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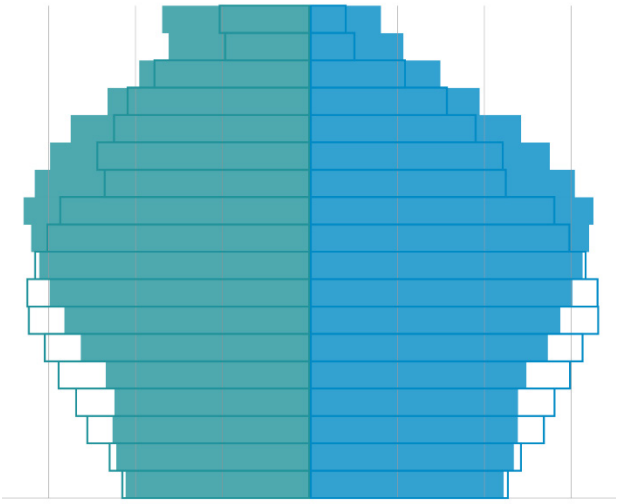
Demographic Outlook for the European Union

2022



STUDY

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Lead author: Monika Kiss
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Demographic Outlook for the European Union

2022

The latest demographic data show that existing demographic tendencies, such as increasing median age, declining fertility rates and a shrinking working age population, continue to prevail. However, it is also becoming clear that the influence of the pandemic was more significant in 2021 than during the previous year – for instance, 'excess mortality' increased even further, while life expectancy decreased in many Member States.

The pandemic also accelerated another phenomenon, present in our lives in recent decades: the digital transition. Social distancing measures favoured automation and digitisation, an increased use of e-government, and led to higher rates of remote working. Parallel to this, new problems and challenges appeared, touching diverse demographic groups in different ways and to differing degrees. Digital fraud, cyber-threats, digital dependency and a deepening digital divide pose more and more challenges for citizens and the EU.

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This is the fifth edition of the EPRS demographic outlook, the first two editions of which were drafted by David Eatock. Its purpose is to highlight and explain major demographic trends as they affect the European Union.

AUTHORS

The paper was compiled under the lead authorship of Monika Kiss. The other contributors were Mar Negreiro, Maria Niestadt, Carolien Nijenhuis and Christiaan Van Lierop, with Anneke Van der Linde.

The statistics were prepared with the assistance of Giulio Sabbati, and the graphics were produced by Lucille Killmayer.

This paper has been drawn up by the Members' Research Service, within the Directorate-General for Parliamentary Research Services (EPRS) of the Secretariat of the European Parliament.

To contact the authors, please email: eprs@ep.europa.eu

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eprs@ep.europa.eu
http://www.eprs.ep.parl.union.eu (intranet)
http://www.europarl.europa.eu/thinktank (internet)
http://epthinktank.eu (blog)

Executive summary

The latest available statistical data on demographic trends in the EU show that population features present in the EU-27 in previous years have persisted, but that the picture is slightly worse due to the Covid-19 pandemic.

The population of the EU[1] represents a progressively shrinking proportion of the world population. While the latter is increasing steadily and is getting proportionally younger, the population of the EU is ageing rapidly, with a median age of 43.9 years in 2020, compared to 38.4 years two decades ago. This is due to increased longevity (a life expectancy of 81.3 years in 2019 compared to 69.86 in the 1960s), but also to a shrinking birth rate, amounting to 4.05 million live births in 2019, compared to 6.79 million in the 1960s. The pandemic led to an increase in 'excess mortality' in 2021, the two biggest peaks being in April and November, coinciding with two waves of Covid-19 infections.

Owing to vaccination campaigns and economic incentives, employment figures in 2021 were more positive than during the previous year. This positive development is also due to another phenomenon, the acceleration of the digital transition.

A digital revolution is transforming the world as we know it at unprecedented speed, and there is a growing awareness among EU citizens that digital technologies play an important role in their daily lives; on a societal level, digital technologies have the potential to improve living standards, life expectancy and quality of life. Looking at prospective demographic trends, this technological dependency is expected to continue. According to a 2021 Eurobarometer survey,[2] more than 80 % of EU citizens think that the use of digital tools and the internet by 2030 will be important in their lives, and that they will bring at least as many advantages as disadvantages to them. However, there are differences according to demographic groups, among whom there remains a digital divide. For instance, younger users are more likely to be intensive internet users, and are also twice as likely to worry about the difficulty of disconnecting and finding a good online/offline life balance than those who are aged 55 and over. The use of digital technologies requires a sufficient level of digital skills, and in this respect the EU is still far away from its target (of 80 % of citizens with basic digital skills in 2030, compared to 58 % in 2021), but this is also strongly influenced by socio-demographic aspects.

Children and young people born after 1996 in the EU – sometimes called 'Generation Z', 'Gen Z' or 'iGeneration' – are the first digital natives: they are used to smartphones and tablets, and most have internet access at home. Demographically, though, their part in society is shrinking. Often young people are ahead of older family members in terms of technical competence (such as ICT skills) or time spent on the internet. The Covid-19 pandemic, which led to school closures and restrictions on physical contacts, also led, for the younger generation, to increased screen time and an abrupt transition to distance learning. The EU, its Member States and even private actors put in place initiatives to try and remedy these difficulties – for example, by providing access to hardware and software for pupils in need, partially opening schools, and providing non-digital home-learning resources.

Digitalisation is also changing the work life of young people, by reducing demand for routine and manual tasks while increasing demand for tasks requiring problem-solving and interpersonal skills. Young people often struggle to find a job, or jump from one precarious job to another. This in turn

[1] By 'EU' is meant the 27 EU Member States after 2020.

[2] Eurobarometer: Europeans show support for digital principles, 2021.

means that young people find it difficult to make the transition to independent life and depend financially, in large part, on their parents.

Apart from a small slice of 'Generation Z', it is 'Generation Y' or the 'Millennials' (those born between 1981 and 1996), as well as 'Generation X' (those born between 1964 and 1980) and some of the 'Baby Boomers' (the generation born between 1946 and 1964) who are present on the labour market and responsible for meeting the needs of the younger and older cohorts who depend on them. From the point of view of digital technologies, this heterogeneous group faces a lot of work-related challenges. These concern mainly automation, digitisation, the expansion of digital platforms and teleworking. While automated workflows and robots can make up for a lack of workers or perform physically demanding or hazardous tasks, they can also lead to job losses, relating mainly to routine tasks.

Digital technology enables people to work from any location at any time. Teleworking and digital platforms, which witnessed unprecedented growth during the pandemic, also have some drawbacks, mainly concerning work-life balance, digital privacy, and physical and mental health.

An ageing society brings challenges relating to growing demand for health and care services, loneliness, and social inclusion of older people. Digital technology could offer a solution to these problems. For example, it creates significant potential to improve support for older adults' (often complex) healthcare needs and their need to stay connected with their social circle. However, the digital transformation also poses challenges. It has increased the exclusion of those who are digitally illiterate, who cannot access or afford digital tools or the internet, or who lack motivation and interest. Moreover, the onset of physical or cognitive impairments and inaccessible technology design renders digital engagement more challenging. The EU is aware of these issues and is backing initiatives and projects to overcome the digital gap and stimulate innovation for ageing well.

The EU's digital transformation is taking place at an uneven pace, with clear differences visible across Europe in a number of different areas. In terms of digital literacy and skills, internet use is generally lower in southern and eastern EU regions than in the north and west, with a similar geographical division for e-commerce. The EU's outermost regions have some of the lowest levels of digital literacy in the EU, particularly when it comes to social media participation, while residents of rural areas generally have lower levels of digital skills than people living in cities, often linked to low levels of digital connectivity in rural areas. Indeed, a significant urban-rural digital divide exists in all EU Member States, in large part due to the high costs and risks involved in the roll-out of digital infrastructure in less built-up areas. However, the recent expansion in the use of telework and ICT-based mobile work could represent one of the keys to the future development of rural areas.

Table of contents

Table of figures

Table of maps

Table of tables

1. Introduction

The year 2021 was impacted by the Covid-19 pandemic and the ensuing social distancing and healthcare measures. New, more contagious variants of the virus appeared and led to new and even greater health and healthcare-related problems; new lockdowns set back economic production and mobility, and increased social vulnerability and tensions.

In the meantime, 2021 was characterised by the struggle to overcome the pandemic economically, aided by financial incentives at EU, Member State and local level, and healthcare-related measures, such as the extension of vaccination to the majority of the EU-27 population. It also saw further acceleration of the digital transformation.

This year's edition of the Demographic Outlook for the European Union examines the demographic situation in the EU in the light of the above-mentioned phenomena. After presenting a state of play of the demographic situation in the EU-27, the focus will be on the impact of digital transformation (which includes a wide range of phenomena, such as automation and robotisation, but also digitisation of administrative procedures and teleworking) on different demographic groups.

2. Demographic tendencies in the EU

2.1. Demographic tendencies in the EU – state of play

2.1.1. A shrinking proportion of the world population

The population of the EU's 27 Member States grew from 354.5 million in 1960 to 447.7 million in 2020.[3] This is related to the fact that people live longer, as figures for annual live births shrank from around 6.69 million in 1960 to 4.04 million in 2020[4] (already comparing to data from 2019 we can see a decrease of 0.11 million live births). Eurostat's baseline projections suggest that the EU-27 population could grow more slowly than in the past, peaking at 525 million in 2044, before declining to 416.1 million by 2100.[5]

According to data from the United Nations, the world population has risen dramatically, from 3.03 billion in 1960 to about 7.79 billion in 2020 (meaning an increase of 10 million compared to 2019), and it is projected to rise further, reaching an estimated 8.55 billion in 2030, and growing to pass 10 billion in 2057 and to 10.87 billion in 2100.[6] Even if the EU-27 population grew faster, it would still form an ever-shrinking proportion of the world population. The EU-27's share of the total world population decreased from 11.68 % in 1960 to 5.7 % in 2020 (a decrease of 0.1 % compared to 2019) – and it is projected to be smaller still, at just 4.35 % in 2057 and 3.83 % in 2100.[7]

[3] Figures from Eurostat demo_gind, no data from 2021 available yet. Natural population change is the difference between the number of live births and deaths during a given time period (usually one year), which can be either positive or negative.

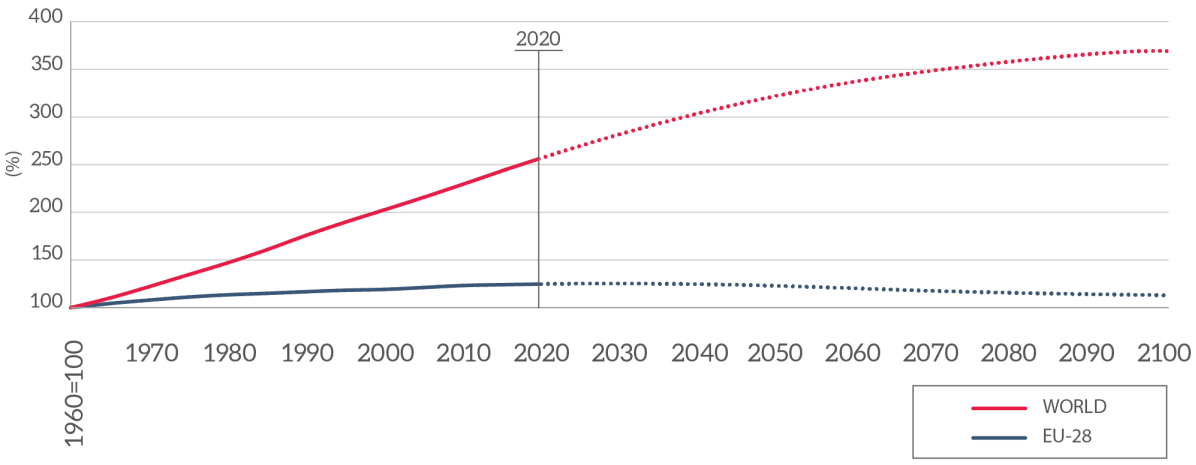
[4] Figures from Eurostat TPS00204.

[5] Figures from Eurostat PROJ_19NP.

[6] Figures from UNDESA.

[7] Resulting from the comparison of UNDESA data for the world and Eurostat data for the EU-27.

Figure 1 – EU-27 and world population (1960=100)



Data source: Eurostat demo_gind and PROJ_19NP, as well as UNDESA data.
Note: Projections (2016 onwards, shown with dotted line) use the UN 'medium fertility variant' scenario.[8]

2.1.2. A rapidly ageing population

Median age

'Age that divides the population in two parts of equal size, that is, there are as many persons with ages above the median as there are with ages below the median.'

Source: UN data.

The decline in the numbers of live births and increasing longevity are steadily changing the age profile of the EU population. When comparing figures from 2001 and 2020, an increase in the median age can be observed from 38.4 years in 2001 to 43.9 years in 2020,[9] which means an increase of 5.3 in just 19 years and an increase of 0.2 years compared to 2019.

There are significant differences between Member States. Cyprus is, for the time being, the Member State with the lowest median age, 37.7 years. Italy and Germany currently have the highest median age, at 47.2 and 45.9 years respectively, having both seen a substantial increase in the median age of their populations (13.6 and 12 years respectively) since 1970. In contrast, Sweden, with a relatively high median age in 1970 (35.5), has seen an increase of just 5.1 years since, and is now one of the youngest Member States in the EU-27, with a median age of 40.5 years.

The median age in the EU-27 is projected to increase by 4.3 years between 2020 and 2050, to 48.2 years. Eurostat projects that Italy will be the first to reach a median age of 50, in 2030,[10] followed by Portugal in 2035 and Greece in 2036. In 2050, Italy is projected to have the oldest median age in the

[8] The medium fertility variant scenario assumes that fertility in each country will converge towards replacement level (Population Analysis for Policies and Programmes).

[9] Eurostat, DEMO_PJANIND, 2020.

[10] Eurostat, PROJ_19NDBI.

EU-27 at 51.6 years, followed by Portugal with 51.2 years. In 2070, the two countries with the highest median ages will be Poland with 52.6 years and Italy with 52.1.[11]

Population pyramid

A population pyramid, also called an age structure diagram or an age-sex pyramid, is a graphical illustration – typically in the shape a pyramid – describing the distribution of various age groups for each gender in a geographical area, representing the oldest age group on top and the youngest at the bottom.

Source: Eurostat, Population pyramid.

When comparing the population pyramids of 2001 and 2020, it can be seen that the pyramid, already rather narrowing at the bottom (meaning fewer people in the younger age groups), becomes even more mushroom-shaped, with the top parts of the pyramid (older age groups) being broader, due in part to people living longer on average than previously,[12] while the lower parts reflect decreasing fertility rates. However, the similar size of the bottom two age bands shows that this trend has stabilised in recent years.

The impact of higher past fertility rates is also seen clearly in the chart, in the bulge caused by the so-called 'Baby Boomer' generation and the following generation, often called 'Generation X' (those born between 1965 and 1980).[13] The Baby Boomer cohort stems from high fertility rates in a number of EU countries in the years following World War II. 'Generation X' are mostly the children of the Baby Boomers. Subsequent declines in fertility rates meant fewer children joining the bottom of the pyramid after the Baby Boomer and 'Generation X' cohorts. Those two cohorts therefore formed a population bulge that moved up the pyramid as they aged. As these outsized cohorts are reaching, or will soon reach, retirement age, they are expanding the numbers in the older age groups, skewing the age structure of the EU population towards an older Europe.[14]

The prevalence of women is characteristic in older age groups, reflecting their greater longevity (on average) than men. This gender disparity in life expectancy has narrowed somewhat, but it is currently expected to continue, with the EU-27 average life expectancy at birth in 2019 estimated at 84 years for women, compared to only 78.5 years for men.[15] This is an increase of 0.3 years for both sexes from 2019 to 2020.

[11] These past and (projected) future differences are based on a baseline scenario. They are the product of evolving trends for fertility rates, life expectancy and migration in the Member States.

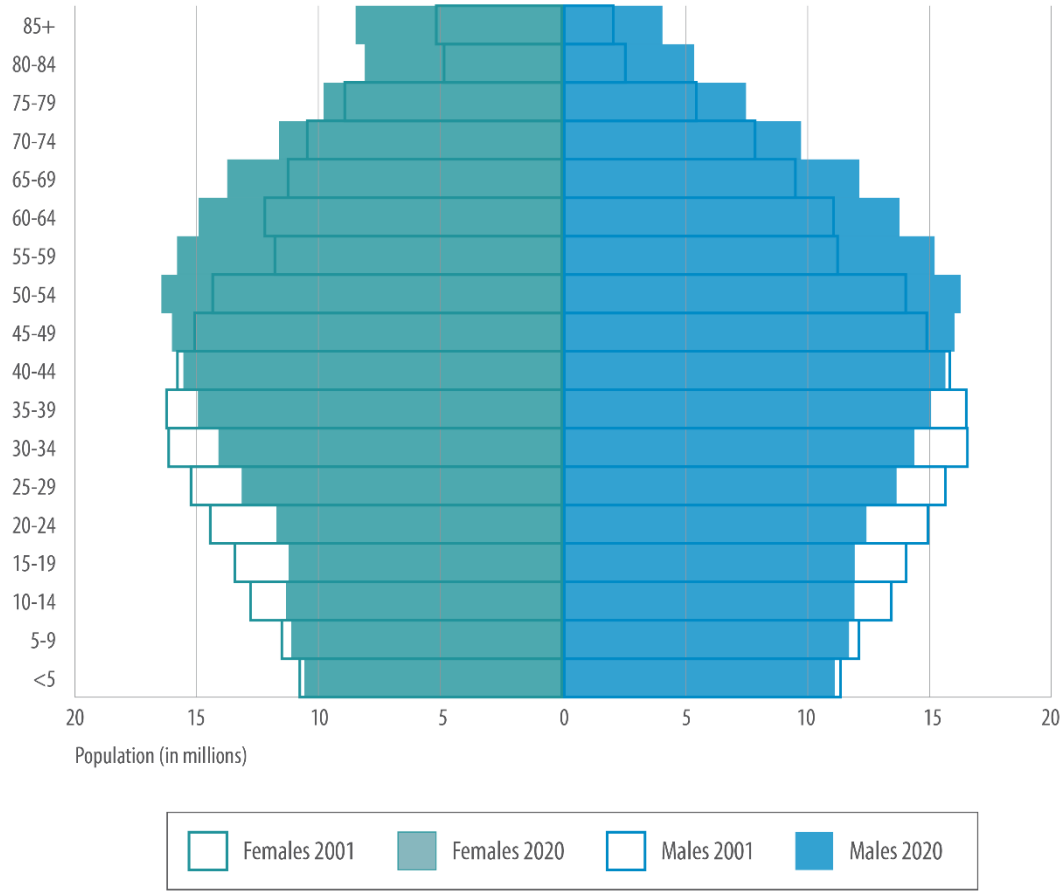
[12] Note: the very top bar on the pyramid also represents the only open-ended age group, covering all those aged 85 and over, whereas all the other bars represent age groups covering fixed five-year spans.

[13] Generations are presented in more detail in Chapter 4.

[14] While there is no agreed definition of 'Baby Boomer', it typically refers to those born in the final years of the Second World War, up until around the mid-1960s, a period that saw more births in many EU and other western countries. For more information, see: The greying of the baby boomers, Eurostat, 2011. 'Generation X' is not a scientific term, although it is increasingly used in research for those born between 1965 and 1980, the generation situated between the Baby Boomers and the Millennials (the latter also referred to as 'Generation Y').

[15] Eurostat, demo_mlexpec (no data available yet for the EU for 2020).

Figure 2 – EU-27 population pyramids for 2001 and 2019 (number of women and men by age group)

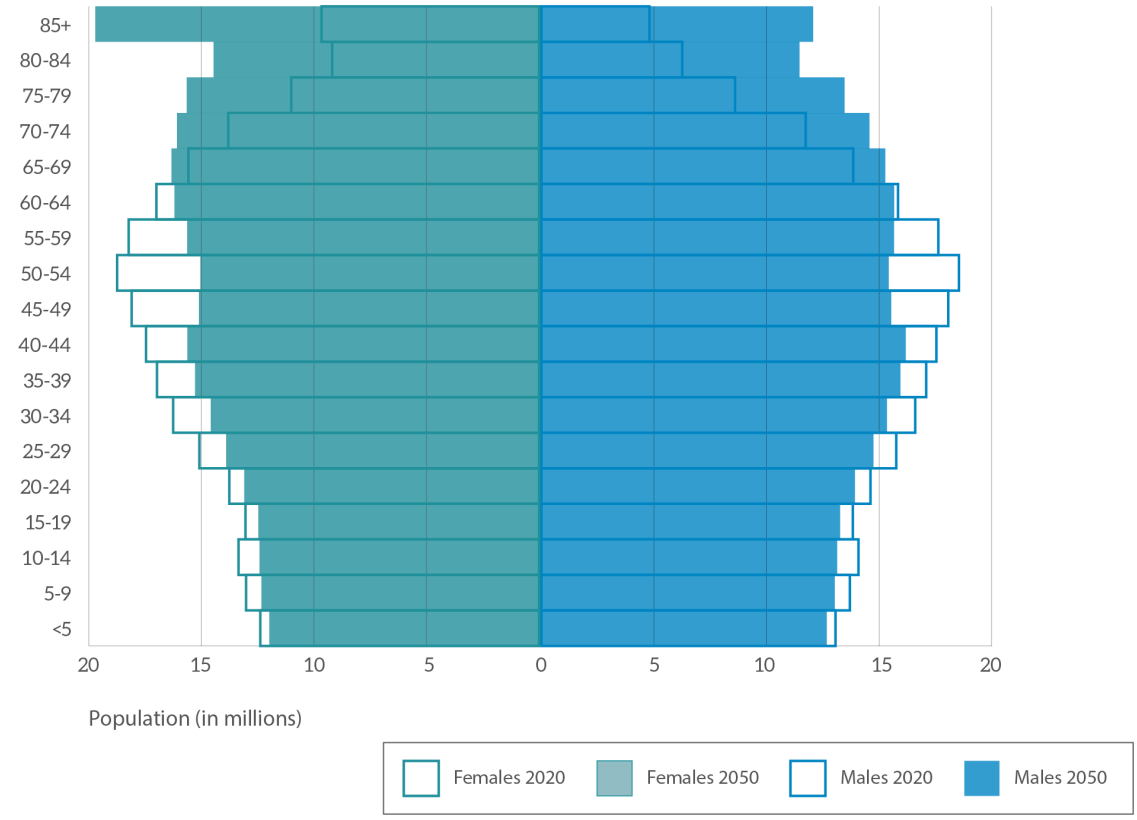


Data source: Eurostat, demo_pjangroup.

A look at the age structure in the EU for 2020 and 2050 (see Figure 3 below) suggests that the shape will change further as the Baby Boomer and 'Generation X' bulge progressively leaves the picture. Together with longer lifespans enlarging the proportion of the population in the older age group, a more rectangular shape associated with a stagnating or slow-growing population will develop.[16]

[16] The open-ended nature of the oldest age group of 85 years and over (rather than the fixed five-year spans of all the others) accounts for the fact this age group is the most numerous.

Figure 3 – Population pyramids for the EU-27 (number of women and men by age group), 2020 and 2050



Data source: Eurostat PROJ_19NP.

2.1.3. A shrinking working age population

Age dependency ratio

The **total-age dependency ratio** relates the number of individuals who need the support of others for their daily living – regardless of their age – to the number of working age individuals who are capable of providing this support. It is calculated on the basis of two ratios, the **young-age dependency ratio** and **the old-age dependency ratio**, which compare i) the number of those aged 0-14 to the number of those aged 15-64, and ii) the number of those aged 65 and over to the number of those aged 15-64.

Source: Eurostat, Total age dependency ratio.

The total age dependency ratio for the EU-27 was 55.5 % in 2020, meaning there were around two people of working age (15-64) for every younger or older person likely to be dependent on them (i.e. aged 0-14 or 65 and over). Breaking this down, the old-age dependency ratio (those 65 and over compared to those 15-64) was 32.0 %, so there were about three people aged 15-64 for each person aged 65 or over. The young-age dependency ratio (those aged 0-14 compared to those 15-64) was 23.5 %, meaning there were roughly four people of working age for each person aged 0-14.[17] Compared to values in 2001 (total-dependency ratio 48.3 %, old-age dependency ratio 23.4 %, young-age dependency ratio 24.9 %), an important increase (7.2 %) in the age dependency ratio can

[17] Eurostat, DEMO_PJANIND.

be observed. This is essentially due to an increasing old-age dependency ratio (by 8.6 %), rather than that of children, which even diminished by 1.6 %. It is interesting to observe that, within one year, from 2019 to 2020, the age dependency ratio increased by 0.6 %, an increase exclusively due to the higher old-age dependency ratio.

