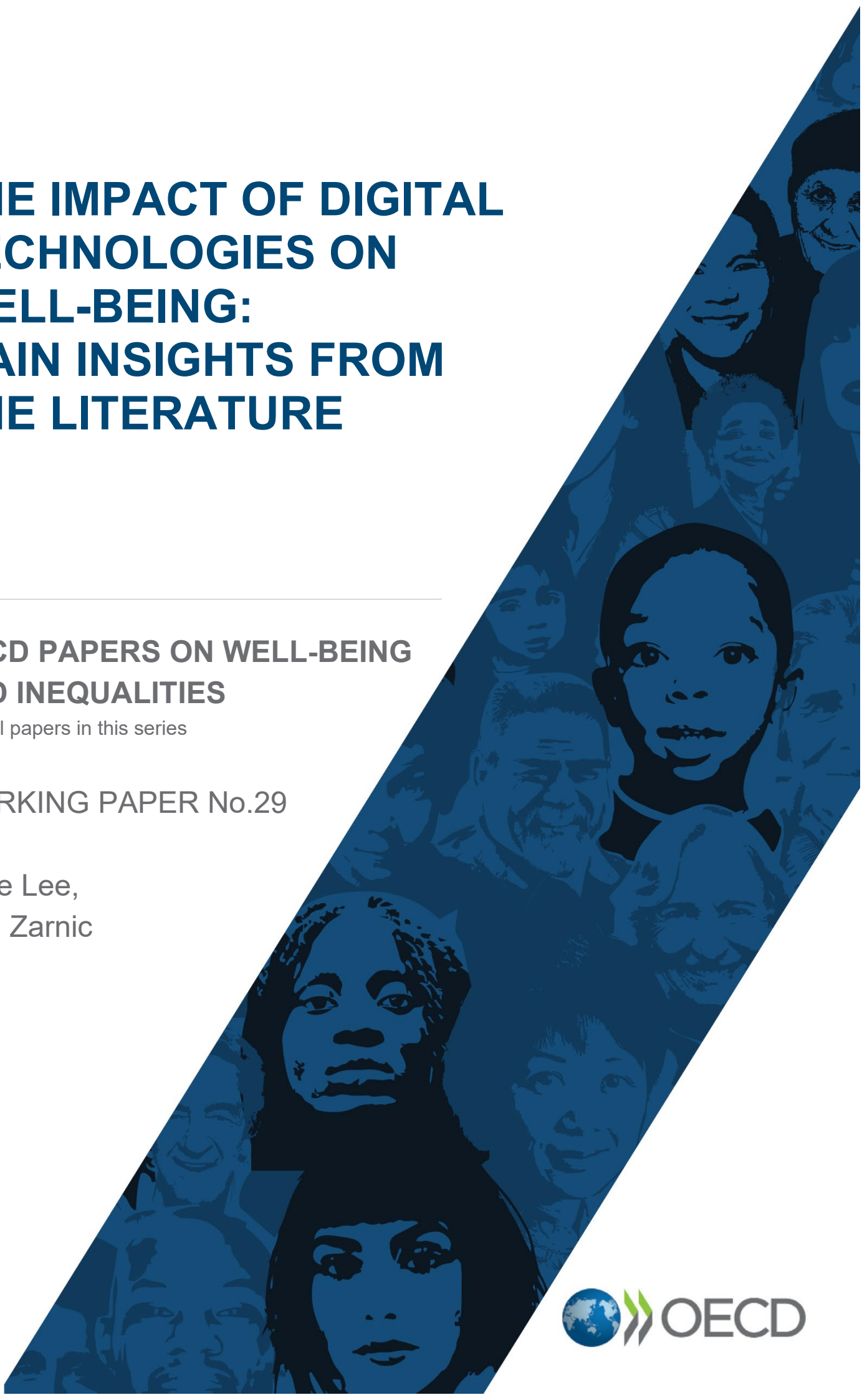
THE IMPACT OF DIGITAL TECHNOLOGIES ON WELL-BEING: MAIN INSIGHTS FROM THE LITERATURE



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Abstract

Digital technologies can shape different aspects of people's lives. When widely accessible and navigated with strong technical skills, these technologies can have positive effects on economic well-being, through their effects on labour markets, productivity, and consumption. However, their effects on social and relational aspects of well-being are less clear-cut. Recent literature highlights that digital technologies (and *digital media* in particular) can have both positive and negative effects across different dimensions of well-being, with risks entailed by *excessive* or *problematic* use of these media. For instance, *excessive* use of digital devices for leisure correlates with lower student performance and lower sense of belonging in schools. The overall impact of digital technologies on health is nuanced: on the one hand, tech-enabled healthcare, improves access to medical information and services, which can enhance well-being. On the other hand, heavy use of digital media and devices can be associated with anxiety, depression and isolation and, especially among, young women they can be the source of behavioral problems. Similarly, digital technologies have changed the way people connect socially, but their effect on social isolation and loneliness remains complex and not fully understood. The influence of digital technologies on civic engagement is also double-edged. While they have facilitated participation in public life, they have simultaneously fuelled mis- and dis-information, fostering mistrust in online information and potentially exacerbating political polarization. Moreover, the rise in online harassment, particularly against women and sexual minorities, highlights the darker aspects of digital interactions. Understanding the relationship between digital technology use and subjective well-being requires further study. Finally, digital technologies can help bridge digital divides, but it can also interact and reinforce them, potentially worsening existing inequalities.

JEL Classification: I1, I3

Keywords: digitalisation, well-being, health, social connections, subjective well-being, civic engagement, personal safety, work-life balance, digital divide

Résumé

Les technologies numériques peuvent façonner différents aspects de la vie des gens. Lorsqu'elles sont largement accessibles et que l'on y navigue avec de solides compétences techniques, ces technologies peuvent avoir des effets positifs sur le bien-être économique, grâce à leurs effets sur les marchés du travail, la productivité et la consommation. Toutefois, leurs effets sur les aspects sociaux et relationnels du bien-être sont moins évidents. La littérature récente souligne que les technologies numériques peuvent avoir des effets à la fois positifs et négatifs sur différentes dimensions du bien-être, avec des risques liés à une utilisation excessive ou problématique des technologies numériques. Cependant, leurs effets sur les aspects sociaux et relationnels du bien-être sont moins clairs. La littérature récente souligne que les technologies numériques (et les médias numériques en particulier) peuvent avoir des effets à la fois positifs et négatifs sur différentes dimensions du bien-être, avec des risques liés à une utilisation excessive ou problématique de ces médias. Par exemple, l'utilisation excessive des appareils numériques pour les loisirs est corrélée à une baisse des performances des élèves et à une diminution de leur sentiment d'inclusion. L'impact global des technologies numériques sur la santé est nuancé : d'une part, les soins de santé assistés par la technologie améliorent l'accès à l'information et aux services médicaux, ce qui peut améliorer le bien-être. D'autre part, l'utilisation intensive des médias et des appareils numériques peut être associée à l'anxiété, à la dépression et à l'isolement et, en particulier chez les jeunes femmes, elle peut être à l'origine de problèmes comportementaux. De même, les technologies numériques ont changé la façon dont les gens se connectent socialement, mais leur effet sur l'isolement social et la solitude reste complexe et n'est pas entièrement compris. L'influence des technologies numériques sur l'engagement civique est également à double tranchant. Si elles ont facilité la participation à la vie publique, elles ont en même temps alimenté la désinformation, favorisant la méfiance à l'égard des informations en ligne et pouvant exacerber la polarisation politique. En outre, l'augmentation du harcèlement en ligne, en particulier à l'encontre des femmes et des minorités sexuelles, met en lumière les aspects les plus sombres des interactions numériques. La compréhension de la relation entre l'utilisation de la technologie numérique et le bien-être subjectif nécessite des études plus approfondies. Enfin, les technologies numériques peuvent contribuer à combler la fracture numérique, mais elles peuvent aussi interagir avec elle et la renforcer, ce qui risque d'aggraver les inégalités existantes.

1. Introduction and main findings

How do digital technologies affect us? This paper reviews the literature to better understand their impact on individual and societal well-being, building on a field of research that, while still in its infancy, is growing rapidly. Existing research explores these issues in various ways and broadly speaking, there is no consensual definition of "digital well-being" or a consistent framework to examine the impacts of digital technologies on people's well-being.

Academic research tends to focus on digital well-being from the perspective of how individuals are able to develop and manage a healthy relationship with technology[1,2]. Increasingly, it considers the subjective aspects of one's individual experience with technology, including affective and cognitive appraisals of how digital connectivity is integrated into ordinary life (Vanden Abeele and Nguyen, 2022[1]). The focus on the subjective dimensions of digital well-being takes into account a social environment where digital media are omnipresent (Büchi, 2021[2]) and aims to understand if individuals can channel digital media usage towards a sense of comfort, safety, satisfaction and fulfilment (Gui, Fasoli and Carradore, 2017[3]). Some of the literature focuses on specific well-being outcomes, such as quality and quantity of sleep, eye strain, depression and anxiety, perceived social isolation, and attention-deficit or hyperactivity disorder (Economic Commission for Europe, 2020[4]). Davis (2024[5]), on the other hand, focuses more narrowly on the digital users' ability to control their digital behaviours.

Policy work, on the other hand, refers to digital well-being in a broader context, emphasising the wide range of implications that digital technologies can have for people's life and societal well-being. For instance, (OECD, 2019[6]) considers the impacts of technology through a prism of the OECD Well-Being Framework (Figure 1), assessing how it is affecting eleven key dimensions of people's well-being (i.e. income and wealth, jobs and earnings, housing, health status, education and skills, work-life balance, civic engagement and governance, social connections, environmental quality, personal security and subjective well-being). Some of the well-being dimensions are interdependent, meaning that changes in one dimension can influence others. For instance, while digital technology can directly impact health, the extent and nature of this impact can be moderated by education and skills. Higher levels of education and skills may amplify the positive effects or mitigate the negative ones, while lower levels might lead to weaker or adverse outcomes.

In this context, the next section updates the analysis from the 2019 OECD's *How's Life in the Digital Age* report (Box 1.1), reviewing the more recently published literature on the relationship between digital

[1] For instance, researchers at the National University of Singapore (Yue et al., 2021[220]) define digital well-being as "an umbrella term that encompasses various dimensions of the digital life: crafting and maintaining a healthy relationship with technology that can be used in a balanced and civic way; identifying and understanding the positive and negative impacts of engaging with digital activities; being aware of ways to manage and control factors that contribute to digital wellbeing". Nine dimensions of digital well-being were identified: digital safety & security, digital rights & responsibilities, digital communication, digital emotional intelligence, digital creativity, digital health & self-care, digital consumerism, digital employment & entrepreneurship, and digital activism/participation.

[2] Burr and Floridi's approach (2020[219]) to digital well-being is also broad, referring loosely to "the project of studying the impact that digital technologies, such as social media, smartphones, and AI, have had on our well-being and our self-understanding of what it means to live a life that is good for us in an increasingly digital society."

technologies and people's well-being, since the report was released, in view of the fast pace of technological development. The final section summarises the main digital divides highlighted in the literature (e.g., OECD's reports on digital divides including (OECD, 2021[7]) and (OECD, 2018[8])), helping to better understand how people with different characteristics (i.e., in terms of skills, gender, income, geographic location, education, age, ethnicity, and disabilities) may be at risk or draw uneven benefits from the use of digital technologies.

The review focuses on a selection of well-being dimensions (i.e., health, social connections, civic engagement, personal safety, subjective well-being) introduced by OECD's *How's Life in the Digital Age* (OECD, 2019[6]) and OECD's Measuring Well-being in the Digital Age (Hatem and Ker, 2021[9]) reports. It also seeks to complement other OECD work focused on specific aspects of well-being, for instance, on income and wealth (OECD, 2022[10]; 2023[11]); employment (OECD, 2023[12]; OECD/ILO/European Union, 2023[13]); education and skills (OECD, 2023[14]; 2023[15]; 2024[16]; Varsik and Vosberg, 2024[17]); mental health (OECD, 2024[18]) and others considering well-being implications of digital technologies (e.g., social media, tech-enabled healthcare, digital applications, generative artificial intelligence). A simple typology of different types of experiences with digital technologies is introduced to illustrate the interplay between potentially beneficial and harmful outcomes from a well-being perspective.

The main findings from the literature review carried out in this paper can be summarised as follows.

Raising the *awareness* of benefits and risks associated with digital technology is key:

- Educating people about potential online dangers, such as phishing scams, misinformation, and data privacy concerns, enables them to make informed decisions. With heightened awareness, individuals are better equipped to recognise and avoid threats, ensuring their safety and well-being in the digital space.
- Awareness transforms users into vigilant digital citizens, reducing vulnerability and enhancing overall security. By increasing transparency of new technologies applied while fostering digital literacy, people can gain the confidence to use technology effectively, unlocking opportunities for education, employment, and personal growth.
- At the same time, it is crucial for people to understand well how technologies can affect their mental health. For example, AI systems can provide tailored support for specific mental health conditions and cognitive disabilities, unaffordable for many before. But at the same time, excessive use of digital devices can contribute to depression, loneliness, and stress, leading to problems in behaviour and conduct.
- Different types of technology like social media and AI can change the way people connect, but their effects depend on how and for what purpose they use them. It is not clear if the connections made online can help them forge meaningful bonds. Online and face-to-face interactions need to be balanced to maintain meaningful relationships – particularly for young children and teenagers and the effect this could have as they develop their social skills.

In order to fully enhance people's well-being, digital technologies should be designed and implemented as to *empower individuals*:

- Empowerment in a technology-driven environment refers to the process by which individuals gain greater autonomy and control over their lives, through a more effective use of digital tools and skills. At its core, it is about being able to make informed decisions and take meaningful actions in daily lives. It is about ensuring that individuals have the necessary digital skills to leverage these tools to their fullest potential for their improved well-being.
- In addition, empowerment is also about giving individuals control over their data, by ensuring robust data privacy protections. Providing them with the appropriate digital tools and skills to master them, people can also manage more effectively their civic engagement. Such autonomy can enable them to learn more easily, to access personalized healthcare, and so on, leading to better well-being.

- Empowered individuals can harness technology to not only improve their well-being but also to adapt to changing contexts.

