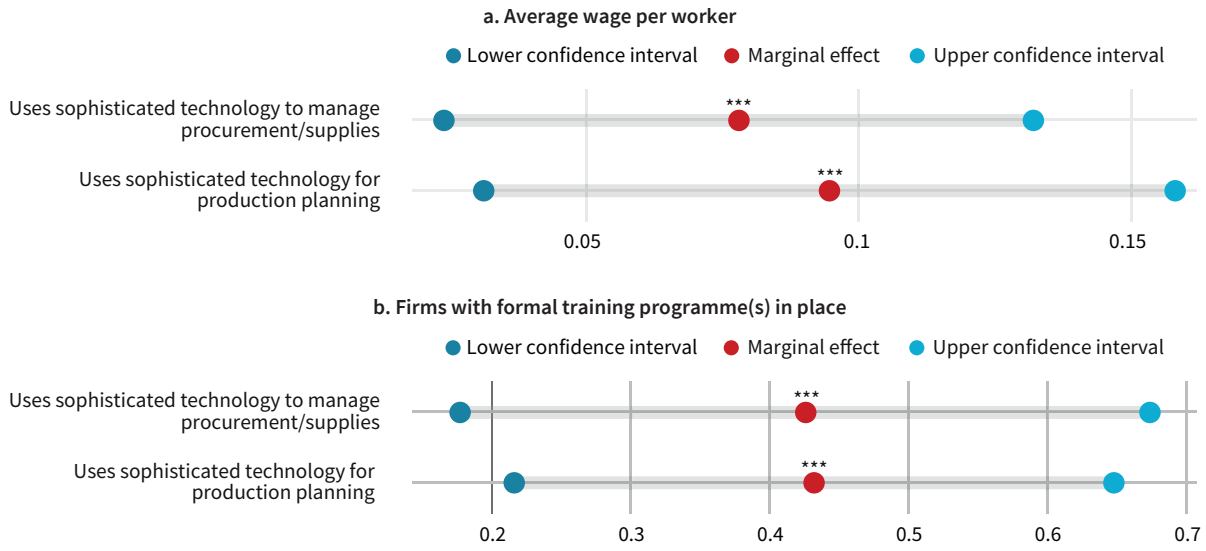
Figure 33: Firm-level digitalisation and productivity for low- and high-performing firms



Notes: *The outcome variable in the regressions is the log of sales (turnover) per worker, which is used as a proxy for labour productivity. The models are run on 10 Member States for which data are available: Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Luxembourg, the Netherlands and Sweden. Regressions also control for the sector of operation, the firm size category (small, medium or large), the country, whether the firm is located in the main business city and the year of survey. Survey weights are applied. Asterisks highlight the coefficients that are statistically significant: *** indicates p < 0.01.*
Source: *Authors' calculations, based on World Bank, 2025.*

firms associated with using more digitally advanced processes, but what about benefits to workers? Previous evidence from the ECS shows a link between being highly digitalised and workplace well-being (Eurofound and Cedefop, 2020). Figure 34 suggests that this positive relationship also exists for the specific forms of technology investigated here. For firms that use sophisticated technologies to manage procurement or supplies, or for production and service planning, these firms pay higher wages on average (panel a) and are more likely to have (any type of) formal training programmes in place for their employees (panel b).

Figure 34: Use of digital technologies and working conditions



Notes: *The graph shows the estimated coefficients from two different models. In panel a, the outcome variable in the regression is the log of the firm's average wage bill per worker. The outcome variable in panel b is a dummy variable indicating whether or not the firm has any type of formal training programme in place for its employees. The model is run on 10 Member States for which data are available: Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Luxembourg, the Netherlands and Sweden. Regressions also control for the sector of operation, the firm size category (small, medium or large), the country, whether the firm is located in the main business city and the year of the survey. Survey weights are applied. Asterisks highlight the coefficients that are statistically significant: *** indicates p < 0.01.*
Source: *Authors' calculations, based on World Bank, 2025.*

The role of digitalisation in the income convergence process

The high policy priority placed upon moving towards a digital Europe is reflective of the view that digitalisation is associated with positive outcomes for both the economy and society. To assess the relationship between digitalisation and economic growth, we follow the approach applied throughout this report and look at the relationship through the lens of convergence. This means that, in practice, the analysis examines whether digitalisation has played a role in the economic convergence that has taken place across the EU. To do so, we extend the beta-convergence model presented in Chapter 1 and estimate a conditional beta-convergence model. Details of the conditional beta-convergence model are presented in Annex 2.

The model considers the role of digitalisation in the economic convergence process in Europe over two periods: 2008–2014 and 2014–2021. The findings indicate that digitalisation was a factor contributing to the economic convergence that was seen in 2008–2014. On the other hand, no evidence was found that it played a role from 2014 to 2021. This could suggest that, from 2014 onwards, the advancements in digitalisation were not significant enough to affect the economic convergence process. This finding is in line with other recent assessments in the literature arguing that digitalisation does not drive economic growth (Mayer et al., 2019; Gomes et al., 2022). However, it is important to highlight another potential reason we do not see digitalisation driving convergence after 2014: the issue may lie in the data underlying the digitalisation index used in the model. It could be that the index does not sufficiently capture more recent technological innovations that could drive growth and convergence. Indeed, Bakiskan and El Kaissi (2023) suggest that it is necessary to look beyond broadband penetration and other basic digitalisation indicators to assess how broadband is employed (e.g. the impact that it has on e-health, education, agriculture and civic engagement). These more advanced technologies, which are not captured in the conditional beta-convergence model, may have the potential to drive economic growth and, consequently, economic convergence.

Summary

Looking at convergence in digitalisation among Europe's businesses suggests an overall upward convergence process, as historically poorer-performing Member States have made progress in ensuring internet access for businesses. However, it is not the case that all Member States have performed equally well in this regard. Portugal has made above-average progress, while other countries, including Bulgaria, Greece and Romania, have not kept pace with advancements elsewhere. A similar picture of mixed progress emerges if we look beyond the overall average convergence process in the e-commerce sales of enterprises and in the provision of digital public services for businesses.

Turning to the analysis at the firm level, the most recent data from across the EU show a high degree of heterogeneity in terms of the digitalisation of Europe's enterprises. The data show that, across the countries studied, there is not a single country that stands out as the best performer across all metrics. While firms in Sweden score highly in terms of the use of advanced manufacturing processes and in terms of sophisticated technologies for managing production or service planning, firms in Finland have the highest average percentage of sales from online channels and firms in the Netherlands have the highest average use of sophisticated technology to manage procurement. Patterns by firm size are clearer, with larger firms showing consistently higher levels of usage of digital and advanced technologies. The breakdown by sector shows, unsurprisingly, a high degree of digital technology usage by firms in the ICT sector, while retail firms are more likely to use sophisticated technologies to manage procurement and supplies.

Turning to metrics of ICT skills and ICT-focused training, most firms appear to be satisfied with the ICT skills of their current staff. However, of the firms that engaged in hiring over the two years before the survey, more than half of them report having struggled to find staff with adequate ICT skills. Across all sectors, relatively few firms ran formal ICT-focused training courses for their employees. The exception is the ICT sector, where almost one quarter of firms conducted such training.

The results show that productivity is higher in firms that use advanced technologies, and this is true of both high- and low-productivity firms. On the other hand, experiencing difficulty in recruiting employees with adequate ICT skills is associated with lower productivity, highlighting that this skills gap may cause constraints on growth. The analysis also shows that the benefits of digital and advanced technologies may extend beyond performance metrics to the firms' employees, as the results show that firms that use advanced technologies are more likely to have formal training programmes for their employees and pay higher wages on average. It is important to bear in mind the caveat that, while the focus of this chapter was on the potential benefits of digitalisation for firms, there will still be new hurdles

that companies adopting digital technologies will need to overcome. These include the need to comply with relevant legislation on the protection of employees' data and their rights in the digital workplace.

Finally, turning from the firm level to the macroeconomic level, an analysis of the link between economic growth and digitalisation through the lens of convergence suggests that digitalisation may have played an important role in the economic convergence that has been experienced across Member States, in particular in the years following the 2008 financial crisis. While evidence of an association between digitalisation and income convergence is not found from 2014 to 2021, more refined data would be needed to verify whether or not digitalisation also played a role in this period.

4 Policies for digital inclusion

Digital inclusion is about ensuring that everybody has the means, the confidence and the capacity to participate in the digital world and exploit its opportunities. As envisaged by the European Commission, inclusiveness in the digital world is pursued through connectivity, accessibility and digital skills and by breaking down linguistic and other barriers through language tools and accessible technologies (European Commission, undated). Still, the transformation of processes and services into 'smart functions' requires 'smart users' who are willing and able to keep pace with rapid changes in ICT. Lack of interest or skills may result in users being left behind if they do not receive the necessary support.

Initially, at the policy level, the focus was on guaranteeing European citizens and businesses access to reliable (and then fast and secure) infrastructure (e.g. physical networks). The scope was subsequently widened to encourage the uptake and usage of digital technologies. At the same time, when the evidence showed that some socioeconomic groups were not taking part in the digital transformation process, the scope widened further to reach out to the digitally excluded.

At the European and national levels, equipping people and businesses with digital skills is addressed through Member States' roadmaps for the Digital Decade and monitored against the EU Digital Decade objectives and targets. This chapter takes a geographical perspective and focuses on the description and analysis of regional and local policies or initiatives aimed at the digital inclusion of vulnerable socioeconomic groups. Sometimes these local and regional interventions simply implement national policies or programmes. Other times, they are initiated by local and regional public authorities to address local needs.

Cases are sourced from five Member States selected according to the results of the convergence analysis presented in the previous chapters, showing varying patterns of convergence and divergence: namely Germany (showing some divergence), Greece (showing mostly divergence), Poland (showing some divergence), Romania (showing mostly divergence) and Sweden (showing mostly good convergence across the different socioeconomic groups). Table 6 provides an overview of the policies and initiatives described in this chapter. Additional innovative projects, from which important lessons can also be drawn, are described in Annex 3.

Digitally excluded individuals are found in vulnerable groups such as older, unemployed individuals, or people with lower levels of education. Often, they also include individuals challenged by material deprivation or social difficulties. By comparing the selected countries in terms of the size of the groups likely to be prone to digital exclusion, it is evident that the worst-performing countries in terms of convergence (Romania and Greece) have the highest shares of people at risk of poverty or social exclusion, and with lower levels of education. It is also evident that ageing countries such as Germany and Greece are challenged by the digital inclusion of older people.

The methodology used for developing the chapter is primarily based on desk research. To fill important information gaps, contacts were made with informed stakeholders involved in the cases described. Furthermore, insights were gathered during an expert meeting to discuss scenarios around digital exclusion organised by Eurofound on 12 November 2024.

Table 6: Overview of regional or local policies and initiatives described

Country	Name	Public authority involved	Target groups	Reach (scale)	Digitalisation level
Germany	Digital ambassadors	Federal state of Rhineland-Palatinate, Germany	People aged 60+	Large (in the range of thousands of people)	Access/use/ outcomes
Germany (†)	Digital inclusion and work in Siegen – come by!	Municipality of Siegen, Germany	Long-term unemployed adults (aged 27+), single parents and migrants	Small (a few hundred people)	Outcomes
Greece (†)	Digital communities of the elderly	10 small and medium-sized towns across 7 regions in Greece	People aged 60+	Small (a few hundred people)	Use/outcomes
Greece	START project	Municipality of Athens, Greece	Unemployed young people, older people, immigrants, refugees and other socially and/or digitally excluded individuals	Large (in the range of thousands of people)	Access/use/ outcomes

Country	Name	Public authority involved	Target groups	Reach (scale)	Digitalisation level
Poland (†)	Digital inclusion programme	Podkarpackie Voivodeship, Poland	Low-skilled people, unemployed individuals, older people and people living in semi-urban/rural areas	Small (a few hundred people)	Use
Poland	Digital rural women's circles	Local authorities in 12 counties in Poland	Members of rural women associations	Medium (over a thousand people)	Access/use
Romania (†)	Centre for Digital Inclusion	Municipality of Snagov, Romania	Young people, older people, unemployed individuals, local entrepreneurs and local public servants	—	Use
Romania	Reducing the digital divide for employees	West region, Romania	SME employees	Small (a few hundred people)	Outcomes
Sweden	Digital exclusion project	Municipality of Helsingborg, Sweden	Users of the city's social and labour services	Small (a few hundred people)	Outcome
Sweden (†)	Funk-IT Liftet	Municipality of Uppsala, Sweden	People with disabilities and older people	Large (in the range of thousands of people)	Access/use/ outcomes

Notes: *The table gives an overview of the case studies, detailing the country, the name of the policy or initiative, the target group and the size of the target group. The final column classifies the case studies according to the three levels of digitalisation – access, use and outcomes – that are used throughout the report. The case studies for which 'access' is given as a relevant digitalisation level are those where a physical connection, for example at a library, or a device that could be kept was supplied to the beneficiaries. (†) Denotes that the project is described in Annex 3.*
Source: *Authors.*

Germany

Country background. Germany's share of individuals who have never used the internet, 5.06 % of the population in 2023, or almost 4.3 million individuals, is close to the EU average (5.97 %). At NUTS 1 level, this indicator ranges from 3.19 % in Saarland and in Hamburg to 8.49 % in Schleswig-Holstein. In the Digital Decade country report for 2024, Germany is reported to have progressed slowly in enhancing the digital skills of its citizens. Nonetheless, the country prioritises inclusiveness in its national digital strategy (17 measures are dedicated to digital skills in its roadmap) and has developed specific inclusion programmes, especially for older people.