According to projections, the total age-dependency ratio could accelerate intensely, and is projected to reach 61.8 % in 2030 and 76.1 % in 2050 before increasing more slowly, exceeding 80 % (projection 80.8 %) in 2080. At these levels, there would only be around five people of working age (15-64) for every four people older or younger than this age band. This would have serious policy implications for economic growth, fiscal sustainability, health and long-term care, wellbeing and social cohesion, especially since the main driver of this increase is the old-age dependency ratio,[18] projected to reach 39.1 % in 2030 and 52.0 % in 2050. This means that, by 2050, there will be less than two people of working age (15-64) for every person aged 65 or over, two times less than in 2001, when there were about four working-age people for every person aged 65 or over. In contrast, the young-age dependency ratio is projected to decrease first to 22.6 % in 2035, and then to increase slowly to 24.3 % in 2060 and reach 25.1 % in 2100.[19]

2.1.4. Increasing life expectancy?

Life expectancy

Life expectancy is the average number of years persons of different ages may expect to live, starting from age zero. **Life expectancy at birth** is the mean number of years a newborn child can expect to live if subjected throughout his or her life to the current mortality conditions, the probabilities of dying at each age. Any later age can also be chosen as a starting point; the **total expected life span** is this age plus the life expectancy at that age.

Source: Eurostat, Life expectancy.

Together with fertility rates and migration, life expectancy is one of the main drivers of demographic change. In recent decades, life expectancy has increased continuously in most developed countries, including in the EU, for a number of reasons, including education, socio-economic conditions and lifestyle, as well as progress in healthcare (for instance, decreasing infant mortality or better treatment of diseases).[20]

According to Eurostat data[21] for the 'life expectancy at birth' indicator, life expectancy at birth in the EU-27 was estimated at 81.3 years in 2019 (0.3 years more than in 2018), reaching 84.0 years for women (from 83.7 in 2018) and 78.5 years for men (from 78.2 in 2018). Compared to data from 2002 (the first year for which life expectancy data became available for all EU Member States), life expectancy in the EU-27 increased by 3.7 years (from 77.6 to 81.3); the increase was 3.1 years for women and 4 years for men.

Even if EU-wide Eurostat data on life expectancy for 2020 is not available yet, it is important to highlight that provisional estimates by Eurostat[22] with data from Member States show a decrease in life expectancy in 2020 in the vast majority of Member States compared to the previous year, most

[18] Green paper on ageing, European Commission, COM(2021) 50.

[19] Eurostat, Population projections in the EU.

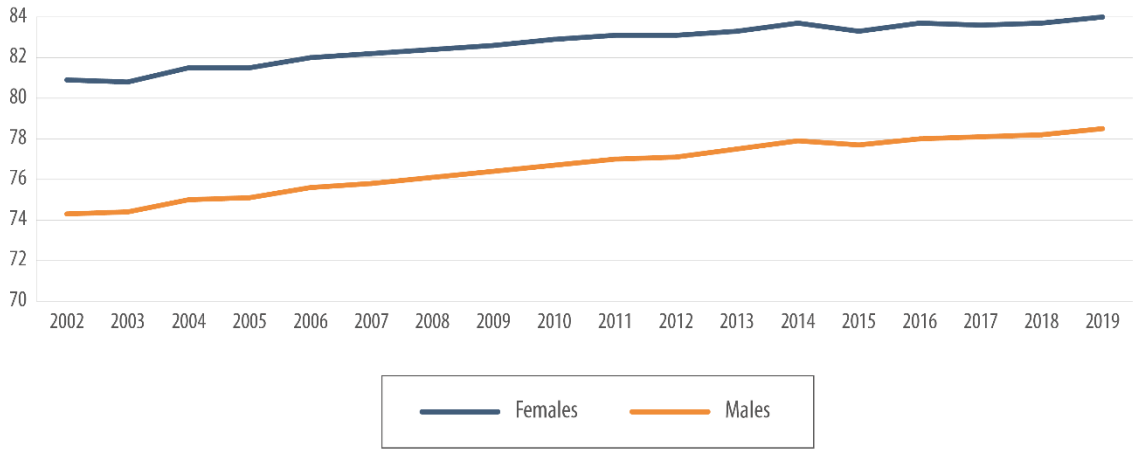
[20] Health at a Glance: Europe, OECD/European Union, 2020.

[21] Eurostat, demo_mlexpec (no EU data for 2020).

[22] Eurostat, demo_mlexpec.

probably due to the Covid-19 pandemic. The largest decreases were recorded in Spain (-1.6 years compared with 2019) and Bulgaria (-1.5), followed by Lithuania, Poland and Romania (all -1.4). According to these data, men were slightly more affected by this decrease.

Figure 4 – Life expectancy at birth in the EU-27, between 2002 and 2019



Data source: Eurostat, demo_mlexpec.

Taking a look at data from UNDESA's World Population Prospects 2019,[23] life expectancy has risen dramatically since the 1960-1965 period. Concerning overall life expectancy at birth, figures stood at 69.86 in 1960-1965, women's life expectancy was 72.4 years and equivalent figures for men were at 67.0 years. Today therefore, people live more than a decade longer than 60 years ago.

As briefly mentioned above, women have a greater life expectancy than men. This gap is a worldwide phenomenon,[24] indicating that gender-specific characteristics, biological as well as behavioural, social and life circumstances, have an influence. Life expectancy also varies significantly between EU Member States today. Women born in the 1960-1965 period started out with approximately 72 years of life expectancy in all EU Member States.[25]

Life expectancy is expected to grow further. According to Eurostat, it is projected that there will be close to half a million people aged 100 years or older in the EU-27 by 2050[26]. UNDESA data suggest that life expectancy in the EU-27 will exceed 85 years during the 2045-2050 period and 90 years during the 2095-2100 period.

While the indicator of life expectancy measures the purely quantitative length of life, the indicator of healthy life years[27] (also called disability-free life expectancy) estimates the years spent in a healthy state. In 2019,[28] the number of healthy life years at birth was estimated at 64.6 years on

[23] World Population Prospects: The 2019 Revision is the 26th round of official United Nations population estimates and projections prepared by the Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat. Please note that these data are for the EU-28.

[24] Ostan R. et al.,'Gender, aging and longevity in humans: an update of an intriguing/neglected scenario paving the way to a gender-specific medicine', Clinical Science, Vol. 130(19), 2016, pp. 1711-1725.

[25] More information about life expectancy, including life expectancy for later age brackets, can be found in the earlier editions of the Demographic Outlook for the EU.

[26] Eurostat, Ageing Europe – Statistics on population developments.

[27] Eurostat, Healthy life years.

[28] Latest data available.

average in the EU-27, amounting to 65.1 years for women and 64.2 years for men, representing about 77.5 % and 81.8 % of the total life expectancy for women and men.[29] Compared to 2004, when first data were available, this means an increase of 1.7 years on average, 1.4 years for women and 2.2 years for men.[30]

2.1.5. Low fertility rates

Fertility rates

The **total fertility rate** is defined as the mean number of children who would be born to a woman during her lifetime, if she were to spend her childbearing years conforming to the age-specific fertility rates that have been measured in a given year.

Source: Eurostat, Fertility.

According to Eurostat statistics, in 2019 there were 1.53 live births per woman in the EU. This is a decrease of 0.1 compared to 2018. Figures range from 1.14 in Malta (1.23 in 2018) to 1.86 in France (1.88 in 2018). The average age of women at the birth of their first child in the EU in 2018 was 29.4 years (an increase of 0.1 years compared to 2018), ranging from 26.3 in Bulgaria to 31.3 in Italy.[31]

Fertility rates have been declining in the EU-27 since the mid-1960s. The EU-27 as a whole had a total fertility rate above 2.1 live births per woman until the mid-1970s, ranging from 3.78 in Ireland to 1.98 in Estonia.[32] Rates declined in the following decades, then saw a modest recovery, reaching 1.47 in 2005 before climbing to 1.57 in 2010. Total fertility rates for the EU-27 have since fallen back slightly, dipping to 1.51 in 2013; they currently stand at 1.53 (according to the latest data from 2019).

Total fertility rates in the world as a whole have also been on a generally declining trend, albeit from a much higher starting point of around five live births per woman in 1960. They fell below four in 1977 and to under three by 1993, and currently (2018) stand at 2.41.[33]

[29] Eurostat, HLTH_HLYE.

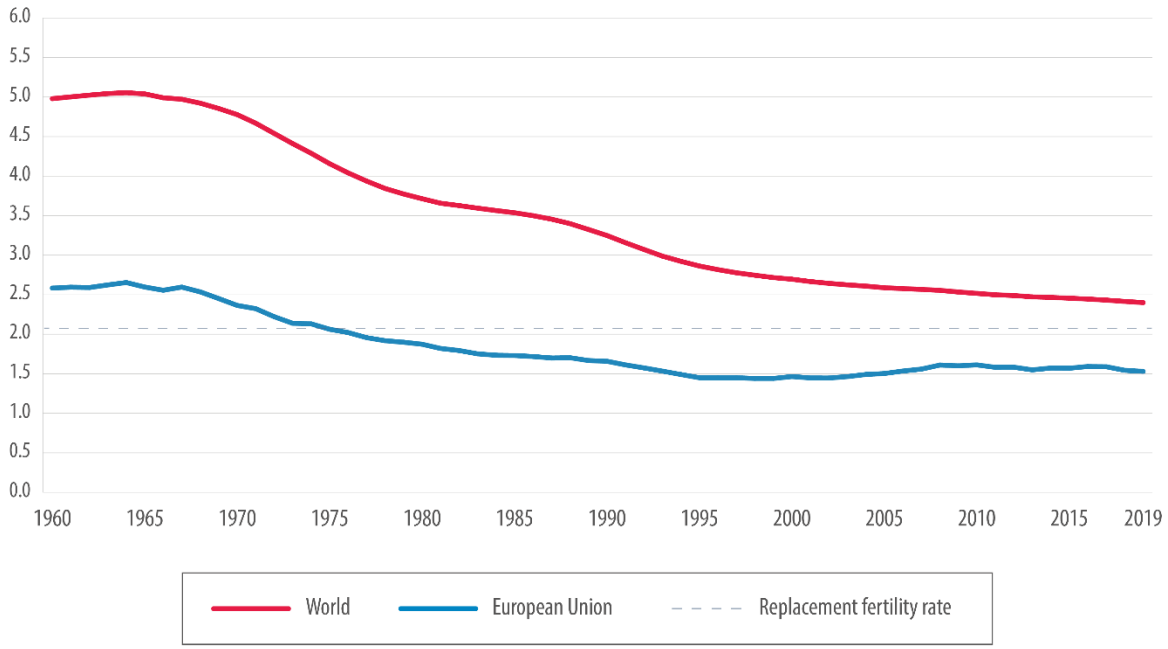
[30] Considering that, in 2020, a decrease in life expectancy could be observed in most Member States, it is likely that the healthy life years indicator will also show a decrease for the same period, once available.

[31] Eurostat, Fertility statistics.

[32] Eurostat statistics TPS00199.

[33] World Bank data.

Figure 5 – Total fertility rate (live births per woman)



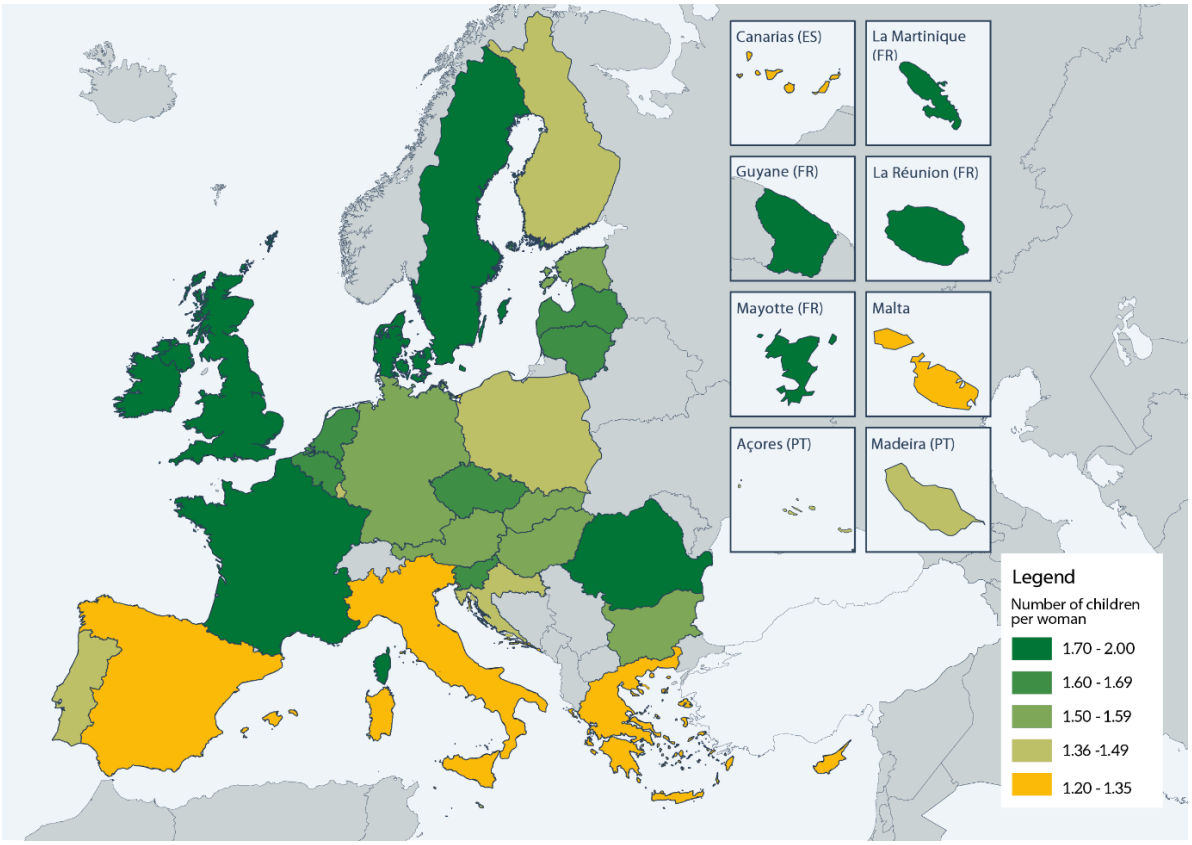
Data source: Eurostat, TPS00199, demo_find, Word Bank World Development Indicators data.[34]

As already mentioned above, considerable variations in fertility rates are apparent at Member State level (see Map 1 below): France (at 1.86) had the highest total fertility rate in 2019, while Malta had the lowest (at 1.14). Other Member States with relatively high fertility rates included Romania (1.77, ascending trend), as well as Sweden and Ireland (both 1.71, descending trend). At the other end of the scale, with Malta, were Spain (1.23, decreasing), Italy (1.27, decreasing) and Cyprus (1.33, increasing).[35]

[34] 1) United Nations Population Division: World Population Prospects Report; 2) census reports and other statistical publications from national statistical offices; 3) Eurostat: demographic statistics; 4) United Nations Statistical Division: Population and Vital Statistics Report (various years); 5) US Census Bureau: international database; and 6) Secretariat of the Pacific Community: Statistics and Demography Programme.

[35] More information about fertility rates and births in the EU can be found in the earlier editions of the Demographic Outlook for the EU.

Map 1 – Total fertility rates in the EU-27, 2019



Data source: Eurostat, TPS00199, demo_find.

In terms of number of live births, during the 1961-2019 period, the highest annual total in the EU-27 was recorded in 1964, at 6.79 million. By contrast, in 2020 there were 4.05 million live births – 100 thousand less than in 2019 and less than two thirds of the 1964 peak – despite the EU-27 population having grown in the meantime by around one quarter, from 367.35 million people in 1964 to 447.7 million people in 2020.[36]

Based on available data from the United Nations Population Fund (UNFPA), a short-term decline in births could be observed during the first year of the pandemic; however, this was followed by a recovery. UNFPA concludes that this decline has been more short-lived than in the case of former crises.[37]

Concerning deaths, 5.19 million people died in the EU-27 in 2020. This is more than half a million more than in 2019 (4.65 million deaths). This significant increase was due most probably to the Covid-19 pandemic, as in the previous years mortality in the EU was relatively stable (4.66 million deaths in 2017, 4.69 million in 2018 and 4.65 million in 2019). The countries with the highest proportional increase (almost 20 %) are Italy (746 thousand deaths in 2020 from 643 thousand in 2019) and Spain (491 thousand in 2020 compared to 416 thousand in 2019).

[36] All figures from Eurostat, Population change – Demographic balance and crude rates at national level, demo_gind.

[37] How will the Covid-19 pandemic affect births?, Technical brief, UNFPA.

If we crosscut this with live births[38] (see above), there is a total reduction of the EU-27 population by 1.15 million in 2020. Compared to figures in 2019 (reduction of the EU-27 population by 0.5 million people) the EU-27 lost 0.65 million more people in 2020 than in 2019, which is a great difference within a year. This is most probably due to the Covid-19 pandemic.

2.2. The implications of Covid-19 on demography

The questions of how the Covid-19 pandemic has impacted the EU-27's demographic patterns and what possible consequences the pandemic could have on long-term population dynamics have been examined since the outbreak of the pandemic. A briefing[39] by Population Europe highlighted that countries with high proportions of older people showed higher mortality rates, but this is not the only factor that matters: other vulnerabilities, such as level of education, socio-economic status, living and housing arrangements, pre-existing conditions and comorbidities also influence Covid-19-related mortality statistics.

As of March 2020, the number of deaths due to Covid-19 started to rise rapidly in the EU-27, compared to the average mortality of previous years.[40] In 2020, a first peak of excess mortality could be observed in April (25 % more deaths than during the same month of the previous year),[41] but it was not evenly spread across the EU-27. Member States with the highest values were Spain (78.9 % higher), Belgium (73.9 %) and the Netherlands (53.6 %). During the summer period, from May to July 2020, excess mortality diminished in the EU as a whole. At the end of summer 2020, another peak in excess mortality began, reaching 40.0 % in November (the highest rate for the whole of 2020). This second peak was prevalent in eastern Europe, with the highest values reached in Poland (97.2 %), Bulgaria (94.5 %) and Slovenia (91.4 %), countries that showed a much flatter curve during spring. In December 2020, a slight decrease started, lasting until March 2021.

In 2021, similar tendencies could be observed: excess mortality peaked again in April (21.0 %) then decreased again until the middle of the summer, with a minimum of 5.6 % in July. During summer 2021, the downward trend reversed and the EU rate increased again to reach 12.7 % in September. In the autumn, there was a new rebound, with the EU excess mortality rate reaching 17.7 % in October and 26.5 % in November 2021, with variations between -0.5 % in Sweden and 3.9 % in Italy to 83.9 % in Romania and 88.2 % in Bulgaria.[42]

[38] Figures obtained by calculating the difference between live births and deaths.

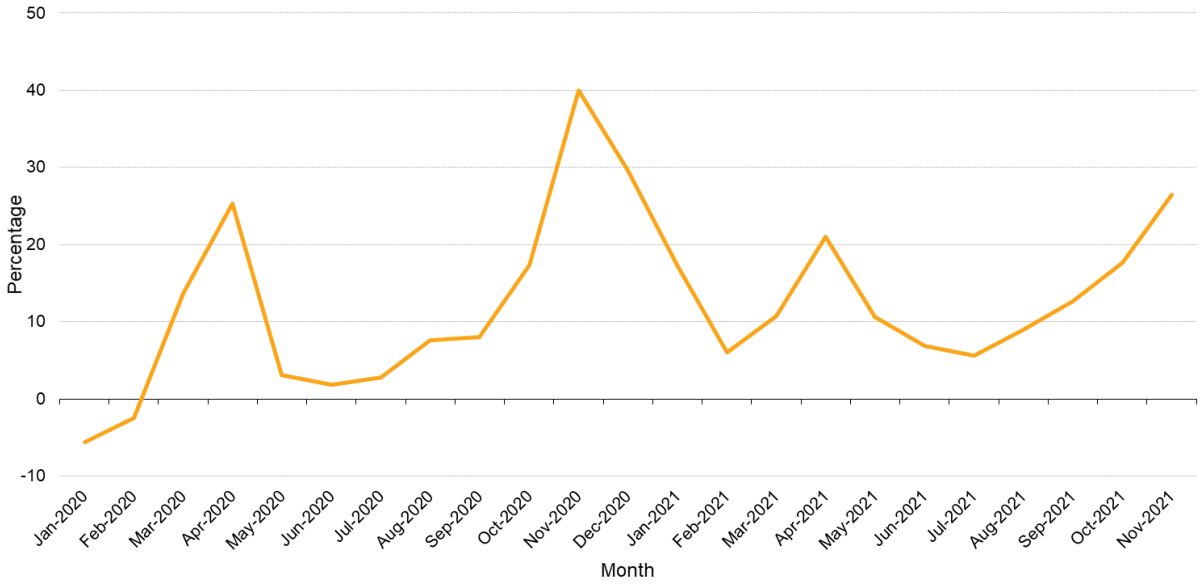
[39] Demography and the Coronavirus Pandemic, Population Europe, 2020.

[40] In 2020, responding to the demand for timely data on the health crisis, Eurostat set up the 'excess mortality' indicator, for Member States of the EU and the European Free Trade Association (EFTA). Excess mortality is expressed as the percentage rate of additional deaths in a month, compared with a 'baseline' in a period not yet affected by the pandemic. The baseline adopted consists of the average number of deaths that occurred in each of the 12 months during the period 2016-2019.

[41] Eurostat, Excess mortality in 2020.

[42] Eurostat, Excess mortality in 2021.

Figure 6 – Monthly excess mortality in the EU



Source: Eurostat, Monthly excess mortality in the EU.

As already mentioned in subchapter 2.1.4., provisional estimates by Eurostat[43] show that life expectancy in 2020 decreased by more than 1 year in the vast majority of Member States compared to 2019, most probably due to the Covid-19 pandemic.

Concerning the influence of the pandemic on fertility rates, different tendencies can be observed during the lockdown periods. As a general tendency, because of the economic and psychological uncertainty caused by the pandemic, people of childbearing age were and are less likely to have children. Increasing unemployment rates[44] during the pandemic also led to a postponement of childbirth, and access to in-vitro fertilisation procedures was lower.

An increasing delay in the childbearing age of women (in other words, the fact that the desired childbirth is postponed) could already be observed before the outbreak of Covid-19. The pandemic contributed further to this delay, which could lead in the future to the birth of fewer children than initially planned.

According to Eurostat and the Employment and Social Developments Quarterly Review of the European Commission, due to the Covid-19 pandemic and related confinement measures the employment rate in the EU went down from 73.1 % in 2019 to 72 % in the second quarter of 2020, the strongest decline since 2000. Most impacted were young people (their employment decreased from 33.3 % to 31.2 % during the same period). A policy brief by the Commission's Joint Research Centre[45] highlights that, in almost all EU countries, women and young workers were and are more represented in the sectors that were forcibly closed, which reinforces the tendency of postponing childbirth.

Employment figures in 2021 were more positive.[46] As massive vaccination campaigns started all around the world in 2021, the situation began to improve gradually as of the first quarter of 2021. In the second quarter of 2021, the share of employed people in the total population aged 20 to 64

43 Eurostat, demo_mlexpec.

44 Living, working and Covid-19, Eurofound, September 2020.

45 The Covid-19 confinement measures and EU labour markets, Joint Research Centre, 2020.

46 Labour market in the light of the Covid-19 pandemic – quarterly statistics, European Commission, 2021.

again reached 72.8 %, just slightly less than before the pandemic. The EU unemployment rate was 6.4 % in December 2021, down from 7.5 % in December 2020.[47]

Population increase by migration diminished radically due to the closing of the international borders. There was a decrease of 33 % in asylum applications in 2020 and they were also handled considerably more slowly. The number of illegal border crossings decreased by 10 % in 2020.[48]

2.3. Demography in EU policies

Policies to modify future demographic trends are limited and take time to produce an impact. A group of Member State policies and incentives intended to tackle the problem of ageing demographics focuses on encouraging people to have, or to have more, children through better support for families, or by offering better childcare facilities. Another group of incentives encourages young people from third countries with sought-after skills to migrate to the EU. Still other programmes focus on keeping workers longer in the labour market by modifying pension systems and by providing older workers with skills needed in a changing labour market, including digital skills. Welfare policies contributing to healthy ageing can also serve this purpose.