The responsible use of digital technologies can help promote democratic values, ethical standards and human rights; for instance, by:

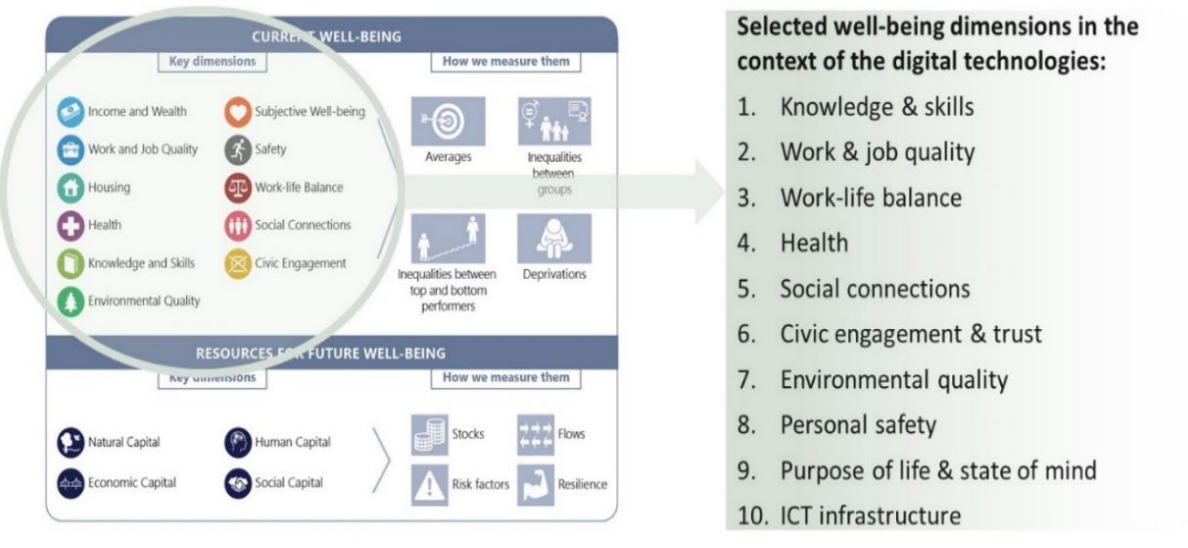
- First, using digital technologies responsibly implies respecting others' freedom of expression while avoiding hate speech or discrimination based on sexual orientation, ethnicity, or any other personal characteristic. Social media platforms, while connecting communities and amplifying voices, can for example create echo chambers that reinforce biases and spread misinformation.
- Second, involving safeguarding privacy and personal data, recognising that the misuse of information can infringe on individual rights or ethics.
- Finally, supporting the spread of accurate information and combating misinformation that can harm public discourse and democratic processes.

Box 1.1. Framing well-being in the context of digital technologies

The OECD's *How's Life in the Digital Age* report has examined the impacts of digital technologies on societal well-being through the OECD Well-Being Framework that the Organisation introduced in 2011 to measure living conditions and societal progress. This is an outcome-focused framework designed to assess whether life as a whole is getting better for people, the planet and future generations across OECD Member countries. It includes current well-being outcomes, their distribution across the population, and the systemic resources that help to sustain outcomes over time and for future generations (Figure 1).

In the context of OECD's Going Digital Toolkit and the OECD.AI Policy Observatory, the conceptual framing starts from the notion that digital technology can offer both negative and positive wellbeing effects, whereas the outcomes depend on the extent and manner in which individuals use it. Inappropriate or excessive use can lead to issues like stress, social isolation and information overload, potentially harming mental and physical health. Thus, the key lies in balancing and optimising technology usage to maximise its benefits while minimising risks.

Figure 1. Application of the OECD Well-being Framework to digitalisation



The OECD's *How's Life in the Digital Age* report highlighted the following pathways through which digital technologies interact with people's well-being:

- **Health**: Digital technologies can affect people's health status through the emergence of new physical and mental health risks and through its impact on the health-care delivery system online that is affected by new technologies, for instance, the use of electronic records, new treatment options, telecare and teleconsultation.
- **Social Connections**: Digital technologies have changed the way people interact with each other, and the effect of more recent digital technologies on social connections has been widely debated. When considering the impact of digital technologies in terms of relational well-being, it is important to understand both the quantity and quality of social connections made online.
- **Civic Engagement and Trust**: Digital technologies allow new ways for individuals and governments to express themselves and communicate with each other, receive and disseminate information and consult public services online. In turn, the Internet has also created new ways for governments to

provide services to citizens through online government portals (i.e., e-government or digital government).

- **Personal Safety**: Personal safety means being free from harm whether in the form of crime, conflict, harassment or other challenges posed by the digital transformation for individual well-being, with a due distinction among data governance, privacy and data protection that are stand-alone factors in building trust and reducing inequalities (in line with the OECD Privacy Guidelines and a recent report on *Shaping a rights-oriented digital transformation* (OECD, 2024[19])).
- **Life Satisfaction**: Digital transformation impacts people's purpose of life and state of mind, altering overall life satisfaction in both positive and negative ways. For instance, addressing technology-related stress (e.g., difficult access, information technology malfunctions or security breaches) can help improve mental health, productivity, and life satisfaction.
- **Work-Life Balance**: Finding a balance between family commitments, leisure and studying or work can be challenging, particularly with heightened use of digital devices that has blurred the lines between the time spent outside, versus the time in classrooms or in the workplace. The ability to connect from anywhere has changed the way people experience time in general as well as the nature of the relationship between work and home life, and people's family relations.
- **Work and Job Quality**: The effect of new technologies may not be directly visible in terms of lost employment but through changes in the tasks workers perform and changes in job quality. New technologies can reduce tedious or dangerous tasks but may leave workers with a higher-paced work environment and improve the workers' enjoyment at work by allowing them to focus on more complex and interesting tasks. While AI, for instance, has a potential to support managers' tasks, it may affect the job quality of their subordinates with serious ethical challenges and implications for the workplace inclusiveness. There are many real-world examples of AI-hiring tools that embed human biases against women, people with disabilities and ethnic or racial minorities.
- **Knowledge and Skills**: Digital skills are essential for people to reap the benefits of digitalisation and are necessary to participate in a society that relies increasingly on digital platforms to interact with other people and institutions. Many social and economic transactions now include some form of digital components. The digital economy increasingly demands workers who are able to solve problems in technology-rich environments. Also, digital technologies are transforming the learning experience, both in schools as well as in adult education, where problem-solving cognitive skills as well as specialised ICT and complementary skills are needed.
- **Environmental Quality**: The environmental impact of the digital transformation takes a number of forms, both positive and negative – including either direct effects (e.g. increased use of digital technologies refer mostly to the increased use of resources associated with the production and consumption of digital products or even mining cryptocurrencies) or indirect effects coming from the improved efficiency and de-materialisation of technological change and digital devices used.
- **Connectivity Services and Infrastructures:** This is a cross-cutting dimension (i.e., including communication networks (i.e., including ICT networks, computer systems, devices, programmes and data) that is necessary for people to access the Internet and participate in the digitalised society and economy. It is a prerequisite for people to interact with employers, medical services, family, friends and the society at large in the digital age.

Sources: OECD (2019[6]), *How's Life in the Digital Age? Opportunities and Risks of the Digital Transformation for People's Well-being*, OECD Publishing, Paris, https://doi.org/10.1787/9789264311800-en; OECD (2020[20]), *How's Life? 2020: Measuring Well-being*, OECD Publishing, Paris, https://doi.org/10.1787/23089679; OECD (2023[21]), *How to Make Societies Thrive? Coordinating Approaches to Promote Well-being and Mental Health*, OECD Publishing, Paris, https://doi.org/10.1787/fc6b9844-en; OECD (2021[22]), *Measuring What Matters for Child Well-being and Policies*, OECD Publishing, Paris, https://dx.doi.org/10.1787/e82fded1-en; Siegerink, Shinwell and Žarnic (2022[23]), *Measuring the non-financial performance of firms through the lens of the OECD Well-being Framework*, OECD Papers on Well-being and Inequalities, No. 03, OECD Publishing, Paris, https://doi.org/10.1787/28850c7f-en.

2. Main insights from the literature on the relationship between digital technologies and people's well-being

2.1. Exploring the literature

The approach to the literature review

A wide scan of relevant literature was carried out to gather fresh insights on a selection of well-being dimensions (i.e., health, social connections, civic engagement, personal safety and subjective well-being) for which evidence is less well-established. The following criteria were considered.[3]

- **Concepts analysed**: Scientific articles were first identified by using keyword combinations' search on *Google Scholar* database. Keyword combinations for the search included: digital; digital technologies; digital well-being; digitalisation; social media; teleworking (also referred in the literature as work-from-home, offsite work or smart-working from home); digital divide, together with health; mental health; e-healthcare; social connections; loneliness; civic engagement; mis/disinformation; polarisation; trust; online harassment; digital security, cyberbullying; subjective well-being; life satisfaction; job satisfaction; work-life balance.
- **Time horizon**: The review focuses on the studies published after releasing the OECD's *How's Life in the Digital Age* report (2019[6]), since the primary objective is to provide its update. Nevertheless, a selection of studies before 2019 with pioneering approaches or an analytical basis for subsequent research was included in the review.
- **Country coverage**: By default, the literature scan included a global coverage of the topic, however, it is somewhat skewed towards studies written in English, partly due to their availability of data from English-speaking countries (e.g., Australia, Canada, European countries, the United Kingdom, and the United States).
- **Selection of included studies**: The selection of articles was based on the relevance to the topic and the analytical soundness of methodological approaches (see Annex A for the list of selected articles and their key findings). Over 120 academic articles were selected from peer-reviewed journals from different fields of science (e.g., digital technology, sociology, psychology, neuroscience, political science, economics, and public health among others) and had been cited in peer-reviewed journal at least once since publication. In addition, expert reports and working

[3] Paré et al. (2015[214]) suggests there can be four different approaches of literature review with distinct goals of 1) summarising knowledge; 2) data aggregation of empirical studies; 3) explanation building; and 4) critical assessment of literature; whereby this working paper focuses on the first one, which is, summarising knowledge.

papers from international organisations and public institutions were also included to provide a broad and extensive narrative of the current state of discussion and policy relevance on the topic.

A broader view on the linkages between digital technologies and well-being

In the literature, the terms *digital technologies* and *digitalisation*[4] are generally used to refer to a wide-range of digital technologies, when analysing their impacts in terms of well-being dimensions. The types of digital technologies include, but are not limited to, digital devices (e.g., computers, smartphones, information technology (IT) gadgets), social media, video games, tech-enabled healthcare, Artificial Intelligence (AI) and Internet of Things (IoT).

Human interaction with digital technologies is characterised in different ways across the reviewed studies, implying a range of different well-being impacts with respect to how (much) people use them and what they use them for. Some studies define the relationship between the digital technology and well-being outcomes by recognising the difference between the "quantity or intensity" and the "quality or active engagement" of human interactions, while others make no such distinction. "Screen time" is often used as the mediating variable for studying the relationship between the use of technologies and well-being (Harvey et al., 2022[24]; Davies et al., 2012[25]), even though it may be an imperfect proxy as, typically, it does not allow for the separation of active from passive usage of technologies (Tomczyk and Selmanagic Lizde, 2023[26]) and it lumps all activities on line as one homogenous category making the assumption that the risk (type and intensity) is common across these activities. For instance, watching television can be described as one-way passive screen time, whereas communicating with others on a digital device (e.g., facetiming) is a form of two-way active screen time, and either of the two different types can have distinct impacts on people's well-being. In this context, the literature review is organised in a way that looks at how different types of human interactions and different types of technologies are connected (Table 2.1).

Table 2.1. Analysing the relationship between digital technologies and well-being

Different layers of digital technologies and well-being dimensions included in the literature review[5]

	Digital experiences analysed by the studies reviewed in this paper		Selected well-being dimensions
Technologies	Digital devices (e.g., computers, smartphones, IT gadgets), Internet, social media (SNS), video games, tech-enabled healthcare, Artificial Intelligence (AI), Internet of Things (IoT) etc.		Health, social connections, civic engagement, safety, subjective well-being, work-life balance; Inequalities
Human interactions	**Measured as:**		
	Digital use (e.g., cellphone use, texting), Internet use/access, digital exposure, screen time, social media use (e.g., time spent on social media, time spent browsing), AI use, smartphone application use, etc.	- In terms of quantity (e.g., intensity of use or exposure, availability of access); and - In terms of quality (e.g., active or passive usage).	

[4] Digitisation is the conversion of analogue data and processes into a machine-readable format. Digitalisation is the use of digital technologies and data as well as interconnection that results in new or changes to existing activities. Digital transformation refers to the economic and societal effects of digitisation and digitalisation (OECD, 2019[216]).

[5] Referring to "screen time" without distinguishing for the specific type of online activity may result in inconsistent conclusions of results, not accounting for concerns and risks that are pertinent to specific activities considered under the "screen time" term. Besides is relevant to examine the context and content of the "screen time", rather than just time spent in front of a screen (Molnar, Ronchi and Barberis, 2020[217]).

2.2. Digital technologies and health

Digital technologies can improve people's lives by facilitating online healthcare and prevention services but some of these opportunities need to be managed with risks, equity considerations and implementation costs (Digital health | OECD). Digital technologies can enhance access to healthcare, enable personalised consultations with specialists from thousands of miles away, improve disease diagnosis and management, as well as facilitate physical health improvements through fitness apps or technology that allow people to better monitor their health. People with visual, speech or hearing impediments can access life-changing AI-powered assistive devices, while breakthrough progress is made in prosthetics and bio-mechatronics to aid mobility. AI systems can also provide tailored support for specific mental health conditions and cognitive disabilities, among others (OECD, 2023[27]).

When looking at health *outcomes*, the literature generally considers both digital use (active) and digital exposure (passive) in relation to health. For instance, the WHO's guidelines on physical activity and sedentary behaviour distinguish between the screen time and the screen exposure,[6] and the US Surgeon General's *Advisory on Social Media and Youth Mental Health* warns about some of the risks of content exposure as well as excessive and problematic use of social media, found to negatively affect behavioural patterns, particularly of children with negative implications for mental health (e.g., anxiety and depression). A number of studies also found excessive or problematic (e.g. exposure to screens during meals) to be negatively correlated with physical health (e.g., with implications for diabetes, obesity and dry-eye syndrome). The evidence on causal links between the overall digital use and mental health and/or physical health conditions, however, is still inconclusive (as discussed in subsequent sections).

Digital technologies and mental health[7]

There are potential risks from using and being exposed to digital technologies in terms of mental health conditions that ought to be weighed against the potential benefits. Recent OECD work on mental health and digital environments (OECD, 2024[28]) examines the rise of negative digital behaviours, such as cyberbullying and problematic Internet use, and how immersive technologies may worsen these mental health issues, disproportionately affecting girls. The report discusses three features of digital environments that help explain potential risks, while considering their potential benefits for mental health. Anonymity, disembodiment, and disinhibition are considered in the report as key features of digital environments that can significantly impact mental health (Suler, 2004[29]) (Whitty and Young, 2016[30]). Anonymity can create a safe space for self-expression and connection, especially for marginalised individuals, but also carries risks like moral disengagement and increased aggression, including cyberbullying. Disembodiment allows users to explore identities free from physical constraints, yet it raises concerns about identity dissociation and distorted body image. Disinhibition, often fuelled by anonymity, can reduce social restraints, leading to both positive behaviours and harmful actions like trolling and cyberstalking (OECD, 2024[28]).

Some studies find evidence that heavy use of digital devices is associated with mental health issues. Active digital use (e.g., cell phone use and texting) were found to be positively correlated with symptoms of anxiety (Lepp, Barkley and Karpinski, 2014[34]), while time spent using Social Network Service (SNS) and intensity of SNS use were found to be significantly, but weakly, correlated with depression

[6] World Health Organisation (WHO) guidelines on physical activity and sedentary behaviour recommend that one-year-old infants should not have digital screen exposure, 2-4 years old toddlers should not have more than 1 hour per day of digital screen exposure, and 5-17 years-old children and adolescents should not exceed 2 hours per day of recreational screen time (Qu et al., 2023[43]).