The Digital 21 initiative, a non-profit national network mandated and funded by both private and public actors, reports regularly on the challenges posed to German society by the digital transition. 6 % of the population is offline, but only 13 % of them perceive their exclusion from the internet as a disadvantage. The offline individuals give their reasons as 'I cannot do it' or 'I do not need it'. They primarily include people born before 1945 (53 %), women (61 %) and people with low educational attainment (76 %) (Initiative D21, 2024). 58 % of the offline individuals generally have no problem doing things without the internet, and any problems they do have relate to their interaction with the public sector and its services. Also, a significant 43 % of the offline individuals (an increase of 9 percentage points compared with the previous survey) believe that more processes should be shifted back to analogue mode, while 26 % accept digitalisation as long as analogue alternatives are still made available (Initiative D21, 2024).

Digital ambassadors in Rhineland-Palatinate

Target group: People aged 65 or older. **Scope:** Regional. **Core approach:** Open meetings, consultations and home visits by trained volunteers.

Description and analysis. The 'Digital ambassadors' project is implemented by the Rhineland-Palatinate Media Authority and is funded by the Ministry of Labour, Social Affairs, Transformation and Digitalisation (MASTD) of Rhineland-Palatinate. The project is one of the actions planned in the regional digitalisation strategy to achieve digital inclusion across the federal state (MASTD, undated-a). Since 2018, the project has been building a network of volunteers, called digital ambassadors or Di-Bos, who reach out to older people (aged 65 and over) who have little or no experience with digital media (DigitalPakt Alter, 2024). Support is given free of charge and provided in open meetings (i.e. gatherings participated in by several beneficiaries and focusing on topics of general interest, such as the use of digital devices to access the internet), during consultations (i.e. one-to-one assistance focusing on solving individual problems or replying to individual questions), and also in home visits or visits to care facilities for older adults. Di-Bos are asked to provide support with a certain regularity, but they are free to decide the form of support, the timing and the place. Training content relates, for example, to the use of devices (e.g. smartphones), the use of applications (apps)

for communication, the online purchase of transport tickets, information searching, media and entertainment (Medienanstalt Rheinland-Pfalz, undated-a). Di-Bos are themselves trained by the Rhineland-Palatinate Media Authority to interact appropriately with the target group. They are also supported in networking with each other and with the municipalities where they do volunteer work. Among the networking events, the Silver Surfer Conference, sponsored by MASTD, takes place each year and allows Di-Bos to share experiences and enhance their professionalisation.

The project is evaluated each year based on feedback collected from Di-Bos. In 2023, the project reached some 36 000 participants in 9 600 activities, which was three times the number achieved in 2022. Most of the support activities consisted of home visits, meetings and consultations. More than 2 000 individuals were supported at home because they either had limited physical mobility (60 %) or were reluctant to attend other forms of training (36 %). Over 75 % of the target group were aged 70 and over, and women represented most (69 %) of the attendees. In addition, some three quarters of the Di-Bos reported teaming up with one another and said that they were supported locally by municipalities (Medienanstalt Rheinland-Pfalz, undated-b; MASTD, undated-b). In 2023, the original target of having 300 trained Di-Bos was more than doubled with the recruitment of 231 new Di-Bos, who were trained in a total of 15 courses. In September 2024, the network included over 670 Di-Bos across all districts and cities of Rhineland-Palatinate (DigitalPakt Alter, 2024).

Because of its success, the project's funding has been extended until the end of 2026 (Rhineland-Palatinate Media Authority, 2024). The project is also providing online resources, such as training courses. Furthermore, it delivers specialised support in the use of electronic patient records through selected Di-Bos who are qualified as certified electronic patient records coaches and can offer tailored advice on this aspect of digital engagement (DigitalPakt Alter, 2024).

Greece

Country background. In 2023, the percentage of individuals in Greece who had never used the internet was 12.62 % (equivalent to around 1.3 million people), the second highest in the EU. There are significant territorial disparities in this indicator at NUTS 1 level, as it ranges from 7.78 % in Attiki to 17.29 % in Kentriki Elláda. Some 52.40 % of the population have at least basic digital skills, which is close to the EU average (55.60 %).

In Greece, policy initiatives for digital inclusion are mainly designed and implemented through a national top-down approach, although there are local bottom-up interventions promoted by civil society actors. The National Digital Decade Strategic Roadmap (Ministry of Digital Governance, 2023) includes 14 measures to create digitally skilled human capital able to drive the digital transformation. Some measures are oriented towards including vulnerable groups in digital engagement. In particular, measure 9, 'Development of model digital centres in all regions', aims to strengthen the digital skills of the population in general and of specific socioeconomic groups in particular (e.g. senior citizens, people with disabilities, refugees and people living in remote areas) through the establishment of 15 digital centres across the country, actively supported by local governments and by the Union of Hellenic Chambers of Commerce.

Evidence from recent EU-funded projects points out that older people experience severe digital exclusion in Greece, leading to the 'grey digital divide' (Alexopoulou, 2023). Among the national initiatives pursuing the digital empowerment of older people is the 'Third e-age' pilot project, which was recognised as a best practice in the 2024 DESI country report.

The START project

Target groups: Unemployed young people, older people, immigrants, refugees and other socially and/or digitally excluded individuals. **Scope:** Local. **Core approach:** Training courses of different durations and tailored to each target group, delivered in premises made available by the Municipality of Athens.

Description and analysis. The START project is an educational programme that aims to tackle the existing digital skills gap within Athenian society by increasing the digital literacy and inclusion of people at risk of being socially and/or digitally excluded (SocialInnov, 2022). In 2016, the municipality launched the Athens Digital Council, an advisory body composed of Greece's leading technology companies and academic institutions, to receive guidance for its digital transformation process. In 2018, the Athens Digital Roadmap envisaged a collaboration with Microsoft Hellas to provide digital skills to 4 000 people (City of Athens, 2018). This led to the START project, implemented by SocialInnov (Social Innovation), a non-profit organisation working to reduce digital skills gaps and computer science gaps through education.

The START project was supported by the Municipality of Athens, international technology companies and local bodies dealing with social exclusion. It fosters education, participation and innovation through continuous free training to promote the social and digital inclusion of various vulnerable groups. The main actions carried out under the START project umbrella include support for beneficiaries of all ages, from entrepreneurs and individuals willing to start a business in Athens, to young, unemployed and homeless people wishing to increase their chances of (re-)entering the labour market (SocialInnov, 2022).

In February 2018, the municipality set up the historic house of Lela Karagiannis as a digital skills development centre to host START's free educational activities (Sarri, 2019). In March 2020, the training moved to a multipurpose centre of the municipality, hosting cultural and social activities as well as technological innovation initiatives (START project, undated).

The project targeted 4 000 beneficiaries, but by April 2019 the actual number of beneficiaries was much higher, and participation increased further over the years. In 2018, more than 250 workshops and courses were delivered to 2 500 participants (of whom approximately 50 % were aged 50 and over) (Athina984, 2019). In 2022, the project's seminars were attended by more than 19 000 participants, mostly women or members of underserved communities. While the overall numbers were large, small-scale project components were also impactful. For example, in 2021, the START School of Integration involved only 10 people, but the participants reported that they 'saw in technology something more important than the interest to learn something new – they recognised a hope of following new paths in their lives' (SocialInnov, 2022, p. 3).

Poland

Country background. Poland is among the EU countries with the highest shares of individuals who have never used the internet (9.78 % of the population in 2023, or almost 3.6 million individuals). At NUTS 2 level, the indicator ranges significantly from 3.22 % in the Warsaw metropolitan area to 15.51 % in Świętokrzyskie. The Digital Decade country report for 2024 highlights that Poland lags in equipping people with digital skills and that all skills indicators score below the EU average. In addition, data by degree of urbanisation clearly indicate the in-country presence of a rural–urban divide when it comes to internet use. Research by Bartol et al. (2021) reports that in 2020 nearly 66 % of the people who did not use the internet stated that they do not need it, while over 52 % of the households without a connection justified this condition by explaining that they do not have the skills to use the internet. The research also found that older people are among the groups that are most vulnerable to digital exclusion, especially in rural areas.

In Poland, several projects funded within the framework of the Digital Poland Operational Programme for 2014–2020 have been implemented at the territorial level. For example, the European Regional Development Fund (ERDF), under measure 3.1. 'Training activities for the development of digital competencies', funded two major initiatives addressing the digital exclusion of older people within specific regions: 'Digital senior' in Świętokrzyskie and Podlaskie and 'E-senior' in Lower Silesia.

Digital rural women's circles

Target group: Members of rural women's associations. **Scope:** Local. **Core approach:** In-person and online training courses.

Description and analysis. 'Digital rural women's circles' is a project funded by the ERDF with approximately EUR 870 000 (EU co-funding is about 85 %) under the Digital Poland Operational Programme (EBB, undated). The project ran as a pilot from August 2022 to March 2023, and targeted the members of local rural women's associations (KGWs). The project's specific objective was to improve the digital competencies of participants and their access to online communication, services and opportunities. Also, by going through existing local associations, the project was expected to help mitigate the digital exclusion of villages in rural areas, as trained members would share their new skills within their small communities. Training was delivered in person and online, depending on the skills level of participants. Each type of training, regardless of the level, lasted 27 hours. All participants received tablets.

The project was evaluated as a successful pilot (Digital Poland Project Centre and EBB, undated). Participants were recruited within less than one month; 234 KGWs (compared with a target of 120) located in 12 counties across 8 regions were involved. All but one of the 1 220 participants completed the training.

A satisfaction survey revealed that the majority of respondents were happy with the project and would recommend it to other KGW members. Respondents also reported that the project increased their motivation to develop digital competencies. Only about one third of respondents appreciated the in-person training, with just over half indicating that they would have preferred a hybrid form. Participants also appreciated the specificity of the training to the needs of the KGW members, the location of the training near their places of residence and the fact that the training took place in autumn and winter, when participants had fewer other demands on their time.

Overall, training beneficiaries developed competencies enabling them to use public e-services, online shopping or electronic banking. The pre- and post-training tests indicated that all participants in the training gained some knowledge.

Romania

Country background. In 2023, the percentage of individuals in Romania who had never used the internet was 7.45 %, or over 1.4 million people. Disparities among regions range from 2.70 % in the Bucureşti-Ilfov area to 11.26 % in the Sud-Est region. According to the Digital Decade country report for 2024, the availability of high-speed internet in Romania is above the EU average (95 % coverage of households with very high

capacity networks). However, only 27.7 % of the population have at least basic digital skills (compared with the EU average of 55.60 %) and fewer than 27 % of SMEs have basic digital intensity (compared with the EU average of 57.70 %) ([12]). This poor performance in terms of digital skills endowment is mirrored in the country's low ambitions with regard to the 2030 Digital Decade targets. For example, two of the goals are to ensure that 50 % of the population have at least basic digital skills (the EU target is 80 %) and that 75 % of SMEs have basic digital intensity (the EU target is 90 %).