At EU level, demography is an important topic for the von der Leyen Commission: a Commissioner for Democracy and Demography has been nominated in the person of Dubravka Suica and demography is part of the work programme of the Commission published in January 2020, under the sixth priority – 'A New Push for European Democracy'. On 17 June 2020, the Commission published the report on the impact of demographic change.[49] It presents the main drivers of demographic change and the impact they have across Europe. Its aim is to identify concrete actions and solutions, bearing in mind the first lessons learned from the Covid-19 pandemic, to support people, regions and communities that are most affected and to enable them to adapt to changing realities. Based on the latest figures and projections from Eurostat, it addresses the following issues:

- the drivers of demographic change in Europe (longer life expectancy; fewer live births; an ageing population; smaller households; a more mobile Europe; a changing population size);
- the impact of demographic change on the social market economy of the EU (skills and education issues; a larger and more inclusive labour market; health- and long-term care; public budgets; the regional and local dimension; life quality and access to services);
- the twin transitions (environmental and digital) and demographic change;
- geopolitical questions, Europe in the world.

The report identifies the following challenges for the future:

- a shrinking working-age population;
- the necessity of a higher age-related public spending;
- a rapid population change in certain regions necessitating new solutions;
- the impact of demographic change on Europe's position in the world;
- the interactions between demographic change and the green and digital transitions.

The findings of the report show that there is no one-size-fits-all approach. Policymaking needs to take into account local realities. Member States and regions will have an important role in responding to demographic change for the benefit the whole EU. The long-term vision for the EU's

[47] Eurostat, Unemployment statistics, 2021.

[48] Migration statistics update – the impact of Covid-19, European Commission, 2021.

[49] Report on the impact of demographic change, European Commission, June 2020.

rural areas[50] put forward by the Commission on 30 June 2021 identifies – based on foresight and wide consultations with citizens and other actors in rural areas – challenges and concerns that rural areas are facing, and stresses some of the most promising opportunities available for these regions.

The Commission's green paper on ageing, adopted on 27 January 2021,[51] is the first outcome of this report and launches a debate on one of the defining demographic transformations in Europe. The paper highlights the importance of healthy and active ageing and of lifelong learning as the two concepts that can enable a thriving ageing society. Active ageing necessitates promoting healthy lifestyles throughout our lives, including consumption and nutrition patterns, as well as encouraging physical and social activity. Lifelong learning means constantly acquiring and updating skills to help people remain employable and succeed in job transitions. To tackle the problem of a shrinking working age population, the EU and the Member States should increase the activity rate at all ages and promote policies enhancing gender equality and inclusiveness on the labour market, as well as enabling longer working lives and improving productivity. The potential of less developed regions should also be increased. To bring more people in the 55-64 age group onto the labour market, it might be useful to postpone retirements, improve working conditions for older workers (for instance, through better digital connectivity), or give subsidies to companies hiring older workers and encourage senior entrepreneurship. The paper also raises the importance of improving wellbeing through intergenerational solidarity.

The Atlas of Demography, launched on 29 April 2021, is a new interactive tool from the European Commission. It brings together demographic data from official statistics and projections as well as new data produced by the Joint Research Centre (JRC). The Atlas helps EU citizens to better understand how demographic change is shaping the future of Europe. It contains data according to geographic areas, from an EU overview to the national, regional and local dimensions, and also allows readers to look at specific themes, which are presented as 'stories'.[52]

In addition to these publications directly related to demography, demographic aspects – such as a shrinking population, or the decreasing number of people of working age – which can lead to shortages on the labour market is indirectly taken into account in several proposals by the European Commission related to employment or regional aspects.[53]

3. Towards a digital transformation

A digital revolution is transforming the world as we know it at unprecedented speed. Digital technologies have changed the way businesses operate, how people connect and exchange information, and how they interact with the public and private sectors.

For decades, Europe's societies and economies have been experiencing a radical digital transformation, fostered by 'digitalisation' and the speeding up of many kinds of interaction through the increasing number of connected devices and data flows.[54] According to Frost & Sullivan, the number of connected devices globally might increase from 30.4 billion in 2020 to 200 billion in 2030.

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50 A long-term Vision for the EU's Rural Areas - Towards stronger, connected, resilient and prosperous rural areas by 2040 European Commission, June 2021.

51 Green paper on ageing, European Commission, January 2021.

52 Atlas of Demography, European Commission, 2021.

53 See concrete examples in the following chapters.

54 World Economic Forum, 4 key areas where AI and IoT are being combined, 2021.

Increased connectivity of objects, places and people will result in new products, services, business models, and life and work patterns in a changing world. The digital transformation is becoming an increasingly important condition for modern economies to thrive and has the potential to affect many sectors of the economy (including transport, energy, agri-food, telecommunications, financial services, factory production and health care) and to transform people's lives. The impact differs, however, between demographic groups, as we will see in the following chapters.

Digital transformation covers both the integration of digital technologies by European enterprises and the impact on society of such new technologies,[55] such as the Internet of Things (IoT), cloud computing, innovative digital platforms and blockchain technologies. According to the OECD,[56] the greater computing power of consumer devices, which are available at ever more affordable prices, is accelerating this transformation. Furthermore, artificial intelligence (AI) and advanced robotics are viewed as an important manifestation of the digital transformation, with a profound impact throughout society – including on productivity, employment, education, business models and delivery of public services.

On a societal level, digital technologies have the potential to improve our living standards, life expectancy and quality of life. It is also widely agreed that such technologies contribute positively to productivity and economic growth. For instance, the World Economic Forum[57] estimates that the combined global value of digital transformation to society and industry will exceed US$100 trillion[58] by 2025. There is a growing awareness among EU citizens that digital technologies play an important role in their daily lives. However, they also bring new challenges. The Covid-19 pandemic has shown even further the importance that digital technologies can have in confinement, lockdowns and other social distancing restrictions for continuing operations in our everyday lives, for both young and elderly users. This will also be described later on in this study.

Looking at prospective demographic trends, this technological dependency is expected to continue: according to a 2021 Eurobarometer,[59] more than 80 % of EU citizens think that the use of digital tools and the internet by 2030 will be important in their lives, and they will bring at least as many advantages as disadvantages to them. Only a small minority (12 %) expects more disadvantages than advantages from them. There are also differences according to demographic groups: this feeling is considerably stronger among young people, who find more advantages to them as they are also intense internet users. Younger users aged 18-24 are more likely (57 %) to expect digital tools and the internet to bring them more advantages than disadvantages than those aged 25-39 (50 %), those aged 40-54 (44 %), and substantially more than those aged 55 and over (30 %). Likewise, young internet users are twice as likely to worry about the difficulty of disconnecting and finding a good online/offline life balance than those aged 55 and over. The youngest age group is also more likely (28 %) to worry about the environmental impact of digital products and services, than those aged 55 and over (20 %).

According to Eurostat,[60] in 2021 the most active internet users were young individuals (97 % of those aged between 16 and 24 are regular internet users), those with a high level of formal education (97 %) and students (98 %). They are also more prone to do online shopping, as shown below: 78 %

55 The rise of digital health technologies during the pandemic, Negreiro M., EPRS, 2021.

56 Going Digital Project, OECD, 2020.

57 Digital Transformation Initiative, World Economic Forum.

58 About €895 900 billion.

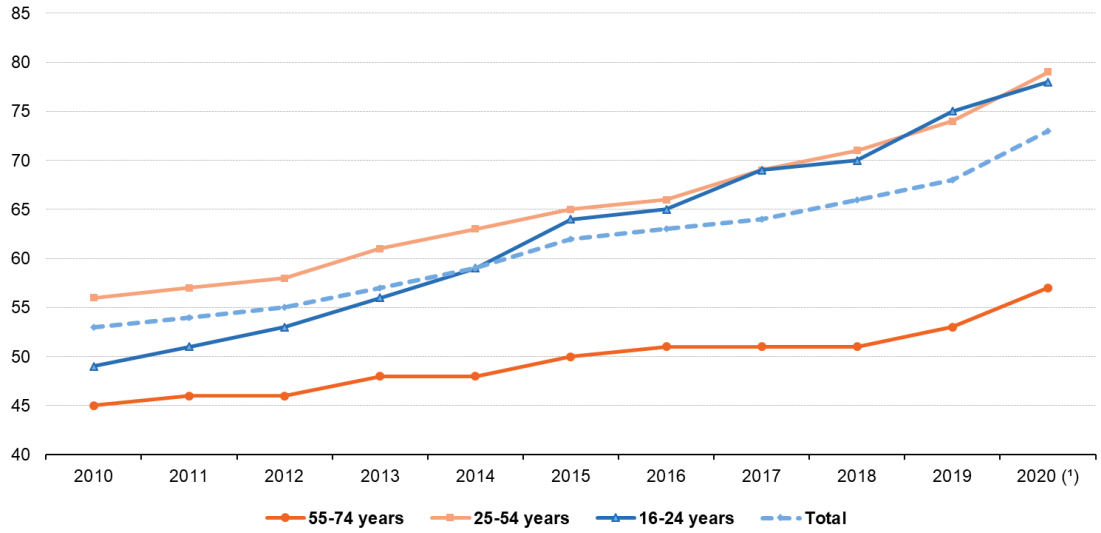
59 Eurobarometer: Europeans show support for digital principles, European Commission, December 2021.

60 Eurostat, ISOC_CI_IFP_FU.

of 16-24 year-olds shopped online in 2020, while the proportion of internet users with a higher level of education shopping online (85 %) is 35 percentage points higher than those with a lower level of formal education.

Figure 7 – Internet users who bought or ordered goods or services for private use in the previous 12 months by age group, EU, 2010-2020

(% of individuals who used the internet in the previous 12 months)



(1) EU-27 estimates for 2020

Data source: Eurostat, isoc_ec_ibuy.

Thus, overall, while 73 % of internet users in the EU shopped online in 2020 (over double from 32 % in 2009), most of them were in the younger age groups and better educated, who happened also to be more digitally competent. According to Eurostat, they shop online for – among the most popular items – clothes, sports goods, travel, and online content such as games, videos and music. This trend is also driven by the increase in cashless payments,[61] which have become very popular in some countries. One such example, the digital wallet, is gaining particular importance, and will continue growing. A new study from Juniper Research[62] estimates, for instance, that the number of unique digital wallet users will surpass 4.4 billion globally in 2025, almost twice the 2.6 billion in 2020.

Not all consumers and businesses in Europe might benefit from the digital transformation though, given the current and future digital divide between urban and rural areas and across EU countries and demographic groups.

According to the OECD, the term 'digital divide'[63] refers to the gap between individuals, households, businesses and geographic areas at different socio-economic levels with regard to both their opportunities to access digital technologies and to their use of the internet for a wide variety of activities. To use them adequately, they also need to be digitally literate, with basic e-skills, and ideally digitally competent to enable enhanced use of digital technologies.

61 The rise of e-commerce and the cashless society, Negreiro M., EPRS, 2020.

62 Digital wallet users to exceed 4.4 billion by 2025, as mobile drives digital payment's revolution, Juniper Research, 2021.

63 Glossary of statistical terms, OECD.

According to an EU recommendation on lifelong learning,[64] 'digital competence' involves the confident, critical and responsible use of, and engagement with, digital technologies for learning, at work, and for participation in society. It includes information and data literacy, communication and collaboration, media literacy, digital content creation (including programming), safety (including digital well-being and competences related to cybersecurity), intellectual property related questions, problem solving and critical thinking.

3.1. State of play and impacts

There is little doubt the digital transformation brings opportunities to the EU's economy, including:

Increased productivity and jobs: Investments in ICT account for 50 % of European productivity growth.[65] Supporting high-growth start-ups and firms scaling up brings innovation and employment benefits, as these companies typically create new jobs.[66] Likewise, in recent years, new markets, such as the app economy,[67] have brought with them new work opportunities. Many more jobs could be created: according to the Commission[68] there are more than 350 000 vacancies in Europe for highly skilled technical experts in areas such as artificial intelligence, data analytics and cybersecurity. It terms of other economic gains, The World Economic Forum[69] estimates that the combined global value of digital transformation to society and industry will exceed US$100 trillion[70] by 2025. The combined economic impact of the automation of knowledge, work, robots and autonomous vehicles is estimated to reach between €6.5 trillion and €12 trillion annually by 2025, including gains in productivity and benefits in areas such as healthcare and security. Nevertheless, such changes, and their speed, can disrupt existing industries, with new business models, and also governments, obliged to review existing frameworks to embrace digital transformation.

According to a study[71] ordered by the Commission on this issue, by 2030 the cumulative additional GDP contribution could amount to €2.2 trillion in the EU (equivalent to the 2019 combined GDP of Spain and the Netherlands). For instance, digital health solutions in Germany and France alone could bring savings of €55 billion.

Similarly, McKinsey & Company see that an increasing amount of 'digital ecosystems' could account for more than US$60 trillion[72] in revenue by 2025, about 30 % of all global corporate revenue. In fact, in 2021 tech stocks have continued to rise in the US.[73] Yet, of the world's top 100 internet firms in 2021,[74] only four are from the EU – Otto group (DE), Spotify (SE), Zalando (DE) and Coldblue (NE). The top 15 are from either the United States or China.

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64 Council Recommendation of 22 May 2018 on key competences for lifelong learning, Council of the European Union, May 2018.

65 The ICT sector represents 4.8% of the European economy, Horizon 2020, European Commission.

66 EU start-up calculator: impact of Covid-19 on employment, European Commission.

67 European app economy – State of play, challenges and EU policy, Szczepanski M., EPRS, 2018.

68 Proposal for a regulation of the European Parliament and the Council establishing the Digital Europe Programme for the period 2021-2027, European Commission, June 2018.

69 Shaping the Future of Digital Economy and New Value Creation, World Economic Forum.

70 About €895 900 billion.

71 Shaping the digital transformation in Europe, European Commission, 2020.

72 About €537 900 billion.

73 Top 10 S&P 500 Stocks by Index Weight, Investopedia, 2021.

74 List of largest Internet companies, Wikipedia, 2021.

At the same time, the average lifespan for traditional companies is declining and they need to benefit from the emerging digital disruption to survive. For instance, from technologies such as 5G networks, which, according to Juniper Research, are expected to generate more than US$600 billion[75] in new business by 2026,[76] or from the distributed 'edge' computing technology, which is expected to more than triple between 2019 and 2024, to US$9 billion.[77]

Increased efficiencies: According to the Commission, digital transformation helps traditional (non digital-intensive) industries to produce new goods in a more resource-efficient way, and allows public authorities to deliver better, faster and cheaper services. The use of artificial intelligence in different technological solutions and sectors can lead, for example, to fewer fatalities on roads, better management of the pandemic, smarter use of resources such as energy and water, less pesticide use on farms, and a more competitive manufacturing sector.

Empowerment: Digital technologies are empowering us with increasing amounts of data and information that are transforming the way we shop, travel, work, learn, communicate, get entertainment and generally deal with anyone, even more since the pandemic started, as shown in the next section. However, not everybody is being empowered in the same manner, as there are differences according to levels of digital competence and different demographic groups.

Against this background, the EU has been making efforts to help enterprises and citizens embrace these changes, and benefit from the creation and deepening of the digital single market (DSM),[78] which dates back to the mid-1990s, when the liberalisation of the telecoms market started in Europe. European businesses and citizens alike need an adequate policy framework and appropriate skills and infrastructure to capture the enormous value created by the digital economy and make a success of the digital transformation. The EU's current digital strategy[79] aims to make digital transformation work for people and businesses, while helping to achieve its target of a climate-neutral Europe by 2050. The Commission has identified four main areas for action in its new strategy:

1. achieve a digitally-skilled population and highly-skilled digital professionals;
2. implement secure and performant sustainable digital infrastructures;
3. achieve the digital transformation of businesses; and
4. achieve the digitalisation of public services.

To achieve these aims, Member States have committed to spending at least 20 % of their national endowments from the Recovery and Resilience Facility on digital technologies. In fact, about 15 % of digital investments in the Recovery and Resilience Plans[80] adopted by the Council (close to €18 billion out of a total of €117 billion), are dedicated to digital capacities and digital research and development.[81]

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75 About €538 billion.

76 5G Monetisation: business models, strategic recommendations & market forecasts 2021-2026, Juniper Research, 2021.

77 About €8.07 billion.

78 Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: a Digital Single Market Strategy for Europe, European Commission, 2015.

79 A Europe fit for the digital age, European Commission.

80 The Recovery and Resilience Facility, European Commission.

81 Digital Economy and Society Index 2021: overall progress in digital transition but need for new EU-wide efforts, European Commission.

According to an EC study,[82] Member States and the EU will need to contribute approximately €75 billion per year for ICT investment in the next decade, and €42 billion per year to educate, upskill and reskill the labour force to manage the digital transition.

Even though all EU Member States have made progress on the yearly digital indicators measured by the Commission (i.e. the Digital Economy and Society Index – DESI), the gap between the EU's frontrunners and those with the lowest DESI scores remains large, also according to demographic groups. Yet all Member States will need to make efforts to meet the new 2030 targets as set out in Europe's Digital Decade.[83] Below we look into the state of play of the four main dimensions.

3.2. Connectivity

The 2030 digital strategy[84] set the target that gigabit networks should be available to all by 2030. According to the data from 2020 in the DESI 2021[85] exercise, about 60 % of households can benefit from fixed very high capacity network connectivity with the potential of offering gigabit connectivity. In rural areas it has also improved – from 22 % in 2019 to 28 % in 2020 – but a large gap and digital divide between rural and national figures remains. Likewise, by 2030, the EU aims for all populated areas to have 5G coverage. A precondition for the commercial launch of 5G is the assignment of 5G spectrum in every country. By January 2022,[86] a majority of Member States had assigned some of the 5G pioneer bands and there had been commercial 5G launches in all EU countries. All deployments to date in the Member States cover major cities and urban areas, so rural areas are at risk from a digital divide. In addition, only 17 of 27 Member States are involved in the existing 12 5G cross-border corridors. Thus, there has to be more participation to achieve the 5G action plan targets by 2025. According to a recent study[87] and to the Commission, only 11 Member States are likely to achieve uninterrupted 5G coverage in all their urban areas and along major terrestrial transport paths by 2025.

3.3. Human capital

While 84 % of people used the internet regularly in 2019, only 56 %[88] had at least basic digital skills in that same year. This indicator has not changed much since 2015. This is still far from the digital skills target, which aims for at least 80 % of EU citizens to have basic digital skills by 2030.

Looking into demographic breakdowns, skills indicators are strongly influenced by socio-demographic aspects. For example, 82 % of young individuals (16-24), 85 % of those with a high level of formal education, 68 % of employed or self-employed people and 87 % of students have at least basic digital skills. By contrast, only 35 % of those aged 55-74 and 30 % of retired and inactive people possess basic skills. There is a need to avoid the risk of a digital divide in these groups. Likewise, given that 55 % of enterprises reported difficulties in recruiting ICT specialists in 2020, this

82 Shaping the digital transformation in Europe, European Commission, 2020.

83 Europe's Digital Decade: digital targets for 2030, European Commission.

84 Proposal for a Decision of the European Parliament and of the Council establishing the 2030 Policy Programme 'Path to the Digital Decade', 2021.

85 Broadband Connectivity in the Digital Economy and Society Index, DESI, 2021.

86 5G Observatory Quarterly Report 14 Up to January 2022, European Commission, 2022.

87 5G roll-out in the EU: delays in deployment of networks with security issues remaining unresolved, European Court of Auditors, 2022.

88 2019 was the latest measurement year available for this Eurostat indicator.

is also a contributing factor towards the slower digital transformation of businesses, especially in SMES, in many Member States.

Looking at trends in regular internet use, country-specific differences remain. In six Member States – Denmark, Sweden, Luxembourg, Finland, Ireland, and the Netherlands – regular use of the internet is prevalent, with more than 95 % of users being regular internet users, while in others the share of regular internet users falls to about three quarters of internet users (74 % in Bulgaria and 77 % in Greece). Moreover, the proportion of the EU's population that had never used the Internet was 8 % in 2021, though this has improved substantially in the last decade (from 26 % in 2011). When it comes to older people (55-74 years old) and those with lower levels of education, the proportion doubles to about 20 % in 2021.

3.4. Integration of digital technology

The aim of the EU's current target is that, by 2030, at least 90 % of SMEs in the EU should use digital technologies in their enterprise; in 2020, only 60 % of SMEs had adopted digital technologies. There are again wide disparities between countries: Denmark and Finland are already very close to the EU target with 88 %, while Bulgaria and Romania are falling behind (33 %).

The second target for the next 10 years is that at least 75 % of companies should use advanced digital technologies such as AI, cloud and big data technologies by 2030. The DESI 2021 analysis demonstrates that, while businesses are becoming more and more digitalised, the use of advanced digital technologies remains low, especially for SMEs. For instance, only one in four companies use AI or cloud computing and only 14 % use big data, with large enterprises leading the way in use of these digital technologies. The EU's ambition for 2030 is that 90 % of SMEs have at least a basic level of digital intensity, as opposed to the baseline of 60 % in 2020, and that at least 75 % of enterprises overall use advanced digital technologies in 2030.

3.5. Public services

According to DESI 2021, any major improvement in e-government services does not yet show in the data on digital public services despite the boost that the pandemic might have given it. During the first year of the pandemic, several Member States implemented improved or new digital platforms to provide more public services online, and there are increasing amounts of EU funds to support this: 37 % of investments in digital in the Recovery and Resilience Plans[89] that have been adopted by the Council (approximately €43 billion out of a total of €117 billion) are actually meant to be dedicated to digital public services, so significant improvements are expected in the coming years.

A study by McKinsey[90] has found that the pandemic has accelerated digitalisation by 7 years globally, boosting, among other things, the digitalisation of government services. Yet the Covid-19 pandemic has made it more difficult for those demographic groups without the necessary digital knowledge or equipment to access public services that are offered online. Affordability also remains a key constraint according to Eurostat.[91]

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89 The Recovery and Resilience Facility, European Commission.

90 How Covid-19 has pushed companies over the technology tipping point – and transformed business forever, McKinsey, 2020.

91 Protecting Fundamental Rights in the Digital Age – 2021 Annual Report on the Application of the EU Charter of Fundamental Rights, European Commission, December 2021.

Likewise, the Commission's eGovernment Benchmark 2021[92] highlights that the pandemic has accelerated change but only in some areas of digital public services. In terms of usage, according to Eurostat, in 2020 64 % of internet users interacted with public administration online, compared to 58 % in 2015. This is still far from the target of getting 80 % of citizens using them by 2030.

There is also the need to make sure that public services online are accessible to people with disabilities. The new telecoms legislation entitled the European Electronic Communications Code ensures equivalent access to and choice of electronic communications services for end-users with disabilities, facilitating their participation in the digital society.[93] In addition, the European Accessibility Act that will come into effect in 2025[94] will expand the inclusion of people with disabilities and older people in the digital world by making a set of key products and services from both the private and public sector more accessible.

3.6. The Covid-19 pandemic and its impact on the development of digital technologies

3.6.1. The impact of Covid-19 on digital transformation

The coronavirus pandemic is bringing an unforeseen acceleration in the digital transformation of societies around the world. This is the first pandemic in history in which digital technologies are being used on a massive scale to keep people connected while in isolation, allowing them to telework, follow online courses, shop online or consult health professionals from home. As a result, internet traffic has increased substantially since 2020.[95] According to EU Member States' national regulators and BEREC monitoring exercises, operators have so far been able to manage this surge, while also introducing many exceptional measures, such as temporarily removing broadband data caps and making extra data and free online content available.[96]

The current crisis has highlighted the importance that upgraded telecoms networks, including 5G, will have for societies and economies. The scope of contact-tracing apps is likely to expand, and teleworking, telehealth and e-learning are likely to become more prevalent than before.

According to the World Economic Forum,[97] the unprecedented disruption caused by Covid-19 is accelerating the urgency for agility, adaptability and transformation. Industry structures and business models are being disrupted – and the digitalisation of the economy is being rapidly accelerated. For instance, an estimated 70 % of new value created in the economy over the next decade will be based on digitally enabled platform business models. Online sales and the number of online shoppers continue to rise, hitting a record high in 2021. This trend is forecast to continue as younger generations will continue shopping online.[98]

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92 eGovernment benchmark 2021, European Commission, 2021.

93 Proposal for a Directive of the European Parliament and of the Council establishing the European Electronic Communications Code (Recast), European Commission, 2016.

94 Directive (EU) 2019/882 of the European Parliament and of the Council of 17 April 2019 on the accessibility requirements for products and services, 2019.

95 Internet traffic rocketed globally from 2020 to 2021, Stackscale, 2021.

96 BEREC summary report on the status of internet capacity, regulatory and other measures in light of the Covid-19 crisis, BEREC, 2021.

97 Shaping the Future of Digital Economy and New Value Creation, World Economic Forum.

98 E-commerce worldwide, Statista, 2021.

3.6.2. Rise of digital health

When it comes to digital health technologies, coronavirus has accelerated the rise of digital health,[99] a broad concept that includes solutions for telemedicine and teleconsultation, remote monitoring, connected devices, digital health platforms and health apps. The concept also covers the related health data analysis and application in systems based on big data, such as for epidemiological research and AI-enabled diagnosis support.