[7] Mental health is defined by the World Health Organisation (WHO) as "a state of well-being in which the individual realises his or her abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community" (OECD, 2023[209]).

symptoms (Cunningham, Hudson and Harkness, 2021[35]).[8] Analysing administrative data on mental disorders in Italian hospitals between 2001 and 2013 and availability of high-speed Internet, (Donati et al.[36]) further found that Internet access is correlated with higher levels of depression and anxiety for younger cohorts (10-28 year-olds), but not for older individuals. As for social media, a gradual introduction of Facebook to colleges in the mid-2000s was found to have had a negative impact on students' mental health and consequently led to reduced academic performance (Braghieri, Levy and Makarin, 2022[37]). Similarly, when a screen-use reduction measure was introduced in Denmark for 89 families (with 164 adults) between 2019 and 2021, it resulted in a statistically significant improvement in self-reported well-being and mood in adults of the intervention group (Pedersen et al., 2022[38]). However, (Vuorre and Przybylski, 2023[39]) find only small and inconsistent changes in global well-being and mental health in the last two decades, calling for more research on whether and how much the adoption of Internet and mobile broadband is consistently linked to negative psychological outcomes.

The COVID-19 pandemic provided an opportunity to gather additional evidence on the relationship between increased screen time and health. For instance, (Smith et al., 2020[40]) studied 932 adults in the UK during the pandemic and found a positive correlation between people having symptoms of anxiety and depression and increased screen time. Lower physical activity and increased screen time during the pandemic were also found to be correlated with higher levels of depression, loneliness and stress, in a survey including 3 052 US adults in 2020 (Meyer et al., 2020[41]).

The causal link between the use of digital technology and mental health needs however further exploration. While a number of studies have indicated some degree of correlation between the exposure to or use of the digital technology and the mental health issues, the overall causal link is inconclusive and warrants further research addressing a number of issues, such as potential reverse causality, the lack of suitable counterfactuals and compounding other factors that affect health conditions besides digital technology (Davie, 2022[31]). For instance, an increased use of technology may result in poor mental health, but conversely, those with mental health conditions (such as depression) may be devoting more time to using digital devices than others (Scherr, Toma and Schuster, 2019[32]). Based on a sample of 25 literature reviews, (Valkenburg, Meier and Beyens[33]) find no conclusive evidence of positive or negative impacts as most studies interpreted the causal effects (between social media use and mental health) as weak or statistically insignificant.

Digital devices and young individuals

The influence of digital devices on mental health and behavioural changes has been subject of a much-heated debate, particularly concerning children and adolescents. Preschoolers with excessive screen time showed higher odds of behavioural and conduct problems (Qu et al., 2023[43]),[9] and attention difficulties (Jourdren, Bucaille and Ropars, 2023[44]). Attention problems, depression, and ADHD scores were higher in 9- and 10-years old children who spend more than 21 hours per week videogaming, compared with non-video gamers (Chaarani et al., 2022[45]). A number of studies also find that higher levels of screen time and social media use among youth were correlated with poor body image, which studies argued could perpetuate disordered eating behaviours, obsessive social comparisons, and low self-esteem

[8] In the survey by (Lepp, Barkley and Karpinski, 2014[34]), participants are asked to indicate how much they are bothered by that symptom on a 4-point Likert scale from "Not At All" to "Severely" across the representative items that include "Unable to relax", "Fear of worst happening", "Heart pounding/racing", and "Feeling nervous". The majority of studies use self-report measures of depression, which do not allow to include mode of assessment (i.e., self- vs. clinician-report) as a moderator.

[9] (Qu et al., 2023[43]) have also found that preschoolers with one hour per day of screen time showed significantly lower risk of intellectual disability, and that children with two or more hours per day of screen time showed significantly lower odds of intellectual disability.

(Harriger et al., 2022[48]; Ganson et al., 2023[49]; Office of the U.S. Surgeon General, 2023[50]).[10] [11] In relation to behavioural shifts, a study on French middle-school students found that higher screen time by students can be associated with non-intentional injuries inside and outside of schools that may increase since the first adolescence year (age 10) over adolescents' life, associated with elevated screen time (Chau, Perrin and Chau, 2024[51]). In Canada, 3 826 adolescents were included in a study, which found that social media use was associated with fighting and conduct problems that depends, among others, on the type of digital platform through which such content is presented (Wallace et al., 2023[52]). Elevated screen time (i.e. in excess of 2 hours per day) was also associated with suicidality during high school in the US, with cyberbullying mediating a substantial proportion of the relationship between the two (Mantey, Yockey and Springer, 2023[53]). In this context, the US Surgeon General issued an *Advisory on Social Media and Youth Mental Health* in 2023, which provides recommendations to make social media safer for youth (Office of the U.S. Surgeon General, 2023[50]).

Understanding the relationship between digital devices and mental health remains complex. The effects of social media are dependent on adolescents' own personal and psychological characteristics and social circumstances, influence by what youth can do and see online, considering their pre-existing strengths or vulnerabilities, and the contexts in which they grow up (American Psychological Association, 2023[54]). The effects of online screen time on mental health remain ambiguous: Haidt (2024[47]) claims that debate on smartphones causing a mental health crisis in teens has been met with criticism from prominent psychologists who argue there is insufficient empirical evidence supporting unambiguously negative effects. The research is ongoing to establish causal links between smartphone use and declining mental health in teens by analysing in more detail the relationship in terms of numbers of hours spent online and types of activities captured by the "screen time". (Paulus et al., 2023[42]) argues that social media effects on behaviour may be small and need more research. When the OECD examined the relationship between the use of digital devices and academic performance, a moderate use of digital devices was not found to be intrinsically harmful, but the overuse or misuse of digital devices was negatively associated with student performance (Box 2.1).

[10] Teenagers seek "real-time peer affirmation" (e.g. liking a post), which may in turn, pressure them to be connected 24/7 and show intimacy (James et al., 2017[55]), fearing social repercussions otherwise. Social media also increases social comparison, with users or celebrities portraying themselves as highly connected and influential (Masur, 2021[56])

[11] For instance, peer pressure on adolescents via social media can influence eating behaviours (Chung et al., 2021[57]), and a study on an international sample of 12 031 adolescents found that social media use (e.g. Facebook, Instagram, Twitter/X/X) was positively associated with weight-change behaviours such as weight gain, weight loss and dieting (Ganson et al., 2023[49]).

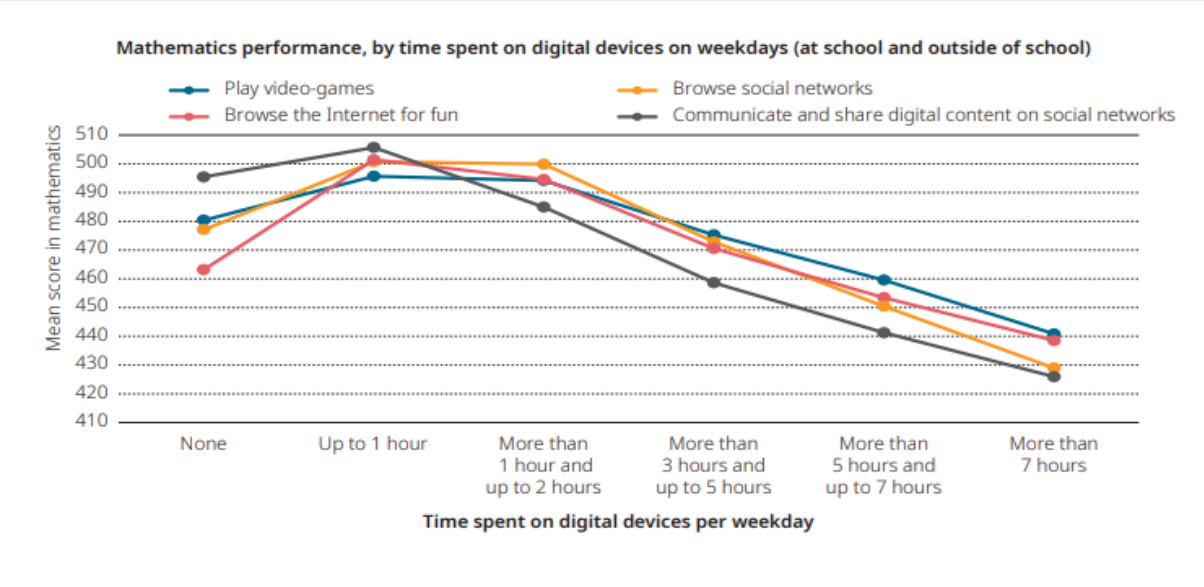
Box 2.1. Students' screen time and distraction in school

The Programme for International Student Assessment (PISA) 2022 results examined the relationship between the use of digital devices by 15-years-old students in school and their performance and sense of belonging at school across OECD Member countries. The key findings are:

- On average across OECD Member countries, students who spent one to five hours per day on digital devices for learning at school had 20 (PISA score) points more in mathematics than those who spent no time on such devices.
- Unless limited in duration, time spent on digital devices for leisure typically correlates with lower student performance. Students spending over one hour on digital devices for leisure at school scored more than 9 points lower in mathematics than those who spent no time on digital devices for leisure, indicating their higher distraction.
- Students spending over one hour on digital devices for leisure at school also reported a lower sense of belonging at school than those who spent no leisure time on digital devices.
- Allowing students to have a small amount of time to relax and play in online space can actually help them perform well in school, since the results suggest that students that spent one to two hours relaxing on their digital devises did better.

Figure 2.1. Students who spent more than one hour daily on various leisure activities online scored lower in mathematics

Based on 2023 PISA students' reports; OECD average



Note: Differences between categories are all statistically significant.
Source: OECD (2024[16]), "Managing screen time: How to protect and equip students against distraction", PISA in Focus, No. 124, OECD Publishing, Paris, https://doi.org/10.1787/7c225af4-en.

There are also gender differences in how digital use or social media use can affect mental well-being. Girls spend more time on smartphones, social media and texting, while boys spend more time gaming (Twenge and Martin, 2020[58]). The same study, drawing from 221 096 adolescents in the US and the UK, also led to the conclusion that the correlation between heavy digital media use and low psychological well-being was more pronounced for girls than boys (Twenge and Martin, 2020[58]). Another study based on 3 957 adolescents in Sweden found that social media use was highly and positively correlated with internalizing symptoms, indicative of emotional stressors that are inwardly directed, for girls but the same association was not found for boys (Svensson, Johnson and Olsson, 2022[59]). On average across OECD Member countries, cyberbullying is becoming more prevalent and girls are more cyberbullied than boys: Among OECD Member countries where girls were cyberbullied more than boys, the gap between cyberbullied girls and boys ranged from almost 1 percentage point in Norway to just over 6 percentage points in France (OECD, 2024[28]).

Digital technologies and physical health

Intensive use of digital devices has *been linked to* physical health conditions, such as, obesity, Type-2 diabetes, neck and shoulder strain and dry-eye syndrome. These conditions may also be attributed to a number of complex and compounding factors such as sedentary behaviour, lack of physical activity and decrease in the quality of sleep. For instance, high screen time, together with no physical activity, was found to be correlated with low health-related quality of life, especially in men (Davies et al., 2012[25]). On the other hand, the system of wireless, interrelated, and connected digital devices (i.e., the IoT) that can collect, send, and store data over a network promises many benefits for achieving better physical health by enhancing preventive care and health care delivery to predict health issues and diagnose, treat, and monitor patients both in and out of the hospital (Kelly et al., 2020[60]).

Increased screen time has also been correlated with increased dietary intake, and with obesity in children, which could be linked to the exposure of schoolchildren (from 8 to 17 years) to food advertising and passive food consumption (Pardhan et al., 2022[61]). A study in Poland on 3 127 children found a negative correlation between screen time and time devoted to physical activities, and between screen time and exposure to screens during meals (with 89% of children surveyed exposed to screens during meals), increasing the risk of obesity (Rocka et al., 2022[62]). On the contrary, when 121 children and adolescents of 10-15 years were studied in Sweden, no link was established between smartphone use and physical activity levels (Dahlgren et al., 2021[63]).

Intensive use of digital devices can affect eye health. Prolonged and daily use of digital screens, which influences blink rate and blink completeness, is associated with symptoms of dry eye (DE), such as ocular discomfort and visual disturbances (Mehra and Galor, 2020[64]; Al-Mohtaseb et al., 2021[65]; Muntz et al., 2022[66]). Increased screen time is associated with symptoms of digital eye strain, involving both ocular symptoms as well as non-ocular symptoms such as neck pain, headache and general fatigue (Agarwal et al., 2022[67]). The results for screen time and myopia or short-sightedness, however, are mixed, and further studies are needed to assess the relationship between screen time and myopia (Lanca and Saw, 2020[68]).

The effect of digital use on the quality of sleep is inconclusive. A majority of the studies showed that increased screen time spent was correlated with shorter sleep or poor sleep quality (Christensen et al., 2016[69]; Echevarria et al., 2023[70]; Cabré-Riera et al., 2019[71]). Blue light, which affects melatonin production, is found to affect sleep (Gottschalk, 2019[72]). In particular, more screen time was associated with delayed bedtimes and shorter sleep duration among children and adolescents (Lebourgeois et al., 2017[73]). A study of 7 849 working young adults (aged 18 to 44 years) found that digital usage delayed bedtime, but it was not linked to sleep duration (Zhao and Wu, 2022[74]). However, (Garcia et al.[75]) found no association between screen time and sleep quality or sleep duration when they examined 771 Brazilian college students during the COVID-19 pandemic, although physically active students demonstrated

improved sleep quality compared to physically inactive individuals. A study on a sample of 50 212 American children found that digital screen time, on its own, had little practical effect on paediatric sleep (Przybylski, 2019[76]).

Technology-enabled online healthcare services

New technologies have helped to advance the provision of online healthcare services. Recognising the increasing importance of digital health readiness, the OECD has redefined "digital health" based on an WHO definition as: *"The field of knowledge and practice associated with the development and use of health data and digital technologies to improve health. Digital health expands the concept of eHealth to include digital consumers, with a wider range of smart devices, connected equipment, and digital therapeutics. It also encompasses other uses of data and digital technologies for health such as the Internet of things, artificial intelligence, big data and robotics, and predictive and prescriptive analytics. Analytics can be for health system improvement, public health preparedness, or research and innovation"* (OECD, 2023[77]).

Digital technologies have expanded online consultations with medical professionals and provision of health-related information.[12] Telemedicine (i.e., the provision of remote clinical services) and teleconsultations with medical staff (i.e., interactions between a clinician and a patient providing diagnostic or therapeutic advice) have become more frequent and accessible after the COVID-19 pandemic. Telemedicine has the potential to improve effectiveness, efficiency and equity in health care but despite its potential benefits, these services still represent a small fraction of all health care activity and spending (Hashiguchi, 2020[78]). During the pandemic, when the governments moved to lift regulations and to promote the use of remote care, telemedicine quickly increased: about two in five patients who used remote care services reported that they prefer telemedicine services to in-person appointments (OECD, 2023[79]). Digital technologies facilitate access to medical information online and the use of Internet-connected devices for collecting health-related data, such as heart rate, steps taken and calories burned (OECD, 2023[11]). Clinicians can benefit from digital technologies as well, for instance, generative AI can be used as a "second opinion" in reviewing images, such as when a radiologist looks at breast cancer images (Anderson and Sutherland, 2024[80]). In addition, wearable devices, or remote measurement technologies (RMTs) that carry benefit for screening and monitoring health conditions and improve prevention and monitoring of chronic diseases (Walsh et al., 2024[81]; OECD, 2023[11]).