The national digital roadmap includes 16 measures to reduce the country's digital skills divide. Some of these measures target specific socioeconomic groups. For example, measure 3 'Funding schemes for libraries to become digital skills development hubs' aims to transform libraries into digital centres for the provision of basic digital skills, especially to marginalised socioeconomic groups and rural areas. Another example is measure 7 'Support for young people on the labour market', which aims to provide basic digital skills to young people not in employment, education or training (NEET), long-term unemployed individuals and other groups excluded by the labour market. Additionally, digital skills for businesses are tackled through measure 2 'Programmes dedicated to training/improving the skills of employees in enterprises' (Ministry of Research, Innovation and Digitalisation, 2023). Non-profit organisations play a significant role in supporting digital inclusion in proposing strategies and action plans (see, for example, EOS, undated).

Reducing the digital divide for employees in the West region

Target group: SME employees. **Scope:** Regional. **Core approach:** Training courses and work-based learning programmes offering digital skills to enhance competitiveness.

Description and analysis. The project aimed to reduce the digital divide for employees of SMEs located in the West region and operating in economic sectors with competitive potential. Co-funded by the 2014–2020 European Social Fund (ESF) (with a contribution of EUR 695 571.30) and with a total budget of EUR 832 851.35, the project was implemented by the Chamber of Commerce, Industry and Agriculture of Arad County (CCIA Arad), in partnership with the Road to the West Association from Hunedoara County. The project lasted from October 2022 to December 2023 and was, in practice, the follow-up to a former project in the region to build competitive human resources. This former project (implemented from May 2018 to May 2019) allowed CCIA Arad to identify SMEs' interest in lifelong training for the enhancement of employees' digital and ICT skills, so as to exploit the competitive potential of digital uptake (Kohesio, undated; CCIA Arad, undated).

The project's targets were to reach 308 employees (at least 40 % women and around 10 % aged 55 and over) in at least 36 SMEs and to certify at least 280 participants (CCIA Arad, undated). Activities to address the digital skills gaps included raising awareness of the benefits of digital technologies, vocational training for the provision of professional basic and advanced digital skills, and support for the design and implementation of work-based learning programmes on digital and ICT skills (Kohesio, undated). Training activities covered various topics, including computer use (60 hours, for around 170 people); web design and Java (50 hours each, for around 50 people); and social media use, customer relationship management and cloud computing (for 160 people each) (CCIA Arad, undated).

The project's results reflect the success of the intervention: 310 employees working for 50 SMEs in the West region benefited from free digital and ICT skilling and upskilling; a total of 174 employees attended at least one course organised by CCIA Arad; 136 employees attended at least one course organised by the Road to the West Association; and 305 participants had their competencies certified at the national level by the Romanian National Qualification Authority. A total of 17 SMEs (compared with the 10 expected) introduced work-based learning programmes providing digital and ICT skills (CCIA Arad, 2024). To avoid future digital skills gaps, a network of SMEs and other stakeholders was established with the support of CCIA Arad as a mechanism to anticipate the needs of professional digital and ICT skills (Kohesio, undated; CCIA Arad, 2024).

Sweden

Country background. Sweden is considered a digitally mature country and scores well above the EU average in terms of internet usage and the basic digital skills of its population, at both the national and regional levels. However, research carried out by the Swedish Internet Foundation in 2024 indicates that 5 % of the population does not use the internet (Internetstiftelsen, 2024). This share is primarily composed of older people, especially older women. Also in 2024, the Swedish Internet Foundation, in collaboration with Järvaveckan Research (2024), found that young residents of socioeconomically disadvantaged areas have less access to digital society in Sweden. It concluded that

([12]) Digital intensity is determined using a composite indicator that measures the adoption by businesses of (12 predefined) digital technologies.

there needs to be a better understanding of the phenomenon of digital exclusion of groups that are often underrepresented in national surveys.

At the national level, policies have been tailored towards people with disabilities, e-health resources and digital development (Wendt-Lucas et al., 2024). Sweden's National Roadmap for the Digital Decade acknowledges the presence of groups lacking basic digital skills and largely entrusts their support to initiatives involving Digidel (a national network set up to promote digital participation across the country) and the DigidelCenters established in 28 municipalities across the country. In 2023, the Swedish Agency for Digital Government (Digg), released a memo titled 'No digitalisation without inclusion'. This calls for greater coordination of interventions across the country, a deeper understanding of the phenomenon, nationwide support through digital helpers and the provision of an internet connection and equipment to digitally excluded individuals (Wendt-Lucas et al., 2024). Digital inclusion has also had an important role at the subnational level. For example, it is one of five focus areas in the Regional Digitalisation Strategy for Västerbotten 2022–2030. Region Västerbotten highlights not only challenges (e.g. lack of shared responsibility for digital inclusion, short-term and fragmented interventions, difficulties for policymakers in predicting its negative consequences or unanticipated costs) but also potential actions to make digitalisation socially sustainable (Region Västerbotten, 2022).

The digital exclusion project in Helsingborg

Target group: Users of the city's social and labour services. **Scope:** Local. **Core approach:** Users learning from users, in spaces within the municipality's social and labour administrative buildings, the city's library and the premises of a non-profit training association.

Description and analysis. The Municipality of Helsingborg (which has around 150 000 inhabitants) is in Skåne County in southern Sweden. Its digital exclusion project started in 2016, at the initiative of the Innovation Group of the city's social services. This group consisted of both the social services' administration staff and the users of the services. Because of the municipality's high ambitions in terms of digitalisation (in 2015, Helsingborg became Sweden's 'IT Municipality of the Year'), the users in the group were fearful that digital developments would negatively affect their access to services, as several of them had neither the relevant technology nor the skills. After surveying users' digital competencies, the administration staff realised that some users were digitally qualified and decided to combat users' digital exclusion through a 'users learning from users' approach. The project was piloted in collaboration with three separate groups of users and the city's labour administration office. In 2017, in order to reach a wider audience, the project placed its instructors in the city's library, and in 2018 it began a collaboration with a non-profit training association (Studiefrämjandet) (Helsingborg, 2020, 2023). The training took different forms: structured courses for users of the labour administration office (where 'newcomers were learning from newcomers'); service times for users of the social services and for visitors to the library; and formal courses delivered by Studiefrämjandet. All activities related to this demand-driven but small-scale initiative ended in 2023 (Helsingborg, 2023).

The 'users learning from users' approach alleviated fears of being perceived as failing or stupid. Ultimately, it enhanced users' digital competencies and made social services more accessible, while instructors had the opportunity to validate the users' digital competencies and increase their chances of entering the labour market. This continuous dialogue also allowed the city's social services to monitor and adapt support over time. Consequently, training was tailored to users' concrete needs and interests; it focused on the use of smartphones rather than computers (as the former were more accessible for most users); and it was delivered at a slow pace, often through one-to-one supervision, and in a flexible manner. For example, users of the social services had difficulty committing to structured courses lasting several weeks and were thus offered support in slots during service hours (Helsingborg, 2020).

In 2020, the social services supported about two or three users on every service occasion. By 2020, more than 250 visitors had been supported at the library and a total of 15 individuals had been recruited as instructors. In addition, around 140 people had completed the course offered by the labour administration office (Helsingborg, 2020). The project is mentioned as a good example by the association of the 26 municipalities in Stockholm County (Storsthlm, 2022).

Lessons learned

Defining and adopting a 'do no harm' principle for the social sustainability of digitalisation policies

Evidence from the case studies provides information about barriers to accessing services not only for digitally excluded individuals but also for those individuals consciously remaining offline. Research in Germany, for example, shows the existence of a category of offline individuals who are not interested in being connected and ask for services to still be provided in analogue form (Initiative D21, 2024). In Poland, research refers to 'mental barriers' as the main drivers of digital exclusion. In addition to fear, lack of awareness of missed opportunities or lack of recognition of personal

capacities, these barriers also include a lack of will (Bartol et al., 2021).

In practice, the 'digital by default' trends (Schou and Pors, 2019) increase the risk of losing analogue options for (public) services and of exacerbating the social exclusion of individuals who are offline for one reason or another. Learning from the environmental domain, policymakers should consider defining and adopting a 'do no harm' principle for digitalisation policies to ensure that they are socially sustainable.

Profiling socioeconomic groups prone to digital exclusion at the territorial level

There is a need to more deeply understand the factors determining the offline state of vulnerable socioeconomic groups. National data and information on these groups are not sufficient to effectively combat their digital exclusion. In addition, if some vulnerable groups are digitally excluded because of their individual characteristics (e.g. age in the case of older people), the offline condition of other groups may depend on the context in which they live or on mental barriers. In Sweden, young residents in socioeconomically disadvantaged areas were found to have less access to digital society than their peers living in other parts of the country, pointing to the need to better understand the digital exclusion phenomenon in groups that are often underrepresented in national surveys (Järvaveckan Research, 2024). In the long term, profiling exercises may also help to prevent digital exclusion rather than combat it.

Lessons from the case studies, including the additional case studies presented in Annex 3, demonstrate several points.

- The DIAS.komm project in Siegen (described in Annex 3) shows that in urban contexts the digital exclusion of some groups becomes evident only when considering data and information at the neighbourhood level.
- In the Funk-IT Liftet project (described in Annex 3), the Municipality of Uppsala recognised early signals of digital exclusion among the people receiving support from its health and care administration, and it worked to design appropriate inclusion activities.
- The project in the West region of Romania demonstrates that digital exclusion may also concern SMEs' employees when they no longer meet the digital skills demands of businesses. To prevent the professional digital exclusion of workers, CCIA Arad established a network of local stakeholders as a mechanism to anticipate the future professional digital skills requirements and mitigate negative consequences for both workers and SMEs.

Tailoring digital inclusion approaches to each target group

Each digitally excluded target group has specific reasons behind its offline condition that should be understood thoroughly by means of assessment practices, through dialogue (driven by demand) or using a peer's perspective. One consideration that emerges when classifying the case studies according to the three digitalisation levels is that only focusing on one level – access, use or outcomes – might not always be sufficient and that the design of the project should take into account the multifaceted needs of beneficiaries.

When training is not adapted to the characteristics of each target group, it is likely to increase participation in the training, but not necessarily boost digital skills. This also points to the importance of recognising the digital competencies gained through training formally (e.g. through certification) or informally (e.g. through testing).

Lessons from the case studies demonstrate several points.

- In Helsingborg, social services users voiced their concerns about the consequences implied by the digitalisation of services. They did so through the Innovation Group, which functioned as a dialogue forum for the staff of the social administration office and the users. In addition, the continuous collection of feedback from participants in the training allowed the project to tailor content and delivery modalities to participants' concrete needs and interests. Finally, the 'users learning from users' approach created trust among trainees, allaying common fears such as of failing, feeling stupid or being judged.
- The START project operationalised the concepts that there is no digital skilling, upskilling or reskilling that fits all and that educational programmes should be tailored to the needs of vulnerable groups with ad hoc digital inclusion solutions.
- In the 'Digital rural women's circles' project, the modality of training delivery was adapted to the skills ambition of participants. Individuals tackling basic or intermediate digital skills were provided with in-person tutoring, while distance learning was used for individuals who aspired to achieve certification of their skills. In addition, appropriate tools (pre-tests) and tailored training content helped to make the project's training effective.
- The 'Digital communities of the elderly' project was conceived to address the vulnerability of older people to online financial fraud. Voluntary local groups of older people trained within the project were established to support other older people in becoming confident with electronic transactions and online financial services and products. In this way, trainers could clearly understand the needs and challenges faced by their peers.

- In the 'Digital ambassadors' project in Rhineland-Palatinate, Di-Bos are trained to work with older people in an appropriate manner, for example by being patient, providing everyday examples or explaining things in simpler terms.
- The Podkarpackie digital inclusion programme (presented in Annex 3) included measures that highlighted the importance of tailoring interventions more effectively to the needs of the target groups. This requirement is particularly important when a single initiative targets a wide range of diverse vulnerable groups.

Breaking the double loop of inequality

There is a link between digital and social inclusion, as digitally excluded individuals are often found among vulnerable socioeconomic groups, and digital exclusion may negatively affect some aspects of offline life (i.e. the double loop of inequality) (British Academy, 2022). It is also noted that digital inclusion is not an on/off condition, meaning that having some basic digital skills does not necessarily imply the capacity to exploit all the opportunities offered by the internet. In addition, digital inclusion is a fluctuating condition, as an individual's skills may become obsolete and inadequate while technologies change. For these reasons, support needs to be continuously adapted to changing needs.

Lessons from the case studies demonstrate several points.