Digital technologies are becoming critical in the fight against the ongoing pandemic. They have been used, among other things, for online medical consultations from home and for increasing efficiency in diagnosis and treatment of patients through telemedicine, which, like teleworking and online education, has been a novel experience for many. Patients with existing critical illnesses, indisposed to go to hospital because of the risk of contracting the virus, have been able to get online consultations from home and have, in some cases, been monitored remotely. Moreover, thanks to the availability of digital health records and e-prescriptions in many EU countries, it has been possible to issue repeat prescriptions remotely, limiting unnecessary contact between doctors and patients and reducing the chances of exposure to the virus.[100]

Nevertheless, there are many challenges to overcome as advances in digitalisation of healthcare come with drawbacks. They highlight a widening 'digital divide' that risks leaving behind the elderly and socially disadvantaged, who are less able to master or afford the technology. In addition, liability, reimbursement and cybersecurity issues are among the other key challenges that need to be considered, as cyber-attacks on hospitals are on the rise. Meanwhile, the transfer of personal health data is fuelling a debate over who owns and controls that data, raising questions over individuals' rights to privacy[101] and the effectiveness of GDPR.

Thus the digital transformation demands robust, secure and resilient digital network infrastructure. Yet cybersecurity incidents are on the rise, even more since the pandemic started. More than half (56 %) of the EU citizens surveyed expressed their concern about cyber-attacks and cybercrimes in society. In terms of demographic groups, respondents who have higher education (64 %) are more likely to worry about cyber-attacks and cybercrime such as theft or abuse of personal data, ransomware (malicious software) or phishing, than those who finished their education aged 16 to 19 (54 %), and those who went to school until the age of 15 (39 %).[102]

Across the EU, a particular demographic group needs to be protected against cybercrime: children. More than nine in ten (93 %) respondents indicate[103] they should be protected in the online environment, as they are also increasingly targeted and are spending time online from an even younger age.[104]

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99 The rise of digital health technologies during the pandemic, Negreiro M., EPRS, 2021.

100 Richardson E., Aissat D., Williams G. and Fahy, N., Keeping what works: remote consultations during the Covid-19 pandemic, Eurohealth, 2020.

101 Covid-19 ransomware, Europol.

102 IOCTA 2021 reveals the most recent cyber threat (r)evolutions, Europol.

103 Digital rights and principles, Eurobarometer, December 2021.

104 Curbing the surge in online child abuse – The dual role of digital technology in fighting and facilitating its proliferation, Negreiro M., EPRS, 2020.

4. Digital transformation and demography

Even if there are some common changes and challenges for the entire population, such as the increased use of the internet, of digital bank transactions, of healthcare technologies or of e-governance, different demographic groups (for instance, according to age or geographical situation) are affected differently by the digital transformation. As will be visible in the next part of this study, generations[105] have a different way of life and different points of focus – such as playing, studies and peer groups for the youngest ones, finding a job and working, home and family, and leisure activities for the middle generations, and preserving health and connectivity with their loved ones for the older generations – with, of course, numerous overlaps.[106] Consequently, generations encounter different problems related to digital, or, in the case of similar difficulties, their capacity to cope with challenges related to digital technologies might not be the same. This can lead to disadvantages for certain generations, but also for certain geographical groups, not only because of different skills and capabilities, but also due to differences in infrastructure and available resources.

4.1. Digital transformation and young people

Children and young people born after 1996[107] in the EU, sometimes called 'Generation Z' or 'Gen Z', are the first digital natives: they are used to smartphones and tablets, and most have internet access at home.

Demographically, their part in society is shrinking. According to Eurostat (see Table 1), the combined share of children and young people aged 29 and under in the total population of the EU-27 fell from 38.1 % in 1999 (excluding Croatia) to 31.8 % by 2019, and this trend is forecast to continue. Eurostat predicts that, in 2052, the share of children and young people under 29 will be 28.6 %. There are major differences between EU Member States, with Ireland having the highest share of children and young people aged 29 and under (39 %) and Italy the smallest share (28.3 %). In the world as a whole, the share of children and young people aged 29 and under is much higher: 49 % in July 2019.[108]

Table 1 – Share of children and young people in the total EU-27 population (%)

	1999	2009	2019
Children and young people	38.1	34.2	31.8
Children (0-14 years)	17.2	15.4	15.2
Young people (15-29 years)	21.0	18.7	16.6

Data source: Eurostat, Being young today – demographic trends.

[105] According to a United Nations definition, generations are 'specific groups of people with a major characteristic in common. A generation of persons (or cohort) can relate to all the people born at a certain time, who pass through life experiencing changes at the same time, or refer to all persons at a particular stage of their lives at different times' – see Generations and Equity, UNDESA, 2001.

[106] Generations examined in the following subchapters of this study are: 'Generation Z' (those born after 1996), 'Generation Y' or the 'Millennials' (those born between 1981 and 1996), 'Generation X' (those born between 1964 and 1980), the 'Baby Boomers' (the generation born between 1946 and 1964), the 'Silent Generation' (born between 1928 and 1945), and living members of the 'Greatest Generation' (1901-1927). See also Defining generations: Where Millennials end and Generation Z begins, Pew Research Center, 2019.

[107] Milotay N., Next generation or lost generation? Children, young people and the pandemic, EPRS, European Parliament, 2020.

[108] Eurostat, Being young in Europe today – demographic trends, July 2020.

Often young people are ahead of their parents or other older family members in terms of technical competence[109] (such as ICT skills) or time spent on the internet. According to Eurostat, 94 % of those aged between 16 and 29 were daily internet users in 2019, compared to 77 % for the whole population. Many of these young people also have a personal mobile phone.[110] As evidenced by a recent Eurobarometer survey,[111] 99 % of respondents aged 15-24 had a personal mobile phone. Another survey[112] revealed that 7 % of children aged 6-7 years, 27 % of children aged 8-9 years and 54 % of children aged 10-11 years owned a smartphone in 2020 in Germany.

Even very young children regularly use digital devices, such as smartphones, tablets, video-game consoles, laptops and, more rarely, PCs.[113] Usually, the first contact is at a very early age (below 2 years old), through their parents' devices. However, the time spent on digital devices and the content consulted depends on the parenting style (restrictive, permissive). A study done in the Netherlands[114] concludes that young children are more likely to consume educational digital content (and less violent content) when encouraged by parents.

Young people also see more advantages in the use of digital tools than other age groups. According to a 2021 Eurobarometer survey,[115] 96 % of young people (aged 15-24) in the EU think that the use of digital tools and internet by 2030 will be important in their lives (compared to 81 % of all surveyed EU citizens). However, some parents, as seen from a survey done in Germany,[116] believe that children, especially when they are very young, should be protected from digital devices, fearing that these tools may make children too passive.

The most common activities for young people using internet are sending and receiving e-mails, watching internet-streamed TV or video, and participating in social networks. The latter is used also to stay up to date with current affairs.[117] Lastly, Generation Z is more influenced by digital advertising and has more active online shoppers than some other generations: 78 % of 16-24 year-olds shopped online in 2020, compared to 57 % of those aged 55-74 years.[118] As seen from an article on young children's digital literacy practices in Finland,[119] younger children use the internet mostly for watching videos, playing games, making calls to friends and family members, or taking photos.

There are also some differences based on gender or educational level. For example, playing online games is more popular among boys, while girls participate more in social networks by uploading photos or stories. According to an Ofcom survey done in 2021 in the United Kingdom,[120] 78 % of boys aged 5-15 played games online, compared to 64 % of girls at the same age.

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109 Bynner J. and Heinz W., Youth Prospects in the Digital Society: Identities and Inequalities in an Unravelling Europe, Policy Press, March 2021, p. 96.

110 Eurostat, Being young in Europe today – demographic trends, July 2020.

111 E-Communications in the Single Market, Eurobarometer, June 2021.

112 Smartphone ownership among children in Germany in 2020, by age group, Statista, January 2022.

113 Young Children (0-8) and Digital Technology – A qualitative study across Europe, Joint Research Centre, 2018.

114 Piotrowski J., The parental media mediation context of young children's media use, Youth & Media Entertainment, 2017.

115 Digital rights and principles, Eurobarometer, December 2021.

116 Knauf H., Digitalisierung in Kindertageseinrichtungen. Ergebnisse einer Fragebogenerhebung zum aktuellen Stand der Nutzung digitaler Medien, 2019.

117 Gen Z is Talking. Are you Listening?, PwC, June 2020.

118 Eurostat, E-commerce statistics for individuals, January 2022.

119 Kumpulainen K., Sairanen H. and Nordström A., Young children's digital literacy practices in the sociocultural contexts of their homes, Journal of Early Childhood Literacy, Vol. 20(3), 2020, pp. 472-499.

120 Children and parents: media use and attitudes report, Ofcom, April 2021.

Research shows that higher-achieving students use the internet more for researching topics or collaborating online, while lower-achieving students are more likely to use the internet for chatting, playing games or surfing through links of celebrities and sport figures.[121]

4.1.1. Impact of the Covid-19 pandemic on screen time and its consequences on mental and physical health

The Covid-19 pandemic, which led to school closures and restrictions on physical contacts, has had an enormous impact on Generation Z (like on many other generations). Besides affecting children's and young people's education, social and work life, it has also led to increased time spent online[122] and less time spent outside.

Controlling and supervising screen time has been a major source of conflict between many parents and their offspring, with parents tending to worry about the negative impact of increased screen time. During the pandemic, parents found it harder to control screen time. Up to half of parents of children aged 5-15, who answered to the Ofcom survey mentioned above, said they had to relax some rules about what their child did online during 2020.

Research on the impact of screen time on health does not reach the same conclusions. Some studies have found positive associations between screen time and mental health problems, including depressive symptoms and suicidal feelings.[123] Furthermore, an association has been found between increased digital screen time and progression of myopia,[124] as well as between playing video games for long periods (particularly in the evening) and sleep deprivation.[125] However, other studies have concluded that screen time has near-negligible[126] or even beneficial effects on mental health, if it is not excessive.[127] Many adolescents appreciate the social support that they receive online in challenging times and say that they feel more connected to their friends while using social media. Some smartphone-based activities such as geo-catching can also be a motivation for physical activity. UNICEF[128] concludes also that 'no use and excessive use can have a small negative impact on mental well-being, while moderate use can have a small positive impact'.

A study, which compared the physical activity and recreational screen time of 1 711 children and young people aged between 4 and 17 before and during the strictest time of the first Covid-19 lockdown in Germany, concluded that lockdowns have led to less time spent doing sports and more recreational screen time among boys and girls of all age groups.[129] This was mainly due to the

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121 Enhancing learning through digital tools and practices, European Commission, October 2021.

122 Hammerstein S., König C., Dreisörner T. and Frey A., Effects of Covid-19-Related School Closures on Student Achievement, Front. Psychol., September 2021.

123 Twenge J., Joiner T. et al., Increases in Depressive Symptoms, Suicide-Related Outcomes, and Suicide Rates Among U.S. Adolescents After 2010 and Links to Increased New Media Screen Time, Clinical Psychological Science, Vol. 6, issue 1, 2018.

124 Wai Wong C., Tsai A. et al., Digital Screen Time During the Covid-19 Pandemic: Risk for a Further Myopia Boom?, American Journal of Ophthalmology, Vol. 223, March 2021, pp. 333-337.

125 Peracchia S. and Curcio G., Exposure to video games: effects on sleep and on post-sleep cognitive abilities. A systematic review of experimental evidences, Sleep Science, Vol. 11 (4), July-August 2018, pp. 302-314.

126 Orben A. and Przybylski A., The association between adolescent well-being and digital technology use, Nat. Hum. Behav., Vol. 3(2), February 2019, pp. 173-182.

127 Przybylski A. and Weinstein N., A Large-Scale Test of the Goldilocks Hypothesis: Quantifying the Relations Between Digital-Screen Use and the Mental Well-Being of Adolescents, Psychological Science, Vol. 28, issue 2, 2017.

128 How does the time children spend using digital technology impact their mental well-being, social relationships and physical activity?, UNICEF, February 2017.

129 Schmidt S., Anedda B. et al., Physical activity and screen time of children and adolescents before and during the Covid-19 lockdown in Germany: a natural experiment, Scientific Reports, Vol. 10, issue 1, November 2020, pp. 1-12.

shutdown of organised sports and public sport facilities. However, non-organised sport activities increased during the lockdown, even among some children and young people who did not do sports before lockdown (30.2 % of respondents who did no sport activity before the lockdown, did non-organised sport during the lockdown).

Digital technologies can also offer support for children with mental problems. Apps such as CalmHarm help young people resist and manage the urge to self-harm, and Catch It and SilverCloud help them better understand their moods. Online platforms can provide a space where children and young people are able to discuss topics that might be more difficult in their offline lives. They also provide a space where they can instantly connect with others, share personal stories and get useful information.

4.1.2. Work life

Digitalisation is radically changing the work life of young people. According to the OECD,[130] it 'is reducing demand for routine and manual tasks while increasing demand for low- and high-skilled tasks and for problem-solving and interpersonal skills'. This does not apply to all routine and manual tasks – for example, demand for routine and manual tasks in the health care sector is increasing.

Demand for digital experts is also rising. As mentioned in the digital education action plan (2021-2027),[131] 'all Member States face shortages of digital experts, including data analysts, cybersecurity analysts, software developers, digital accessibility specialists and machine-learning experts'. That is why the EU has set the objective of having 20 million employed ICT specialists by 2030.[132] More details on the automation of work can be found in Chapter 4.2 on digital transformation and people of working age.

This development takes place against an economy in which many young people struggle to find jobs or are forced to take one precarious job after another. Digitalisation and the 'platform economy' (also known as the 'gig-' or 'on-demand economy') has opened ground for new work arrangements, where people (often young) are offered work via online platforms like Uber, Takeaway or Deliveroo. Often, these platforms control practically every aspect of the work, but without giving employees a right to employment benefits such as paid sick leave, annual leave or retirement.

That is why the European Commission has proposed a set of measures to improve the working conditions in platform work.[133] These include a proposal for a directive, which automatically classifies workers who meet certain criteria (such as being subject to upper limits of their remuneration, not being able to work for third parties) as employees, unless the platform is able to prove otherwise.

According to Eurostat,[134] in November 2021 2.842 million persons aged between 15 and 25 (15.4 %) were unemployed[135] in the EU. In Southern Europe, youth unemployment rates were much higher: 39.1 % in Greece, 29.2 % in Spain and 28 % in Italy.

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130 Automation and Independent Work in a Digital Economy, OECD, May 2016.

131 Communication on the Digital Education Action Plan 2021-2027, COM(2020) 624, European Commission, September 2020.

132 Communication on the 2030 Digital Compass, COM(2021)118, European Commission, March 2021.

133 Commission proposals to improve the working conditions of people working through digital labour platforms, press release, European Commission, 9 December 2021.

134 Eurostat, Unemployment statistics, November 2021 and Unemployment by sex and age, UNE_RT_M.

135 An unemployed person is defined by Eurostat as someone 'without work during the reference week who is available to start work within the next two weeks and who has actively sought employment at some time during the last four weeks'.

Unemployment and precarious work often means that young people find it difficult to make the transition to independent life and depend financially, in large part, on their parents. In the EU-27, 71.6 % of men and 62.7 % of women aged 16-29 still lived with their parents in 2020.[136] There are big differences between Member States; while in Croatia 92.7 % of young men and 86.4 % of young women still lived with their parents in 2020, in Denmark only 32 % of young men and 24.8 % of young women lived with their parents. By the age of 34, most young people have left their family home, bringing the overall percentage of young people aged 18-34 still living with their parents in the EU-27 down: 54.5 % of young men and 44.2 % of women aged 18-34 still lived with their parents in 2020.

The most recent changes brought by digitalisation relate to artificial intelligence and robotics.[137] These technologies can radically change the nature of work and the role of individuals, as well as the contracts (or the lack of them) under which people are employed. Artificial intelligence and robotics can replace jobs and services from law to agriculture. Even stocking of shop shelves can become automated and self-managed by robots using artificial intelligence.

4.1.3. Digital skills

Generation Z is ahead of older generations in terms of digital skills. As seen from the DESI report[138] for 2021, 80 % of young adults (aged 16-24) have at least basic digital skills, compared to 33 % of those aged 55-74. However, these skills also need to be developed. According to a recent study[139] which assesses digital skills of eighth-graders based on a competence test, 'young people do not develop sophisticated digital skills just by growing up using digital devices'. In nine out of 14 EU Member States who participated in the study, more than one third of the pupils achieved scores below the threshold for underachievement in digital competence.

Some researchers[140] say it is a myth that young people are digitally native. Instead, they say that young people have very diverse uses for, attitudes towards and experiences with digital technology. Furthermore, some young people have less quality of access to technologies, less support and less skills to use digital technologies. That is why it is important to provide wider support for young people.

The Covid-19 pandemic has been a turning point for digital skills, and many countries have temporarily closed schools or applied hybrid or online learning.[141] These closures have had a varied duration, with Latvia (49 weeks) experiencing the longest and France (12 weeks) the shortest school closures in the EU.[142] During school closures, some lessons were given via video-conferencing, while in other cases students were simply given self-learning material or no lessons at all. For example, in Romania 32 % of children attending school did not have any access to online education between March and June 2020.[143]

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136 Eurostat, Young people – social inclusion, February 2022.

137 Bynner J. and Heinz W., Youth Prospects in the Digital Society: Identities and Inequalities in an Unravelling Europe, Policy Press, March 2021, p. 35.

138 Digital Economy and Society Index (DESI) 2021, European Analysis, European Commission, 2021.

139 The 2018 International Computer and Information Literacy Study (ICILS), European Commission, 2019.

140 Eynon R., The myth of the digital native: Why it persists and the harm it inflicts (chapter in Education in the Digital Age), OECD, 2020.

141 Education and youth in post Covid-19 Europe – crisis effects and policy recommendations, Policy Department for Structural and Cohesion Policies, European Parliament, May 2021.

142 Education: From disruption to recovery, UNICEF, February 2022.

143 Growing up in lockdown: Europe's children in the age of Covid-19, Eurochild report, 2020.

Governments and private and charitable organisations facilitated digital learning through open access resources, television and radio. Support from parents was equally important, although it was often difficult to give, due to work assignments at the same time.

The abrupt transition to distance learning challenged teachers and students, and the success of this transition has been unequal. In some EU countries, like Estonia,[144] schools were routinely using digital study materials and electronic school management systems for years before the pandemic. In other parts of Europe, like Wallonia in Belgium,[145] digital learning has been patchy. The transition to digital learning has been especially difficult in certain socio-economic and ethnic groups, such as rural or Roma students, refugee or migrant children or children from low socio-economic backgrounds.

The difficulties in transition to digital learning were due to numerous factors, like limited preparedness of teachers and students, lack of devices, inadequate internet connections and difficult family situations.[146] In Europe, around 5 % of children do not have a suitable quiet place to do homework and 6.9 % have no access to internet.[147] In addition, in many homes, digital devices are shared among parents and siblings, impeding many children from following lessons during school closures. Vocational education and training suffered also due to the closure of certain companies, which disrupted work-based learning. For example, in Slovenia 22 % of final-year students in upper-secondary vocational programmes had no access to work-based learning in the first half of the 2020/2021 school year.[148] Finally, the lack of social interactions during lock-downs, as well as stress related to distance learning, has had a major negative impact on many students.

The EU, its Member States and even citizens have put in place measures that are trying to remedy these difficulties.[149] This has included providing access to hardware and software for pupils in need, partially opening schools and providing non-digital home-learning resources.[150] In Estonia, for example, a group of citizens launched the 'A computer for every pupil'[151] initiative to ensure that all children in Estonia have the same learning opportunities. Thanks to this initiative, more than 1 200 computers were donated to children in need. Another example comes from Federation Wallonia-Brussels, which offers €75 to parents of pupils who need to buy or rent a digital device.[152]

Several EU Member States have especially prioritised investments in digital transition in their national recovery and resilience plan, above the minimum threshold of 20 %. For example, Germany,[153] which devotes 52 % of its recovery and resilience plan to digital transformation, plans to invest €1.4 billion in digitalisation of education (e.g. equip all teachers with mobile digital devices on a lending basis).

144 Lessons from Estonia: why it excels at digital learning during Covid, The Guardian, 30 October 2020.

145 Enquête en FWB sur les pratiques des enseignants en temps de pandémie et sur la rentrée scolaire 2020-2021, University of Mons, 2021.

146 Education and training monitor 2020, Executive Summary, European Commission, November 2020.

147 Van Lancker W., Covid-19, school closures, and child poverty: a social crisis in the making, The Lancet, Vol. 5, issue 5, May 2020.

148 Implications of the Covid-19 pandemic for vocational education and training, OECD, June 2021.

149 Enhancing learning through digital tools and practices, European Commission, October 2021.

150 Education responses to Covid-19: Implementing a way forward, OECD, July 2020.

151 Website igalekoolilapselearvuti.ee (only in Estonian and Russian).

152 Une aide de 75 euros pour un ordinateur ou une tablette, Federation Wallonia-Brussels, 15 January 2021.

153 Jochheim U. and Mildebrath H., Germany's National Recovery and Resilience Plan: Latest state of play, EPRS, European Parliament, December 2021.

4.1.4. EU initiatives to support young people in using digital technologies

Ensuring safe and secure internet for young people

'A Europe fit for the digital age' is one of the six political priorities of the European Commission for 2019-2024.[154] In the framework of this priority, the EU is taking measures to make the internet a safer place for minors. The EU is currently upgrading digital platform rules through the Digital Services Act[155] and the Digital Markets Act.[156]

The European Parliament, in particular, proposed in the Digital Services Act to prohibit targeting or amplification techniques involving the data of minors for the purpose of displaying ads.[157] The Parliament emphasised the importance of protecting personal data of minors also in its position on the Digital Markets Act,[158] by adding that 'personal data of minors collected or otherwise generated by gatekeepers should not be processed for commercial purposes, such as direct marketing, profiling and behaviourally targeted advertising'.

In addition, the European Parliament has repeatedly called for the protection of children against cybercrimes. For example, in a 2017 resolution[159] it called on law enforcement authorities to pay special attention to crimes against children when fighting cybercrime, and emphasised the importance of awareness-raising campaigns.

Furthermore, the EU is taking steps to protect minors in AI practices. In its proposal for an AI act,[160] the European Commission proposes to prohibit such AI practices that could 'manipulate persons through subliminal techniques beyond their consciousness or exploit vulnerabilities of specific vulnerable groups such as children'.

Other examples of how the EU tries to make the internet a safer and more stimulating space for children include the European strategy for a better internet for children.[161] It offers funding, coordination and self-regulation measures to help create a safer online environment for children.

Finally, the European Commission has declared 2022 the European Year of Youth.[162] The initiative aims to highlight the importance of European youth to build a greener, more inclusive and digital future. On the website dedicated to the European Year of Youth, the Commission lists a number of initiatives in the digital field (such as a project financed by the Commission that helps to create technologies to identify, categorise and prioritise online child sexual abuse material).

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154 Bassot E., Commission's priorities for 2019-2024, EPRS, European Parliament, January 2020.

155 Madiega T., Digital services act, EPRS, European Parliament, April 2022.

156 Madiega T., Digital markets act, EPRS, European Parliament, February 2022.

157 Digital Services Act: regulating platforms for a safer online space for users, press release, European Parliament, 20 January 2022.

158 Amendments adopted by the European Parliament on the proposal for a regulation of the European Parliament and of the Council on contestable and fair markets in the digital sector, European Parliament, 15 December 2021.

159 European Parliament resolution on the fight against cybercrime, European Parliament, October 2017.

160 Proposal for a regulation laying down harmonised rules on artificial intelligence (artificial intelligence act) and amending certain union legislative acts, European Commission, April 2021.

161 See European Commission website on creating a better internet for kids.

162 European Commission website on the European Year of Youth.

Supporting digital learning

The EU is also supporting digital education. The digital education action plan (2021-2027) proposes a set of measures for high-quality, inclusive and accessible digital education in Europe. It supports the objective that 70 % of 16-74 year-olds should have at least basic digital skills by 2025.

More recently, the Council recommendation[163] on blended learning gives a series of recommendations on how to improve this type of learning. It recommends developing longer-term strategic approaches for blended learning, providing individual support and taking into account physical and mental health. The right to learn digital skills is also recognised in the proposal for a Declaration on European Digital Rights and Principles.[164]

The EU also supports digital learning through concrete projects such as eTwinning, financed from the Erasmus+ programme.[165] Launched in 2005, eTwinning provides schools with support, tools and services for the use of information and communication technologies. Another project co-financed from Erasmus+ that supports digital learning is the European Massive Open Online Courses[166] (MOOC) Consortium,[167] an initiative bringing together the main European MOOC platforms in order to extend the use of MOOCs.