Technology enabled health care services have an added value in producing volumes of digitised health data, which may bring additional value to health systems and enable AI applications in healthcare. Health data are necessary to improve the quality, safety and patient-centeredness of healthcare services, support scientific innovation, discover and evaluate new treatments, and redesign and evaluate new models of health service delivery. The volume of personal health data will continue to grow with the growth in administration of digital health services, the digital transformation of health systems and the use of wearables for health management and monitoring. These data are highly beneficial in serving health-related public interest goals such as improving diagnosis and patient outcomes, detecting unsafe practices and treatments and identifying high quality and efficient ones, promoting preventive medicine and personalised medicine and supporting public health management decisions and the efficiency of health care systems (OECD, 2017[82]). In order to make beneficial use of health data for the public interest, it is necessary to develop standardised and interoperable data infrastructures of quality, as well as provide for privacy and security safeguards and controls (OECD, 1980[83]). There are legal, technological and cultural challenges to overcome in order to achieve a high level of data governance in support of public interests, as detailed in (OECD, 2022[84]; 2022[85]).

[12] Among the key technologies supporting online healthcare and prevention, (Smits et al.[210]) considers support platforms, sensor technology, telephone and video-based tools, social media, VR/gaming/audiovisual and wearable/clothing digital devices.

Digital security and protection of sensitive health-related data are nevertheless pressing issues. Disruptions in health services by cyberattacks or digital security breaches can pose serious threats to health, and several countries including Norway (in 2018), Czechia (in 2020), Ireland (in 2021), Canada (in 2021), United Kingdom (in 2022), and Costa Rica (in 2022) have recently been exposed to such attacks (Sutherland et al., 2023[86]) and understanding limitations of technologies enabling telehealth is key for effective risk management (Eisner, Berry and Bucci[87]).

2.3. Digital technologies, social connections and loneliness

Digital technologies have changed the way how people interact with each other; in a similar way as to the arrival of early-age technologies, notably television and the telephone. Recent research is also looking at the potential of AI and particularly robotics to support therapeutic, palliative and healthcare of elderly, there are however pending ethical concerns of reducing human contact in population groups that largely need it (Nature, 2024[88]). To better understand the impact of digital technologies in terms of relational well-being, both the quantity and quality of social connections need to be considered. The quantity of social interactions, their quality and diversity of social connections are all relevant in measuring and understanding the interplay between digital technologies and people's social connections (OECD, 2020[20]; OECD, 2024[89]). This paper focuses on the impact of digital technologies on the structure (i.e., the quantity of social connections), function (i.e., loneliness) and the quality of social connections (i.e., whether increased online interactions translate into meaningful bonds) at the individual level rather than communal or societal levels (Box 2.2).

Box 2.2. Framing and measuring social connectedness: the OECD approach

Taking into account the multidimensionality of social connectedness, the OECD has identified the following components of social connections to better measure its different effects on various health and well-being related outcomes:

- **Structure** encompasses people's connection to others via the existence of social relationships, roles and interactions (e.g., time spent with others, type of social contact, network size and diversity);
- **Function** aims to capture the actual or perceived support provided by people's relationships (e.g., social support, loneliness);
- **Quality** acknowledges the positive and negative aspects in one's social relationships (e.g., relationship satisfaction, closeness, strain, conflict); and
- **Communal and societal connectedness** measures capture indicators showing how individuals relate to one another – and to larger group entities – in the broader societal context.

Source: OECD (2024[89]), "Measuring social connectedness in OECD countries: A scoping review", OECD Papers on Well-being and Inequalities, No. 28, OECD Publishing, Paris, https://doi.org/10.1787/f758bd20-en, adapted from Holt-Lunstad, Robles and Sbara (2017[90]), "Advancing social connection as a public health priority in the United States", *The American Psychologist*, Vol. 72/6, p. 517, https://doi.org/10.1037/AMP0000103.

Digital technologies and social connections

Digital technologies have enabled people to connect more frequently and more easily. The quantity of social interactions has increased significantly with online social interactions (e.g., through emailing, texting, instant messaging and social networking) and can include everything from mere social attention (e.g., browsing through other people's feeds) to deep communication (e.g., having a conversation with other people) (Meier and Reinecke, 2021[91]). Digital technology has enabled communications regardless of time and space (Masur, 2021[56]). In particular, social media is in its core, an Internet-based platform that "connects" users (Di Cara et al., 2022[92]) and provides an *"unparalleled opportunity for the exchange and discovery of information, as well as for instantaneous and seamless connection with people around the world"* (Cunningham, Hudson and Harkness, 2021[35]). However, some studies argue that one cannot equate social media use with meaningful social interaction, noting that browsing or broadcasting classify as unfocused interaction and social attention (Hall, 2018[93]; Masur, 2021[56]).[13]

The use of social media platforms differs across population groups, for instance, by gender. Women are overall found to be more frequently using social media than men, however, Instagram and YouTube showed substantial differences in use patterns across male and female users, with approximately double the percentage of women using Instagram daily as men and, conversely, approximately double the percentage of men using YouTube daily as women (Di Cara et al., 2022[92]). In the case of generative AI[14], the algorithmic response suggestions ("smart replies") were found to increase both the communication speed and the use of positive emotional language, despite people's negative perceptions of AI in communication, for instance, linked to the lack of transparency about its use (Hohenstein et al., 2023[94]).

Children use digital technologies to stay socially connected. Childhood is marked by stages of rapid development, including the development of social skills and children may leverage digital technologies when fulfilling their needs for family, friendship and intimacy. On average across OECD Member countries, nearly all 15-year-old students have their own smartphone at home, and about 75% spend more than one hour per weekday browsing social networks (OECD, 2024[16]). The Pew Research Centre surveyed 1 453 US teens in 2023 and found that nearly 1 in 5 teenagers (from 13 to 17 years) are connected through social media platforms such as YouTube (16% of teens) and TikTok (17% of teens) 'almost constantly' (Pew Research Center, 2023[95]). Networked technologies are found to support existing connections and help establish new connections: for instance, 52 % of teenagers (aged 13 to 17) indicated that social media "mainly helps" with relationships with friends, and 57% of teenagers have met a new friend online (James et al., 2017[55]). In the US, teenagers (from 13 to 17 years) reported that social media helps them feel more accepted (58%), like they have people who can support them through tough times (67%), like they have a place to show their creative side (71%), and more connected to what's going on in their friends' lives (80%) (Office of the U.S. Surgeon General, 2023[50]).

In some instances, digital technologies can help reinforce existing social interactions online and offline. For instance, digital technology tends to benefit social relationships for migrants who are away from their relatives and friends – including by making it easier to participate in native-language educational and work-related programmes, socialising remotely and transferring money to their relatives (Robeyns, 2020[96]). Digital technology is also used by older adults to maintain relationships affected by barriers of geographical distance (Al Mahmud et al., 2022[97]). Even video gaming, often stereotyped as isolating

[13] (Hall[93]) classifies the use of social media by different types of social behaviour, from social attention (e.g., browsing), unfocused interaction (e.g., "like"-giving), routine impersonal interaction (e.g., "re-tweeting" or "sharing"), to focused social interaction (e.g., commenting and chatting) and deep communication (e.g., consulting and advising).

[14] Generative AI, among others, can include an array of applications from producing text, images and videos to data augmentation and generation of synthetic data and analysis. It can facilitate many tasks, such as legal research, technical support, fixing computer bugs and fielding customer service inquiries (Generative AI – The issues - OECD.AI).

technologies, may allow for opportunities for social connections and a sense of community among players and audiences, especially in the cases of cooperative games and game streaming (i.e., broadcasting one's video game play through digital platforms), and a more robust merging on researches on gaming and well-being is called for (Bowman, Rieger and Tammy Lin, 2022[98]). In Norway, a study on 400 students over two years found that using *Minecraft*, a digital multiplayer game which involves constructing different buildings and figures, can contribute to students' development of teamwork and collaboration skills (Andersen and Rustad, 2022[99]). In 2023, the US Surgeon General released an *Advisory on Social Connection*, recognising the critical role that connection plays in individual, community, and social health and well-being. The Advisory calls for reforming digital environments to minimize harms and develop pro-connection technologies to promote healthy social connections, create safe environments for discourse, and safeguard the well-being of users (Office of the U.S. Surgeon General, 2023[100]).

The studies are, however, inconclusive on whether online connectedness also forges meaningful bonds between people. The evidence is so far inconclusive as to whether online connections can generate benefits or not, for instance, by reinforcing or diminishing offline interactions and meaningful bonds, and overall positively affecting the lives at individual, family and work levels (Pew Research Centre, 2018[101]). The so-called "displacement hypothesis" suggests that digital communication may replace more valuable face-to-face communication or stronger ties (Masur, 2021[56]; Suárez Álvarez and Vicente, 2023[102]). Recently, a randomized experiment in the US found that 60 minutes were freed up by deactivating Facebook for four weeks, and this new free time was then reallocated to offline activities, both solitary (e.g., solitary TV watching) and social (e.g., spending time with friends and family) (Allcott et al., 2020[103]).

Digital technologies and loneliness

Digital technology's impact on loneliness is the subject of the most recent research, but the causal link between the two is unclear (Luhmann, Buecker and Rüsberg, 2023[104]). Some studies on social Internet use and loneliness point to a bi-directional and dynamic relationship, as the Internet could be used to enhance existing relationships and forge new relationships, but some people may use it to escape the "social pain" of interaction, aggravating loneliness (Nowland, Necka and Cacioppo, 2018[105]). A qualitative study on loneliness during the COVID-19 pandemic in the UK noted the perceived inferiority of digital social interaction relative to in-person meetings (McKenna-Plumley et al., 2021[106]). In another US-based study, participants who reported using social media for more than two hours a day had about double the odds of reporting increased perceptions of social isolation compared to those who used social media for less than 30 minutes per day (Primack, 2017[107]).

There are differences in the relationship between digital use and loneliness according to age groups. A study in Australia based on an online survey of 979 men found that loneliness is a determinant of time spent on social media, for younger men only (Seidler et al., 2022[108]). The authors found a positive relationship between loneliness and time on social media for those men in the young and middle-aged groups. Another study explored the linkages between Internet/email use and loneliness for a sample of 4 492 older English adults (aged 50+): those using Internet/email less than once every three months were significantly more likely to be socially isolated than every day users (Stockwell et al., 2021[109]).

Recent studies are focused on the technology-based approaches to reduce loneliness. (Ramo and Lim[110]) asserts that smartphone applications can be useful in addressing loneliness, especially for digital native young people (from 18 to 25 years), if they are engaging enough to interest them but at the same time can nudge young people out in the real world. For instance, a pilot smartphone application, *+Connect,* was tested for 6 weeks with 10 young people with early psychosis in Australia. It was found to be feasible and acceptable intervention to target loneliness, with no qualitative negative outcomes (Lim et al., 2020[111]). For older adults, several studies have reported that digital technology interventions are effective in reducing loneliness, but a meta-analysis by (Shah et al., 2019[112]) of six studies found no statistically

significant reduction in loneliness. Drawing on three case studies in Canada and Australia to explore technology-based interventions among frail older people (aged 65+), (Barbosa Neves, Waycott and Maddox[113]) found that technologies such as communication apps also came with negative unintended consequences; termed as "*increasing awareness of loneliness rather than its alleviation*".

Different age groups have different expectations and needs from connecting socially online. A qualitative study was implemented in the UK to understand older adults' (aged 50+) experiences with using digital technologies considering their social connectivity, and to use that understanding in app designs. It revealed that older adults desired app functionalities that can support mutual activities, maintain and forge new connections, but were less interested in sharing their emotional well-being (Stuart et al., 2023[114]). (Al Mahmud et al.[97]) also teamed up with older adults in Australia to develop a prototype of communication tool, *ElderConnect*. Participants were able to present six key recommendations for developing web-based interventions for older adults: tone (e.g., avoid using negative terminologies such as loneliness), relatability, accessibility, readability, engagement and trustworthiness of the site. In addition, (Boucher et al.[115]) argues that because the subjective nature of loneliness, interventions to tackle it need to be flexible and individualized.

2.4. Digital technologies, civic engagement and trust

Digital technologies have transformed the way *civic engagement* works (i.e., defined by UNICEF as *"individual or collective actions in which people participate to improve the well-being of communities or society in general"* (Cho, Byrne and Pelter, 2020[116]). Digital technologies enable different and novel ways for individuals and governments to participate, express themselves and communicate with each other, receive and disseminate information and consult public services online. The Internet has also created new ways for governments to provide services to citizens through e-government and digital government platforms. On the other hand, there is an increasing risk of mis/disinformation that could influence civic engagement, and the herding of like-minded people online which can lead to political polarisation through algorithms that drive content shown.

Digital technologies and civic engagement

Whether Internet use may expand civic engagement or not is being debated. From one standpoint, Internet use is considered to displace off-line social contact and civic engagement activities, while another standpoint considers Internet use as a means for retrieving additional information and forging social connections that enable civic engagement (Erhardt and Freitag, 2021[117]). From the latter point of view, (Boulianne, 2020[118]) argues on the basis of meta-analysis of 300 studies that there is a positive relationship between digital media use and offline participation in civic and political life, with the effect becoming more pronounced in recent years. (Erhardt and Freitag[117]) examined the relationship between civic engagement and several types of Internet use and activities by using two panel surveys, the Dutch LISS Panel (i.e., the Longitudinal Internet Studies for the Social Sciences gathering 31 308 observations from respondents via online questionnaires) and the SHP (i.e., the Swiss Household Panel gathering 17 948 observations from Swiss citizens mainly via telephone interviews). They found a robust positive effect of social Internet use for information (in the form of writing emails) on civic engagement (i.e., becoming or remaining active in an organisation), but not for other Internet activities (e.g., passive use of Internet for entertainment).

People are more likely to engage politically offline (i.e., attend public meetings) when they are more politically engaged on social media; as indicated by another study using data from the 2016 Cooperative Congressional Election Study (CCES) on 64 400 US adults. It finds a 2-percentage point increase in level of political engagement offline with additional levels of engagement on social media (Piatak and Mikkelsen, 2021[119]). In addition, in the run up to the 2020 US presidential election, one of the largest-scale

randomized experiment so far (with 19 857 Facebook users and 15 585 Instagram users) showed that deactivation of Facebook and Instagram reduced the index of political participation, while also reducing knowledge of general news and possibly belief in mis- and dis-information (Allcott et al., 2024[120]). The authors, however, could not find any statistically significant effects of social media on voter turnout or political polarisation.

Several studies have highlighted the role of digital technologies in the civic engagement of youth. Between 43 and 64 percent of 9 to 17-year-olds in 11 countries (Albania, Argentina, Brazil, Bulgaria, Chile, Ghana, Italy, Montenegro, the Philippines, South Africa and Uruguay) were shown to look for news online, with 12 to 27 percent discussing political problems online (Cho, Byrne and Pelter, 2020[116]). Online political activities of youth have specific characteristics of being interactive and often-peer-based, and often do not fall under institutional or elite guidance (Lee, White and Dong, 2021[121]). A recent study which uses survey data on 1 224 American youths found that one's social media capital (measured by Facebook friends, Twitter/X/X followers and Twitter/X/X following) is positively correlated with participation in political, non-political and charitable organisations (Lee, 2022[122]). Digital media has empowered today's youth, particularly those traditionally marginalised, to be more actively engaged politically, developing social stances and creating political content online. A study based on 23 minority teens in the US showed that these teens, equipped with digital skills used in their social lives, are more actively seeking, sharing and using information for political activity (Kaskazi and Kitzie, 2023[123]). A qualitative study on 20 young people (aged 16-21) in the US also found that youth with historically marginalised identities use social media to be civically engaged, by *Restorying* (e.g., telling their personal stories), *Building Community,* (e.g., establishing community bonds for sharing ideas and getting help) and *Taking Collective Action* (e.g., organising to collaborate in taking actions for the benefit of community) (Wilf and Wray-Lake, 2021[124]).