- In Helsingborg, digital inclusion became essential to continue accessing social services that were being digitalised by the administration.
- The 'Digital communities of the elderly' project (presented in Annex 3) was designed to pursue the active participation of older people, reducing both their digital and social exclusion. Besides being trained in basic digital skills, they were given the opportunity to voluntarily contribute to a community service supporting the digital inclusion of other older people in their municipality.
- The Funk-IT Liftet project (presented in Annex 3) shows that changing the technologies (e.g. devices) or the appearance of information on the web requires continuous training and updating of training material, especially when individuals with specific physical impairments are involved. It also outlines that learning how to use the technology is not a sufficient condition to overcome digital exclusion, as the costs of devices and connection subscriptions are not necessarily affordable for vulnerable groups.
- In the 'Digital rural women's circles' project, participants were equipped with a tablet that became their own property after the training. The donation of the device lowered the risk of participants ending up in a situation of exclusion again if they could not afford the cost of technology.
- The START School of Integration specifically targets homeless people, with the aim of increasing their chances of (re-)entering the labour market. In addition to digital skills, devices and software, beneficiaries were also provided with individual career guidance and mental health counselling.
- The DIAS.komm project (discussed in Annex 3) shows that the digital inclusion of unemployed individuals through the learning of basic soft digital skills is a necessary, but not sufficient, condition to access the labour market. Employability is a much more complex situation that requires additional job-related competencies and concrete actions such as internships.
- The project in the West region of Romania shows that digital inclusion is also necessary in the professional sphere, as progress in technological development quickly makes workers' digital skills obsolete, preventing SMEs from reaping all the benefits of digitalisation.

Using physical spaces to reach out to digitally excluded individuals

Because digitally excluded individuals are offline, any outreach activities that target them are likely to occur in physical spaces. Existing public places that are easily accessible to all citizens and can be adapted for digital inclusion purposes are a primary option. For example, libraries are commonly used in the Nordic countries for digital inclusion initiatives (Nordic Council of Ministers, 2022). Libraries are also expected to become potential digital skills development hubs in Romania's national digital roadmap. Alternatively, physical spaces may be created on an ad hoc basis with a view to providing digitally excluded individuals with a place where they feel at ease.

Lessons from the case studies demonstrate several points.

- In Helsingborg, the scaling up of support for the project at the city's library reflects the role of inclusive public institutions such as libraries in Swedish society. According to the provisions of the Swedish Library Act (2013:801), libraries 'shall act to increase knowledge about how information technology can be used for the attainment of knowledge, learning and participation in cultural life' (Swedish Library Association, 2015, p. 17).
- 'Access knowledge without discrimination' was the key message of the START project. Its initial activities took place in a refurbished building that was culturally iconic for the Athenian community. Accessibility remained a priority even when the project's activities were transferred to a new centre in Athens that still had a 'social aggregation value'.

- The Centre for Digital Inclusion in Snagov (described in Annex 3) was conceptually designed to have a physical space for reaching out to diverse target groups (e.g. young and old people, unemployed individuals, local entrepreneurs and public servants). The centre was physically hosted in the municipality's House of Culture.
- In Siegen, the DIAS.komm project (described in Annex 3) physically set up a meeting point to first welcome and then (digitally) support those persons in need who resided in the target neighbourhood.
- In the 'Digital communities of the elderly' project (described in Annex 3), the Open Protection Centres for the Elderly (KAPI) were used as the physical reference points for the target group.

Embedding top-down modular approaches for digital inclusion at the territorial level

There are several examples of centrally designed, nationally or regionally funded and locally implemented policies or initiatives for digital inclusion that reflect good coordination across governance levels. Even in well-digitalised countries such as Sweden, poor coordination of interventions among different administrative levels is considered a shortcoming in addressing the digital exclusion of vulnerable socioeconomic groups (Wendt-Lucas et al., 2024). Conversely, some cases show that valuable but small-scale initiatives are likely to be discontinued or are unable to scale up or be replicated if they are not strategically supported at the political level.

Lessons from the case studies demonstrate several points.

- In the 'Digital rural women's circles' project, implementation through the local rural women's circles (KGWs) facilitated the transfer of knowledge from the trained members of KGWs to the other members of the associations and to the members of their small (often rural) communities, thus multiplying the project's impact. In addition, the patronage of the project by national politicians raised interest in the project, achieved good media coverage at both the national and local levels, and encouraged the voluntary participation of KGWs.
- In Rhineland-Palatinate, the set-up of a network of digital ambassadors (Di-Bos) makes the approach easily scalable across the territory, as any municipality where digital ambassadors reside can be served. In addition, the Di-Bos' liaison with municipalities and/or organisations aims to build networks locally and foster structures for the sustainable provision of support over time.
- In Greece, a modular approach was adopted for engaging older people in digital communities (as outlined in the Greek case study presented in Annex 3). By exploiting a standard model, the intervention successfully addressed the identified digital skills gaps of the older people across different small- and medium-sized urban areas, even with a limited budget.
- The rationale behind the Centre for Digital Inclusion model (described in Annex 3), piloted in Snagov and promoted by the Romanian Smart City Association, was to provide local authorities with a replicable, scalable and adaptable instrument conceived to structurally address digital inequality among their citizens and businesses.

Considering digital inclusion a shared responsibility within society

Favouring the digital inclusion of socioeconomically vulnerable groups means tackling challenges in diverse policy areas and thematic domains. Thus, interventions to fight digital exclusion require a multistakeholder approach. Almost all the case studies show that local and regional public authorities cooperate in their initiatives with a range of actors, from organisations working in the health and social services sectors to private companies providing ICT solutions, institutions delivering training, entities representing vulnerable categories or chambers of commerce.

Lessons from the case studies demonstrate several points.

- In the Centre for Digital Inclusion in Snagov (as described in Annex 3), cooperation between public authorities and private actors operating in the ICT sector has proved to be effective in starting up actions to address digital inclusion at the local level. The formal collaboration with the Romanian Smart City Association allowed the city to set a digitalisation path where the deployment of digital infrastructures is coupled with actions aimed at reducing the digital skills divide of its inhabitants.
- In the START project, the engagement of technology companies was crucial to ensure the provision of devices, software and digital competencies.
- The Funk-IT Liftet project (described in Annex 3) demonstrates that content development of training courses and training delivery methods requires a wide range of areas of expertise, especially for vulnerable socioeconomic groups with specific physical impairments. This expertise may be accessed by relying on the experience and know-how of the associations of the target groups.

5 Conclusions

Key takeaways

This report has documented the progress, and highlighted the challenges, of Europe's digital transformation. While significant progress has been made in rolling out digital access across Europe, the EU's targets for digitalisation are ambitious, and significant efforts will have to be made in order to reach them. These ambitious targets are supported by important legislation and significant funds: notably, EUR 150 billion allocated to the digitalisation process through the Recovery and Resilience Facility, EUR 250 billion in funding through NextGenerationEU and a EUR 43 billion investment supporting the European Chips Act.

When considering progress in reaching Europe's ambitious targets for digitalisation, it is important to look beyond headline national-level statistics and to consider progress made in specific regions, among specific population groups and according to specific indicators. In doing so, it becomes clear that progress towards a digital Europe has been unequal. For example, there remains a clear rural–urban divide when it comes to both digital access and digital skills. Moreover, digital gaps are larger for certain population groups, including those on lower incomes, people with lower levels of education and older people.

Despite the progress that has yet to be made, statistics covering the past decade show that the EU has made commendable progress towards closing digital gaps, with historically lower-performing regions narrowing the gap with the front runners across several indicators. Notably, indicators of infrastructure and access have shown higher rates of progress in historically less well-connected Member States (beta-convergence), an overall reduction in disparities between Member States (sigma-convergence) and a general decline in the average distance from the best-performing country (delta-convergence). Together, this points towards the success of the EU's efforts to progress the digital agenda. This broad pattern of convergence across Member States holds when the evolution of digital skills is assessed. However, the overall progress across the EU conceals the fact that progress has not been made by all Member States. The analysis highlights the continued dominance of the Nordic countries and the Netherlands when it comes to digital access and skills. The results also show that some poor-performing countries, such as Bulgaria and Greece, are catching up at rates that are below the average. This suggests that policymakers may need to double down on their efforts to close the digital gap.

Digitalisation matters, both on the individual level and for the macroeconomy. Indeed, analysis of country-level data shows that digitalisation has been an important component in the income convergence process that has taken place in Europe over the last decade. However, the overall role of digitalisation in the income convergence process was driven by the progress that was made in the period immediately after the financial crisis (2008–2014). If the more recent advances in digital technologies were captured in the indicator, it is possible that we would again see digitalisation driving income convergence.

Given the evidence that digital advances have spurred economic convergence, it is perhaps unsurprising that we see benefits accruing in private sector firms when they utilise more advanced technologies in their business operations. Analysis of microdata from several Member States shows that those firms that utilise these technologies enjoy higher levels of labour productivity and are more likely to be engaged in international markets. Moreover, the benefits of using more advanced technologies appear to extend beyond the firms themselves to their workers, with indications that these firms are also better places to work. However, it is also important to highlight that the digital skills gaps that remain in some Member States may impose a constraint on the performance of the private sector and thus on economic growth. This is because analysis suggests that, when a firm finds it difficult to recruit new employees with adequate ICT skills, the firm's performance suffers. Governments may need to consider how to equip their citizens with the skills needed to respond to the demands of the private sector. Research by the ILO has highlighted the potential role of apprenticeships in this regard, as they can play a key role in providing the digital skills needed for knowledge-based and digital economies, in a fast and flexible manner (ILO, 2022).

Another point that may temper the positive findings of overall convergence in digitalisation across Europe is the fact that not all socioeconomic groups are participating equally in this catching-up process. The gaps in access, use and outcomes register a catching-up process in all indicators, but only for the use of social networks did disparities between all age groups across Member States decrease. In the cases of online interaction with the public authorities and use of online banking, the catching-up process was not sufficient to decrease disparities, suggesting that, even with the national levels of digitalisation rising, supports should be kept in place for those people who are in the 55–74 age group; people with lower levels of education; or unemployed, retired or economically inactive people.

Indeed, there are several examples of certain groups having less access to the internet, engaging at below-average rates in certain online activities and those whose skills in these areas may continue to fall relative to the rest of the population. Notably, data show that those who are retired, are outside the labour force or have lower levels of education have not been keeping pace in terms of their propensity to use the internet for online learning. Disparities seem to be more marked in Member States where the progress made in digitalisation is less advanced relative to other Member States, and where the literature reports that there is a greater degree of social exclusion, which is reflected in greater gaps among the groups. The link between social exclusion and digital exclusion found in the literature is therefore confirmed in the empirical findings.

To address the challenges faced by certain groups, policies have been implemented across the EU to reach out to the digitally excluded. Initially, efforts to promote digital inclusion focused on ensuring everyone had access to digital infrastructure. Efforts to ensure access then expanded to increase the digital skills of those at risk of being left behind in the digital transformation. More recent policy efforts have focused on reaching out to those socioeconomic groups that remain digitally excluded. In this regard, an array of initiatives are being implemented at the local and regional levels. Sometimes they are designed at the regional level to address specific territorial needs; at other times they focus on the implementation of national initiatives at local level. Studying in detail some of the recent initiatives leads to important lessons for policymakers.

Designing policies to close the digital divide

- For digital policies to be sustainable from a social perspective, policymakers should adopt a 'do no harm' approach to implementing them. One important implication of this principle in practice suggests that policymakers should ensure that, as services continually move online, analogue options remain available. This would facilitate continued service availability to those people who are digitally excluded, including those who remain offline by choice.
- More work needs to be done to understand, at the micro level, which population groups and regions risk being left behind in the digital transformation process. This report has shown the overall progress that has been made in narrowing the digital divide, but it has also highlighted where and for whom such progress may not have been felt. The specific barriers to digitalisation need better understanding at the local level in order to design targeted policies for inclusion.
- Local digital initiatives and local digital training need to be customised for local realities, with an assessment of the needs of the specific local community. This could, for example, be for more digital inclusion broadly, or specifically for work-related digital skills. To improve the effectiveness of these initiatives, local communities could be involved in helping to create learning programmes. Moreover, training programmes should be targeted at older adults and low-income groups to bridge the skills gaps where they are largest.
- Those designing a project should take into account the multifaceted needs that beneficiaries might have. This may entail tackling all three levels of digital exclusion: access (providing access and devices), use (developing skills) and outcomes (enabling tangible benefits, be they social, economic or cultural).
- Inequalities in digitalisation often compound existing inequalities and indeed may reinforce one another (the double loop of inequality). This means that more vulnerable socioeconomic groups are more likely to be digitally excluded and that this digital exclusion may negatively impact other aspects of their lives. Policymakers should be cognisant of how digital gaps may exacerbate social exclusion and conscious of how these gaps may grow as digital technologies evolve.
- One approach to breaking the double loop of inequality is by ensuring that digital upskilling processes are not too narrowly focused on current technologies, but that they also foster competencies of learning to learn. This would ensure that, in the fast-moving environment of technology advancements, people will be able to learn to use new tools as they come on stream.
- Helping citizens to develop critical thinking is crucial to deal with the challenges of digitalisation and to understand the processes at work behind generative AI, including the risk of biases and AI 'hallucinations'. This competence should be developed from a young age to equip children, who will be the citizens and workers of the future, to fully and meaningfully participate in the digital Europe of the future.
- While the focus of digital training initiatives may be to increase people's skills online, it is important to remember the importance of physical spaces and in-person learning. Because many of the digitally excluded may be (fully or partially) offline, in-person learning may be essential, especially for the most digitally excluded.