4.2. Digital transformation and people in working age

The working age population is generally defined[168] as the part of the population between 15 and 64 years old. As Chapter 4.1. has already detailed the impact of digital transformation on Generation Z (those born after 1996), this part of the study presents some overlaps with this previous chapter. The working age population includes, besides a small slice of 'Generation Z', the 'Millennials'[169] (or 'Generation Y', those who were born between 1981 and 1996), 'Generation X' (those born between 1965 and 1980) and the part of the 'Baby Boomer' generation (born between 1946 and 1964) which is still on the labour market. The digital transition has already found a way into their everyday lives – for instance, through digital household and home technologies or digital technologies for recreation (such as the use of social media or virtual reality technologies). As most of them are on the labour market, or are jobseekers, lots of the challenges they have to face in relation to digital technologies are work-related.

As already mentioned in Chapter 2, this segment of the population is under increasing pressure on the labour market: due to an increasing age-dependency ratio, there will be less and less people of working age to meet the needs of younger and older generations. If we take the age dependency ratio for those aged between 19 and 65,[170] figures are even worse than presented in Chapter 2: the ratio in this case is 69.1, meaning that for the time being, there are less than 3 people of working age for every two older or younger citizens of the EU. This fact is a booster for the implementation of digital solutions on the labour market. The solution for filling the gap on the labour market is seen

[163] Council recommendation on blended learning approaches for high-quality and inclusive primary and secondary education, November 2021.

[164] Commission puts forward declaration on digital rights and principles for everyone in the EU, press release, European Commission, 26 January 2022.

[165] See etwinning website.

[166] Massive Open Online Courses.

[167] See European MOOC Consortium website.

[168] Working age population, OECD, 2022.

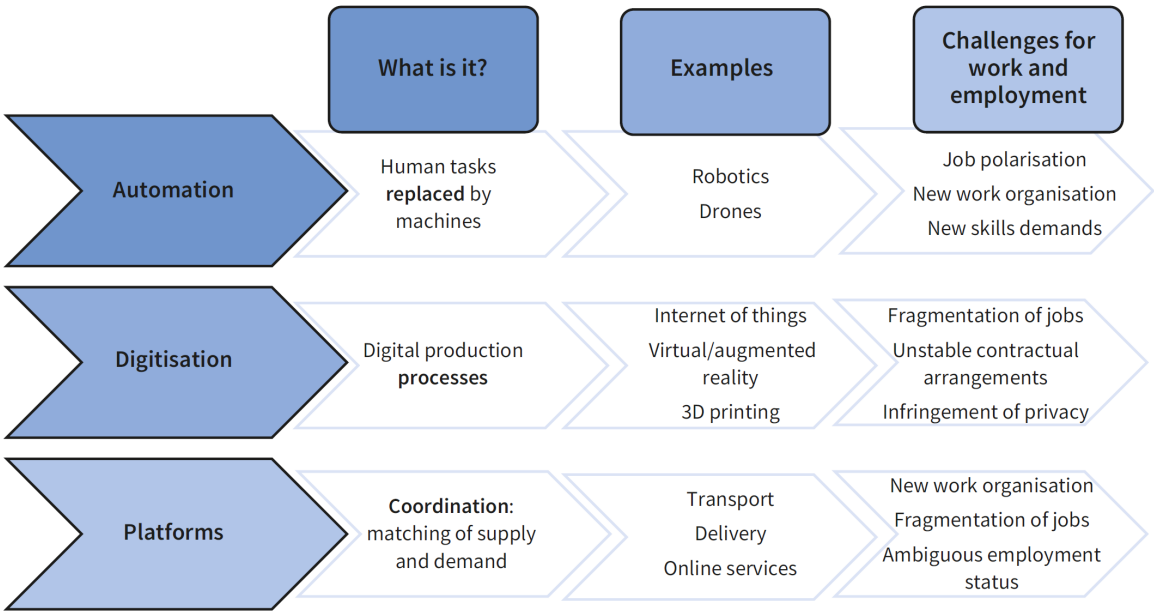
[169] Defining generations: Where Millennials end and Generation Z begins, Pew Research Center, 2019.

[170] Eurostat statistics, age dependency ratio 3rd variant (population 0-19 years and 65 years and above).

more and more in an increased use of digital technologies and their capacity to replace or complement workers in an ever-broadening range of tasks.[171]

The impact of digital transformation on the labour market has already been addressed to some extent in Chapter 3. A 2021 Eurofound study[172] differentiates challenges and opportunities for work and employment in three different domains: automation, digitisation and the expansion of digital platforms. These can affect jobs, work organisation, working conditions and the skills needed.

Figure 8 – Overview of the expected challenges for work and employment by vector of change



Source: Eurofound, 2021.

4.2.1. The impact of automation on the labour market

Automation, which means the creation and application of technologies to produce and deliver goods and services with minimal human intervention,[173] is a way to increase overall productivity, to lower production costs and to fill gaps on the labour market. Data from the International Federation of Robotics show that the stock of industrial robots operating in factories around the world reached the highest level in history, meaning a worldwide increase of about 85 % within five years (2014-2019), and that trend is projected to accelerate.[174] Automation, however, is a double-edged sword for the labour market and thus for people of working age. While on the one hand automated workflows and robots can remedy a lack of workforce and perform physically demanding or hazardous tasks that humans would not be ready to do, it could also be leading to job losses.

McKinsey Global Institute projects that 22 % of European jobs are at risk of becoming automated.[175] Observed differences across countries may reflect general variations in workplace organisation, differences in previous investments in automation technologies, as well as variances in the

171 Job automation, use of new technologies and transformation of the labour market, EIGE, 2020.

172 The digital age: Implications of automation, digitisation and platforms for work and employment, Eurofound, 2021.

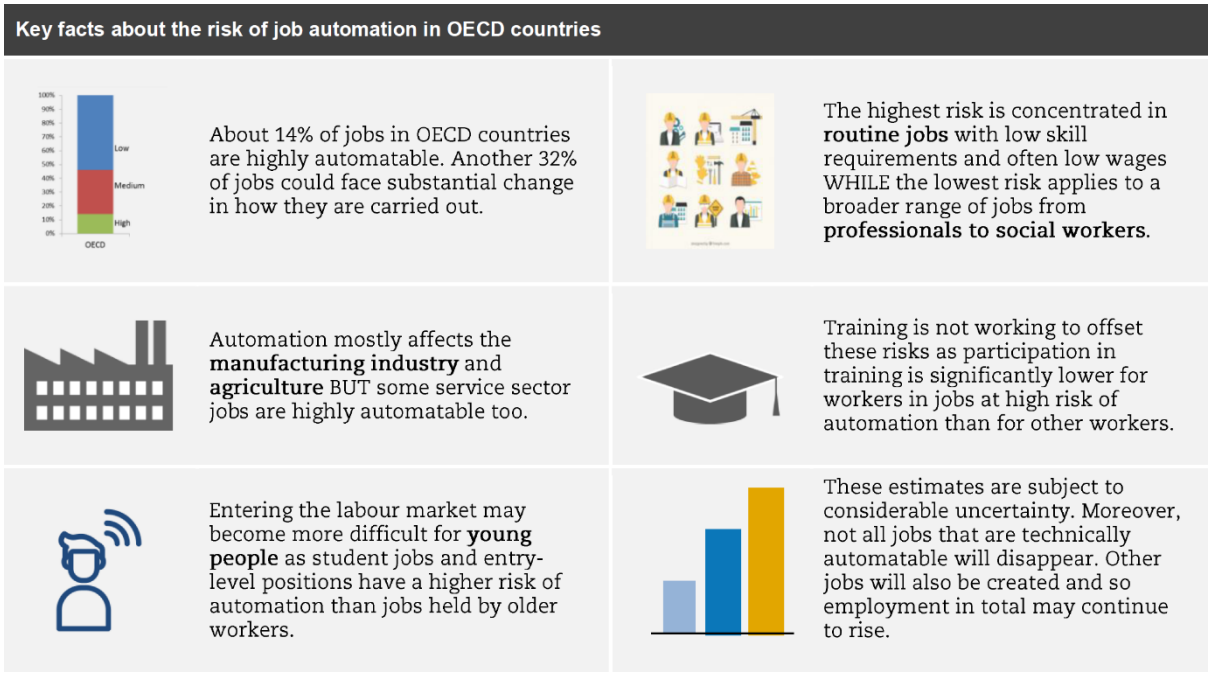
173 Techopedia.

174 World Robotics Report 2020, International Federation of Robotics, 2020.

175 The future of work in Europe, McKinsey, 2020.

education of workers across countries. Jobs that fall in the high-risk category for automation are those involving mainly routine tasks (e.g. bookkeeping, auditing and accounting). Services, sales and office jobs are especially at risk. The risk of automation is higher for low-skilled workers and for low-wage occupations.[176]

Figure 9 – Key facts about the risk of job automation



Source: OECD, 2018.

A study by the European centre for the development of vocational training (Cedefop) on risks of automation for different sectors[177] found that the jobs less threatened by automation are those that involve active observation, perception and manipulation, especially when such tasks are performed in unstructured situations, the so-called 'engineering bottlenecks'. Other tasks that are likely to continue to be carried out by humans are those that require creativity and social intelligence.

However, the OECD points out[178] that new technologies are unlikely to fully automate workplaces or occupations on a large scale, but they will instead transform workplaces and the tasks involved in certain occupations. The adoption of new technologies goes hand in hand with a new division of labour, one in which workers increasingly perform tasks that complement machines (for instance, tasks involving the monitoring of machines). Another OECD study[179] indicates that the digital revolution has contributed significantly to job creation: four out of 10 jobs created over the past decade were in digitally intensive industries.

McKinsey[180] adds further nuances to the picture: while a large share of potential job losses (if not all) would be compensated by job creation and a shrinking workforce (due to ageing populations), this job creation could be concentrated geographically, leading to local labour market disruptions. Additionally, 94 million workers are expected to need digital upskilling, as technology becomes a

176 Job Creation and Local Economic Development 2018: Preparing for the Future of Work, OECD, 2018.

177 Automation risk in the EU labour market. a skill-needs approach, CEDEFOP, 2018.

178 Job Creation and Local Economic Development 2018: Preparing for the Future of Work, OECD, 2018.

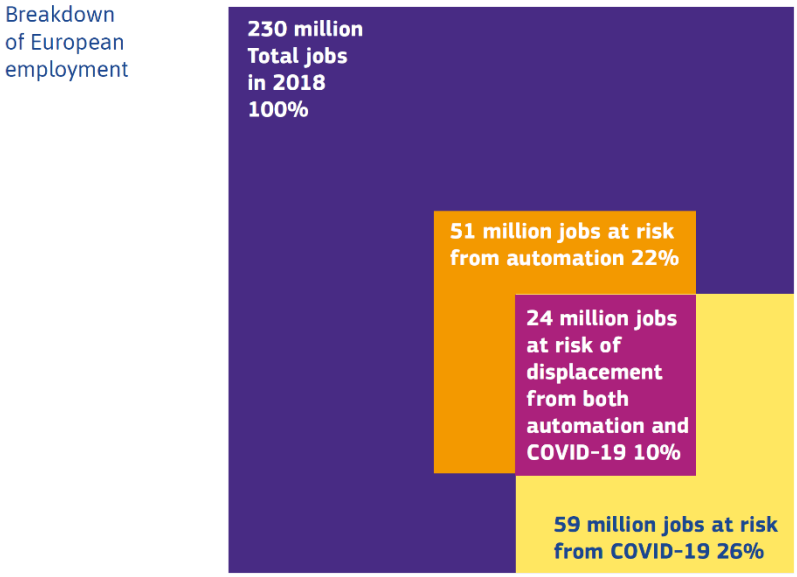
179 Going Digital: Shaping Policies, Improving lives, OECD, 2019.

180 The future of work in Europe, McKinsey, 2020.

growing part of their occupation, while an estimated 21 million workers may need to completely change occupation.

The coronavirus recession, combined with automation, has created a 'double-disruption' scenario for workers in certain sectors. Three occupational groups account for about half of all jobs at risk in Europe: customer service and sales, food services, and building occupations. There is a large overlap between jobs at risk due to Covid-19 in the short term and jobs displaced by automation in the longer term. Around 24 million jobs, almost 50 % of the number of jobs displaced through automation, are at risk of displacement though both Covid-19 and automation.[181]

Figure 10 – Overlap between jobs at risk due to Covid-19 in the short term and jobs displaced by automation in the longer term



Source: Shaping the digital transformation in Europe, European Commission.

4.2.2. Digitalisation, digitisation and digital skills

While digitalisation means the ongoing integration of digital technologies and digitised data across the economy and society,[182] digitisation refers to processes that transform elements of the physical word into bytes.[183] Examples of digitisation are the Internet of Things (IoT), already mentioned in Chapter 3, as well as 3D printers, and virtual and augmented reality.

Digital technology complements almost all existing job tasks; consequently, digital skills are required for nearly every kind of job. According to the Digital Skills and Jobs Coalition, in the near fuure, 90 % of jobs (especially engineering, medicine, art and architecture) will require some level of digital skills.[184]

Digital skills have to be seen as a continuum. They range from basic usage skills that enable individuals to take part in the digital society and consume digital goods and services (for instance, to use the Internet or a smartphone), to advanced skills that empower them to acquire new

181 The future of work in Europe, McKinsey, 2020.

182 Digitalisation, Eurofound, 2022.

183 Digitisation, Eurofound, 2019.

184 Digital Skills and Job Coalition, European Commission.

specialised digital skills, develop new digital goods and services (such as programming or developing an application). An OECD classification[185] differentiates between ICT generic skills (related to the use of digital technologies for professional purposes, such as accessing information online or using software); ICT specialist skills (skills needed for the production of information technology products and services (such as programming, developing applications and managing networks); ICT complementary skills (skills for performing tasks associated with the use of ICT, such as information processing, self-direction, problem solving and communication); foundation skills (digital literacy, and emotional and social skills enabling the use of digital technologies).

According to the 2021 DESI index,[186] 56 % of Europeans possess at least basic digital skills, 31 % with above basic digital skills. The skills indicators are strongly influenced by socio-demographic aspects. For example, 80 % of young individuals (aged 16-24), 84 % of individuals with high formal education, and 87 % of students have at least basic digital skills. On the other hand, only 33 % of those aged 55-74 have at least basic digital skills.

Software skills are becoming more and more of a requirement for entry into many jobs. There is, however, a digital skills gap (a lack of digitally skilled people) to fill job vacancies, despite high unemployment rates. According to the DESI index, in the domain of internet users' skills, the sub-dimension which is the largest skills deficit, both among the active labour force and the population at large, is the use of software for content manipulation: 58 % of Europeans have at least basic software skills.

Table 2 – DESI human capital indicator

	EU	
	DESI 2019	DESI 2021
1a1 At least basic digital skills % individuals	**55%** 2017	**56%** 2019
1a2 Above basic digital skills % individuals	**29%** 2017	**31%** 2019
1a3 At least basic software skills % individuals	**58%** 2017	**58%** 2019
1b1 ICT specialists % individuals in employment aged 15-74	**3.8%** 2018	**4.3%** 2020
1b2 Female ICT specialists % ICT specialists	**17%** 2018	**19%** 2020
1b3 Enterprises providing ICT training % enterprises	**22%** 2018	**20%** 2020
1b4 ICT graduates % graduates	**NA** 2016	**3.8%** 2018

Source: DESI Human Capital 2021.

According to data from the Digital Skills and Jobs Coalition,[187] about 42 % of Europeans today still do not have a basic level of digital skills. Among people on the labour market, 37 % of active – farmers, bank employees, and factory workers alike – also lack sufficient digital skills, despite the increasing need for such skills in all jobs. Europe also lacks skilled ICT specialists to fill the growing

185 Skills for a digital world, OECD, 2016.

186 Digital Economy and Society Index, 2021.

187 Digital Skills and Jobs Coalition, European Commission.

number of job vacancies in all sectors of the economy. According to a Eurostat survey, 55 % of companies experienced difficulties in recruiting ICT specialists over the course of 2019.[188]

4.2.3. Teleworking

Digitalisation also affects other, non-digital elements of work organisation such as the place of work and working time. As stressed by the Eurofound study mentioned above,[189] digital technology has enabled people to work from anywhere and at any time, meaning that there is potential for more flexible work organisation, which can be beneficial for companies as well as for workers. Workers could, though, benefit from a better work-life balance, as their working time is getting more flexible and as they can save time by being able to spare trips to work.

Teleworking can nevertheless also have a socially divisive character, as some social groups have limited access to financial resources to acquire the required material (such as computers and broadband internet) and they lack the required digital skills. This 'digital divide'[190] can disadvantage certain social groups so much that they cannot participate in teleworking at all. Digital divide can refer to two different phenomena. The first gap is the division between those who have access to ICT technologies, such as higher speed internet, and those who do not. This often falls together with the urban-rural divide, described in more detail in Chapter 4.4., but is also often influenced by social factors. The second gap refers to different types and levels of internet use, motivation and digital skills (already mentioned in subchapter 4.2.2.).

The share of teleworking among the EU population witnessed an unprecedented growth during the Covid-19 pandemic. The public health crisis following the outbreak of the pandemic led governments to shut down all workplaces, apart from those providing essential goods and services, in order to bring the spread of the virus under control. Teleworking from home turned out to be a viable option for many, despite having its own challenges (for instance, the need for technical equipment and technical support, or problems with time management and work-life balance). Telework has ensured continuity for many sectors, and has saved many people's jobs. According to one survey, 37 % of the EU population was teleworking in April 2020 (in certain Member States, such as Finland, the figure was as high as 60 %).[191] Interestingly, figures in spring 2021 were less high, although 24 % of the EU-27 population still worked exclusively from home and another 18 % in a combination of home and their employer's premises or on location, and the preference to telework every day has increased since summer 2020, the most popular choice being to work from home several times a week.[192]

While this new way of working undoubtedly has a lot of advantages, it can have undesirable effects on workers in terms both of workload and stress levels. A briefing requested by the European Parliament's Committee on Employment and Social Affairs[193] points out a number of potential risks. The hyperconnectivity of workers (being potentially reachable anytime and anywhere) allowed by new, intrusive technologies, can lead to a particular type of stress, referred to as 'technostress'. This stress presents different characteristics in different demographic groups. While women are more likely to be exposed to higher levels of techno-complexity and techno-uncertainty, men suffer more from the effects of techno-overload. Older people feel more overloaded by the characteristics of

188 ICT specialists: the skills gap hinders growth in the EU countries, Digital Skills and Jobs Platform, 2021.

189 The digital age: Implications of automation, digitisation and platforms for work and employment, Eurofound, 2021.

190 Bridging the digital divide in the EU, Negreiro M., EPRS, 2015.

191 Living, working and Covid-19, Eurofound, 2020.

192 Living, working and Covid-19 (update April 2021), Eurofound, 2021.

193 The mental health of workers in the digital era, Graveling R. et al., European Parliament, EMPL Committee, 2020.

technology, while younger users tend to overestimate the amount of loading information they can handle. Other possible psycho-social effects of this exposure include addiction, fatigue, sleep deprivation, anxiety, isolation and even burnout. Hyperconnectivity can be intrusive and unhelpful, potentially blurring the boundaries between work and personal life, and can also raise privacy concerns and lead to work-life balance conflicts. According to Eurofound, 22 % of respondents working exclusively from home reported difficulty concentrating on work because of family obligations, compared to only 8 % of those working in other locations.[194]

Another problem related to remote work (and this is a shared problem of teleworking employees of companies and platform workers) is the tracking of employees, more precisely their presence and their performance, during working hours through digital software and applications. This kind of monitoring can raise the question of how to strike the right balance between legitimate business interests and the digital privacy of employees and gives renewed importance to 'right to disconnect' initiatives.[195]

4.2.4. Workers on digital platforms

Remote work can be carried out by employees of a given company, or officials of public administrations (teleworking), but it can also be performed through online platforms, allowing a large income to be generated at almost zero cost. In parallel to the growing proportion of teleworking, the importance of digital platforms and web-based platform work is also increasing. In 2020, more than 28 million people in the EU worked through digital labour platforms, and by 2025 their number is expected to reach 43 million.[196] The Covid-19 pandemic has accelerated the digital transition, which led to the expansion of digital platforms, and an increase by around 500 % of their revenues in the last five years.[197] On 9 December 2021, the European Commission published a proposal for a directive on the improvement of the working conditions of platform workers.[198]

Digital labour platforms are internet-based companies that intermediate and organise the work provided by workers or the self-employed to third-party clients. The principal characteristics of platform work are a triangular relationship between the platform, the platform worker(s) and the client(s), coupled with online intermediation. Technology plays an important role in work organisation, for instance by using algorithms to pair clients and platform workers. Services are provided on demand and the work is usually carried out on a temporary or piecemeal basis.[199]

Platform work is very heterogeneous. According to a CEPS study,[200] it can be classified according to several parameters:

- **Skill requirement for tasks**: higher or lower-skilled workers.
- **Selection process**: decision made by platform, platform worker, or client.
- **Location of tasks**: work is performed online or on location.

194 Living, working and Covid-19, Eurofound, 2020.

195 The General Data Protection Regulation (GDPR) protects natural persons with regard to the processing of their personal data and the free movement of such data. This regulation is essential to strengthen individuals' fundamental rights in the digital age and facilitate business by clarifying rules for companies and public bodies in the digital single market.

196 Improving working conditions in platform work, European Commission.

197 Back to the future: policy pointers from platform work scenarios, Eurofound, 2019.

198 Proposal for a Directive of the European Parliament and of the Council on improving working conditions in platform work, European Commission, 9 December 2021.

199 Study to gather evidence on the working conditions of platform workers, CEPS, European Commission, 2020.

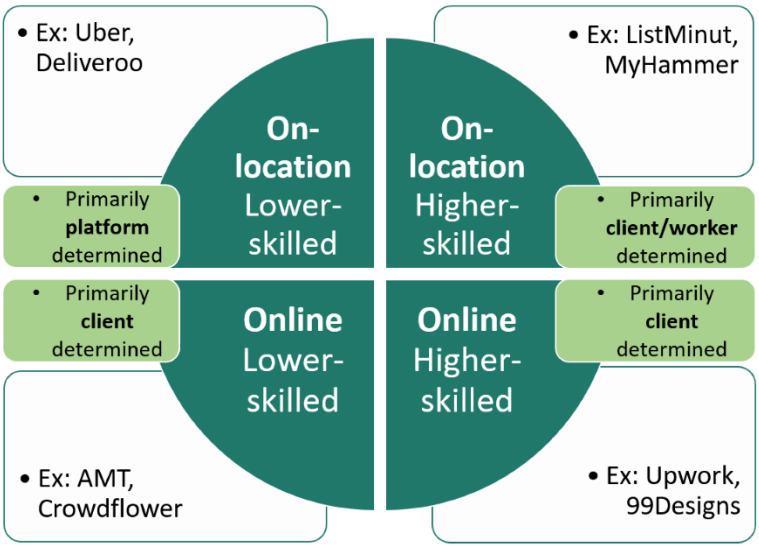
200 ibid.

The latter two categories include the following types of tasks:

Online platform work (also called crowd work) includes tasks that platform workers carry out from any suitable location on electronic devices. In most cases, platform workers perform this type of work as part of teleworking (e.g. at home using a computer). Tasks performed this way can be clerical and data entry tasks, online professional services (such as accounting, writing and editing, creative and multimedia work), sales and marketing, software development and IT tasks. Interactive services (such as online lessons, assistance and consultations) also belong to this category.

On-location platform work must take place in a specific physical location (for instance, the client's home or a workplace). However, the matching is still carried out online, as in the case of online platform work. Services in this category include housekeeping, cleaning, beauty services, on-location photography, but also transportation and delivery services, as well as short-term rental accommodation.

Figure 11 – Typology of platform work



Source: Study to gather evidence on the working conditions of platform workers, CEPS, European Commission, 2019.

Platform work is considered as a non-standard form[201] of employment.[202] Therefore, working conditions and social rights of platform workers are not enshrined in standard labour regulations. Many people working through digital labour platforms face poor working conditions and inadequate access to social protection. In addition, platform workers often do not have the capacity to have their rights promoted or defended. The absence of an employment contract can make it impossible for them to negotiate collectively or be represented by trade unions.[203]

Another problem related to platform work can be the digital control by the platforms (the use of algorithms to assign tasks, monitor, supervise, evaluate and draw consequences). Concerning their working conditions, platform workers often have to face a lack of transparency and of adequate

[201] The 'standard form' being full-time work and open-ended contracts.

[202] The platform economy and precarious work, Hauben H., Lenaerts K. and Wayaert W., European Parliament EMPL Committee, September 2020.

[203] Improving the working conditions of platform workers, Kiss M. and Rittelmeyer Y-S., EPRS, 2021.

information. Their human development (possibilities for adequate training, recognition of skills and diplomas) is also not guaranteed in all cases.

