

2 Getting the most of the digital transformation

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Digital technologies can help Portugal to address economic challenges, including low productivity growth and to mitigate the negative impact of the COVID-19 crisis. Despite impressive progress over recent years, especially in the public sector, Portugal lags OECD best performing countries in the use of key digital technologies. Broad-based policies should aim at getting the most out of digitalisation, lifting capabilities and sharpening incentives to adopt new technologies, while limiting the rise in inequalities it might generate. While communication infrastructure is good overall, addressing connectivity bottlenecks, improving affordability, and increasing digital security is key for the digital transformation. Equipping citizens with the skills needed in a digital economy is a pre-requisite to ensure the benefits of digitalisation are widely shared. Investment in knowledge-based capital and ICT equipment needs to be supported in SMEs by developing expertise and diversifying financing sources, while further reducing regulatory and administrative barriers to business growth.

Portugal achieved impressive progress in the digital transition over the past decade, catching up best performing OECD countries in some areas. Digital technologies could help Portugal address both new challenges such as the recovery from the COVID-19 crisis, and long-lasting ones such as low productivity growth. During the COVID-19 crisis, businesses have increasingly turned to digital tools, such as e-commerce and teleworking, to maintain and expand economic activity. Going forward, the adoption of digital technological and organisational innovations can unlock the potential for productivity growth from low and declining levels.

However, the digital transformation risks exacerbating pre-existing socio-economic inequalities. Like in most OECD countries, small firms are lagging behind larger ones in the adoption of new technologies. The relative slow diffusion of digital technology in the economy has likely deepened the productivity gap between firms and across sectors. The COVID-19 crisis created new business opportunities that only digitally enabled firms could seize and increased the penalty of delays in the adoption of digital tools. Digitalisation is also transforming the labour market by reducing job opportunities for low and middle skilled workers with jobs at high risk of automation.

Against this background, broad-based policies should aim at getting the most out of digitalisation, lifting capabilities and sharpening incentives to adopt new technologies, while limiting the rise in inequalities it might generate. After presenting the main opportunities and challenges of the digital transition, the chapter will propose policy avenues to achieve these objectives. It will first present policies to improve access to communication infrastructure and e-government. It will then discuss measures to equip citizens with adequate skills to thrive in digitalisation. Finally, it will propose options to remove barriers for SMEs' digitalisation.

Portugal needs to accelerate the digital transition

The digital transition can foster resilience and growth, but risks increasing inequalities