Countries have made significant progress in strengthening the governance of digital government and improving user-experience, as shown by the OECD Digital Government Index (OECD, 2024[125])**.** Ensuring that services meet users' needs and expectations remains a primary objective for governments, but these are not always reflected in concrete practices. OECD (2024[125]) results show that governments need to strengthen policy levers to implement the user-driven approach in practice. Less than 50% have formal requirements or government-wide initiatives to employ digital government tools to engage citizens and businesses in co-designing services. Additionally, only 29% of countries mandate user testing for digital government services. Facilitating the user-experience with online government sites also requires progress on ensuring the data are being used effectively by anticipating user needs and providing proactive services online.

Digital technologies and mis- and dis-information

The spread of *mis- and dis-information poses risks to the well-being of people and society, and* can contribute to polarisation, jeopardise the implementation of policies, and undermine trust in democratic institutions and processes (Disinformation and misinformation | OECD). Given there is no universally accepted typology, the OECD developed a set of definitions to help streamline the international discourse on false and misleading online. False, inaccurate, and misleading information can vary based on context, source, intent, and purpose, making it essential to distinguish between types for better policy design and measurement (Lesher, Pawelec and Desai, 2022[126]). Key terms include disinformation, which is intentionally false and harmful; misinformation, which is unintentionally shared falsehoods; contextual deception, which manipulates truth for a misleading narrative; propaganda, often used to shape opinions emotionally rather than informatively; and satire, where humour may blur intent when shared. These categories are framed along axes of intent to harm and fabrication. (Acemoglu, 2021[127]), for instance, argue that misinformation can proliferate in echo chambers and filter bubbles, where users are more likely to share content aligning with their beliefs, further amplifying the spread.

There is a considerable level of mistrust in online information, with pronounced differences among countries from one to more than two thirds of the total population reporting to see doubtful information online. The OECD *Truth Quest* (OECD, 2024[128]) reveals that confidence in identifying false content online is not correlated with actual ability, as both confident and non-confident respondents identified such content correctly 60% of the time. Satire was the easiest false content to detect, while misinformation and true content were more challenging. AI-generated content was generally easier to identify correctly than human-generated content. Additionally, those with positive perceptions of AI were better at recognising AI-labelled content's accuracy. Social media, despite being a popular news source, is the least trusted, and higher reliance on it correlates with lower accuracy in identifying true and false content. By examining how misinformation spreads, its consequences, and the existing evidence on the impact of false content, the OECD *Going Digital Toolkit* (Lesher, Pawelec and Desai, 2022[126]) highlights the importance of access to accurate information online and introduces a new typology of online untruths.

New sets of skills, including digital literacy, are necessary to establish trust based on people's ability to verify the credibility of online content and information sources. The verification and fact-checking features on social media platforms could help minimize the traffic of mis- and dis-information (Olan et al., 2024[129]), but the ability to sort fact from fiction, and to recognise mis- and dis-information, is essential for information consumers in the digital age (Breakstone et al., 2022[130]). A regression analysis on 2 584 Korean adolescents found a positive relationship between three components of digital literacy (i.e., information usage, communication and creation) with civic engagement (i.e., expressing opinions about social issues, volunteering, donating) (Moon and Bai, 2020[131]). Caution is needed when interpreting the causality of this relationship, given that the study could not determine whether news consumption is the cause or consequence of media literacy and to what extent it is related to the news-reading. For instance, only one-in-five adults get news through social media in the US (Pew Research Center, 2018[132]). Critical digital literacy, referring to both the ability to evaluate online content and the knowledge of the potential benefits and limitations of Internet for civic life, can facilitate civic engagement (Polizzi, 2023[133]). A study including 263 college students in the US evaluated online sources about public policy issues. It found that most students were not effectively discerning the credibility of a given website (Breakstone et al., 2022[130]).

Intense polarisation is arguably another type of risk attributed to the use of digital technologies, although evidence of an associated link is inconclusive. Polarisation can be understood as the "distance" between two extreme positions (Esau et al., 2023[134]), and can be manifested by attitudes (e.g., toward issues), beliefs (e.g., about certain issues) and behaviours (e.g., verbal expression, political choices) (Yarchi, Baden and Kligler-Vilenchik, 2020[135]). While people have more access to divergent ideas in the digital environment, some of them may seek to actively ignore or stick with inter-group conversations (Esau et al., 2023[134]), which can be polarising political discourse. For instance, (Lang, Erickson and Jing-Schmidt[136]) collected a total of 412 959 stance-taking hashtags about mask wearing by Twitter/X/X users in the US during the COVID-19 pandemic. Their findings showed a complex picture of digital polarisation on mask wearing, presenting semantic antagonism between pro- (93.6%) and anti-mask (6.4%) hashtags. Their findings (Lang, Erickson and Jing-Schmidt[136]) suggest an asymmetric participatory polarisation, referred to as an "echo chamber effect" of the dominant pro-mask group that ignored the rhetoric of the anti-mask minority.

Polarisation of discussion online can peak around major political events. A study analysed 5.1 billion comments made over 14 years on Reddit (Waller and Anderson, 2021[137]). Tracking the distribution of political activity from 2012 to 2018, the authors found the polarisation of discussion (measured with the mean absolute value partisan z-score of political comments) to be peaking around the 2016 US presidential election. This overall shift in polarisation on the platform in 2016 was entirely driven by the activity of the new users from right-wing communities. Furthermore, polarisation can take different forms depending on the type of social media platform but may depend on the geo-political context. In general, a study using Dutch panel data found no evidence that social media contributed to the level of affective polarisation, but

it showed that the level of affective polarisation can affect the use of social media (Nordbrandt, 2023[138]). In a specific case concerning the political situation in Israel, (Yarchi, Baden and Kligler-Vilenchik[135]) found the presence of polarisation on Twitter/X/X, but the results were more ambiguous on WhatsApp and Facebook – based on a rich dataset including a quarter million online comments over 16 months.

Efforts are underway to boost trust in digital technologies, notably in Artificial Intelligence (AI). For example, international organisations are increasingly focused on improving the trustworthiness of AI. The *OECD AI Principles*, adopted in 2019, guide AI actors in their efforts to promote trustworthy AI that respects human rights and democratic values, and provide policymakers with recommendations for effective AI policies (OECD/LEGAL/0449). The Recommendation was updated in May 2024 in response to recent developments in AI technologies, notably the emergence of general-purpose and generative AI. The Recommendation promotes five principles that apply to all AI actors: the pursuit of beneficial outcomes for people and the planet; human-centric values and fairness; transparency and explainability; robustness, security, and safety; and accountability. Furthermore, the OECD published "*Tools for Trustworthy AI: A framework to compare implementation tools for trustworthy AI systems*" in 2021, in which technical, procedural and educational tools for trustworthy AI were classified according to the *Principles* (OECD, 2021[139]). Other international organisations have also taken steps to promote trustworthy AI and advance international AI governance. The UN, for instance, established a new Advisory Body in 2023 that includes 39 experts with the aim to harness AI for the common good, and for its recommendations to feed into the preparation for the UN Summit of the Future in 2024 (UN, 2023[140]).

Digital technologies and personal safety

Concerns about personal safety[15] online are important, however, should be viewed separately from digital security issues.[16] As digital technologies advance, concerns about digital security are growing, including the protection of privacy and personal data, maintaining online resilience, and safeguarding against cyber breaches and attacks that threaten the availability, integrity, or confidentiality of data, systems, and networks. Such cybersecurity incidents undermine people's sense of security and reduce their trust in online communication and Internet-based services. To address these challenges, the (OECD, 2024[141]) report proposes a checklist for measuring cybersecurity risks and introduces innovative methods, such as leveraging news reports and Google Trends data, to complement existing statistics. These tools aim to anticipate emerging cybersecurity trends, develop targeted cybersecurity awareness programs, and promote a more secure and resilient digital ecosystem.

As for personal safety, online harassment via the Internet and other electronic communication devices, is prevalent and growing. A three-year survey with 50 000 participants across 22 countries was conducted to estimate the prevalence and growth of online harassment. An average of 48% of participants reported experiencing some form of hate or harassment. For the 12 countries with data from both 2016 and 2018, participants reporting hate and harassment online grew from 45% to 49% (Thomas et al., 2021[142]). Another survey in 2020 found that 41% of American adults have experienced some form of online harassment, of which around half responded that they were harassed because of their political views (Pew Research Center, 2021[143]). Literature also indicates that some demographic subgroups, such as young women, LGBTQIA+, children and adolescents, and minorities are more exposed to online harms than others.

[15] Safety involves being free from harm, whether from crime, conflict, harassment, or natural disasters (OECD, 2020[20]).

[16] OECD Policy Framework on Digital Security defines digital security as a set of measures taken to manage digital security risk for economic and social prosperity (OECD, 2022[218]).

Women perceive greater harm from online harassment. An online survey with nearly 4 000 participants across 14 regions around the world was conducted to understand the perception of harm associated with online harassment, and how respondents would like platforms to respond to it (Im et al., 2022[144]). Results showed that women perceive greater harm associated with online harassment than men, especially for non-consensual image sharing. As for the platform's desired response, women more than men preferred removing content and banning users from the site. In another study, in-depth interviews with 23 women (aged 18-24) were conducted to explore the impact of online harassment on college-age women. Its findings confirmed previous academic research that experiences of harassment are common online for young women, but it also found that the vast majority accepted online harassment as inevitable and adopted self-censoring strategies (Chadha et al., 2020[145]). Moreover, female journalists and activists are easy targets of online harassment (often with offline implications), because of their profession which require transparency about their identity and often involves covering stories of injustice (Goyal, Park and Vasserman, 2022[146]; Lewis, Zamith and Coddington, 2020[147]). When UNESCO and the International Centre for Journalists (ICFJ) conducted a global survey about online violence against women journalists in 2020, 73% of 714 respondents said that they had experienced online violence (Posetti et al., 2020[148]).

People from sexual and gender minorities are at high risk for online harassment. A study based on a survey about experiences of technology-facilitated sexual violence showed that transgender participants (66.7%) were more like to report "*having experienced someone spreading rumours or lies about them*" than female (13.3%) or male (16.7%) participants; and 60% of transgender participants reported "*having experienced someone posting offensive and/or offensive messages about their gender*" (Powell, Scott and Henry, 2020[149]).

Children and adolescents are more susceptible to cyberbullying and online harassment; including from accessing unsafe material and entering into communication with unknown persons that may lead to grooming or radicalisation (Gottschalk, 2019[72]). A systematic review of 63 studies found that the cyberbullying victimization rate, of which verbal violence was the most common type, increased significantly in the observed period of 2015-2019 for adolescents and children (Zhu et al., 2021[150]). Based on the US sample of 1 152 adolescents (between 10 to 18 years), (Copp, Mumford and Taylor[151]) found that approximately 37% of adolescents reported being victims of cyberbullying, with nearly 15% experiencing online sexual harassment. Female adolescents are more likely to experience online sexual harassment than their male peers, whereby online sexual harassment was also correlated with negative mood (i.e., depression and anxiety symptoms) especially for those with low levels of resilience; in the study including 277 female Croatian adolescents (on average 15.8 years old) over a 26-month period (Mitchell and Štulhofer, 2021[152]).

2.5. Digital technologies and other dimensions of people's well-being

Digital technologies and subjective well-being

How digital technologies impact subjective well-being, including life satisfaction, affect and eudaimonia (i.e., a sense of meaning and purpose in life), has become an increasingly researched topic in recent years. Seventy-two articles published after 2019 were found when the keywords of *digital* and *subjective wellbeing* were searched on Scopus database. Subjective well-being is defined in the *OECD Guidelines on Measuring Subjective Well-being*, *as "good mental states, including all of the various evaluations, positive and negative, that people make of their lives and the affective reactions of people to their experiences"* (OECD, 2013[153]). This definition groups subjective well-being in three broad categories of life evaluation

(e.g., life satisfaction, domain satisfaction), affect (e.g., feelings, emotions or states), and eudaimonia (i.e., psychological flourishing) (OECD, 2013[153]).[17]

The link between the use of digital technologies and subjective well-being is ambiguous and depends on the way the technology is used. Several studies have investigated the relationship between digital use (e.g., by Internet use, social media use and screen time) and subjective well-being, life satisfaction or negative feelings. For instance, a study using the European Social Survey (ESS) data for Spain (for 2016 and 2018), explored the link between people's life satisfaction and Internet use (daily use of Internet), and found that those who use the Internet more intensively report lower life satisfaction and happiness than those who use it to a lesser extent. The findings of the same study, however, indicate that people who use the Internet more intensely have more people to discuss intimate matters with and engage more in social activities (Suárez Álvarez and Vicente, 2023[102]). Another study on digital inclusion in New Zealand found that adults and adolescents who do not have Internet access tend to have lower levels of subjective well-being, but once daily Internet use for 15-years old teens exceeds about two hours, there is no positive correlation between the Internet use and subjective well-being (Grimes and White, 2019[154]).

As for social media use, (Bailey et al., 2020[155]) analysed the data of 10 560 Facebook users in order to determine whether authentic self-expression (i.e., by looking at the number of Facebook "likes" and "status updates") is associated with greater life satisfaction. Its findings show that there is a positive correlation between the two, suggesting that users who engage in self-expression on social media enjoy psychological benefits of being authentic. In addition, a study using two UK datasets with 84 011 participants (of 10-80 years of age) highlighted how the relationship between the estimated social media use and life satisfaction varies by age. The findings showed a negative correlation between self-reported estimates of social media use and life satisfaction, most notably amongst young adolescents (of 10-15 years of age) (Orben et al., 2022[156]). Finally, a study of 1 540 children in Chile showed that the excessive screen time (i.e., of two or more hours per day) was found to be correlated with negative feelings among children, independent of the level of their physical activity (García-Hermoso et al., 2020[157]).

The link between the use of digital technologies and eudaimonia are unclear. The literature exploring the relationship between digital technologies and people's sense of purpose, meaning and psychological flourishing is relatively scarce. (Meier and Reinecke[158]) reviewed studies that looked at the relationship between social media and eudaimonia, distinguishing between passive and active use or regardless of both types. Their literature review notes that the evidence is too limited and inconsistent to make any conclusions about the systematic effects of social media on eudaimonia. Another literature review of 82 publications, focused on eudaimonic game entertainment experiences (Daneels et al., 2021[159]), showed that *"digital game appreciation was often and closely connected to meaningful, emotionally moving or challenging, and self-reflective experiences".*

Digital technologies and job satisfaction

Addressing *technostress* can help improve workplace satisfaction. *Technostress* can be defined as negative effect on human attitudes, thoughts, behaviour, and psychology which can directly or indirectly result from technology use (Tu, Wang and Shu, 2005[160]). It is found to include physiological and emotional arousal that can affect job satisfaction at the individual level as well as at the organisational level via employee commitment and performance (e.g., turnover, absenteeism) (Atanasoff and Venable, 2017[161]). *Techno-stressors* (i.e., the causes of technostress) include system breakdown (e.g., IT malfunctions), usability issues (e.g., system learnability), security issues (e.g., unauthorised access), accessibility (i.e., ease of access to communication technologies, leading to communication overload), and techno-

[17] Similarly, (Büchi, 2021[2]) refers to subjective well-being as "*happiness in terms of pleasure and satisfaction*", with the latter including "*purpose, positive relationships and functioning in social groups*". It further goes on to characterize digital well-being in terms of individual's affect, domain satisfaction (e.g., satisfaction about one's job) and overall life satisfaction in a society abundant with digital use options.

uncertainty (i.e., where constant changing of technology causes anxiety) (Nisafani, Kiely and Mahony, 2020[162]). For instance, ease of digital communication has increased the volume of email messages at work as well as the variety in the messages (from advertisements to important information), but unnecessary communication only hinders concentration on tasks and workflow interruptions (Bordi et al., 2018[163]). Both explicit and implicit expectations of constant connectivity can also undermine well-being at work (Bordi et al., 2018[163]). In addition to putting in place measures to help cope with technostress at work, respecting boundaries between work and personal time can be beneficial for worker's mental health by reducing psychosocial stressors (ILO-WHO, 2022[164]).