- Access has expanded greatly but, in many cases, especially for people with lower levels of education, this translates into a use of technology for entertainment rather than for enhancement of capital. Initiatives showcasing and supporting the benefits of digital use beyond entertainment, including digital literacy and critical thinking, are vital.

Avenues for future research

Due to the inherently backward-looking nature of the convergence analysis, which considers historical progress and rates of catch-up, our analysis focused on what have been the important metrics of digitalisation over the past decades. However, future analyses should consider recent advancements in technology, most notably in generative AI. There are likely to be large differences in how these technologies spread across countries, regions and sectors (OECD, 2024b). While these technological advances may be associated with large benefits, the risks that come with them need to be better understood and quantified. Moreover, advances in generative AI may further exacerbate the digital skills gap, if not everyone has an equal ability to keep abreast of and utilise the most advanced digital technologies. It is important to monitor this gap and address it as it evolves. The concept of learning to learn that was highlighted earlier could be particularly important here. It will also be essential to continue to monitor the successes and failures of regional policy initiatives, which may only become evident through longitudinal analyses.

Another area that is important to focus on monitoring over time is advancement in e-government. As the provision of essential public services becomes increasingly digitalised, there is a growing risk that those most in need of public services will struggle the most to access them. Understanding these challenges and developing strategies to address them will be key in ensuring adherence to the principles set out in the European Pillar of Social Rights. The trends, challenges and opportunities involved in the digitalisation of social protection are analysed in a forthcoming Eurofound report (Eurofound, forthcoming).

The link between digitalisation and social exclusion has been a key focus of this report. Another important domain where digitalisation can have important implications for Europe is in terms of the just green transition. Digital technologies can be harnessed to advance environmental objectives, but, also, digital poverty may interact with economic and environmental poverty. In order to achieve Europe's digital and environmental targets, a better understanding of the links between the digital transformation and environmental sustainability may be needed (Ruiu and Ragnedda, 2024).

Throughout the report, it was highlighted that a deeper diagnosis is needed of the various causes of digital exclusion, in particular among those who choose to be offline. Having a deeper understanding of the causes of aversion to digital technologies could help overcome barriers to digitalisation and promote a digitally oriented mindset. Alongside this, distrust in digital technology needs to be better understood, especially in the context of the diffusion of generative AI, the risks associated with which could deepen levels of distrust.

We are at a very interesting moment in the digital evolution. The rapid progress in digital technologies in very recent years will generate many questions for future research. But what remains crucial when considering these advancements is to remain mindful of disparities between regions and socioeconomic groups. Rapid progress may be accompanied by growing disparities, which is why it is crucial to continue to monitor these trends through the lens of convergence.

References

All Eurofound publications are available at www.eurofound.europa.eu

Active Citizens Fund (undated), 'Senior citizens in digital communities!', Active Citizens Fund website, accessed 17 October 2024, https://www.activecitizensfund.gr/en/project/self-assisted-use-of-financial-products-services-and-processes-from-the-elderly/.

Alexopoulou, S. (2023), '"Please mind the grey digital divide": An analysis of digital public policies in light of the welfare state (Sweden and Greece)', *Örebro Studies in Political Science*, No 46, Örebro University, Örebro.

Andrews, D., Criscuolo, C. and Gal, P. N. (2015), 'Frontier firms, technology diffusion and public policy: Micro evidence from OECD countries', *OECD Productivity Working Papers*, No 2, OECD Publishing, Paris.

ARSC (Asociația Română pentru Smart City) (2021a), 'Centrul pentru Incluziune Digitală Snagov – imagini de la deschidere', ARSC website, accessed 12 November 2024, https://arsc.ro/centrul-pentru-incluziune-digitala-snagov/.

ARSC (2021b), 'Primăria Snagov lansează proiectul Snagov Green & Clean', ARSC website, accessed 12 November 2024, https://arsc.ro/snagov-green-clean/.

ARSC (2021c), 'Centrul pentru Incluziune Digitală deschis de Asociația Română pentru Smart City la Snagov', ARSC website, accessed 12 November 2024, https://arsc.ro/arsc-a-deschis-centrul-pentru-incluziune-digitala-la-snagov/.

ARSC (undated), 'Centrul pentru Incluziune Digitală', ARSC website, accessed 12 November 2024, https://arsc.ro/centrul-pentru-incluziune-digitala/.

Athina984 (2019), 'Start Project: Ισότιμη πρόσβαση στην τεχνολογία χωρίς διακρίσεις', Athina984 website, accessed 27 October 2024, https://athina984.gr/2019/04/03/start-project-isotimi-prosvasi-stin-technologia-choris-diakriseis/.

Bădîrcea, R. M., Manta, A. G., Florea, N. M., Popescu, J., Manta, F. L. et al. (2022), 'E-commerce and the factors affecting its development in the age of digital technology: Empirical evidence at EU-27 level', *Sustainability*, Vol. 14, No 1, 101.

Bakiskan, A. and El Kaissi, S. (2023), *Literature review of the economic impacts of broadband*, Centre for the Study of Living Standards, Ottawa.

Bartol, A., Herbst, J. and Pierścińska, A. (2021), *Wykluczenie społeczno-cyfrowe w Polsce: Stan zjawiska, trendy, rekomendacje*, Fundacja Orange and Fundacja Stocznia, Warsaw.

Belgian Presidency of the Council of the European Union (2024), 'Report of the ministerial conference on digital inclusion organised by the Belgian Presidency'.

Bergmann, R., Rintel, S., Baym, N., Sarkar, A., Borowiec, D. et al. (2023), 'Meeting (the) pandemic: Videoconferencing fatigue and evolving tensions of sociality in enterprise video meetings during COVID-19', *Computer Supported Cooperative Work* (CSCW), Vol. 32, pp. 347–383.

BIWAQ (Bundesministerium für Wohnen, Stadtentwicklung und Bauwesen) (undated), 'Digitale Inklusion und Arbeit in Siegen – kommen Sie vorbei! (DIAS.komm)', BIWAQ website, accessed 30 October 2024, https://www.biwaq.de/BIWAQ/DE/Projekte/Projekte_BIWAQ4/70_Siegen.html.

Blank, G. and Lutz, C. (2017), 'Representativeness of social media in Great Britain: Investigating Facebook, LinkedIn, Twitter, Pinterest, Google+, and Instagram', *American Behavioral Scientist*, Vol. 61, No 7, pp. 741–756.

Borowiecki, M., Pareliussen, J., Glocker, D., Kim, E. J., Polder, M. and Rud, I. (2021), 'The impact of digitalisation on productivity: Firm-level evidence from the Netherlands', *OECD Economic Department Working Papers*, No 1680, OECD Publishing, Paris.

British Academy (2022), *Understanding digital poverty and inequality in the UK: A summary of insights from our evidence reports*, British Academy, London.

Brynjolfsson, E. and McAfee, A. (2014), *The second machine age: Work, progress, and prosperity in a time of brilliant technologies*, W. W. Norton & Company.

Burke-Kennedy, E. (2023), 'Slowdown in Irish labour market described as "striking" as tech jobs fall by 3,400', *The Irish Times*, 16 November 2023.

Castelló-Climent, A. and Doménech, R. (2022), 'Converging to convergence: The role of human capital', *BBVA Working Papers*, No 22/12, BBVA Research, Madrid.

CCIA Arad (Chamber of Commerce, Industry and Agriculture of Arad County) (2024), 'Comunicat de presă', CCIA website, accessed 26 May 2025, https://www.ccia-arad.ro/wp-content/uploads/2024/01/Comunicat-presa-finalizare-proiect-143613.pdf (PDF).

CCIA Arad (undated), 'Reducerea decalajului digital pentru angajații și IMM-urile din Regiunea Vest COD SMIS 143613', CCIA website, accessed 28 October 2024.

Cedefop (European Centre for the Development of Vocational Training) (2023), 'Do low-educated adults have fewer opportunities to participate in education and training?', Cedefop website, accessed 18 December 2024.

Censis (Centro Studi Investimenti Sociali) (2020), *L'Italia post lockdown: La nuova normalità digitale delle famiglie Italiane*, Rapporto Auditel-Censis No 3, Censis, Rome.

Cibian, Ş., Drăgan, M., Fierăscu, S., Ruşitoru, I. and Beserman, E. (2022), *A national study on digital inclusion and exclusion in Romania*, Făgăraş Research Institute, Făgăraş.

City of Athens (2018), *Athens Digital Roadmap 2018*, https://networking.barter.es/gestor/upload/sideevents/47/20181101Athens Digital Roadmap_Eng_Feb13.pdf (PDF).

Diakonie (2019), '"DIAS.komm": Raum der Begegnung eröffnet', Diakonie website, accessed 23 November 2024, https://www.diakonie-sw.de/details/artikel/diaskomm-raum-der-begegnung-eroeffnet/.

DigitalPakt Alter (2024), 'Digital-Botschafterinnen und -Botschafter Rheinland-Pfalz', DigitalPakt Alter website, accessed 15 November 2024, https://www.digitalpakt-alter.de/wissen-vermitteln/themen-entdecken/landesprogramme-rheinland-pfalz/.

Digital Poland Project Centre and EBB (Education without Barriers) (undated), 'Raport z monitoringu i ewaluacji projektu Cyfrowe Koła Gospodyń Wiejskich'.

EBB (undated), 'Projekt: Cyfrowe Koła Gospodyń Wiejskich', EBB website, accessed 21 October 2024.

EEKE (Union of Working Consumers of Greece) (2020), *Ηλεκτρονικές Συναλλαγές και Τρίτη Ηλικίακαι Τρίτη Ηλικί*, EEKE, Athens, https://eeke-seniors.gr/wp-content/uploads/2020/06/Μελέτη-«Ηλεκτρονικές-Συναλλαγές-και-Τρίτη-Ηλικία».pdf (PDF).

EEKE (undated), 'Οι "Ψηφιακές Κοινότητες Τρίτης Ηλικίας" είναι γεγονός!', EEKE website, accessed 17 October 2024, https://eeke-seniors.gr/.

EOS (Educating for an Open Society) (undated), 'Propunere Strategie Naţională De Incluziune Digitală', EOS website, accessed 12 November 2024.

Eurofound (2018), *Upward convergence in the EU: Concepts, measurements and indicators*, Publications Office of the European Union, Luxembourg.

Eurofound (2021), *Monitoring convergence in the European Union: Looking backwards to move forward – Upward convergence through crises*, Challenges and prospects in the EU series, Publications Office of the European Union, Luxembourg.

Eurofound (2023a), *Ethical digitalisation at work: From theory to practice*, Publications Office of the European Union, Luxembourg.

Eurofound (2023b), *Bridging the rural–urban divide: Addressing inequalities and empowering communities*, Publications Office of the European Union, Luxembourg.

Eurofound (2023c), *Hybrid work in Europe: Concept and practice*, Publications Office of the European Union, Luxembourg.

Eurofound (2024a), *Social protection 2.0: Unemployment and minimum income benefits*, Publications Office of the European Union, Luxembourg.

Eurofound (2024b), *Company practices to tackle labour shortages*, Publications Office of the European Union, Luxembourg.

Eurofound (forthcoming), *Digitalisation in social protection: Trends, risks and opportunities*, Publications Office of the European Union, Luxembourg.

Eurofound and Cedefop (2020), *European Company Survey 2019: Workplace practices unlocking employee potential*, European Company Survey 2019 series, Publications Office of the European Union, Luxembourg.