4.2.5. EU initiatives related to digital technologies on the labour market

According to estimates, by 2025 working tasks will be carried out by humans and machines in equal proportions.[204] If this path is pursued with due respect for ethical guidelines and in the interests of both employees and employers, it could be beneficial to the economy. This means that adequate job protection measures are needed for workers whose jobs are at risk of automation. If the automation of certain tasks is unavoidable, upskilling, reskilling and redeployment of the workforce concerned must be ensured.

Eurofound points out[205] that there are several initiatives at EU level aiming to ensure that, even if digitalisation spreads rapidly, there remains a 'human in the loop', meaning that task assignment, management and surveillance are not left exclusively to algorithms, but are monitored by humans. Examples include the ethics guidelines for trustworthy AI,[206] linked to the EU digital strategy[207], the General Data Protection Regulation (GDPR)[208] (requiring employees' consent for the use of tracking software or applications), the Digital Markets Act[209], and the Digital Services Act.[210]

If the automation of certain tasks is unavoidable, upskilling, reskilling and redeployment of the workforce concerned must be ensured, as new types of professional and personal skills are required to respond to technological progress. Upskilling is also necessary to reduce the mismatch between the skills available and those demanded for a digital transformation of the economy.[211] This has been a key EU-level priority for the past decade and will continue to remain one, for instance through the new European Skills Agenda,[212] launched to ensure that the right training, the right skills and the right support are available for people in the EU.

The task of the Digital Skills and Jobs Coalition[213] is to support the cooperation between education, employment and industry and to develop a pool of digital talent in the EU. Organisations wishing to take action to boost digital skills in Europe can become members of the Coalition. Actions can range from developing citizens' digital skills to enable them to participate in the digital society, upskilling and reskilling workers and jobseekers, hosting online courses for teachers, offering coding classes for children, and developing high-level digital skills for ICT professionals.

Teleworking and working on digital platforms can lead to connectivity at any time and anywhere, often accompanied by a high workload. This can increase stress levels for workers. In January 2021,

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204 The Future of Jobs Report, World Economic Forum, 2020.

205 Artificial intelligence and the world of work, Eurofound, 2021.

206 Ethics guidelines for trustworthy AI, Independent High-Level Expert Group on Artificial Intelligence set up by the European Commission, 2019.

207 A Europe fit for the digital age, European Commission.

208 Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation), European Commission, 2016.

209 Digital Markets Act: ensuring fair and open digital markets, European Commission.

210 Proposal for a regulation of the European Parliament and of the Council on a Single Market For Digital Services (Digital Services Act), European Commission, 2020.

211 The future of work: trends, challenges and potential initiatives, Kiss M., EPRS, 2021.

212 European Skills Agenda, European Commission, 2020.

213 Digital Skills and Jobs Coalition, European Commission.

the European Parliament called, in a legislative-initiative resolution,[214] on the Commission to put forward a legislative proposal to secure workers the right to disconnect at specific times of the day, in order to preserve their mental health.

Measures on social protection and improved working conditions have to be extended to all types of workers. The Council recommendation on access to social protection for workers and the self-employed,[215] and the Directive on transparent and predictable working conditions,[216] are first steps in this direction. Following a resolution of the European Parliament,[217] the Commission presented a legislative proposal on improving the rights of platform workers on 9 December 2021.[218] The proposal suggests measures to improve the working conditions of platform workers and clarify their employment status, and to support the sustainable growth of digital labour platforms in the EU. The proposed directive intends also to increase the transparency in the use of algorithms by digital labour platforms, by introducing the requirement for human monitoring, in order to ensure fairness and accountability in algorithmic management and respect for working conditions.

4.3. Digital transformation and the ageing population

Europe has a strongly ageing population: more than a fifth (20.6 %) of the EU population was aged 65 years or over in 2020; this is 3.0 percentage points higher than the corresponding share from a year earlier. As mentioned in Chapter 2, between 2001 and 2020 the median age increased from 38.4 years in 2001 to 43.9 years – which represents an increase of 5.5 years in just 19 years. There are significant differences between Member States, with Cyprus having the lowest median age, 37.7 years, and Italy the highest median age, 47.2 years.[219]

At the same time, our life expectancy[220] has been rising, on average, by more than two years per decade since the 1960s and is, according to the latest figures from 2019,[221] 84 years for women and 78.5 for men. By 2070,[222] around a third (30.3 %) of the population is projected to be aged 65 or older and 13.2 % is projected to be aged 80 or older.

This growing ageing population confronts society with some considerable challenges, among which a smaller working population, a much larger need for health and care services, and the issue of loneliness and social inclusion of older people. Digital transformation might help, but also poses some other challenges.

214 Resolution of 21 January 2021 with recommendations to the Commission on the right to disconnect, European Parliament.

215 Council Recommendation of 8 November 2019 on access to social protection for workers and the self-employed 2019/C 387/01.

216 Directive (EU) 2019/1152 of the European Parliament and of the Council of 20 June 2019 on transparent and predictable working conditions in the European Union.

217 Resolution of 16 September 2021 on fair working conditions, rights and social protection for platform workers – new forms of employment linked to digital development, European Parliament.

218 Proposal for a directive of the European Parliament and of the Council on improving working conditions in platform work, COM(2021) 762 final.

219 Eurostat, Population structure indicators at national level, DEMO_PJANIND.

220 Eurostat, Life expectancy by age and sex, demo_mlexpec (no EU data for 2020).

221 Eurostat, Mortality and life expectancy statistics, 2022.

222 The impact of demographic change in Europe, European Commission.

4.3.1. Opportunities of digital transformation

Digital technology has a lot to offer for older people. Recent innovative solutions[223] claim that, thanks to them, seniors could live longer at home and live longer, happier, more independent and active lives – these innovations include shopping online, fall detection systems,[224] a robot companion, a robotic e-walker, and others.

Fall detection systems can sense if the user suffers a fall, or is at risk of falling, and can automatically call for help. The built-in technology can be worn around the neck, or on the wrist or waist. Fall detection is important for active and healthy ageing, as falling is among the most damaging events elderly people may experience. Thanks to the rapid development of sensor networks, artificial intelligence and the Internet of Things (IoT), human-computer interaction using sensor fusion is regarded as an effective method to address the problem of fall detection.

Robotic walkers are smart walking aids for older adults to achieve mobility safety. The walker is usually convenient to use, and is equipped with 3D cameras and sensors to probe the environment and measure distances. It can often support multiple modes of interaction through voice, gait or haptic touch, and allows intelligent control via learning-based methods. On some walkers, the sensor can also recognise gestures, so users can give their walker a hand signal and it will autonomously roll over to them the right way round for them to get into it. Electric motors can provide power so that users do not have to put any effort into pushing the walker along in front of them. The speed adjusts automatically to the user's pace. When going uphill, for example, the electric motors know to give more power.

In recent years, digital methods using artificial intelligence to monitor and detect diseases in early stages have also rapidly developed. These AI-based technologies use biomarkers like electrophysiological data from the brain, or voice, movements, breathing or coughing as diagnostic markers. Through such interventions, diseases such as Parkinson's or Alzheimer's, or frailty in general, can be detected early or better managed.

When it comes to health and care, research shows that digital technology creates significant potential to better support older adults' (often complex) healthcare needs. When exploring the benefits of eHealth and mHealth for older adults, a scientific publication by Kwan Ryc et al[225] found clinically significant improvements in health behaviours (increased physical activity and healthy eating) as well as health outcomes (memory and blood pressure) associated with the use of these technologies: 'eHealth interventions are effective at increasing the time spent on physical activity, energy expenditure in physical activity, and the number of walking steps. It is recommended that eHealth interventions be included in guidelines to enhance physical activity in older people.'

[223] See also 8 tech innovations that support a healthy ageing population, World Economic Forum.

[224] Some examples reviewed by academia: Wang Z., Ramamoorthy V. et al., Possible Life Saver: A Review on Human Fall Detection Technology, ResearchGate, 2020.

[225] Kwan RYC et al., The effect of e-health interventions promoting physical activity in older people: a systematic review and meta-analysis, European Review of Aging and Physical Activity, 2020, 17: 1-17.

A similar systematic literature review by Kampmeijer et al[226] recognises the relevance of eHealth and mHealth tools for older adults. One of the major advantages of remote health services, they found, was that the older adult – especially those with chronic diseases such as diabetes, which requires regular check-ups – did not have to travel as much. Also, eHealth and mHealth proved useful when it came to health promotion and primary disease prevention. However, 'the successful use of eHealth/mHealth tools[227] in health promotion programs for older adults greatly depends on the older adults' motivation and the support that older adults receive when using these tools'.

eHealth, short for electronic health, is the use of information and communication technology, especially the internet, to improve or enable health and care. **mHealth** is short for mobile health and is the use of mobile phones and other wireless technology in health and care.

Additionally, the advances in technology and online social networking can make it easier for older adults to connect with their loved ones. As close relationships are a relevant driver of physical health and well-being, some studies even see a correlation between higher social technology use and better self-rated health: seniors who networked online experienced fewer chronic illnesses, higher subjective well-being, and fewer depressive symptoms. Each of the links between social technology use and physical and psychological health was mediated by reduced loneliness.[228] A 2020 study[229] backs this finding and states that older people's greater internet use is significantly associated with a lower level of loneliness.

The 2020 AGE Barometer[230] – a yearly assessment of the socio-economic situation of older people across the European Union – also observes a strong link between digitisation and social inclusion. According to the report, 'the Covid-19 pandemic has shed light on social isolation among older persons and has increased the challenge of their participation, notably for the most excluded ones, including those living in residential care settings'.

The non-profit European AGE network, representing people aged 50+, also sees the added value of new technology for health and long-term care[231]. It highlights the acceleration that happened during the Covid-19 pandemic, notably of telemedicine with general practitioners who have been pushed to use new technologies for consultations, given the importance of physical distancing.

'From the experiences shared by our members', AGE states, 'we know that organisations like the Bulgarian Red Cross, which provides support to older persons, have further deployed telecare and telemedicine, notably towards those with underlying conditions. And Age & Opportunity (Ireland) has strengthened messages to encourage key health behaviour such as healthy diet and physical activity.'[232]

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226 Kampmeijer R., Pavlova M., Tambor M. et al., The use of e-health and m-health tools in health promotion and primary prevention among older adults: a systematic literature review, BMC Health Services Research, 16, 290 (2016).

227 See also the latest EU developments on eHealth policy, European Commission.

228 Chopik W., The Benefits of Social Technology Use Among Older Adults Are Mediated by Reduced Loneliness, Cyberpsychology, Behavior and Social Networking, 2016.

229 Xu W. and Köttl H., Internet Use and Loneliness Among Older Adults: The Moderating Role of Self-perceptions of Ageing, in Gao Q. and Zhou J. (eds), Human Aspects of IT for the Aged Population. Technology and Society. HCII 2020. Lecture Notes in Computer Science, Vol. 12209, Springer, Cham. (2020).

230 AGE Barometer 2020. The annual report of AGE Platform Europe is a European network of non-profit organisations, which aims to 'voice and promote the interests of the 200 million citizens aged 50+ in the European Union (Eurostat, 2018) and to raise awareness on the issues that concern them most'.

231 AGE network.

232 AGE Barometer 2020, p. 11.

Moreover, researchers found that older adults nowadays have generally positive attitudes towards technology, or at least in the United States. Even though, according to the scientific literature, older people are less familiar and show more negative attitudes towards technology than younger people,[233] a 2016 survey in the US[234] found many respondents noted that technology saves time, increases flexibility in communication, is easy to use, is necessary, and is readily available. Over 70 % of the sample reported that they were open to learning new technologies. Furthermore, 95.6 % of older adults reported that they were at least 'somewhat satisfied' with the technologies they use for communication.

4.3.2. Challenges

The report by the United Nations' Independent Expert on the enjoyment of all human rights by older persons[235] highlights the fact that robotics can lead to important advances for the autonomy and active participation of older persons. However, technological advances and digitalisation have the potential to threaten personal rights, such as the right to privacy.

Furthermore, an increasingly digitalised world makes digital literacy more important. According to the report, digitalisation can exacerbate inequalities and/or exclude certain groups who have limited or a lack of access to digital technology; the use of assistive technology and robotics in the care of older persons can compromise the user's dignity.

Only a minority of older adults seem to use the tools offered by the digital transition. According to the 2019 yearly survey by the Fundamental Rights Agency (FRA),[236] only one in five survey respondents aged 75 and older in the EU at least occasionally engaged in internet activities, compared to 98 % of those between the ages of 16 and 29.

The survey observes multifaceted barriers to digital engagement and technology use in older age. These include:

- lack of access to digital devices or the internet;
- lack of adequate digital skills, experience, and self-confidence;
- lack of motivation and interest and perceived lack of relevance of digital technology to their needs and preferences;
- but also the onset of physical or cognitive impairments in later life and inaccessible technology design that renders digital engagement more challenging.

The FRA survey concludes: 'The digital divide between generations is significant and it increases with age.'[237]

[233] Hauk N. et al., Ready to be a Silver Surfer? A Meta-analysis on the Relationship Between Chronological Age and Technology Acceptance, Computers in Human Behavior, 2018.

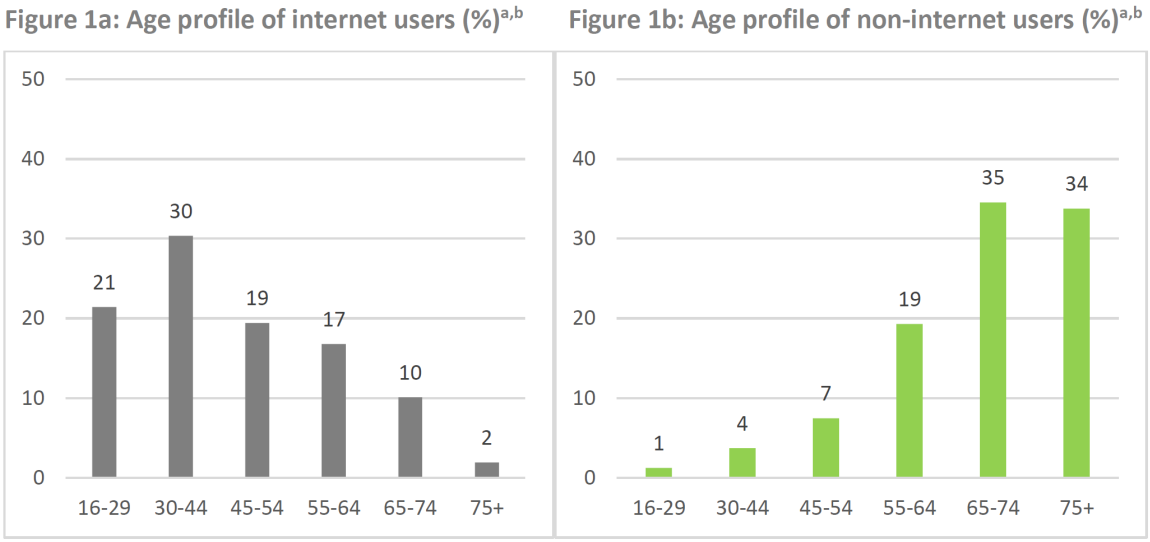
[234] Chopik W., The Benefits of Social Technology Use Among Older Adults Are Mediated by Reduced Loneliness, Cyberpsychology, Behavior and Social Networking, 2016.

[235] Report of the Independent Expert on the enjoyment of all human rights by older persons, United Nations, 2016.

[236] Fundamental Rights Report 2019, Fundamental Rights Agency.

[237] Selected findings on age and digitalisation from FRA's Fundamental Rights Survey, FRA, 2020.

Figure 12 – Internet users and non-internet users by socio-demographic characteristics



Notes: [a] *Out of all respondents in EU-27 who were asked to complete the section 'Technology' of the survey, excluding non-internet users in the countries were the questionnaire was completed online (n = 24,256); weighted results.*

[b] Non-internet users *are respondents from those countries where face-to-face interviews were conducted – who indicate that they never use the internet. Internet users are all respondents across the EU-27 who indicate that they use the internet at least occasionally. Note: Only 64 respondents aged 16-29 indicated they were non-internet users.*

Source: FRA Fundamental Rights Survey, 2019.

The AGE Barometer stresses: 'While new technologies offer an alternative to the physical distancing measures indispensable to contain the coronavirus pandemic, they have also increased the exclusion of those who are digitally illiterate or do not have the means to access or afford the necessary IT equipment. […] Bearing in mind that the Covid-19 pandemic has accelerated the digitalisation of several services', the AGE experts see 'a growing gap between those able to profit from new services and those who could not'.[238] This observation was backed by most AGE members, who developed many initiatives at grassroots levels to overcome the digital gap. In France for example, Old'Up has produced a training guide to help informal and professional carers train older people to use a digital tablet. And in Germany, the Digital Compass was set up: a network of 75 internet pilot support locations where older people can meet and try out digital services.[239]

According to the AGE network, age alone is not enough to explain the overall situation in the EU. 'Other variables such as the socio-economic background and the geographical divide are also important, as well as how well the area you are living in gives the possibility to access digitalised services.'[240]

238 AGE Barometer 2020.

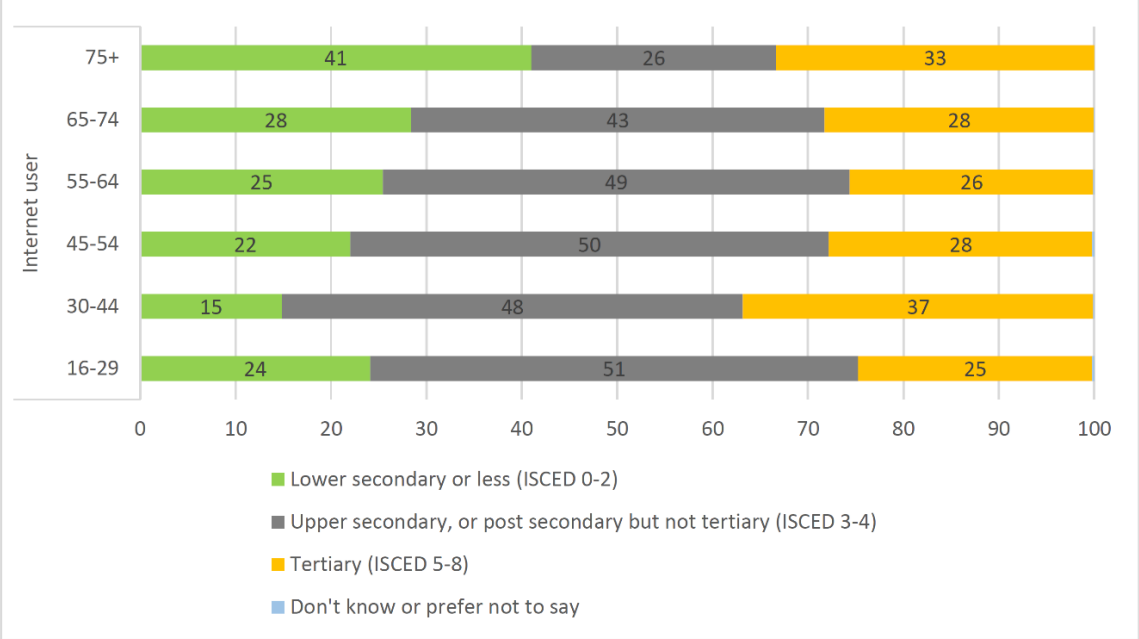
239 AGE members warn against growing digital exclusion, AGE, 11 June 2021.

240 In this respect, see also subchapter 4.4. on regional differences.

The EU FRA survey[241] provides more findings on the matter:

- The results show that education plays an important role for use of the internet across all age groups, but in particular at older ages; higher education levels tend to indicate higher internet use (see graphs below).
- With the exception of the youngest age group, the financial situation of internet users is more advantageous compared to non-internet users.
- Non-internet users perceive as their main obstacles for using the internet their lack of necessary skills, followed by a lack of interest (when the same things can be done without using the internet), and having no access to the internet.

Figure 13 – Internet users by age and highest education level attained



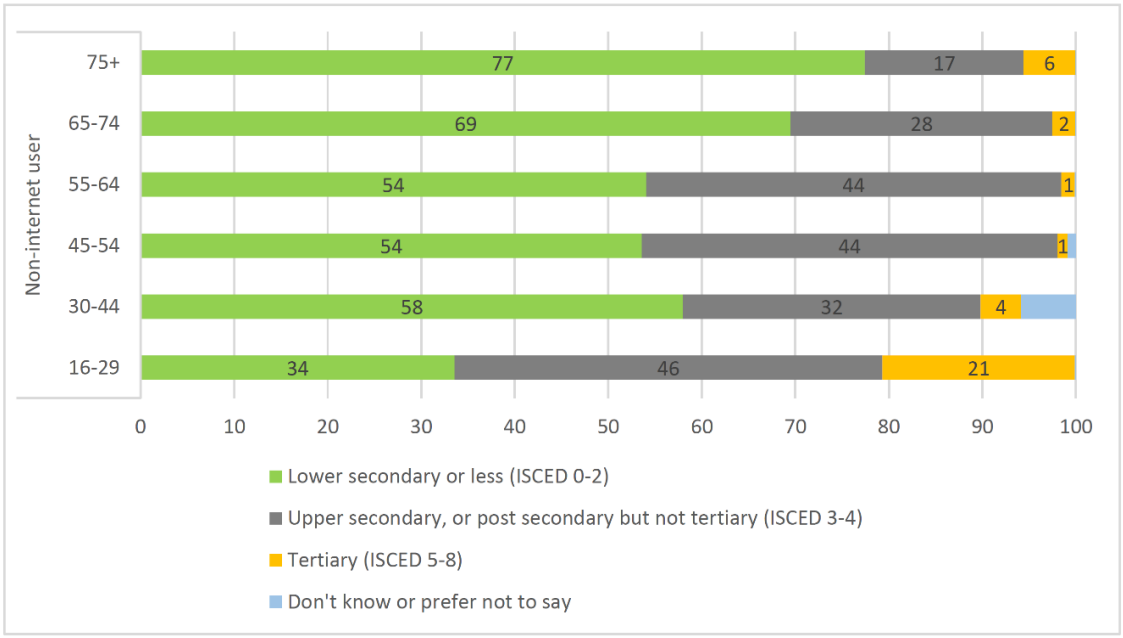
Source: FRA Fundamental Rights Survey, 2019.

The main obstacle to internet use seemed to be the lack of digital skills: the older the non-internet users were, the more 'lack of skills' was reported as the main obstacle (for 49 % of 55-64 year-olds, 52 % of 65-74 year-olds and 56 % of those aged 75 years or more, against only 20 %, 34 % and 39 % for the younger generations). However, it was not necessarily the case that the older non-internet users were less interested than the younger ones (30-64 years).[242]

[241] Selected findings on age and digitalisation from FRA's Fundamental Rights Survey, FRA, 2020.

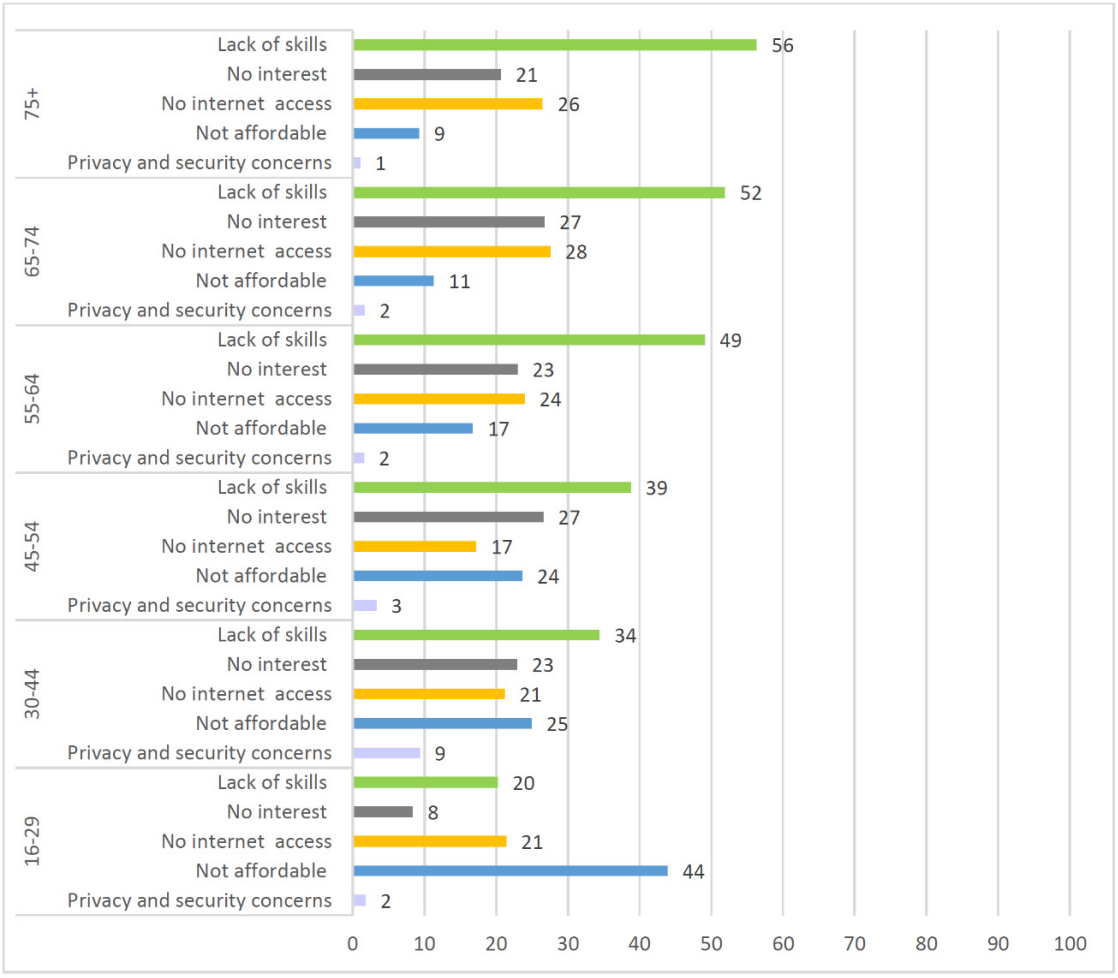
[242] Selected findings on age and digitalisation from FRA's Fundamental Rights Survey, FRA, 2020, p. 11, Figure 5.