Digital technologies and work-life balance

Digital technologies have created opportunities to work and communicate remotely, affecting people's work-life balance in both positive and negative ways. On the one hand, digital technologies have boosted flexibility at work in terms of place, time, and means of communication. They help to improve people's well-being in personal and professional domains. People have more flexibility in time management and can save time spent on commuting, while at the same time benefiting from public services. A survey of employees from seven OECD Member countries in 2022 showed that the presence of teleworking policies was associated with higher level of work satisfaction among workers; 79% of teleworkers who were consulted about teleworking were satisfied with their work-life balance, and 67% of full-time teleworkers responded that teleworking improves trust at work (OECD, 2023[165]). On the other hand, teleworking settings may be unsuitable with regards to the occupational and health standards of traditional worksites, and may affect physical health of workers, resulting in musculoskeletal disorders, eye strain and injures (ILO-WHO, 2022[164]). It is also difficult to respect work-life balance when there are young children or other family members around, with workers burdened by family duties during working hours (ILO-WHO, 2022[164]).

3. Digital divides and well-being

People with different characteristics (i.e., in terms of skills, gender, income, geographic location, education, age, ethnicity, and disability) may face unequal access to or quality of connectivity and may draw uneven benefits from digital technologies. Some of these divides can interact and compound, creating vicious circles that may deepen existing inequalities (OECD, 2020[166]). Bridging these divides is a policy priority in many OECD Member countries, both for the public and the private sector, to promote equitable access to connectivity services and infrastructure and ensure equal participation in the digital economy and society (OECD, 2022[167]) (see also Box 3.2). Reliable, high-quality connectivity is essential for digital transformation, yet disparities persist, deepening digital divides. Along these lines, (OECD, 2021[7]) report offers a roadmap for policymakers, highlighting effective policies and regulations – such as promoting competition, fostering investment, and addressing rural connectivity needs – to ensure inclusive access for all and prevent today's divides to perpetuate into the future (e.g., by addressing harmful content and setting up a measurement agenda to underpin a collective understanding of progress).

In the literature, the term *digital divide* has been often characterised by disparities in access to, usage and outcomes of Information and Communications Technology (ICT) (Lythreatis, Singh and El-Kassar, 2022[168])**, as well as the availability of skills to use these new digital tools** (Kerras et al., 2020[169]). In the initial stages of digitalisation from the 1990s to early 2000s, the term mostly referred to the gap between individuals who could or could not access the ICT, which can either result from personal choices and behaviour or is beyond an individual's control due to factors like socioeconomic status or location. The characterisation of the digital divide has gradually expanded to capture how and for what the ICT is being used (Song, Qian and Pickard, 2021[170]), and whether or not greater connectivity is driving progress and contributing meaningfully to people's lives (Lembani et al., 2020[171]).[18]

Digital inequalities, or digital divides, operate across different levels (Gottschalk and Weise, 2023[172]). **The first-level digital divide refers to unequal access to digital technologies**. In recent years, this gap has narrowed in many OECD Member countries (Burns and Gottschalk, 2019[173]), with broadband subscriptions surpassing population numbers by 2017 (OECD, 2019[174]). By 2018, most students in these countries had home Internet access. Divides in Internet use are also pronounced by age, education and income, with younger and more educated Internet users engaging in a wider range of online activities (OECD, 2018[8]). Challenges persist, however, with inequalities within and between countries. The digital divide particularly affects vulnerable segments of the population, for example, low-income and rural households (OECD, 2024[18]). Focusing on the latter, (OECD, 2018[8]) examines recent policy and technology approaches to bridging the digital divide in rural and remote areas in OECD Member countries. It reviews technological developments that are likely to influence the provision of services in underserved areas, for instance, in rural areas and among socio-economically disadvantaged groups like Roma students (Garmendia and Karrera, 2019[175]).

The second-level digital divide involves differences in digital skills, uses, and motivations. Young people are not a homogeneous group in their use of digital technologies, with data showing disparities

[18] For example, the Australian Digital Inclusion Index (ADII), published in 2020 for the fifth time, provides analysis of digital inclusion in Australia by measuring three key dimensions: access, affordability and digital ability (Thomas et al., 2020[211]).

across socio-economic lines (OECD, 2019[174]). PISA 2018 data indicates that advantaged students are more likely to use the Internet for career or education information and perform better in computer skills than disadvantaged peers. This divide particularly affects students from lower socio-economic or immigrant backgrounds, who often lack digital tools and support networks. In disadvantaged settings, parents may have low digital skills, further hindering children's ability to develop necessary digital competencies (Burns and Gottschalk, 2019[173]).

The third-level digital divide concerns differences in offline outcomes, like material or social benefits, linked to digital technology use. Failure to fully utilize digital opportunities can exacerbate existing inequalities (Van Deursen and Helsper, 2015[176]). To achieve tangible benefits in education, work, health, or other areas, individuals need the necessary resources and skills (Gottschalk and Weise, 2023[172])**.**

3.1. Skills Divide

Lack of familiarity with digital technologies may affect people's ability to use online services and unlock opportunities. It has been observed that older people and those with lower levels of education and income are less sophisticated users of digital technologies (OECD, 2017[177]). This reduces their access to useful information online, e.g., healthcare. For instance, older people and those with low educational attainment use the Internet less than the rest of the population to seek information on their health (OECD, 2023[178]) and other online public services, leaving them with lesser access to social benefits. This difference in familiarity can spill into the labour market, where those with more familiarity with a wider range of technologies may gain a competitive edge over those with less exposure to technology. In addition, AI is highly prevalent in recruitment and hiring platforms, but under-presented groups can be unfairly disadvantaged due to potential biases or use impeding their entry into the labour markets (OECD, 2020[179]).

Highly-educated individuals can benefit more from digital technologies than lower-educated individuals. Individuals with higher education and adequate digital skills can take greater advantage of teleworking or working remotely than less-skilled working in more manual jobs (see Box 3.1). In EU countries, nearly half the AI workforce has labour earnings in the top two deciles of the labour earnings distribution, which is higher than for the employed population with a tertiary degree in these countries (OECD, 2023[12]). A study based on the recent survey data in 35 European countries revealed that the earnings of self-employed individuals who adopted ICT at work are higher than those not using ICT at work at all (Millán et al., 2021[180]). In the UK, (Gallego, Kurer and Schöll[181]) also found a strong positive relationship between increased levels of digital technologies' use in an industry and the hourly net wages of workers with higher education levels, especially university degrees. Another study on 1 323 university students in France showed that the acquisition of digital skills increases students' academic performance (Youssef, Dahmani and Ragni, 2022[182]). Higher-educated individuals are among those most likely taking advantage of online services in their regular day-to-day activities (Elena-Bucea et al., 2021[183]).

Box 3.1. Can virtual work arrangements improve the opportunities for disadvantaged groups?

- While digital technologies can dissolve the geographic barriers that once existed in education and labour markets, there are still concerns as to whether this will boost opportunities for disadvantaged groups. This is particularly relevant when it comes to the **increased availability of flexible working arrangements**, such as remote or occasional teleworking opportunities, which was particularly highlighted during the COVID-19 pandemic.

- The pandemic increased the availability of flexible working arrangements, enabled by new technologies. However, research suggests that these positions are usually open to high-skilled individuals with higher levels of education. Given that high-skilled individuals were already shown to be more mobile when it comes to selecting job locations (OECD, 2020[166]), the benefits reaped by high-skilled individuals will continue to compound.
- For example, a study by the Joint Research Centre (JRC) examined the extent of hybrid work in EU countries and estimated that 37% of place-dependent employment in the EU is currently hybrid work, that is, the share of employment in occupations which workers could technically perform remotely. However, there were stark differences in hybrid work between high- and low-paid workers and white- and blue-collar workers, with the expansion of telework since the COVID-19 pandemic strongly skewed towards high-paid white-collar workers (Sostero et al., 2020[184]).

- In **digital platforms**, workers have been found to be relatively young and often performing their work during atypical hours. While digital platform employment may have increased efficiency of the matching process in the labour market, it has also raised inequality concerns related to job and income security, access to social protection, career development, training and protection against discrimination and opaque management practices (OECD/ILO/European Union, 2023[13]).

3.2. Socio-economic divide

Lower digital literacy among low-income groups has been shown to undermine their effective use of online support systems, such as, telehealth and Fin-tech (i.e., digital financial services). For instance, in New York City during the COVID-19 pandemic, people from socially vulnerable communities faced significant barriers to telehealth services, and used telephone more often than video consultations, with the ratio of using telephone consultations in these communities (41.7%) higher than those in less socially vulnerable communities (23.8%) (Chang et al., 2021[185]). A study of 2 940 patients conducted in the US during the COVID-19 pandemic also showed that low-income, female and black population groups were less likely than others to use telehealth services (Eberly et al., 2020[186]). Moreover, (Nam and Lee[187]) found a disproportionate concentration of Fin-tech services usage among higher-income individuals, based on the 2019 Digital Divide Survey in Korea.

Youth from lower socio-economic upbringings often struggle to acquire adequate digital skills. A study using data on 18 882 15-year-old students from seven countries (Chile, Denmark, Finland, France, Germany, Italy and South Korea) found evidence of a digital divide by the socio-economic status, migration background and gender. Among key drivers for a digital divide during the COVID-19 pandemic are the ICT skills of students, which the study found to be strongly related to students' socioeconomic background. It also found that those of a higher socioeconomic standing used ICT more in the school than their peers from disadvantaged backgrounds (Van de Werfhorst, Kessenich and Geven, 2022[188]).

3.3. Age, gender and accessibility divides

- ***Age divide:*** **The elderly may not be able to benefit as much from new technologies as younger generations.** Unequal access and use of SNS both across generations and within the old-age population (i.e. more than 65 years old) may perpetuate social inequalities, leading to older people's social exclusion and limiting the opportunities that SNS use may offer (Sala, Gaia and Cerati, 2022[189]). For instance, a study on 28 EU Member States also showed that SNS adoption is affected by individual's age, with the Baby Boomers showing significantly lower adoption levels

for e-Services and Social Networks (Elena-Bucea et al., 2021[183]). Having less digital skills, or having negative perceptions of ageing were highlighted as some of the factors aggravating the digital divide for the elderly population (Martins Van Jaarsveld, 2020[190]; Choi et al., 2020[191]). On the other hand, younger generations are becoming "digital natives", having grown up with their lives structured around ubiquitous digital technologies (Youssef, Dahmani and Ragni, 2022[182]). A recent study in Norway, for instance, showed that the awareness of algorithms (i.e, as whether the algorithm is being used to present recommendations, advertisements, and other content on the internet) was high among the youth but it was the lowest among elderly (Gran, Booth and Bucher, 2021[192]).

- ***Gender divide:*** In the European Union (EU), the gender-specific use of the Internet is relatively balanced: 78% of women (versus 80% of men) are Internet daily users, 31% of women (versus 36% of men) have "above basic digital skills" (more specifically, 71% for information skills, 67% for communication skills, 56% for problem-solving skills, and 39% for software skills).[19] This gap may, however, be more pronounced in other parts of the worlds where women are less likely to use smartphones than men (Perifanou and Economides, 2020[193]). A study based on a survey of 10 000 women and men in Colombia, Ghana, Indonesia and Uganda found that men were 21% more likely to be online than women. There was also a hidden digital gender divide: for instance in Colombia, there was a 1% gender gap in basic access to communication services but when it came to the meaningful connectivity gap (taking into account speeds, data allowance, device type and regular access), the gender gap increased to 17% (World Wide Web Foundation, 2020[194]). Higher employment rates for men could also explain between a quarter and a half of the observed gender gap in the Internet use in Latin America (i.e., in Ecuador, Guatemala, Mexico and Peru covered by the research study), ahead of other predictors of use such as age, education and income (Galperin and Arcidiacono, 2021[195]). A qualitative study based on interviews with 32 women in Spain found that because women are active both in the labour market and in the household as unpaid workers, it could influence their availability to develop adequate digital skills for responsible Internet use (Arroyo, 2020[196]). In addition, women sometimes reported that teleworking increased work-life balance inequalities in the home during the pandemic, as they were expected to carry out regular domestic tasks while working remotely at the same time (Touzet, 2023[197]).
- ***Disability divide:*** **Limitations placed on people with disabilities to use digital services may amplify existing social inequalities.** For instance, individuals with visual impairments may face difficulties using QR (quick response) codes to enter certain facilities or purchase goods online. Deaf students may face difficulties in using e-Education system without subtitles or sign language translation (Cho and Kim, 2022[198]). A study in the US which examined 139 of the most popular health websites found that 91.3% of the sample had detectable accessibility failures (Mason, Compton and Bhati, 2021[199]), with low contrast failures and missing alternative text (i.e. the text read by screen readers for people with visual impairments) among the most prevalent accessibility failures (Mason, Compton and Bhati, 2021[199]). Another study in Sweden examined 771 persons with cognitive disabilities, and suggests that most people with cognitive disabilities are lagging behind the general population in terms of access to devices, online shopping, online banking and also feel less included in the digital society (Johansson, Gulliksen and Gustavsson, 2021[200]). They found that 44% of women with aphasia do not feel included in the digital society, while it was 5% for the general Swedish women.

[19] The study shows that in the past three months of participating in the EU survey, 63.1% of women used the Internet to do online banking; 13,1% of women used the Internet for participating in social or professional networks; 8.08% of women used the Internet for doing an online course (on any subject); 0.94% of women participated in on-line civic consultations or voting (e.g. urban planning, signing a petition); and 0.637% of women sent filled forms to public authorities over the internet, during the last year.