European Commission (2019a), Commission staff working document – Country report Romania 2019, SWD(2019) 1022 final of 27 February 2019.

European Commission (2019b), 'Rural areas of Romania get broadband coverage', European Commission website, accessed 10 February 2025.

European Commission (2021), 'Digital Economy and Society Index – Methodological note', European Commission website, accessed 26 May 2025, https://ec.europa.eu/newsroom/dae/redirection/document/80560 (PDF).

European Commission (2024a), 'State of the Digital Decade 2024 report', European Commission website, accessed 9 December 2024.

European Commission (2024b), Annex to the Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – State of the Digital Decade 2024, COM(2024) 260 final of 2 July 2024.

European Commission (2024c), *eGovernment benchmark 2024 background report: Advancing public digital service delivery*, European Commission, Brussels, https://digital-strategy.ec.europa.eu/en/library/digital-decade-2024-egovernment-benchmark.

European Commission (undated), 'Digital inclusion', European Commission website, accessed 29 November 2024, https://digital-strategy.ec.europa.eu/en/policies/digital-inclusion.

European Economic and Social Committee (2024), 'AI for public services, organisation of work, more equal and inclusive societies – Fostering opportunities and managing risks from new technologies for public services, the organisation of work and more equal and inclusive societies (exploratory opinion requested by the European Commission)', SOC/790, Brussels, 23 October 2024, available at https://www.eesc.europa.eu/en/our-work/opinions-information-reports/opinions/fostering-opportunities-and-managing-risks-new-technologies-public-services-organisation-work-and-more-equal-and.

European Parliament (2021), 'Smart villages: Concept, issues and prospects for EU rural areas', European Parliament website, accessed 29 November 2024.

Eurostat (2024a), 'E-business integration', Eurostat website, accessed 6 March 2025, https://ec.europa.eu/eurostat/statistics-explained/index.php?title=E-business_integration.

Eurostat (2024b), 'How digitalised have the EU's enterprises become?', Eurostat website, accessed 6 March 2025.

Gal, P., Nicoletti, G., Renault, T., Sorbe, S. and Timiliotis, C. (2019), *Digitalisation and productivity: In search of the holy grail – Firm-level empirical evidence from EU countries*, OECD Publishing, Paris.

Gmyrek, P., Berg, J. and Bescond, D. (2023), 'Generative AI and jobs: A global analysis of potential effects on job quantity and quality', *ILO Working Papers*, No 96, International Labour Organization, Geneva.

Gomes, S., Lopes, J. M. and Ferreira, L. (2022), 'The impact of the digital economy on economic growth: The case of OECD countries', *RAM Revista de Administração Mackenzie*, Vol. 23, No 6, pp. 1–31.

Gopalan, S., Reddy, K. and Sasidharan, S. (2022), 'Does digitalization spur global value chain participation? Firm-level evidence from emerging markets', *Information Economics and Policy*, Vol. 59, e100972.

Government of Malta (2021), *Achieving a service of excellence: A 5-year strategy for the public service*, Office of the Principal Permanent Secretary, Valletta.

Government of Malta (2022), *Malta Diġitali 2022–2027*, Government of Malta, Valletta.

Grande, R., Muñoz de Bustillo, R., Fernández Macías, E. and Antón, J. I. (2020), 'Innovation and job quality. A firm-level exploration', *Structural Change and Economic Dynamics*, Vol. 54, pp. 130–142.

Grigorescu, A., Oprisan, O., Lincaru, C. and Pirciog, C. S. (2023), 'E-banking convergence and the adopter's behavior changing across EU countries', *Sage Open*, Vol. 13, No 4.

Haller, S. A. and Siedschlag, I. (2011), 'Determinants of ICT adoption: Evidence from firm-level data', *Applied Economics*, Vol. 43, No 26, pp. 3775–3788.

Hardey, M. and Atkinson, R. (2018), 'Disconnected: Non-users of information communication technologies', *Sociological Research Online*, Vol. 23, No 3, pp. 553–571.

Heichel, S., Pape, J. and Sommerer, T. (2005), 'Is there convergence in convergence research? An overview of empirical studies on policy convergence', *Journal of European Public Policy*, Vol. 12, No 5, pp. 817–840.

Helsingborg (2020), 'Digitalt utanförskap – en gemensam samhällsutmaning', https://media.helsingborg.se/uploads/networks/4/sites/135/2021/02/digitalt-utanforskap-raport-1.pdf (PDF).

Helsingborg (2023), 'Digitalt utanförskap', Municipality of Helsingborg website, accessed 11 October 2024, https://oppnasoc.helsingborg.se/utveckling/digitalisering/digitalt-utanforskap/.

Horobet, A. L., Mnohoghitnei, I., Zlatea, E. M. L. and Smedoiu-Popoviciu, A. (2023), 'Determinants of e-government use in the European Union: An empirical analysis', *Societies*, Vol. 13, No 6, 150.

ILO (International Labour Organization) (2022), *Towards lifelong learning and skills for the future of work: Global lessons from innovative apprenticeships*, ILO, Geneva.

Initiative D21 (2024), *D21-Digital-Index 2023/2024 – Jährliches Lagebild zur Digitalen Gesellschaft*, Initiative D21, Berlin.

Internetstiftelsen (2024), 'Svenskarna och internet 2024', Internetstiftelsen website, accessed 10 October 2024.

ITU (International Telecommunication Union) (undated), 'ITU DataHub', ITU DataHub website, accessed 10 March 2025.

Järvaveckan Research (2024), 'Digitalt utanförskap riskerar förstärka segregation och ojämlikhet', https://jarvaveckan.se/wp-content/uploads/2024/05/Pressmeddelande_Digital-inkludering-och-utanforskap-i-Sverige.pdf (PDF).

Jurnalul de Ilfov (2022), 'Dezvoltare rurală inteligentă. Snagov, un reper de "comunitate smart", pentru România', Jurnalul de Ilfov website, accessed 11 November 2024.

Kalinić, Z., Ranković, V. and Kalinić, L. (2018), 'Challenges in cross-border e-commerce in the European Union', *Krakow Review of Economics and Management*, Vol. 5, No 977, pp. 159–170.

Karaoglu, G., Hargittai, E. and Nguyen, M. H. (2022), 'Inequality in online job searching in the age of social media', *Information, Communication & Society*, Vol. 25, No 12, pp. 1826–1844.

Katz, R., Koutroumpis, P. and Martin, C. F. (2014), 'Using a digitization index to measure the economic and social impact of digital agendas', *Info*, Vol. 16, No 1, pp. 32–44.

König, R. and Seifert, A. (2020), 'From online to offline and vice versa: Change in internet use in later life across Europe', *Frontiers in Sociology*, Vol. 5, No 4.

Kohesio (undated), 'Reducing the digital divide for employees and SMEs in the West region', European Commission website, accessed 27 October 2024, https://kohesio.ec.europa.eu/en/projects/Q4610508.

Lal, B., Dwivedi, Y. K. and Haag, M. (2023), 'Working from home during Covid-19: Doing and managing technology-enabled social interaction with colleagues at a distance', *Information Systems Frontiers*, Vol. 25, pp. 1333–1350.

Lehtonen, O. (2020), 'Population grid-based assessment of the impact of broadband expansion on population development in rural areas', *Telecommunications Policy*, Vol. 44, No 10, e102028.

Lithuanian Innovation Centre (2020), *Lithuanian Industry Digitisation Roadmap 2020–2030*, Lithuanian Innovation Centre, Vilnius.

Lutz, C. (2019), 'Digital inequalities in the age of artificial intelligence and big data', *Human Behavior and Emerging Technologies*, Vol. 1, No 2, pp. 141–148.

Manu, M.-A., Burnei, I. M. and Ţuţuianu, C. (2021), 'Learning against the odds: An overview of lifelong learning and online learning in Romania', in: Bratianu, C., Zbuchea, A., Anghel, F. and Hrib, B. (eds.), *Strategica – Shaping the future of business and economy*, 9th edition, National University of Political Studies and Public Administration, Bucharest, pp. 774–784.

Marcus-Quinn, A. (2022), 'The EU Accessibility Act and Web Accessibility Directive and the implications for digital teaching and learning materials', *Routledge Open Research*, Vol. 1, No 30.

MASTD (Ministry of Labour, Social Affairs, Transformation and Digitisation) (undated-a), *Wir vernetzen Land und Leute. Digitalstrategie für das Land Rheinland-Pfalz*, MASTD, Mainz.

MASTD (undated-b), 'Digital-Botschafterinnen und Digital-Botschafter Rheinland-Pfalz', MASTD website, accessed 29 October 2024.

Mayer, W., Madden, G. and Wu, C. (2019), 'Broadband and economic growth: A reassessment', *Information Technology for Development*, Vol. 26, No 1, pp 128–145.

McCoy, S. and Siedschlag, I. (2025), 'Digital skills and the impact of digital technologies in secondary education in the era of artificial intelligence', *ESRI Working Papers,* No 800, Economic and Social Research Institute, Dublin.

Medienanstalt Rheinland-Pfalz (undated-a), 'Entdecken Sie die digitale Welt mit uns!', https://mastd.rlp.de/fileadmin/06/Service/Publikationen/Soziales/2024_Dibo_Flyer_SeniorInnen_R08_Digital_Website_b.pdf (PDF).

Medienanstalt Rheinland-Pfalz (undated-b), 'Ergebnisse aus der Evaluation 2023. Die Di-Bos in Zahlen', Digital Ambassadors project website, accessed 29 October 2024.

Ministry of Digital Governance (2023), *The Greek National Digital Decade Strategic Roadmap*, Ministry of Digital Governance, Athens.

Ministry of Research, Innovation and Digitalisation (2023), *Planul Naţional de Acţiune privind Deceniul Digital pentru România 2030*, Ministry of Research, Innovation and Digitalisation, Bucharest.

Moutafides, G. M. and Economides, A. A. (2011), 'Demand for broadband access in Greece', *Telematics and Informatics*, Vol. 28, No 2, pp. 125–141.

Mubarak, F. and Suomi, R. (2022). 'Elderly forgotten? Digital exclusion in the information age and the rising grey digital divide', *Inquiry: The Journal of Health Care Organization, Provision, and Financing*, Vol. 59, pp. 1–7.

Nordic Council of Ministers (2022), *Monitoring digital inclusion in the Nordic–Baltic region*, Nordic Council of Ministers, Copenhagen.

OECD (Organisation for Economic Co-operation and Development) (2001), 'Understanding the digital divide', *OECD Digital Economy Papers*, No 49, OECD Publishing, Paris.

OECD (2024a), *Financial literacy in Greece: Relevance, actors and initiatives*, OECD Publishing, Paris.

OECD (2024b), *OECD digital economy outlook 2024: Embracing the technology frontier*, Vol. 1, OECD Publishing, Paris.

Oliveira, T. and Martins, M. F. (2010), 'Understanding e-business adoption across industries in European countries', *Industrial Management & Data Systems*, Vol. 110, No 9, pp. 1337–1354.

Polish Ministry of Development (2020), 'Zapytanie Ofertowe Nr RPPK.9.3_0033_01 z 17 sierpnia 2020', Polish Ministry of Development website, 17 August, accessed 21 October 2024, https://archiwum-bazakonkurencyjnosci.funduszeeuropejskie.gov.pl/publication/view/1259061#infowyk.

Ragnedda, M. (2018), 'Conceptualizing digital capital', *Telematics and Informatics*, Vol. 35, No 8, pp. 2366–2375.

Ragnedda, M. and Kreitem, H. (2018), 'The three levels of digital divide in east EU countries', *World of Media – Journal of Russian Media and Journalism Studies*, Vol. 1, No 4, pp. 5–26.

Ragnedda, M., Ruiu, M. L. and Addeo, F. (2022), 'The self-reinforcing effect of digital and social exclusion: The inequality loop', *Telematics and Informatics*, Vol. 72, e101852.

Raihan, M. M. H., Subroto, S., Chowdhury, N., Koch, K., Ruttan, E. et al. (2024), 'Dimensions and barriers for digital (in)equity and digital divide: A systematic integrative review', *Digital Transformation and Society*, Vol. 4, No 2.

Region Västerbotten (2022), *Regional Digitalisation Strategy for Västerbotten 2022–2030*, Regional Development Administration, Region Västerbotten, Umeå, Sweden.