Figure 14 – Non-internet users by age and highest education level attained



Source: FRA Fundamental Rights Survey, 2019.

Figure 15 – Non-internet users: perceived obstacles to use of the internet by age (%)



Source: FRA Fundamental Rights Survey, 2019.

Other studies[243] conclude that the uptake of technologies by older people largely depends on knowledge, affordability, ease of use, functionality, design, personal preferences and concerns over privacy: 'Privacy is a top critical concern to older adults, registering 34% of the total articles examined. Two other equally potent barriers to the adoption of assistive technologies were trust and functionality/added value, representing 27 and 25 per cent each respectively of the total studies examined. Also of serious concerns are cost of the technologies and ease of use and suitability for daily use (23%) each respectively, perception of "no need" (20%), stigma (18%), and fear of dependence and lack of training (16%) each respectively. […] However, more and more older adults adopt different kinds of assistive technologies in order to fit in with the society.'[244]

4.3.3. Online elder abuse

Lastly, digitalisation may be an underpinning dimension of elder abuse. The AGE Barometer states: 'The Covid context has reinforced a phenomenon that existed before, namely online abuse. This can take different shapes from online hate speech to online scams.'[245]

The latest abuse has been reported by AGE members[246] and addressed in the AGE report[247] on the impact of Covid-19 on human rights of older persons: 'Older people in self-isolation appear to have become one of the targets for scammers who attempt to collect bank details, sell fraudulent products, or offer fake Covid-19 testing.'

In a press release[248] issued on 15 June 2020, World Awareness Day on Elder Abuse, UN Independent Expert Claudia Mahler denounces this online abuse against older people: 'Derogatory comments in the media are a direct attack against the dignity of older persons. The "boomer remover" hashtag attached to coronavirus posts and media articles calling for older persons to sacrifice themselves to save the economy or to safeguard younger generations by exposing themselves to the virus are clearly reflections of bias against older persons. […] Verbal abuse often occurs in tandem with mental, psychological, physical, sexual or financial abuse and I urge social media to do their part and at least not enable abuse by propagating messaging that violates human rights of older persons.'

4.3.4. European initiatives

The European institutions address the EU's ageing population and, related to this, the challenges and opportunities of digital technologies. Even though competences for dealing with the effects of ageing are largely in the hands of Member States, the EU is well placed to identify key issues and trends and support action on ageing at national, regional and local level.[249]

In July 2021, the European Parliament officially called on the Commission and the Member States[250] 'to further explore user-friendly, safe and accessible assistive digital technologies, telecare and telemedicine, especially in regions affected by demographic decline and remote regions'. The Parliament underlines that the use of these technologies 'should be fully consistent with the existing

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243 As mentioned in the report on Transforming the future of ageing by SAPEA European Academies, 2019 (p. 197).

244 Older people, assistive technologies, and the barriers to adoption: A systematic review, Yusif et al., Int J Med Inform., 2016.

245 AGE Barometer 2020.

246 AGE members warn against online fraud during Covid-19, AGE, 7 May 2020.

247 Covid-19 and human rights concerns for older persons, AGE report, 18 May 2020.

248 World Elder Abuse Awareness Day, press release, UN Human Rights, 15 June 2020.

249 The impact of demographic change in Europe, European Commission, 2020.

250 European Parliament resolution of 7 July 2021 on an old continent growing older – possibilities and challenges related to ageing policy post-2020 (2020/2008(INI)).

data protection framework, while ethical issues pertaining to the use of technology in health should always be duly taken into account'.

In January 2021, based on the findings of the June 2020 report on the impact of demographic change,[251] the European Commission published the **green paper on ageing**, already mentioned in Chapter 2. Among other things, the paper highlights the importance of the digital transition of society and lifelong learning as a concept that can enable a thriving ageing society. Lifelong learning can be understood as constantly acquiring and updating abilities such as digital skills; this would help people to remain employable and succeed in job transitions, and would help boost European productivity.[252]

Before the green paper, in October 2020, the EPSCO **Council** of the European Union also highlighted the issue by adopting conclusions on human rights, participation and well-being of older persons in the era of digitalisation.[253] The German Presidency of the EU Council also coordinated a joint Declaration on ageing[254] by the Trio Presidency. It states that the 'Council highlights the opportunities, but also the potential risks for older persons in a digitalised world', for instance privacy concerns. The Council recalls that digitalisation helped to reach older persons during the Covid-19 crisis, 'but also that the digital gap between generations is significant and increases with age'. Member States and the Commission are invited to ensure that digitalisation, in particular in health, social and long-term care services, will facilitate access to and use of services, while maintaining non-digital services.

The **Active Ageing Index**[255] was launched by the European Commission and the United Nations Economic Commission for Europe (UNECE) to assess the untapped potential of older people. Over the past six years the index has become a well-tested and applied instrument of policy reform. It measures the extent to which older people can realise their full potential in terms of employment, participation in social and cultural life and independent living, and also measures the extent to which they use information and communication technology.

The **European Innovation Partnership for Active and Healthy Ageing (EIP for AHA)**[256], launched in 2011 and facilitated by the European Commission, is a pan-European network at regional, national and European level that fosters digital innovation for active and healthy ageing. It contains a multi-stakeholder information and communication hub for European citizens, innovators, patients, health and care providers, researchers and policy makers active in this field.

The EIP for AHA also organises **'twinning projects'**: cross-border cooperation programmes that enable knowledge exchange and technology transfer between different EU regions. Other topics for knowledge sharing are participatory design of digital tools, promoting and giving assistance on digital health literacy for older adults, and age-friendly housing.

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251 The impact of demographic change in Europe, European Commission, 2020.

252 Green paper on ageing, European Commission, January 2021.

253 Human Rights, Participation and Well-Being of Older Persons in the Era of Digitalisation, Council Conclusions, 9 October 2020.

254 EU Trio Presidency commits to joint ageing approach, AGE platform, 13 January 2021.

255 Active Ageing Index (AAI) to measure untapped potential of seniors in the EU, European Commission, 2013.

256 The European Innovation Partnership on Active and Healthy Ageing, EIP on AHA.

Lastly, **EU funding programmes** such as Horizon Europe[257] and its predecessor Horizon 2020[258], the European Social Fund Plus (ESF+) – previously the EU Programme for Employment and Social Innovation (EaSI)[259] – and the European Social Fund (ESF)[260] fund initiatives and innovation and research projects that stimulate (the pick-up of) digital solutions for active and healthy ageing and/or develop and apply comprehensive active ageing strategies.

4.4. The regional dimension of digital transformation

With internet and digital technologies playing an increasingly important role in our everyday lives, the digitalisation of Europe has become one of the EU's priorities for the coming decade. Yet, while the EU is making good progress towards its digital transformation, this process is taking place at an uneven pace, with clear differences visible across Europe's regions, particularly in rural areas and in its outermost regions.

The regional dimension of the EU's digital transformation may be examined by looking at a number of different measures. Digital literacy and skills considers the extent to which people are able to function in the digital environment, covering such areas as internet use, e-commerce and social media activity, and measures their specific competences in terms of digital skills. Digital connectivity, on the other hand, looks at the infrastructure that is needed to deliver digital services to people, wherever they live. The European Commission regularly monitors those items that provide an interesting insight into the regional differences that are a key feature of the EU's digital landscape, with Eurostat's 2021 regional yearbook[261] providing a wealth of information on this topic.

[257] Healthy and active ageing projects are mainly funded under the second pillar of Horizon Europe, cluster 1.

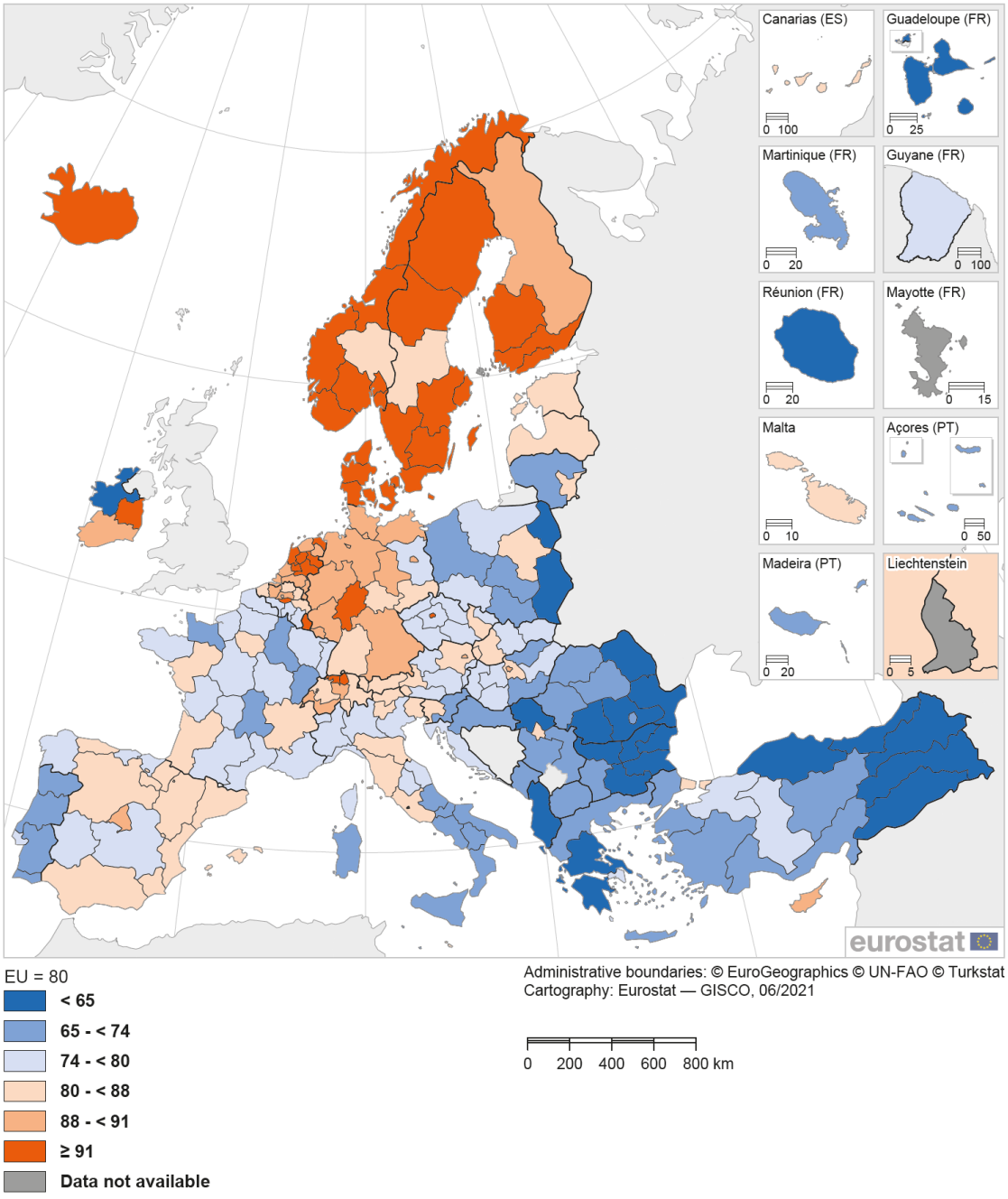
[258] More info and a collection of Horizon Europe/Horizon 2020 projects can be found on the Cordis website of the European Commission: you obtain over 4 300 results when you look for EU-funded projects on 'ICT for ageing'.

[259] First it was called the 'EU Programme for Employment and Social Innovation' (EaSI), and since 2021 it has become the 'European Social Fund Plus' (ESF+). It is the EU's main instrument for investing in people. With a budget of almost €99.3 billion for 2021-2027, the ESF+ will contribute to the EU's employment, social, education and skills policies, including structural reforms in these areas. See also calls for proposals and current/previous projects.

[260] European Social Fund (ESF): each year the ESF helps millions of Europeans improve their lives by learning new skills and finding better jobs. See also calls for proposals and current/previous projects.

[261] Eurostat regional yearbook, Eurostat, 2021.

Map 2 – Daily internet users in 2020



Source: Eurostat regional yearbook, Eurostat, 2021.

4.4.1. Internet use

As digital technology becomes more and more widespread, internet use is continuing to grow throughout the European Union. According to the most recent Eurostat figures,[262] in 2020 four fifths of all adults in the EU used the internet on a daily basis, with internet use defined as all use of the internet at home, work or anywhere else, across all devices (computer, smartphone, tablet or other) and covering all types of connections. Yet, while at least half of the adult population in every EU region made daily use of the internet in 2020, a clear geographical division is evident, with southern

[262] ibid.

and eastern EU regions generally demonstrating lower levels of daily use than northern or western regions, as shown on the above map.

As highlighted by Eurostat's 2021 regional yearbook,[263] the three regions with the largest share of adults using the internet on a daily basis – Hovedstaden, Helsinki-Uusimaa and Stockholm – are not only located in Scandinavia but are also all capital regions, with other largely urban regions in many Member States witnessing particularly high levels of daily internet use among adults.

Conversely, some of the lowest levels of daily internet use were recorded in predominantly rural areas of Bulgaria and Romania, but also in parts of Ireland. The report suggests that there is not only a geographical split when it comes to daily internet use, between the north and west of Europe on the one hand, and southern and eastern EU Member States on the other, but also between the EU's urban and rural regions. This also explains the relatively low rates of daily internet use across many regions of France, with many of the regions in question predominantly rural areas.

The situation of the EU's outermost regions is particularly revealing; two of France's five outermost regions, Guadeloupe and La Réunion, are included on the list of 10 EU regions with the lowest daily internet use among adults, with the latter registering the lowest level in the whole EU. Only one outermost region – the Azores – exceeds the EU average of 80 %.

4.4.2. E-commerce

E-commerce covers a variety of different retail activities, being defined by Eurostat as the purchase of goods or services via online transactions. This includes orders for goods or services that are made online (with payment and final delivery either online or offline) but excludes orders made via e-mail. The flexibility afforded by online shopping, which allows people to buy items 24 hours a day, wherever they live, has led to a growth in e-commerce, a trend that has likely developed even further during the recent pandemic according to Eurostat.

The map below shows the percentage of people aged 16 to 74 who ordered goods or services online for private use during the 12 months preceding the survey in 2020. While the EU average is relatively high at 65 %, this figure hides a number of important regional differences. As outlined in the 2021 regional yearbook, closer inspection of the map reveals that the regions with the lowest levels, marked in the two darkest shades of blue, are located primarily in eastern and southern Europe, while the regions with the highest proportion of adults making online purchases, marked in red, are to be found in north European countries such as Denmark and the Netherlands. With certain regions of northern Germany and Sweden also registering a high proportion of adults who purchased or ordered goods online, this suggests a clear geographical divide as regards levels of e-commerce.

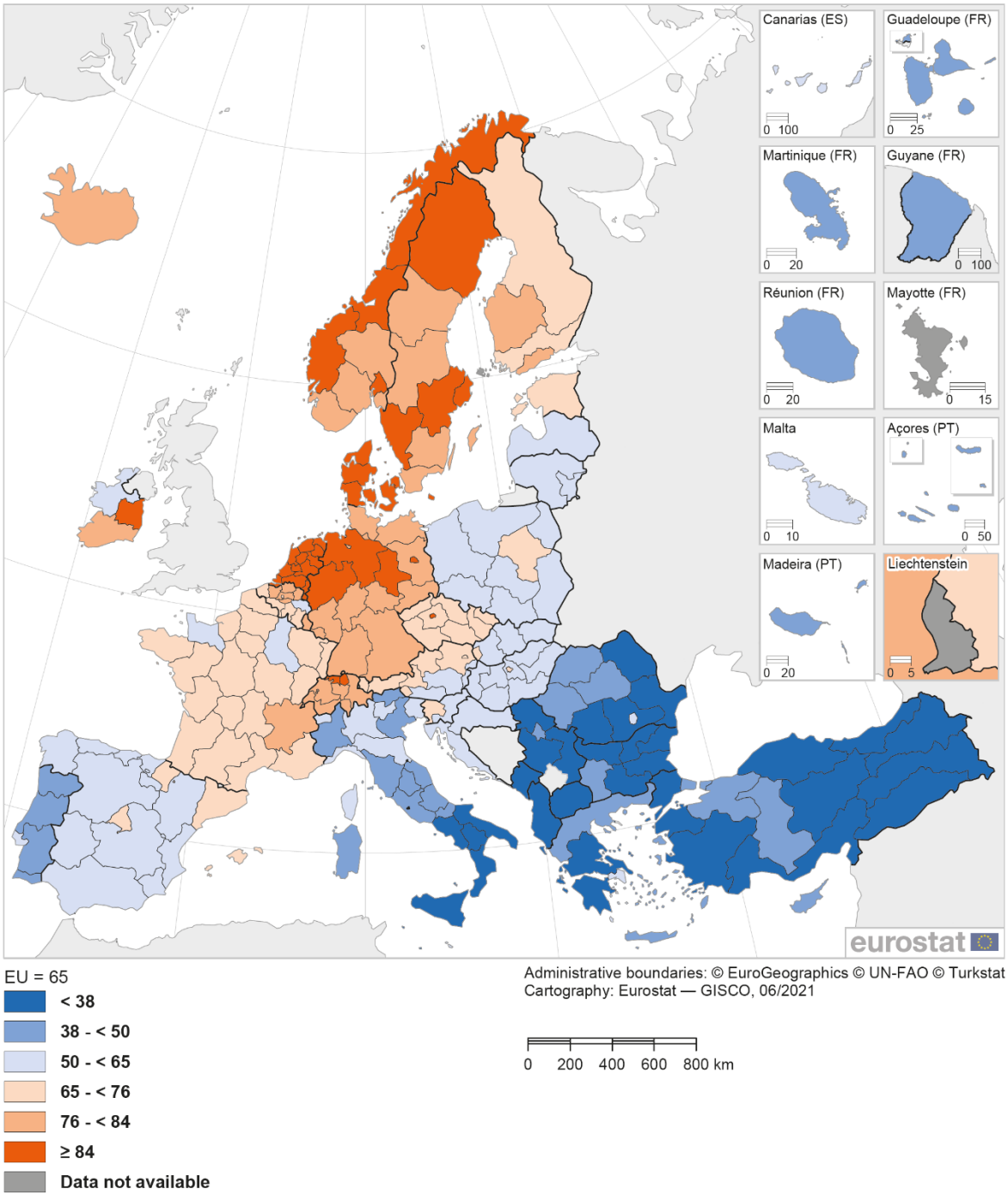
Geographical isolation, which is often characterised by poorer access to certain products and services, might be expected to be a factor that would encourage more online purchases of goods and services that are unavailable in rural areas. This could certainly help to explain the situation in regions such as the north of Sweden, which recorded particularly high levels of online purchases among adults, with much of rural Scandinavia, rural France and rural Germany also registering levels above the EU average, but these regions are arguably exceptions to the general rule.

As with the figures for internet use, the regions with the lowest levels of e-commerce are largely rural, with the bottom 10 regions located in rural southern Italy, Bulgaria and Romania. While these figures are likely to be linked to the low levels of internet use in these regions, other factors could also be at play, with the 2021 regional yearbook pointing to issues such as a lack of trust in such

[263] ibid.

transactions or simply the lack of a bank account. The situation was only slightly better in the outermost regions. Except for the Canary Islands, less than half of all adults in the outermost regions ordered goods or services online during the previous 12 months, with the cost of transporting goods to these regions from mainland Europe a possible additional factor behind this trend.

Map 3 – People ordering goods/services online in 2020 (%)



Source: Eurostat regional yearbook, Eurostat, 2021.

This geographical and rural divide was also confirmed by an EU survey examining how recently people ordered goods or services online, providing statistics for each region on the percentage of adults who ordered online in the last 3 months, in the last 3 to 12 months, over one year ago, or who had never made an online purchase. While almost 20 % of all adults in the EU had never made an

online purchase, it is particularly revealing that the 11 regions in which the number of people who had never made an online purchase were in the majority included the predominantly rural regions of southern Italy, Greece, Cyprus and Madeira, as well as every region in Bulgaria and Romania.

4.4.3. Participation in social networks

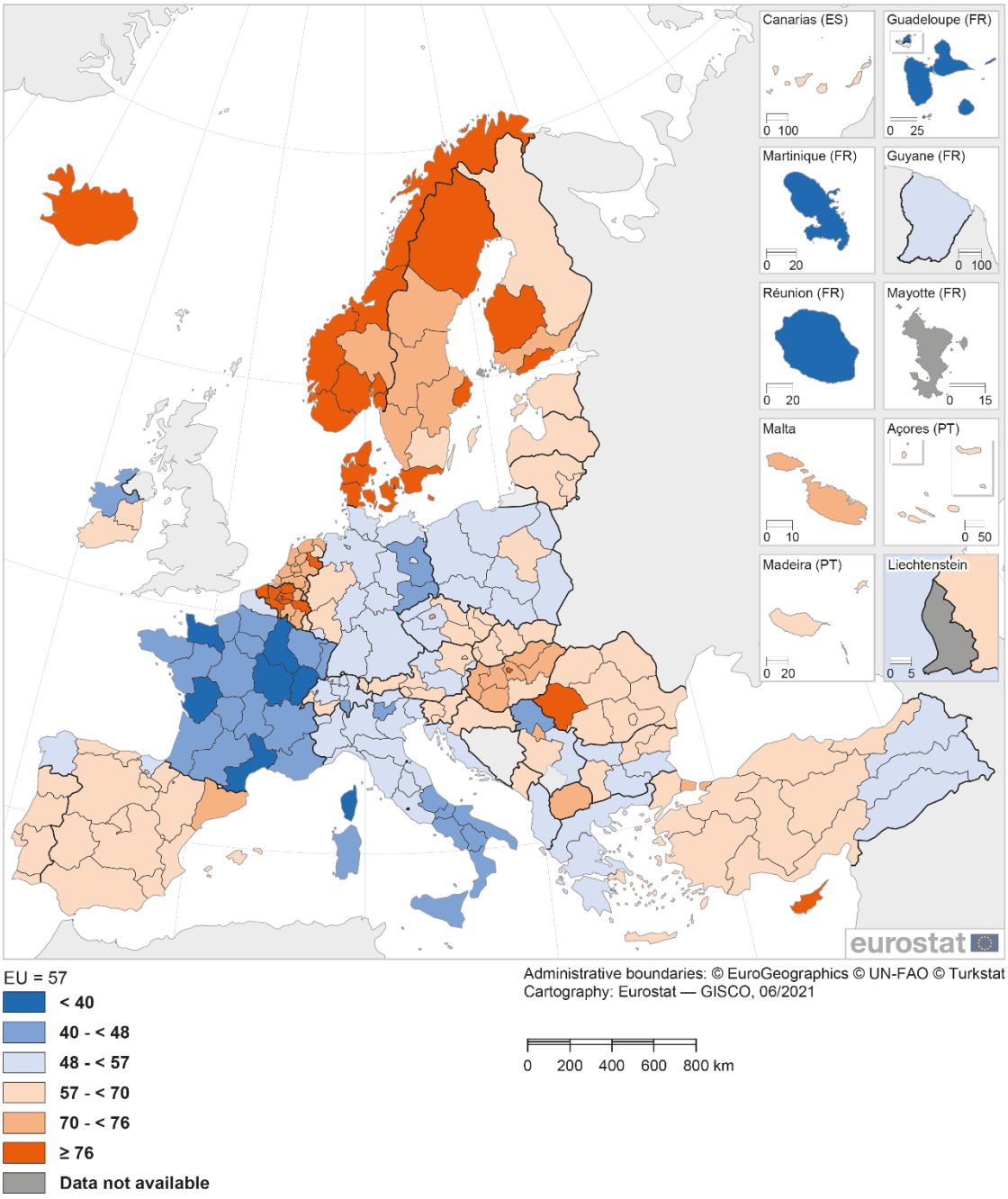
Participating in social networks has changed the way people communicate, connect, consume and do business. With almost six in ten adults (57 %) across the EU active on social networks, participation in social media such as Facebook, Instagram or Twitter is a common pastime among EU citizens. Crucially, social media platforms are playing an increasing role outside the private sphere, with 2019 figures showing that 53 % of EU enterprises[264] used some form of social media for marketing purposes, and/or recruiting new employees, opening up new opportunities for users of social media. Despite the popularity of social networks, there are several EU countries where these levels are below the EU average across all regions.