3.4. Geographical and political divide

- ***Geographical divide:*** The persistent lack of adequate broadband access in rural and remote areas hampers equitable digital participation and economic opportunities (OECD, 2018[8]). In the US for instance, the Federal Communications Commission (FCC) launched the Digital Opportunities Data Collection mapping project, as a response to the rural-urban digital divide and to identify broadband coverage gaps in rural areas (Eruchalu et al., 2021[201]). In addition to the attention on the urban/rural digital divide, the importance of narrowing the digital gap within urban areas is increasingly being highlighted. A study in the US showed that investments in broadband infrastructure during the 2014-2018 period favoured affluent areas in Los Angeles County over low-income and minority communities (Galperin, Le and Wyatt, 2021[202]). A case study in San Antonio in the US, also showed that controlling for all other factors such as income, gender, age, and education, the digital divide in broadband access depended on where you lived in the city (Reddick et al., 2020[203]). There is also the issue of *affordability* of digital access, as low-income households may not be able to connect to digital facilities, even if the physical broadband infrastructure is widely available in urban areas (Koch, 2022[204]).
- ***Political divide****:* The people left behind in the digital age are exposed to economic and social grievances, which may have broad political implications. For example, digitalization can create economic losers who are more likely to vote against the political status quo, but it also creates winners with distinct preferences who support the status quo and can even take over some existing political parties (Gallego and Kurer, 2022[205]). A study using 82 countries for the year 2016 showed that if the business sector's digital adoption is high, it is more likely for the leading political party to adopt populist rhetoric (Güvercin, 2022[206]). However, another study using panel data from the UK from 1997 and 2017 showed that ordinary winners of digitalisation (i.e. neither left-behind in digitalisation nor successful technology entrepreneurs) provide some stabilizing force by supporting the centre-right mainstream or the incumbent party (Gallego, Kurer and Schöll, 2022[181]). It should be noted, however, the issue of political divide stemming from digital technologies is largely complex and has been approached by researchers from many different angles. One such study by (Petrova, Sen and Yildirim, 2021[207]) implies that there can be intensified political competition after social media adoption (i.e. Twitter/X), which lowers costs of disseminating information to their constituents for new entrants.

Box 3.2. Accelerating digital transformation and closing the gap: Example of Cisco's CDA

Cisco's *Country Digital Acceleration (CDA)* program presents an example of efforts in the private sector to close the digital gap. It supports modernization of digital infrastructure and training of digital workforce in more than 50 countries, by teaming up with governments, industry and academia. Examples of the implementation programs include:

- **Healthcare**: *Medibus* is the mobile clinic which provides primary care, company medical examinations, telehealth consultations, video translation services, and vaccination campaigns. It was created by the partnership of Cisco, Deutsche Bahn, VDL Bus & Coach, and A+ Videoclinic GmbH in Germany to reach those who lack access to proper healthcare.
- **Smart communities**: *El Paso Helps* is an online portal which connects community members in crisis (e.g., those experiencing homelessness) to immediate live help 24/7 in Texas in the US It is designed to assist vulnerable populations with vital services such as street outreach, shelter, food, COVID-19 assistance, housing and mental health.
- **Education**: Cisco teamed up with the National Library of South Africa to launch *National Library learning hubs* that provide access in disadvantaged communities for them to be connected to the Internet. Librarians in nine South African provinces were also trained to improve IT skills.
- **Cybersecurity**: In 2022, *DreamPort cyber lab* was built on Zero Trust principles at US Cyber Command's DreamPort facility in Maryland. Its goal is to support closing the cyber skills gap by expanding the Maryland Innovation and Security Institute (MISI)'s Industrial Control Systems/Operational Technology (ICS/OT) workforce training, academic engagement, and cybersecurity test, evaluation and cyber exercise capabilities.

Source: CISCO (2023[208]), Country Digital Acceleration program, https://www.cisco.com/c/en/us/about/country-digital-acceleration.html.

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Annex A. The list of reviewed academic articles (selected)

Table A.1. Selected literature on the link between the digital technology and well-being

Well-being dimension	Author	Year	Source	Methodology	Number of observations/ studies	Key findings related to digital technologies and well-being
Health	Harvey et al.	2022	Preventive Medicine	Quantitative	N= 60,200 (2012); N = 550,500 (2019)	Daily screen time increased from 9 hours in 2012 to 11 hours in 2019.
Health	Davies et al.	2012	Preventive Medicine	Quantitative	N =3,796	The combination of no physical activity and high screen-time demonstrated the greatest negative impact on health-related quality of life.
Health	Tomczyk and Selmanagic Lizde	2023	Telematics and Informatics	Quantitative	N = 1,185	Screen time correlates weakly with problematic smartphone use and social networking.
Health	Davie	2022	Paediatrics and Child Health			Several studies have indicated a negative correlation between screen time and mental health, but its causal relationship is unclear.
Health	Scherr, Toma and Schuster	2019	Journal of Media Psychology	Quantitative		Depression predicted envy, and envy predicted Facebook surveillance over time.
Health	Valkenburg, Meier and Beyens	2022	Current Opinion in Psychology	Literature review	25 studies	There is no conclusive evidence of the causal effects between social media use and mental health.
Health	Lepp, Barkley and Karpinski	2014	Computers in Human Behavior	Quantitative	cell phone use (N = 496) and texting (N = 490)	Cell phone use/texting was negatively related to academic performance (GPA) and positively related to anxiety.
Health	Cunningham, Hudson and Harkness	2021	Research on Child and Adolescent Psychopathology	Meta-analysis	62 studies (N= 451,229)	Depression symptoms were significantly, but weakly, associated with time spent using SNS and intensity of SNS use.
Health	Donati, D. et al.	2022	SSRN Electronic Journal	Quantitative	N=63,496	Internet access is associated with an increase in depression and anxiety for younger cohorts

Well-being dimension	Author	Year	Source	Methodology	Number of observations/ studies	Key findings related to digital technologies and well-being
						(10–28-year-olds), but not for older individuals.
Health	Braghieri, Levy and Makarin	2022	American Economic Review	Quantitative	N= 359,827	The rollout of Facebook at a college had a negative impact on student mental health.
Health	Pedersen et al.	2022	npj Mental Health Research	Quantitative	N= 89 families, 164 adults	Screen-use reduction measure resulted in a statistically significant improvement in self-reported well-being and mood in adults.
Health	Smith et al.	2020	Psychiatry Research	Quantitative	N=932 (adults)	For UK adults self-isolating due to COVID-19, the association between screen time per day in hours and poor mental health was studied in the overall population.
Health	Meyer et al.	2020	International Journal of Environmental Research and Public Health	Quantitative	N=3,052	Decreased physical activity and increased screen time during the COVID-19 pandemic were found to be associated with worse depression, loneliness and stress.
Health	Qu et al.	2023	Journal of Psychiatric Research	Quantitative	N=101,350	The association between excessive screen time and developmental and behavioral problems was stronger among preschoolers than among children and adolescents.
Health	Jourdren, Bucaille and Ropars	2023	Pediatric Neurology	Systematic review	15 studies (5 cross-sectional, 10 longitudinal)	There is evidence of a relationship between high exposure to screens and both immediate and long-term attentional functions in preschool children.
Health	Chaarani et al.	2022	JAMA Network Open	Quantitative	N=2,217	Attention problems, depression, and ADHD scores were higher in 9- and 10-year-old children who spend more than 21 hours per week videogaming.
Health	Harriger et al.	2022	Body Image	Literature review		Social media use is linked to higher body dissatisfaction and the use of algorithms serves to exacerbate this relationship.
Health	Ganson et al.	2023	Preventive Medicine	Quantitative	N = 12,031	Screen time and social media use are associated with weight-change behaviors among adolescents.
Health	Chau, Perrin and Chau	2024	Psychiatry Research	Quantitative	N=1,559	Adolescents' total daily screen-time highly predicts school behaviour, and mental difficulties.
Health	Wallace et al.	2023	JAACAP Open	Quantitative	N=3,826	Social media use was associated with fighting and conduct problems for adolescents that depends, among others, on the type of digital platform through which such content is presented.
Health	Mantey, Yockey and Springer	2023	Preventive Medicine	Quantitative	N= 73,011	Elevated screen time (i.e., 2+ hours per day) was associated with suicidality during high school, with cyberbullying mediating the relationship.
Health	James et al.	2017	Pediatrics	Literature review		A complex interplay of individual factors, type of digital media engagement, and experiences in media contexts informs outcomes related to well-being, social connectedness, empathy, and narcissism.
Health	Masur	2021	Oxford research encyclopedia of communication	Literature review		Digital communication might have bi-directional effects on both loneliness and life satisfaction, which additionally might not follow a linear trend.

Well-being dimension	Author	Year	Source	Methodology	Number of observations/ studies	Key findings related to digital technologies and well-being
Health	Chung et al.	2021	Journal of Medical Internet Research	Literature review	6 articles (N= 1,225)	Adolescent peer influence in social media environments spans the spectrum of healthy eating (ie, pathological) to eating disorders (ie, nonpathological).
Health	Twenge and Martin	2020	Journal of Adolescence	Quantitative	N = 221,096	For both girls and boys, heavy users of digital media were often twice as likely as low users to be low in well-being or have mental health issues, including risk factors for suicide. The correlation between heavy digital media use and low psychological well-being was more pronounced for girls than boys.
Health	Svensson, Johnson and Olsson	2022	BMC Public Health	Quantitative	N=3,957	Social media use was highly and positively associated with internalizing symptoms for girls only.
Health	Pardhan et al.	2022	Journal of School Health	Literature review		Digital screen time was found to have increased for children and adolescents in all the studies examined during the pandemic and data suggests that this has an impact on eye and general health.
Health	Rocka et al.	2022	Nutrients	Quantitative	N = 3,127	The majority of children were exposed to screens during meals, which is a risk factor of obesity.
Health	Dalgren et al.	2021	PLoS ONE	Quantitative	N =121	Smartphone screen time was not associated with physical activity level among children and adolescents aged 10–15 years.
Health	Mehra and Galor	2020	Asia-Pacific Journal of Ophthalmology	Literature review		Visual display terminals (VDTs) use has been associated with a number of Dry Eye Symptoms and signs.
Health	Al-Mohtaseb et al.	2021	Clinical Ophthalmology	Literature review		Digital screen use duration is associated with an increased risk of severe symptoms and clinical diagnosis of dry eye disease in adults.
Health	Muntz et al.	2022	Contact Lens and Anterior Eye	Quantitative	N =456	Extended screen time in a young population was associated with blinking behaviour and symptomology consistent with patients with dry eye.
Health	Agarwal et al.	2022	Journal of Family Medicine and Primary Care	Quantitative	N=435	The most common symptoms associated with digital eye strain were eyestrain 52.8% (N = 230) and headache 31.3% (N = 136).
Health	Lanca and Saw	2020	Ophthalmic and Physiological Optics	Systematic review	15 studies (N=49,789)	The results for screen time and myopia are mixed.
Health	Christensen et al.	2016	PLoS ONE	Quantitative	N=653	Longer average screentime during bedtime and the sleeping period were associated with poor sleep quality, decreased sleep efficiency, and longer sleep onset latency.
Health	Echevarria et al.	2023	Sleep Medicine: X	Quantitative	N=1,949 (sleep quality), N=1,851 (sleep duration)	Screen use for $\geq$ 6hs/24hs was associated with a shorter sleep duration, and $\geq$ 9hs/24hs with poor sleep quality.
Health	Cabre-Riera et al.	2019	Environmental Research	Quantitative	N=258	Frequency of cordless phone calls, mobile phone dependency, and tablet use were related to an increase of subjective and objective sleep problems in adolescents.

Well-being dimension	Author	Year	Source	Methodology	Number of observations/ studies	Key findings related to digital technologies and well-being
Health	Lebourgeois et al.	2017	Pediatrics	Literature review		There is an adverse association between screen-based media consumption and sleep health, primarily via delayed bedtimes and reduced total sleep duration.
Health	Zhao and Wu	2022	Nature and Science of Sleep	Quantitative	N=7,849	Digital usage significantly predicted delayed bedtime, but it was not linked to sleep duration on workdays or free days.
Health	Garcia et al.	2024	American Journal of Human Biology	Quantitative	N=771	No association was found between screen time and sleep quality or sleep duration.
Health	Przybylski	2019	Journal of Pediatrics	Quantitative	N=50,212	Digital screen time, on its own, had little practical effect on pediatric sleep.
Health	Eisner, Berry and Bucci	2023	BMC Psychiatry	Quantitative	N=157 (in-person), N=58 (online)	Smartphones appear appropriate for delivering internet-enabled support for psychosis but barriers to using mental health apps included forgetting, lack of motivation, security concerns, and concerns it would replace face-to-face care.
Social connections	Meier and Reinecke	2021	Communication Research	Meta-analysis	34 reviews, 594 publications	There is a small negative association between social media use and mental health but effects are complex and depend on the indicators investigated.
Social connections	Di Cara et al.	2022	npj Mental Health Research	Quantitative	N= 4,083	Users of different platforms and frequencies are not homogeneous. User groups differ primarily by sex and YouTube users are the most likely to have poorer mental health outcomes.
Social connections	Hall	2018	New Media and Society	Quantitative	N=116(study 1), N=197(study 2), N=54(study 3)	One cannot equate social media use with meaningful social interaction, and browsing or broadcasting can be classified as unfocused interaction and social attention.
Social connections	Hohenstein et al.	2023	Scientific Reports	Quantitative	N=361(study 1), N=510(study 2)	The algorithmic response suggestions ("smart replies") were found to increase both the communication speed and the use of positive emotional language.
Social connections	Al Mahmud et al.	2022	International Journal of Human-Computer Interaction	Quantitative	N=34	Six key recommendations for developing web-based interventions for older adults: tone (e.g., avoid using negative terminologies such as loneliness), relatability, accessibility, readability, engagement and trustworthiness of the site.
Social connections	Bowman, Rieger and Tammy Lin	2022	Current Opinion in Psychology	Literature review		While existing research generally demonstrates the social dynamics of gaming and demonstrates the role of games for well-being, a robust and directed merging of these two complimentary lines of research is currently lacking.
Social connections	Andersen and Rustad	2022	Computers and Education Open	Quantitative /Qualitative	N=400	Using Minecraft, a digital multiplayer game which involves constructing different buildings and figures, can contribute to students' development of teamwork and collaboration skills.
Social connections /subjective	Suárez Álvarez and Vicente	2023	Humanities and Social Sciences Communications	Quantitative	N=3,614	The effect of internet usage depends on the dimension of well-being considered, being negative for happiness, life satisfaction and meetings but positive as regards to connections and participation.

Well-being dimension	Author	Year	Source	Methodology	Number of observations/ studies	Key findings related to digital technologies and well-being
well-being						
Social connections	Allcott et al.	2020	American Economic Review	Quantitative	N=2,710 (endline)	60 minutes were freed up by deactivating Facebook for four weeks, and these newly freed time were then reallocated to offline activities, both solitary (e.g., solitary TV watching) and social activities (e.g., spending time with friends and family). Deactivation also reduced both factual news knowledge and political polarisation; increased subjective well-being; and caused a large persistent reduction in post-experiment Facebook use.
Social connections	Luhmann, Buecker and Rüsberg	2023	Nature Reviews Psychology	Literature review		The link between the digitalization of social interactions and loneliness seems weak, and the causal direction of the association is unclear.
Social connections	Nowland, Necka and Cacioppo	2018	Perspectives on Psychological Science	Literature review		There is a bidirectional and dynamic relationship between loneliness and social Internet use.
Social connections	McKenna-Plumley et al.	2021	PLoS ONE	Qualitative	N=8	The loss of in-person interaction during the COVID-19 pandemic contributed to feelings of loneliness and digital interaction was viewed as an insufficient alternative.
Social connections	Seidler et al.	2022	International Journal of Social Psychiatry	Quantitative	N=979	Loneliness predicts psychological distress via time spent on social media, for younger men only.
Social connections	Stockwell et al.	2021	Ageing and Society	Quantitative	N=4,492	For older English adults (aged 50+), those using Internet/email less than once every three months were significantly more likely to be socially isolated than every day users.
Social connections	Lim et al.	2020	Social Psychiatry and Psychiatric Epidemiology	Qualitative/ Quantitative	N=12	A pilot digital intervention (+Connect) targeting loneliness in young people with psychosis yielded high levels of acceptability and feasibility; and positive reinforcement of in-game rewards and evidence of positive mood changes added to the feasibility of the app.
Social connections	Shah et al.	2019	BMJ Open	Meta-analysis	6 studies	No statistically significant reduction in loneliness was found with digital technology interventions.
Social connections	Barbosa Neves, Waycott and Maddox	2023	Sociological Research Online	Qualitative	3 case studies	Technology-based interventions among frail older people (aged 65+), such as communication apps, can come with negative unintended consequences such as increasing awareness of loneliness.
Social connections	Stuart et al.	2023	JMIR Formative Research	Qualitative	N=33(study 1), N=10(Study 2), N=12(Study 3)	Older adults desired app functionalities that can support mutual activities, maintain and forge new connections, but were less interested in sharing their emotional well-being.
Social connections	Boucher et al.	2021	JMIR Mental Health	Qualitative	N=11	The heterogeneity in participants' experiences with loneliness emphasizes the subjective and complex nature of loneliness, highlighting the importance developing loneliness interventions that use a variety of strategies
Civic engagement	Erhardt and Freitag	2021	Social Science Computer Review	Quantitative	N=31,308 (LISS Panel), N=17,948 (SHP)	There is a robust positive effect of social Internet use for information (in the form of writing emails) on civic engagement (i.e., becoming or remaining active in an organisation), but not for other Internet activities (e.g., passive use of Internet for entertainment).