Rhineland-Palatinate Media Authority (2024), 'Jahresbericht 2023 – Lagebericht', Rhineland-Palatinate Media Authority website, accessed 29 October 2024, https://medienanstalt-rlp.de/jahresbericht-2023/berichte/lagebericht.

Ruiu, M. L. and Ragnedda, M. (2024), *Digital-environmental poverty: Digital and environmental inequalities in the post-covid era*, Palgrave Macmillan, Cham.

Salemink, K., Strijker, D. and Bosworth, G. (2017), 'Rural development in the digital age: A systematic literature review on unequal ICT availability, adoption, and use in rural areas', *Journal of Rural Studies*, Vol. 54, pp. 360–371.

Sarri, S. (2019), 'START Project στην Κυψέλη', Popaganda website, accessed 22 October 2024.

Schou, J. and Pors, A. S. (2019). 'Digital by default? A qualitative study of exclusion in digitalised welfare', *Social Policy & Administration*, Vol. 53, No 3, pp. 464–477.

Schreurs, K., Quan-Haase, A. and Martin, K. (2017), 'Problematizing the digital literacy paradox in the context of older adults' ICT use: Aging, media discourse, and self-determination', *Canadian Journal of Communication*, Vol. 42, No 2.

Scutariu, A. L., Şuşu, Ş., Huidumac-Petrescu, C. E. and Gogonea, R. M. (2022), 'A cluster analysis concerning the behavior of enterprises with e-commerce activity in the context of the COVID-19 pandemic', *Journal of Theoretical and Applied Electronic Commerce Research*, Vol. 17, pp. 47–68.

SocialInnov (2022), *Social impact report 2021*, SocialInnov, Athens.

Spasova, S., Atanasova A., Sabato, S. and Moja, F. (2023), *Making access to social protection for workers and the self-employed more transparent through information and simplification: An analysis of policies in 35 countries*, European Social Policy Network series, Publications Office of the European Union, Luxembourg.

START project (undated), 'The building', START project website, accessed 23 October 2024, https://www.startproject.gr/en/the-building/.

Stoica, V. and Ilas, A. (2013), 'Rural–urban digital divide in Romania', in: Halpin, E. F., Griffin, D., Rankin, C., Dissanayake, L. and Mahtab, N. (eds.), *Digital public administration and e-government in developing nations: Policy and practice*, IGI Global, pp. 317–334.

Storsthlm (2022), 'Digitalt utanförskap – En förstudie finansierad av Europeiska Socialfonden', https://www.storsthlm.se/media/pxmegz5d/digitalt-utanförskap_tryck.pdf (PDF).

Swedish Library Association (2015), *Promoting the development of a democratic society – The Swedish Library Act according to the legislator*, Swedish Library Association, Stockholm.

Taştan, H. and Gönel, F. (2020), 'ICT labor, software usage, and productivity: Firm-level evidence from Turkey', *Journal of Productivity Analysis*, Vol. 53, pp. 265–285.

Triplett, J. E. (1999), 'The Solow productivity paradox: What do computers do to productivity?', *Canadian Journal of Economics/Revue canadienne d'Economique*, Vol. 32, No 2, pp. 309–334.

Uppsala kommun (2021), 'Slutrapport projektgenomförande: Funk-IT Lyftet – ökad delaktighet genom kurser som ger vardaglig digital kompetens', https://digitalskillsjobs.se/inspiration/utbildningsresurser/funk-it-lyftet-kursmaterial-for-modern-teknik-i-vardagen/.

Uppsala kommun (2024), 'Funk-IT', Uppsala kommun website, accessed 14 October 2024, https://funkit.uppsala.se.

van Dijk, J. (2020), *The digital divide*, Polity Press, Cambridge, UK.

van Dijk, J. and Hacker, K. (2003), 'The digital divide as a complex and dynamic phenomenon', *Information Society*, Vol. 19, No 4, pp. 315–326.

Vicente, M. R. (2015), 'Determinants of C2C e-commerce: An empirical analysis of the use of online auction websites among Europeans', *Applied Economic Letters*, Vol. 22, No 12, pp. 978–981.

Vicente, M. R. and López, A. J. (2010), 'What drives broadband diffusion? Evidence from Eastern Europe', *Applied Economics Letters*, Vol. 17, No 1, pp. 51–54.

Wendt-Lucas, N., Jessen, S. and Brynteson, M. (2024), *National digital inclusion initiatives in the Nordic and Baltic countries*, Report 2024:3, Nordregio, Stockholm.

Weßner, A., Mohajerzad, H., Fliegener, L., Bernhard-Skala, C. and Rohs, M. (2024), 'Consensus in uncertainty: A group Delphi study on the impact of digitalisation on the continuing education of low-qualified adults in Germany', *International Journal of Lifelong Education*, Vol. 43, No 4, pp. 355–370.

Wilson-Menzfeld, G., Gates, J. R., Vijaykumar, S. and Morgan, D. J. (2023), 'Understanding older adults' use of social technology and the factors influencing use', *Ageing & Society*, Vol. 43, No 1, pp. 222–245.

wirSiegen.de (2024), 'Diakonie Soziale Dienste kooperiert bei Förderprogramm am Fischbacherberg', wirSiegen.de website, accessed 30 October 2024.

World Bank (2024), *Inflation, consumer prices (annual %) – Romania*, dataset, available at https://data.worldbank.org/indicator/FP.CPI.TOTL.ZG?locations=RO, accessed 11 December 2024.

World Bank (2025), 'World Bank Enterprise Surveys', World Bank Enterprise Surveys website, accessed 10 March 2025, www.enterprisesurveys.org.

Annexes

Annex 1: Defining a digitalisation index for use in the beta-convergence model

This report's digitalisation index for its income convergence model was based largely on the methodology utilised by the Digital Economy and Society Index (DESI) (European Commission, 2021). An outline of all the indicators used in the digitalisation index can be found in Table A1. Indicators were categorised based on four dimensions: digital infrastructure and access, digital skills, e-commerce, and e-government. It is worth noting that e-commerce indicators are monitored at the individual level and were used as proxies in measuring the impact e-commerce had on the income convergence model. First, the minima and maxima of relevant indicators were transposed for those indicators. This normalisation in the creation of the index is important for capturing the 'normal' lower and upper limits of each indicator. For example, for household broadband access, it is expected that most Member States would have achieved at least 50 % coverage, and it would not be unexpected for some states in more recent years to have achieved near-100 % coverage. Conversely, if taking the 'employment of ICT specialists' variable, one expects a Member State to rarely exceed 10 % of the population being employed in these jobs, making that the maximum. Weights were distributed between the four categories (digital infrastructure and access, digital skills, e-commerce, and e-government) so that all had an equal 25 % weight, irrespective of the number of indicators pertaining to each category. Subweights were then assigned within each category, which were based on the guidelines of the DESI methodology (European Commission, 2021). Subweights were assigned based on if the indicators used were the same as in DESI or if the indicator was operationally similar.

Table A1: Digitalisation index indicators, with identifier keys, sources, weights and minima/maxima

Indicator	Identifier/proxy	Source	Component weight (%)	Minima/maxima
Digital infrastructure and access				
Households with broadband access	isoc_r_broad_h	Survey on ICT usage in households and by individuals	50	50/100
Mobile broadband access	Active mobile broadband subscriptions	ITU, undated	40	0/210
Fixed broadband pricing	Fixed broadband internet basket	ITU, undated	5	0/100
Mobile broadband pricing	Mobile cellular low usage basket	ITU, undated	5	0/100
Digital skills				
Individuals who used the internet, frequency of use (daily)	isoc_r_iuse_i	Survey on ICT usage in households and by individuals	25	0/100
Individuals who used the internet for online banking	tin00099	Survey on ICT usage in households and by individuals	25	0/100
Individuals who used the internet for looking for information about goods and services online	isoc_ci_ac_i	Survey on ICT usage in households and by individuals	25	0/100
Employed ICT specialists	isoc_skslf	EU Labour Force Survey (EU-LFS)	25	0/10
E-commerce				
Individuals who used the internet to order goods and services online	isoc_r_blt12_i	Survey on ICT usage in households and by individuals	50	0/100
Individuals who used the internet to sell goods and services online	isoc_ci_ac_i	Survey on ICT usage in households and by individuals	50	0/100
E-government				
Individuals who used the internet for interaction with public authorities	isoc_r_gov_i	Survey on ICT usage in households and by individuals	100	0/100

Annex 2: The conditional beta-convergence model

Conditional beta-convergence models analyse the relationship between the growth of an indicator over a certain period and its initial value, while controlling for certain explanatory factors. The difference from absolute beta-convergence is the implication that countries tend to reach their own steady state instead of a common one. The regression model for conditional beta-convergence is as follows:

$$\Delta ln y_{i,t} = \alpha + \beta\, ln(y_{i,t-1}) + \lambda(ln(z_{i,t})) + \varepsilon_{i,t}$$

It includes $z_{i,t}$, which is our explanatory variable of interest – digitalisation.

The analysis employs a broad metric of digitalisation through the creation of a digitalisation index (Katz et al., 2014; Gomes et al., 2022). The digitalisation index calculated is based largely on the methodology utilised by the DESI (European Commission, 2021) and comprises the following four categories: digital infrastructure and access, digital skills, e-commerce, and e-government. The variables used to compute the index were normalised, and weights were distributed evenly between the four categories ([13]).

In executing the convergence model, the period from 2008 to 2021 was used due to data availability. To account for impacts of the 2008 financial crisis and its aftermath, the data were divided into two periods: 2008–2014 and 2014–2021. This is in line with a previous analysis of conditional beta-convergence carried out by Castelló-Climent and Doménech (2022).

The results of this analysis are presented in Table A2. The dependent variable is the average growth rate in gross domestic product (GDP) per capita over each of the two periods in the sample. Column 1 presents the unconditional beta-convergence model and shows the presence of income convergence in the EU-27 in both periods analysed. When we account for the role of digitalisation in the conditional beta-convergence model (Table A2, column 2), the results present strong statistical evidence of a substantially enhanced convergence effect between 2008 and 2014. Compared with the unconditional convergence model, the convergence effect was almost three times higher and more statistically significant. The convergence effect observed for growth between 2014 and 2021 was not as substantial and, furthermore, was not statistically significant. Several robustness tests were carried out using different specification of the digitalisation index (isolating the effect of infrastructure and access indicators, and also recomputing the index without infrastructure and access components), and the model was robust to these various specifications.

Table A2: Beta-convergence in GDP per capita, EU-27

Dependent variable: The annual growth rate in GDP per capita in the two periods (2008–2014 and 2014–2021)		
	1 – Unconditional beta-convergence	2 – Conditional beta-convergence
Log GDP per capita, 2008	– 1.201** (0.543)	– 3.285*** (1.133)
Log GDP per capita, 2014	– 1.719** (0.844)	– 1.105 (1.473)
Digitalisation index, 2008	—	0.087** (0.036)
Digitalisation index, 2014	—	– 0.024 (0.031)
Constant	20.746** (8.798)	15.355 (14.152)
Observations	54	54
***R*-squared**	0.446	0.512
Adjusted *R*-squared	0.413	0.461

Notes: ** p < 0.1; ** p < 0.05; *** p < 0.01. Model also contains year fixed effects.*

([13]) Further details on the calculation of the index, including the precise subweights given to each indicator, are provide in Annex 1.

Annex 3: Policies for digital inclusion – additional examples of local initiatives

Table A3: Additional regional or local policies and initiatives

Country	Name	Public authority involved	Target groups	Reach (scale)	Digitalisation level
Germany	Digital inclusion and work in Siegen – come by!	Municipality of Siegen, Germany	Long-term unemployed adults (aged 27+), single parents and migrants	Small (a few hundred people)	Outcomes
Greece	Digital communities of the elderly	10 small- and medium-sized towns across 7 regions in Greece	People aged 60+	Small (a few hundred people)	Use/outcome
Poland	Digital inclusion programme	Podkarpackie Voivodeship, Poland	Low-skilled people, unemployed individuals, older people and people living in semi-urban/rural areas	Small (a few hundred people)	Use
Romania	Centre for Digital Inclusion	Municipality of Snagov, Romania	Young people, older people, unemployed individuals, local entrepreneurs and local public servants	—	Use
Sweden	Funk-IT Liftet	Municipality of Uppsala, Sweden	People with disabilities and older people	Large (in the range of thousands of people)	Access/use/outcomes

Germany

Digital inclusion and work in Siegen – come by! (DIAS.komm)

Target groups: Long-term unemployed adults (aged 27+), single parents and migrants. **Scope:** Local. **Core approach:** Counselling, open meetings and individual coaching provided at a neighbourhood meeting point.