This points once again to a geographical divide, but while the northern Member States continue to perform well and Italy's island and southern regions register low levels yet again, the presence of a south-east/north-west split is less apparent than for the previous two measures. Participation rates across much of eastern Europe are above the EU average, bucking the trend that might be expected given the low rates recorded there for internet use and e-commerce. Conversely, all but two of France's regions registered rates at least nine percentage points below the EU average, with Eurostat figures revealing that the EU's 10 worst performing regions are all located in France. While the extent to which people are connected to the internet will necessarily impact on their social media activity, the unexpected social media participation rates in some countries suggest other factors are at play.

In this context, the Eurostat regional yearbook notes that, while social media activity almost doubled among older people since the previous reporting period, the percentage of older adults using social media was almost four times lower than that among young people, revealing a clear link with age.

[264] Eurostat, Social media – statistics on use by enterprises, 2020.

Map 4 – People participating in social networks in Jan-Mar 2020 (%)



Source: Eurostat regional yearbook, Eurostat, 2021.

This could potentially help explain the low rates recorded across numerous regions of France and southern Italy, as such predominantly rural, low-density areas are often characterised by an older population who use social media much less frequently, effectively leading to a rural-urban divide, albeit less pronounced than in the case of the other two measures. Meanwhile, the higher rates recorded in much of eastern Europe, where internet use is much lower than in countries such as France, suggests that being connected to the internet is far from being the only factor governing the level of people's social media participation.

Although Spain and Portugal's outermost regions all record social network participation levels that are above the EU average, the situation of France's outermost regions is particularly striking, with

Martinique and Guadeloupe the two worst-performing regions in the EU and Réunion registering the fifth-lowest participation rate in the EU. With outermost regions characterised by a younger than average population, a factor that could be expected to generate high social media participation, it is also possible that the very low rates recorded in these three regions could also be the result of structural problems[265] relating to their insularity and geographical isolation.

4.4.4. Digital skills

In a context where the digitalisation of our society is not just a priority but is increasingly becoming a necessity, something that was brought into particularly sharp focus during the coronavirus pandemic, there can be little doubt of the strategic importance for the EU of improving digital skills for all. Building on President von der Leyen's 2019 political guidelines, which emphasised the need to harness digital technology and develop digital skills, the 2020 digital education action plan[266] outlined a vision to improve digital literacy, capacity and digital skills, setting a headline objective of ensuring that 80 % of people should have basic digital skills by 2025.

Progress towards this EU headline objective is measured by the annual Digital Economy and Society Index, which examines Member States' digital competitiveness in the areas of human capital, broadband connectivity, the integration of digital technologies and digital public services. According to the 2021 Digital Economy and Society Index,[267] in 2020 just 56 % of Europeans had at least basic digital skills, defined as skills that allow people to participate in the digital society and use digital services and goods. While representing an increase of one percentage point on 2019, this figure remains well below the 80 % objective set for 2025, with the percentage of Europeans with above basic skills (defined as skills in designing, developing, managing and deploying technologies such as artificial intelligence or cybersecurity) also low, at 31 %.

As highlighted by the report, the Netherlands was the top performing country, with 79 % of its citizens possessing at least basic digital skills, closely followed by Finland and Sweden, at 76 % and 72 % respectively, with Denmark and Germany both on 70 %. Conversely, the figure was lowest in Bulgaria and Romania, at 29 % and 31 % respectively, followed by Italy, Latvia, Poland and Cyprus, reflecting the divide between the north and west of Europe and its southern and eastern Member States that is visible in the above three metrics used to measure digital literacy.

The report shows that the level of digital skills was lowest among adults living in rural areas, where just 48 % of residents had basic or above basic digital skills, a full 14 percentage points below the figure for people living in cities (62 %). This points to a significant digital skills divide between adults living in rural areas and those in cities, a gap that is unchanged in terms of its percentage points since the previous reporting period. In the previous reporting period (2019), the digital skills divide was as high as 23 percentage points in four Member States – Bulgaria, Croatia, Greece and Portugal – while a further three Member States recorded a digital skills gap of over 20 percentage points, with Ireland, Lithuania and Hungary registering a gap of 20, 21 and 22 percentage points respectively.

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265 Towards a stronger partnership with the EU outermost regions, report by the Committee on Regional Development, European Parliament, 2021.

266 Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the Digital Education Action Plan 2021-2027 – Resetting education and training for the digital age, 2020.

267 The Digital Economy and Society Index (DESI), European Commission.

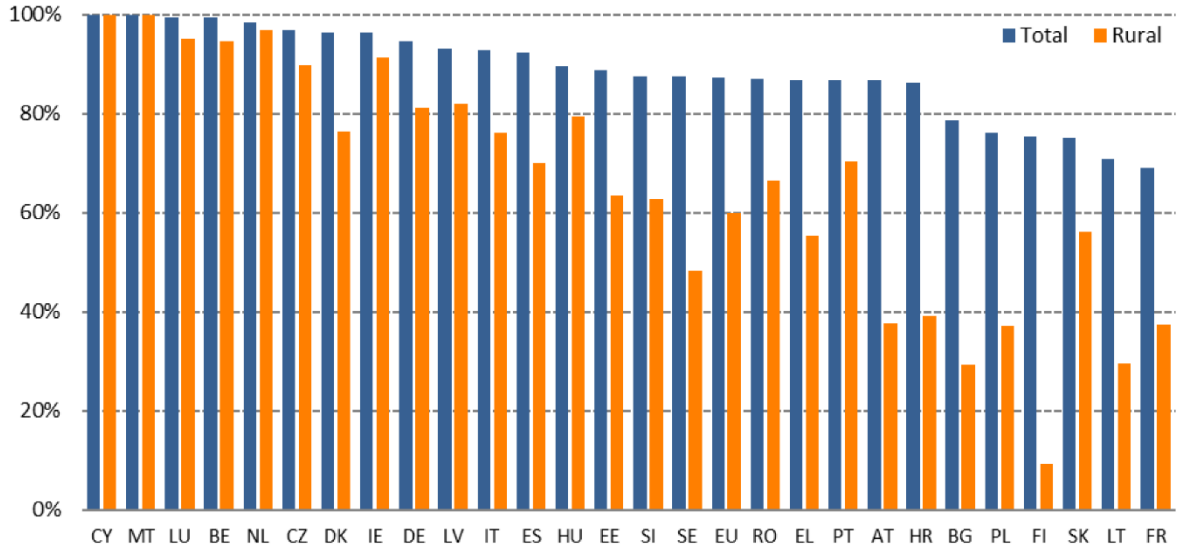
4.4.5. Digital connectivity

Digital connectivity and infrastructure is also one of the aspects measured by the annual Digital Economy and Society Index. Examining the demand and supply of fixed and mobile broadband across the EU, the report monitors, among other things, take-up of fixed broadband overall, assesses fast broadband availability (next generation access (NGA) of at least 30 Mbps) and assesses the availability of fixed very high capacity networks (VHCNs). While the situation varies from one country to another, a significant urban-rural digital divide exists in all EU Member States, in large part due to the high cost and risks involved in the rollout of digital infrastructure in less built-up areas. Characterised by a low population density, numerous rural areas across the EU suffer from a lack of investment in the field of connectivity, which has a negative impact on the lives of people in rural communities.

In terms of overall fixed broadband coverage, the report shows that 97.4 % of EU households had access to at least one fixed broadband service in 2020. Yet, with just over 10 % of households in rural areas not covered by any fixed network, the data reveals a gap of 7.7 percentage points between the availability of fixed broadband services in rural areas (89.7 %) and in all areas combined (97.4 %). In addition, significant differences are visible among individual Member States. While there were 19 Member States in which fewer than 3 % of households had no fixed broadband coverage, over 10 % of households in Lithuania, Poland and Romania had no access to fixed broadband services.

When it comes to high-speed next generation access services, Cyprus, Malta and Luxembourg and Belgium were the EU's top-performing countries, with the report revealing that over 99 % of households in these countries were covered by NGA services, while Lithuania and Poland once again scored relatively poorly, with both countries among the EU's five worst-performing countries. It was France, however, that recorded the lowest figure, with 69 % of all households covered by NGA services, a percentage that dropped to below 40 % in rural areas. This is a pattern that is repeated across many Member States, with a rural-urban digital divide even wider than in the case of fixed broadband coverage. According to the data, NGA networks cover just 59.8 % of homes in rural areas in the EU, a full 27.4 percentage points below the figure for NGA coverage in all areas.

Figure 16 – Next generation access (NGA) to broadband coverage in the EU (% of households), mid-2020

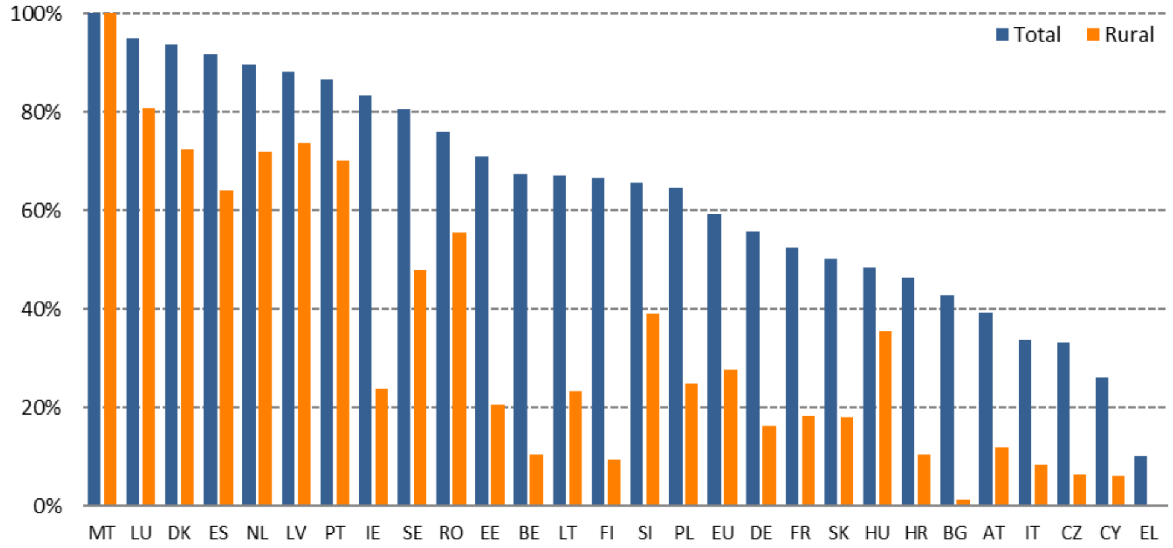


Source: Digital Economy and Society Index (DESI) 2021 – Digital infrastructures.

Fixed very high capacity networks, which can provide connectivity of at least 1 gigabit per second, were available for 59 % of households across the EU in 2020. Malta and Luxembourg performed well on this measure as well, with Malta recording VHCN coverage of 100 %, closely followed by Denmark and Spain. At the other end of the scale, Austria, Italy, Czechia, Cyprus and Greece all had VHCN coverage of below 40 %, with the latter recording a figure of just 10 %. While Spain and Latvia were among the six top-performing countries, both France and Germany were below the EU average for VHCN coverage, suggesting that the southern-eastern divide is not as clear cut for VHCN coverage as in the case of other measures for assessing the digital transformation.

Closer examination of the figures reveals that rural VHCN coverage lags significantly behind the figures at national level in many Member States, with both France and Germany recording rural VHCN coverage of below 20 % and some countries such as Finland or Italy recording single-digit figures when it comes to the percentage of rural areas that have VHCN coverage. Looking at the EU as a whole, just 28 % of homes in rural areas are covered by a very high capacity network, which represents a gap of 31 percentage points compared with the figure for total VHCN coverage across the EU. As highlighted by the DESI report, perhaps more than any other measure this figure demonstrates the need for greater investment in modern digital infrastructure in rural areas to help close the significant gap that divides them from other areas.

Figure 17 – Fixed very high capacity network (VHCN) coverage in the EU (% of households), mid-2020



Source: Digital Economy and Society Index (DESI) 2021 – Digital infrastructures.

In terms of fixed broadband take-up, meanwhile, the report reveals that 77 % of EU homes had a fixed broadband subscription, with top performers Cyprus and Germany both recording figures of over 90 %. Finland came bottom with a figure of 57 %, suggesting that other factors may be at play, with the DESI report noting that the broadband subscription rates in countries such as Finland, Italy, Latvia and Poland could be caused by people relying on fixed-mobile subscriptions instead. However, as with the other digital measures discussed above, a significant gap is visible between urban and rural areas, with a fixed broadband take-up rate of just 69 % in rural areas compared with a figure of 81 % for urban households.

Notwithstanding the continued divisions between rural and urban areas and between the countries of southern and eastern Europe and Member States in the north and west of the EU, the DESI report points to a number of positive developments since the previous reporting period, not least the

narrowing of the gap between network coverage in rural areas and nationally in the case of fixed and NGA technologies. It also emphasises that NGA coverage in rural areas has grown at a steady pace, increasing by 5.7 percentage points on the previous year, while in terms of fixed broadband, fibre to the premises (FTTP) has been rolled out more quickly in rural areas than other fixed broadband technologies, with rural FTTP availability increasing by 6.1 percentage points during the last 12 months.

4.4.6. Digitalisation and the development of rural and urban areas

As outlined above, there is clear evidence of a substantial digital divide between rural and urban areas, with significant differences visible in the area of digital literacy, as measured by internet use, social media participation and online shopping, as well as in terms of digital connectivity or the digital skills of people in rural and urban areas. What is more, there would appear to be an established link between levels of digital literacy and skills and digital connectivity, with people in urban areas (which are generally better connected) demonstrating higher levels of digital literacy and skills. While high levels of digital connectivity in urban areas can help support the rollout of digital skills, in the case of rural areas this effectively means that lower levels of digital connectivity are actually compounding a difficult situation. For although many cities are home to people with low levels of digital literacy, suggesting that high urban digital connectivity does not always translate to higher digital skills for all residents, people living in rural areas generally suffer disproportionately from the effects of digital exclusion when compared with urban residents overall.

This problem is known as the paradox of the digital territorial divide, a concept discussed in a 2020 paper[268] on the rural digital divide. Put simply, while rural areas need better digital connectivity to make up for their geographical isolation, they actually tend to have lower levels of digital connectivity, with the result that people living in these areas are less digitally connected. The digital divide is therefore greatest for people living in rural communities and, in this context, addressing the rural digital divide is of key importance for the future of rural areas.

This was recognised as far back as 2016, with the adoption of the Cork Declaration on a Better Life in Rural Areas.[269] Outlining 10 key policy orientations for EU agricultural and rural policy, this document noted that rural businesses and the rural economy would be increasingly dependent on digitisation and knowledge workers who can capitalise on the digital transformation and enhance rural production. In particular, it stressed that special attention should be paid to addressing the digital divide and to harnessing the potential afforded by the connectivity and digitisation of rural localities.

This debate has gathered momentum in recent months, with the actual extent of the digital divide in rural areas brought into even greater focus during the coronavirus pandemic. As highlighted by the paper on the rural digital divide, older people in rural communities were one of the groups most likely to be excluded from technology-based measures to address social or other needs during the crisis. The inequalities faced by older adults in rural communities, such as their sense of loneliness, were thus exacerbated further, particularly for those people unable to connect digitally. Key stakeholders such as Digital Europe have noted[270] that the crisis has demonstrated a societal

[268] The Rural Digital Divide in the Face of the Covid-19 Pandemic in Europe – Recommendations from a Scoping Review, Informatics, 2020.

[269] Cork 2.0 Declaration – A Better Life in Rural Areas, 2016.

[270] Bridging the urban-rural digital divide, Digital Europe, 2020.

imperative to close this digital gap, which is vital to ensure the socio-economic empowerment of citizens and businesses located beyond large metropolitan areas.

The European Parliament has also actively contributed to this debate, with its March 2022 resolution on the role of cohesion policy in promoting innovative and smart transformation and regional ICT connectivity highlighting the critical digital skills divide between adults in rural areas and those in cities, which particularly affects people on low incomes, women and the elderly. In this context, Parliament calls on the Member States to invest in targeted upskilling and educational measures to close digital gaps, noting that they are related to a lack of access to high-capacity networks, among other reasons. Highlighting its concern regarding the urban-rural digital divide that exists in terms of the quality and affordability of broadband networks, Parliament emphasises that future investments under the ERDF-CF should contribute further to the development of high-speed digital infrastructure networks, noting the need to prioritise rural areas in this respect.

The recent expansion in the use of telework and ICT-based mobilework (TITCM), necessitated by the sanitary restrictions in place during the coronavirus pandemic, could open up a range of new possibilities for rural areas and represent one of the keys to their future development. An April 2021 European Parliament study[271] on the impact of teleworking and digital work on workers and society considers, for instance, that, in cases where there is adequate broadband coverage, remote working could improve the employment opportunities for people in rural and peripheral areas. In particular, the study highlights the possible spatial impact of TICTM. By giving people the choice to work remotely from home in suburban or rural areas rather than commute to urban centres, TICTM could encourage the relocation of companies and workers and companies from urban and metropolitan areas to suburban or rural areas. Indeed, the study argues that it is widely recognised that the significant increase in teleworking during the pandemic is likely to have a long-term impact on the spatial distribution of work, including in geographically isolated areas.

As highlighted in a comprehensive Eurofound 2020 research study[272] entitled 'Living, working and Covid-19', this could lead to the significant relocation of economic activity that is ancillary in nature from urban business centres to more residential areas, including rural areas. In addition, it could also mean there is a certain move away from the tendency to concentrate higher-value added economic activity in larger urban areas, which could clearly have an impact on the growth and development of rural communities.

The European Parliament's 2021 study argues that there is some evidence to suggest that the increase in teleworking is leading people to move out of high-density and expensive urban areas towards lower density suburbs and rural localities, with the US, for instance, seeing a significant movement of people from densely populated areas to lower density areas following the pandemic. Closer to home, a 2021 case study[273] in Sweden reveals an increase in rural in-migration during the pandemic, caused largely by people moving to second homes located in rural areas, but underlines that, if this process is to become permanent, the availability of appropriate services and infrastructure is vital.

In particular, the study notes that, not only could teleworking help make it more appealing for people to live in rural areas, it could also help increase the demand for telecommunications

[271] The impact of teleworking and digital work on workers and society, study requested by the EMPL Committee, European Parliament, 2021.

[272] Living, working and Covid-19, Eurofound, 2020.

[273] Aberg A. and Tondelli S., Escape to the Country: A Reaction-Driven Rural renaissance on a Swedish Island Post Covid-19, Sustainability 2021, 13.

infrastructure improvements or the creation of new co-working spaces. In addition, the growth in the number of workers moving away from urban areas could also lead to a variety of benefits for suburban and rural areas themselves. This could have a number of important local multiplier effects, with the academic Enrico Moretti estimating[274] that the relocation of one skilled job can generate an average of 2.5 more jobs in the local area in the goods and services sector.

These types of changes in the local economy of rural or suburban areas, involving increased local consumption or the greater use of local services, could clearly have a positive impact on the development of non-urban areas. This, in turn, could result in a number of positive knock-on effects. As highlighted by the study, as these rural and suburban areas start to grow, spurred on by development fuelled by the relocation of urban residents, it is probable that more new businesses will be attracted to these rural and suburban areas. This could have the effect of creating more jobs and services, making these areas more attractive to young people, something that could potentially help to reduce the migration of local people away to larger urban areas.

However, it is also important to bear in mind that there are necessarily limitations to the benefits that increased teleworking and the resultant relocation of urban residents can bring to rural areas, and that this process does not represent a panacea for all the problems associated with the rural-urban digital divide. As noted by the 2020 paper[275] on the rural digital divide, this digital divide also ultimately reflects the social inequalities that were present in these regions in the past, caused by factors such as the outward migration of younger people, peripheral location or the absence of economic resources in rural areas. It argues that the impact of such factors should not be underestimated, as people in rural areas are often unable to fully harness the potential of broadband technology even when they have access to such services, as a result of which they continued to be in a disadvantageous position when compared to urban residents. Similarly, the paper emphasises that many people in rural communities do not become active online participants even when broadband is available in their local area, because they either lack the necessary skills or, in some cases, are not interested in learning to use new technology.

As some researchers have noted,[276] giving people greater digital connectivity does not always mean that they will necessarily make use of it. Clearly, therefore, while improved digital infrastructure certainly has the potential to reduce the urban-rural digital divide, successfully closing the digital gap will depend on many other factors beyond increasing investment in infrastructure.

5. Outlook

Digital transformation, ongoing for some decades and enhanced by the Covid-19 pandemic, will reshape our economy, our workplaces, our educational systems and our personal lives at an unprecedented speed. While digital technologies have the potential to improve productivity and economic growth, and can raise our living standards, quality of life and life expectancy, they also go together with new challenges. Research already shows their impact on different demographic groups, such as generations, but also on social and regional groups.

274 Moretti E., Local Multipliers, American Economic Review: Papers & Proceedings, 2010.

275 The Rural Digital Divide in the Face of the Covid-19 Pandemic in Europe – Recommendations from a Scoping Review, Informatics, 2020.

276 Meanings of (dis)connection: Exploring non-users in isolated rural communities with internet access infrastructure, Pavez I., Correa T. and Contreras J., Universidad de los Andes, 2017.

At EU and Member State level, a lot has already been done to alleviate the effect of changes triggered by digital technologies and to design and offer targeted help to demographic groups who have difficulties coping with these challenges, and to regulate legally the impact of digital technologies on their lives.

Working conditions of digital platform workers will be improved in the near future[277] and digital platform rules are being upgraded by the Digital Services Act and the Digital Markets Act. Ethical and data protection issues related to automation have already been addressed through the Ethics Guidelines for Trustworthy AI[278] and the General Data Protection Regulation.[279] The increased use of digital technologies, however, leads to vulnerability to cybercrime, and further measures have to be put in place to protect the most vulnerable age groups in this regard: children, young people and the elderly.

There is an increasing digital divide between geographical areas and social groups due to the lack of infrastructure and resources, but also between age groups and educational levels, due to different levels of digital competence and skills. More has to be done to increase the share of the population with at least basic digital skills, and to reach the target of 80 % of the population having at least basic digital skills set by the EU 2030 digital strategy.[280] Digital skills have already been a priority and have most recently been addressed through the European Skills Agenda.[281] This has to be continued and infrastructure has to be developed further to make the benefits of digital technologies available for all generations, social groups and EU geographical areas in an equal way.

277 Proposal for a directive of the European Parliament and of the Council on improving working conditions in platform work, 2021.

278 Ethics guidelines for trustworthy AI, Independent High-Level Expert Group on Artificial Intelligence set up by the European Commission, 2019.

279 Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation), European Commission, 2016.

280 Proposal for a Decision of the European Parliament and of the Council establishing the 2030 Policy Programme 'Path to the Digital Decade', 2021.

281 European Skills Agenda, European Commission, 2020.

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The latest demographic data show that existing demographic tendencies, such as increasing median age, declining fertility rates and a shrinking working age population, continue to prevail. However, it is also becoming clear that the influence of the pandemic in 2021 was more significant than during the previous year – for instance, 'excess mortality' increased even further, while life expectancy decreased in many Member States.

The pandemic also accelerated another phenomenon, present in our lives in recent decades: the digital transition. Social distancing measures favoured automation and digitisation, an increased use of e-government, and led to higher rates of remote working. Parallel to this, new problems and challenges appeared, touching diverse demographic groups in different ways and to differing degrees. Digital fraud, cyber-threats, digital dependency and a deepening digital divide pose more and more challenges for citizens and the EU.

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