Well-being dimension	Author	Year	Source	Methodology	Number of observations/ studies	Key findings related to digital technologies and well-being
Civic engagement	Boulianne	2020	Communication Research	Meta-analysis	300 studies	There is a positive relationship between digital media use and offline participation in civic and political life, with the effect becoming more pronounced in recent years.
Civic engagement	Piatak and Mikkelsen	2021	Nonprofit and Voluntary Sector Quarterly	Quantitative	N=64,400	There is 2-percentage point increase in level in political engagement offline with additional levels of engagement on social media.
Civic engagement	Allcott et al.	2024	Proceedings of the National Academy of Sciences	Quantitative	N=19,857 (Facebook users), N= 15,585 (Instagram users)	Deactivation of Facebook and Instagram reduced the index of political participation, while also reducing knowledge of general news and possibly belief in mis- and dis-information.
Civic engagement	Lee	2022	International Review on Public and Nonprofit Marketing	Quantitative	N=1,224	One's social media capital (measured with Facebook friends, Twitter/X/X followers and Twitter/X/X following) is positively correlated with participation in both political and non-political charitable organisations.
Civic engagement	Kaskazi and Kitzie	2023	New Media and Society	Qualitative	N=23	Minority teens, equipped with digital skills used in social lives, are more active seeking, sharing and using information for political activity.
Civic engagement	Wilf and Wray-Lake	2021	Journal of Adolescent Research	Qualitative	N=20	Youth with historically marginalised identities use social media to be civically engaged.
Civic engagement	Baptista and Gradim	2020	Social Sciences	Literature review	N=52	Fake news explores all possible aspects to attract the reader's attention, from the formation of the title to the language used throughout the body of the text.
Civic engagement	Tandoc, Thomas and Bishop	2021	Media and Communication	Literature review /Quantitative	N=886 (articles)	Fake news were very much similar to the traditional news articles, but they often lacked in objectivity, not excluding personal opinion of the author.
Civic engagement	Olan et al.	2024	Information Systems Frontiers	Quantitative	N=356	Societal acceptance of information and news is highly dependent on the verification and fact-checking features that are available on the Social Media platforms.
Civic engagement	Breakstone et al.	2022	Journal of Higher Education	Quantitative	N=263	A majority of college students employed ineffective strategies for evaluating digital information.
Civic engagement	Moon and Bai	2020	Journal of Children and Media	Quantitative	N=2,584	A regression analysis on adolescents revealed a positive causal relationship between three components of digital literacy (i.e., information usage, communication and creation) with civic engagement (i.e., expressing opinions about social issues, volunteering, donating).
Civic engagement	Polizzi	2023	New Media and Society	Literature review		It proposes a theoretical framework for researching how critical digital literacy, based on constructing and deploying utopian/dystopian imaginaries of society in the digital age, facilitates civic engagement.
Civic engagement	Yarchi, Baden and Kligler-	2020	Political Communication	Quantitative	N=124,165 (facebook), N=132,226(Twi	Political polarization on social media cannot be conceptualized as a unified phenomenon, as there are significant cross-platform differences between Twitter/X, WhatsApp and Facebook.

Well-being dimension	Author	Year	Source	Methodology	Number of observations/ studies	Key findings related to digital technologies and well-being
	Vilenchik				tter/X/X), N=5395 (whatsapp)	
Civic engagement	Lang, Erickson and Jing-Schmidt	2021	PLoS ONE	Qualitative /Quantitative	N=412,959 (mask-related tokens of 35 distinct types of hashtags from a total of 149,110 users)	The digital discourse on Twitter/X about mask wearing was rhetorically polarized whereby the rallying calls of the mask supporters were amplified by other mask supporters, and the battle cries of the mask resistors resonated with other mask resistors but were drowned out and ignored by a vocal and overwhelming pro-mask majority.
Civic engagement	Waller and Anderson	2021	Nature	Qualitative /Quantitative	N= 5.1 billion (comments made on Reddit posts)	Examining political content, the authors find that Reddit underwent a significant polarization event around the 2016 US presidential election, but the system-level shift in 2016 was disproportionately driven by the arrival of new users.
Civic engagement	Nordbrandt	2023	New Media and Society	Quantitative	N=8,551	No support was found for the hypothesis that social media use contributed to the level of affective polarization but the results lend support to the hypothesis that it was the level of affective polarization that affected subsequent use of social media.
Personal safety	Thomas et al.	2021	Proceedings of IEEE Symposium on Security and Privacy	Literature review /Quantitative	N=150 (papers) N=50,000	Hate and harassment is a pervasive, growing experience for online users, particularly for at-risk communities like young adults and people who identify as LGBTQ+.
Personal safety	Im et al.	2022	Proceedings of the ACM on Human-Computer Interaction	Quantitative	N = 3,993	On average, women perceive greater harm associated with online harassment than men, especially for non-consensual image sharing.
Personal safety	Chadha et al.	2020	International Journal of Communication	Qualitative	N=23	Women deploy various defensive strategies while navigating online spaces, from normalizing harassment to self-censorship and withdrawal.
Personal safety	Goyal, Park and Vasserman	2022	Proceedings of CHI Conference on Human Factors in Computing Systems	Qualitative	N=27	Tackling documentation and reporting challenges is an important effort for empowering female journalists and their support networks to address online harassment attacks.
Personal safety	Lewis, Zamith and Coddington	2020	Digital Journalism	Literature review/ Quantitative	N=450	Nearly all journalists experience at least some online harassment but such harassment is generally infrequent overall. However, online harassment against journalists disproportionately affects women.
Personal safety	Powell, Scott and Henry	2020	European Journal of Criminology	Quantitative	N=282(sexuality diverse adults), N=90	Transgender individuals experience higher rates of digital harassment and abuse overall, as compared with heterosexual cisgender individuals.

Well-being dimension	Author	Year	Source	Methodology	Number of observations/ studies	Key findings related to digital technologies and well-being
					(gender diverse adults)	
Personal safety	Zhu et al.	2021	Frontiers in Public Health	Systematic review	63 studies	Cyberbullying victimization rate, of which verbal violence was the most common type, increased significantly in the observed period of 5-year period (2015-2019) for adolescents and children.
Personal safety	Copp, Mumford and Taylor	2021	Journal of Adolescence	Quantitative	N=1,152	Online sexual harassment and cyberbullying victimization have similar risk profiles, and both contribute to heightened risk of mental health and behavioral problems.
Personal safety	Mitchell and Štulhofer	2021	European Child and Adolescent Psychiatry	Quantitative	N=477	Female adolescents are more likely to experience online sexual harassment than their male peers, whereby online sexual harassment was also correlated with negative mood especially for those with low levels of resilience.
Subjective well-being	Grimes and White	2019	Motu Economic and Public Policy Research	Quantitative	N= 3,455 (2017 NZES survey)	Adults and adolescents who do not have Internet access tend to have lower levels of subjective well-being, but once daily Internet use for adolescents exceeds about two hours, there is no positive correlation between the Internet use and subjective well-being.
Subjective well-being	Bailey et al.	2020	Nature Communications	Quantitative	N=10,560 (facebook users)	Individuals who are more authentic in their self-expression report greater Life Satisfaction.
Subjective well-being	Orben et al.	2022	Nature Communications	Quantitative	N=84,011	A negative correlation between self-reported estimates of social media use and life satisfaction, most notably amongst young adolescents (of 10-15 years of age).
Subjective well-being	García-Hermoso et al.	2020	International Journal of Clinical and Health Psychology	Quantitative	N=1,540	Excessive screen time (i.e., of two or more hours per day) was found to be correlated with negative feelings among children, independent of the level of their physical activity.
Subjective well-being	Daneels et al.	2021	Media and Communication	Literature review	N=82 studies	Digital game appreciation was often and closely connected to meaningful, emotionally moving or challenging, and self-reflective experiences.
Subjective well-being	Nisafani, Kiely and Mahony	2020	Journal of Decision Systems	Literature review	N= 42 papers	Techno-uncertainty, techno-complexity, and technology dependency are some causes of technostress and with these causes, workers experience strains such as emotional exhaustion and some negative emotions.
Subjective well-being	Bordi et al.	2018	Nordic journal of working life studies	Qualitative /Quantitative	N=36	Six themes were found to affect wellbeing at work: the volume of digital communication, expectations of constant connectivity, the quality of the messages, adaptation of new tools, technical problems, and flexibility in communication.
Inequalities	Millán et al.	2021	Journal of Business Research	Quantitative	N = 5,700	Earnings rise with the level of ICT use but only from a threshold of utilisation accounting for at least 25 per cent of the time
Inequalities	Youssef, Dahmani and Ragni	2022	Information	Quantitative	N = 1,323	Poor investment in ICT affects students' academic performance; student performance improves with the innovative and collaborative use of ICTs; and acquisition of digital skills increases students' academic performance.

Well-being dimension	Author	Year	Source	Methodology	Number of observations/ studies	Key findings related to digital technologies and well-being
Inequalities	Elena-Bucea et al.	2021	Information Systems Frontiers	Literature review/ Quantitative		E-Services adoption is influenced primarily by the education level of individuals, while Social Networks adoption is more affected by individuals' age.
Inequalities	Sostero et al.	2020	JRC Working Papers Series on Labour, Education and Technology	Quantitative		Differences in teleworkability emerge between high- and low-paid workers, between white- and blue-collar workers, as well as by gender.
Inequalities	Chang et al.	2021	Milbank Quarterly	Quantitative	N =918	People from socially vulnerable communities faced significant barriers to telehealth services during the COVID-19 pandemic, and used telephone more often than video consultations.
Inequalities	Eberly et al.	2020	Circulation	Quantitative	N =2,940	During the COVID-19 pandemic, inequities was compounded even among patients without COVID in outpatient routine care via inequitable access to telemedical care for female, non–English-speaking, older, and poorer patients. Non-English language was independently associated with >50% lower telemedicine use.
Inequalities	Nam and Lee	2023	Telematics and Informatics	Quantitative	N =5,477	A disproportionate concentration of Fin-tech services usage was found among higher-income individuals.
Inequalities	Van de Werfhorst, Kessenich and Geven	2022	Computers and Education Open	Quantitative	N = 18,882 (study 1), N = 135,169 (study 2)	Those from higher SES background used ICT more for school than their peers from the less advantaged backgrounds.
Inequalities	Sala, Gaia and Cerati	2022	Social Science Computer Review	Quantitative	N= 97,786 (aged 65-74), N=16,444 (aged 55-64)	There is the persistence of the intergeneration digital divide in old age together with the marked cross-countries differences in SNS use across European countries and over time.
Inequalities	Elena-Bucea et al.	2021	Information Systems Frontiers	Literature review/ Quantitative		E-Services adoption is influenced primarily by the education level of individuals, while Social Networks adoption is more affected by individuals' age.
Inequalities	Choi et al.	2020	The Gerontologist	Quantitative	N=5,914	Greater exposure to ageism is generally related to less use of the internet. For women, a lower level of internet use was predicted by more negative perceptions of ageing, whereas men's internet use was associated with the experience of age discrimination.
Inequalities	Gran, Booth and Bucher	2021	Information Communication and Society	Quantitative	N=1,624	There are clear demographic differences regarding levels of algorithms awareness. Awareness of algorithms was high among the youth but it was the lowest among elderly.
Inequalities	Galperin and Arcidiacono	2021	Telecommunications Policy	Quantitative	N=69,172 (Ecuador), N=8,725,065 (Guatemala), N=108,615	Differences in employment patterns between men and women is the largest single contributor to the gender gap in Internet use in four Latin American countries, ahead of differences in other predictors of Internet use such as income, age and education.

Well-being dimension	Author	Year	Source	Methodology	Number of observations/ studies	Key findings related to digital technologies and well-being
					(Mexico), N=29,605 (Peru)	
Inequalities	Arroyo	2020	Social Inclusion	Qualitative	N=32	Because women are active both in the labour market and in the household as unpaid workers, it could negatively affect their availability to connect to the Internet and develop adequate digital skills
Inequalities	Cho and Kim	2022	Disability and Health Journal	Quantitative	N= 5,575 (People without disabilities), N=1,781 (People with disabilities)	A higher number of people with disabilities (PWD) reported that their Internet usage with both computers and mobile devices remained similar to the pre-pandemic period while that of people without disabilities (PWOD) reported that their internet usage via the same has increased.
Inequalities	Mason, Compton and Bhati	2021	Journal of Health Communication	Quantitative	N=139	On 130 health-focused websites, the most common accessibility failures were low contrast, empty links, missing ALT text, empty buttons, and missing form labels.
Inequalities	Johansson, Gulliksen and Gustavsson	2021	Universal Access in the Information Society	Quantitative	N=771	There are differences in digital inclusion between sub-groups of diagnoses/impairments; people with disabilities related to language and understanding reported more difficulties using internet than other disability groups.
Inequalities	Galperin, Le and Wyatt	2021	Government Information Quarterly	Quantitative	N=28,273	Competition and fiber-based services are less likely in low-income areas and minority communities, with the most severe deficits observed in census block groups that combine poverty and a large share of Black residents.
Inequalities	Reddick et al.	2020	Cities	Quantitative	N=6,048	Controlling for all other factors such as income, gender, age, and education, the digital divide in broadband access depended on where you lived in the city.
Inequalities	Gallego and Kurer	2022	Annual Review of Political Science	Literature review		Digitalization creates economic losers who are more likely to vote against the political status quo, but it also creates winners with distinct preferences who support the status quo and can even take over some existing political parties.
Inequalities	Güvercin	2022	Technology in Society	Quantitative	N=82 (countries)	If the business sector's digital adoption is high, it is more likely for the leading political party to adopt populist rhetoric; and digitalization increases populism for both left-wing and right-wing political parties.
Inequalities	Gallego, Kurer and Schöll	2022	Journal of Politics	Quantitative	N= 287,352 (for 61,071 individuals)	Ordinary winners of digitalization (i.e. neither left-behind in digitalization nor successful technology entrepreneurs) provide some stabilizing force by supporting the center-right mainstream or the incumbent party.