Description and analysis. The DIAS.komm project was implemented in two communities in the Municipality of Siegen, in North Rhine-Westphalia. In the community of Fischbacherberg, the project focused on enhancing the digital skills of long-term unemployed individuals aged 27 or older, single parents and migrants. In 2017, this community had a higher unemployment rate than the city of Siegen (16.2 % versus 9.9 %), a higher share of people with a migrant background (33.8 % versus 23.5 %) and a higher share of people in need of assistance (17.5 % versus 9.5 %) (BIWAQ, undated). DIAS.komm was implemented by Diakonie in South Westphalia (a large non-profit health and social service provider) in partnership with the city of Siegen and a private company providing healthcare, social and education services (Gemeinnützige Weiterbildungsgesellschaft Achenbach mbH). The project ran from January 2019 to December 2022 and was funded through Germany's 2014–2020 federal ESF operational programme, with a budget of EUR 527 175.34.

In Fischbacherberg, the project set up a meeting point equipped with digital devices and internet connection. Support primarily focused on the enhancement of digital skills and counselling activities (Diakonie, 2019). In terms of digital skills, participants were trained in e-learning, online applications (including taking photos) and job search skills. The project also developed an app showing locally available job vacancies and training opportunities. In terms of advice, the project organised regular gathering and exchange occasions (e.g. an intercultural women's breakfast group) and offered training on aspects of the German labour market such as mini-jobs and labour rights. Among the individuals requesting support were, for example, qualified people who nevertheless had difficulty accessing the labour market because their skills were not certified, and women who were seeking small jobs to combine work with their family duties.

Besides the enhancement of digital skills, the employability of participants was also tackled within the project by offering other knowledge (e.g. in sales and hospitality industry in the community of Heidenberg or Achenbach) and support (e.g. placement in internships).

The project supported and advised 335 participants (versus a target of 300 individuals), of whom 123 found employment. In 2024, a continuation of the project (named 'Ausblick – Raum für Bildung, Arbeit & Vielfalt', or 'Outlook – Space for education, work and diversity') was supported through the 'Education, economy and work in the neighbourhood – BIWAQ' federal funding programme. The continuation is still implemented in Fischbacherberg by

Diakonie, and support has been extended to younger (aged 18 and over) unemployed individuals through a collaboration with Katholisches Jugendwerk Förderband (Catholic Youth Organisation) (wirSiegen.de, 2024).

Greece

Digital communities of the elderly

Target group: People aged 60 and over. **Scope:** Local (in different municipalities). **Core approach:** Training workshops (online during the COVID-19 pandemic), the creation of 'peer trainers' and the establishment of a network of municipality-based digital communities.

Description and analysis. The project aimed to create communities of older people who are aware of the opportunities and risks inherent in using online financial services. With a total budget of EUR 77 994.15 (of which EUR 70 194.17 was co-funded by the Active Citizens Fund in Greece), the project contributed to the fund's mission of empowering vulnerable groups (Active Citizens Fund, undated). The project targeted older citizens in 10 Greek small and medium-sized towns across seven regions, on the mainland and in the country's archipelagos ([14]). The project was led in each municipality by the Union of Working Consumers of Greece (EEKE), supported by the leading cadres of the General Greek Confederation of Labour (GSEE). It was also supported by the Open Protection Centres for the Elderly (KAPI), which are operated by local authorities to prevent the social exclusion of older people. The project started in early 2020 and lasted 11 months. From May to July 2020, the project kicked off in the towns, supported by different municipal stakeholders such as labour centres, local politicians, departments or entities dealing with social policies and/or civil-society actors (EEKE, undated).

At the beginning of the project, a countrywide online questionnaire investigated the needs of older people in terms of digital skills and confidence level related to online financial transactions. This informed the design of the training content, which focused on topics such as secure use of credit or debit cards, internet banking, online purchases of products and services, different types of internet fraud and protection of bank accounts (EEKE, 2020). A total of 200 people aged 60 and over participated across 10 towns in a one-day training workshop lasting five hours. The training was delivered online (because of the pandemic) in the labour centres of the municipalities, where rooms and equipment were made available.

Following the training, five trainees from each of the 10 towns were selected to establish a local volunteer group to transfer their new knowledge. With the support of the local branches of EEKE and KAPI, each group began assisting other older people, raising awareness of the opportunities and risks of electronic transactions and online financial services and products. As a follow-up to the project, from 2022 to 2023, eight more workshops provided skills to 160 individuals aged 60 and over for the safe use of financial services. This led to the establishment of new volunteer local groups or to new volunteers joining existing groups (OECD, 2024a). As of late 2024, these groups continue to exist, supported by EEKE local branches, GSEE working centres and the central unit of EEKE in Athens.

Poland

Podkarpackie digital inclusion programme

Target groups: Low-skilled people, unemployed individuals, older people and people living in semi-urban and rural areas. **Scope:** Regional. **Core approach:** In-person training courses in venues selected by the project's implementer.

Description and analysis. Podkarpackie Voivodeship is one of the least developed regions in Poland. The Podkarpackie digital inclusion programme was implemented from 1 August 2020 to 30 April 2022 within the framework of the 2014–2020 regional operational programme for ERDF and ESF. It was funded by the ESF with a total budget of EUR 255 167.67 (of which 85 % was co-funded by the EU). The aim of the project was to develop the digital skills of those with the lowest level of ICT skills and to provide European Computer Driving Licence certification to at least 80 % of the participants. The target group included 360 people, focusing in particular on women, people with low levels of skills, people with a disability and those living in rural areas, among other criteria.

In August 2020, Podkarpackie Voivodeship launched a competitive tender to implement the project's various activities. The tender was divided into several lots, all but one of which were awarded to a private company (Polish Ministry of Development, 2020). No tenders were received for the component of the project to carry out accredited exams and award certificates, leading to the assumption that certification activities were not implemented. For other

([14]) Nafpaktos, Messologi, Veria, Katerini, Kastoria, Lamia, Volos, Syros-Ermoupolis, Rhodes and Chania.

project components, the terms of reference stated they should entail the delivery of 2 528 hours of ICT training for 360 individuals, divided into groups of 10, according to three levels defined against the digital competence framework for citizens (DigComp); organisation of the training and of its logistics took place all over the region, including in small towns and villages. While no specific information on the Podkarpackie digital inclusion programme was found, evaluation documents of the 2014–2020 regional operational programme showed progress towards the enhancement of ICT skills of individuals, particularly for people aged 50 and over.

Romania

Centre for Digital Inclusion in Snagov

Target groups: Young people, older people, unemployed individuals, local entrepreneurs and local public servants. **Scope:** Local. **Core approach:** physical centre for digital inclusion offering formal training on basic and advanced digital skills.

Description and analysis. In November 2021, the country's first Centre for Digital Inclusion (CDI) was opened in Snagov, a municipality of around 8 000 inhabitants in the rural area of Bucureşti-Ilfov (ARSC, 2021a). The centre, hosted in the municipality's Antim Ivireanul House of Culture, was conceived by the Asociaţia Română pentru Smart City (ARSC), or Romanian Smart City Association, and implemented together with Snagov City Hall. Its establishment was based on a collaboration protocol signed by the two parties for the 'Snagov green & clean' programme, an umbrella initiative aimed at improving the quality of life of Snagov's inhabitants and envisaging the implementation of a 'smart village concept' ([15]). The CDI was also supported by national and international technology partners and civil society organisations, and it was funded exclusively through private financing, namely with part of an investment of approximately EUR 100 000 raised by ARSC for the 'Snagov green & clean' programme (ARSC, 2021b, 2021c). The CDI was conceived as an example of civic engagement addressing the entire local community for the free acquisition of basic and advanced digital skills. The digital inclusion scope of the CDI targets young people, older people, unemployed people, local entrepreneurs and local public servants (ARSC, 2021c; Jurnalul de Ilfov, 2022).

The CDI format, supplemented by 'digital inclusion ambassadors' – trained beneficiaries sharing their expertise in digital technologies – has become a transferable model proposed by ARSC in partnership with the Polytechnic University of Bucharest and the Ecological University of Bucharest to support local public authorities in the digital inclusion of citizens lacking digital skills. Digital equality is fostered through training activities addressing specific needs of different target groups. The ARSC supports the transferability of this successful CDI model through operational design, the identification of procurement needs and procedures, assistance throughout the set-up process, consultancy for training courses and programmes, mentoring activities and civic engagement initiatives (ARSC, undated).

Sweden

Municipality of Uppsala: Funk-IT Liftet

Target groups: People with disabilities and older people. **Scope:** Local. **Core approach:** Tailored training courses in small groups at meeting points, and individual support (online during the COVID-19 pandemic).

Description and analysis. The Municipality of Uppsala (around 240 000 inhabitants) is in East-Central Sweden, in Uppsala County. Co-funded by the Post and Telecommunications Agency (PTS), its Funk-IT Liftet project was implemented by the city's health and care administration from February 2019 to March 2021. PTS contributed SEK 3 million (approximately EUR 289 000 as of 1 February 2019) and the municipality contributed SEK 600 000 (approximately EUR 58 000). The project objective was to increase the digital competence of people with mental, neuropsychiatric and/or cognitive disabilities who were receiving support from the health and care administration. The target group was then enlarged to include older people and people with visual impairment. Through the development of tailored courses and individual support, beneficiaries were expected to start using smartphones, tablets or computers to assist in reading news, communicating online, accessing e-government information, using email, booking and paying for goods or buying bus tickets (Uppsala kommun, 2021, 2024).

The municipality applied for PTS funds after realising that many of the people supported by the city's health and care administration were unable to get in contact with the service or implement other simple tasks, such as making payments, because they could not use the technology. Once the project started, the first stage was dedicated to

([15]) The 'smart village concept' is based on the adoption of digital solutions in both the public and private sectors over a wide range of policy fields, with the scope of improving the living and working conditions of communities, especially in rural areas (European Parliament, 2021).

developing the material. This was done by qualified internal staff in cooperation with representatives of the associations of the target groups. In the second stage, the material was tested in trials and finally used to run the courses, which were then regularly evaluated (Uppsala kommun, 2021, 2024).

During its implementation, the project supported 2 720 people and ran over 300 courses. It engaged around 10 000 users, considering both the number of participants in the courses and the number of times the material was accessed online following the training. The Funk-IT Liftet project saw several indicators of impact by the project's end.

- Many of the participants were using technology more often in their everyday life, even if usage was often limited by the participants not owning their own device.
- Many of the participants were able to contact authorities online or complete e-forms. However, it was noted that changing the appearance of the web pages required the provision of additional support to some individuals.
- Only a few individuals were able to start making payments online independently, but more could independently make mobile payments.
- Many people learned how to buy bus tickets using a mobile app.
- Almost all participants learned how to search for information on the internet, which implied accessing knowledge, entertainment, emails and social media (Uppsala kommun, 2021, 2024).

Today, the Funk-IT Liftet project material is still available on the internet from many sources, including the municipality's website.

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Digitalisation has been on the EU policy agenda since 2000. While great strides have been made in this area over the past two decades, the digital transformation is not yet complete. This report seeks to deepen our understanding of the evolution towards a digital Europe. By applying the lens of convergence, the report assesses the progress of Member States towards the EU's policy targets, where Member States are growing together and where digital gaps are expanding. It also considers the gaps in the progress of digitalisation between socioeconomic groups and regions.

According to almost all indicators analysed, historically lower-performing Member States have been catching up with the digital leaders. However, at a more granular level, digitalisation of businesses has been uneven and significant inequalities persist between regions and socioeconomic groups. The report shines a light on the role of digitalisation in the EU's economic convergence and considers the progress in and benefits of digitalisation for the private sector.

The findings show that access is still an issue for vulnerable groups, in particular low-income households, older individuals and those with lower levels of education. Importantly, these are the groups that are more reliant on public services, and they may struggle to access e-government. While progress is being made, some groups remain at risk of being left behind in the digital transition. Considering this, the report highlights a range of policy approaches being deployed across Europe that aim to narrow the digital divide.

The European Foundation for the Improvement of Living and Working Conditions (Eurofound) is a tripartite European Union Agency established in 1975. Its role is to provide knowledge in the area of social, employment and work-related policies according to Regulation (EU) 2019/127.

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