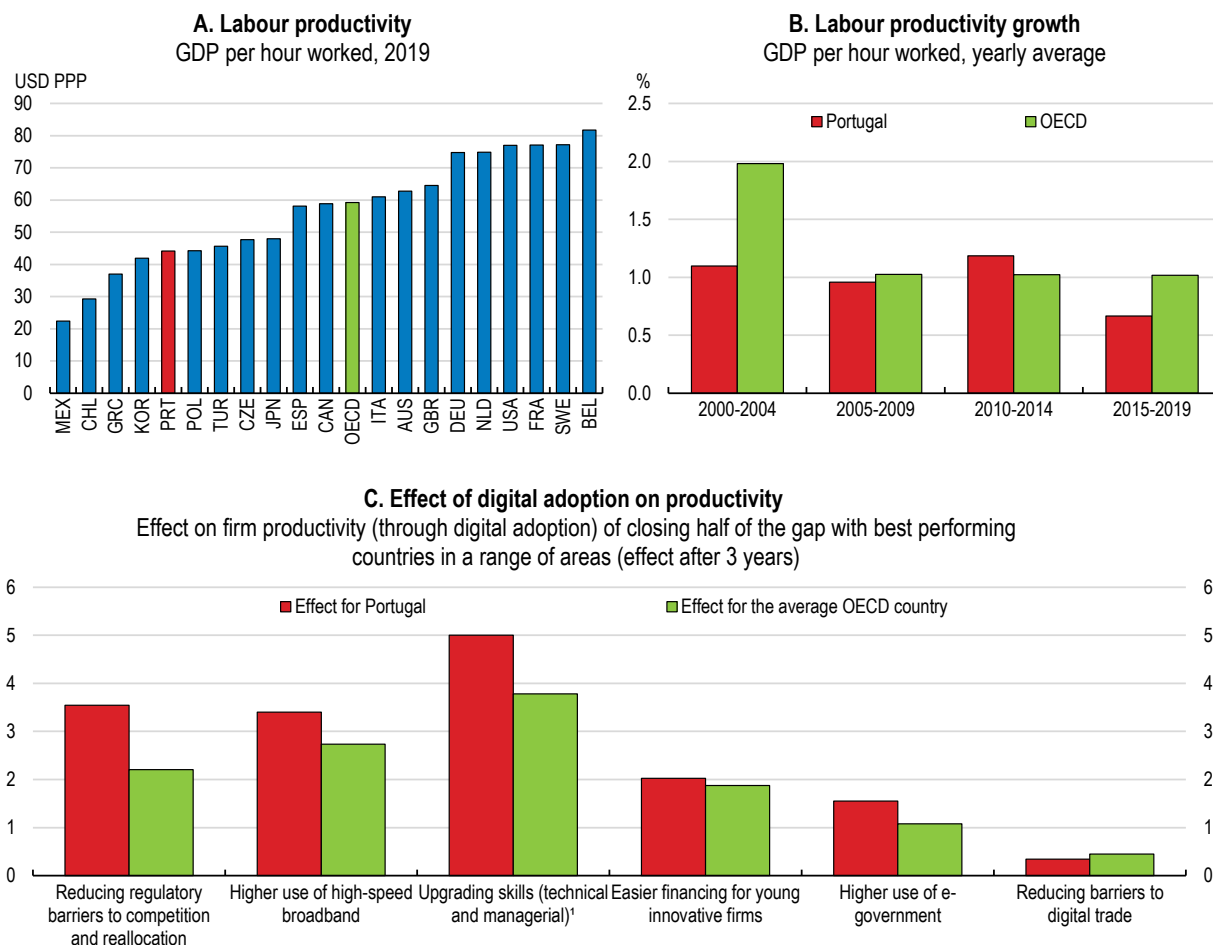
Digitalisation is one of the major global trends of this century. It has accelerated in response to the major economic crisis the COVID-19 pandemic triggered in 2020. Digital technologies have helped to organise policy responses to the pandemic (i.e. provision of online information and advice to the public, allocation of patients across hospitals) and to adapt economic activity to containment measures (i.e. teleworking, online sales). In this context, delays in adopting digital technologies likely undermine economic resilience and competitiveness. It is thus crucial that policy makers ensure that all citizens and firms have access and can use digital tools.

The digital transformation can be an important productivity growth driver for Portugal. Productivity growth has been weak over the past two decades, with a marked slowdown since the global financial crisis, undermining improvements in living standards (Figure 2.1, Panel A and B). A recent OECD empirical study shows that policies that stimulate the adoption of digital technologies can increase productivity significantly (Figure 2.1, Panel C).

Digital technologies enable new business models and opportunities for innovation, with the digitalisation of final products and services and of business processes (OECD, 2020a). They can increase competition pressures to reduce costs. Digital technologies also have complementarities that boost each other's positive impacts (Gal et al., 2019). Productivity increasing technologies, robots in particular, can compensate for the negative impact of a declining and ageing workforce, that is particularly pronounced in Portugal (see Chapter 1) (Acemoglu and Restrepo, 2020; OECD, 2019a). Digitalisation can also boost the innovative capacity of Portuguese firms, by bringing in new process and practices of innovation, for instance with the use of big data analytics, new simulations techniques, and market platforms for commercialisation (OECD, 2020a). Empirical evidence suggests that using advanced technologies can double the odds of reporting innovations (Galindo-Rueda, Verger and Ouellet, 2020). Portugal ranks as "Moderate Innovator" according to the 2021 European Innovation Scoreboard which assessed the national


innovation systems, scoring particularly well on basic conditions for innovation in terms of the attractiveness and internationalization of the research system (European Commission, 2021). However, as discussed below there is room to improve innovative capacity of Portuguese firms further.

Figure 2.1. Digitalisation can help strengthen Portugal's poor productivity performance



Note: 1. Average of peer countries Greece, Italy and Spain.

Source: OECD (2021), Productivity Database; Sorbe, et al. (2019) Digital Dividend: Policies to harness the potential of digital technologies, Economic Policy Papers, 26, <https://doi.org/10.1787/273176bc-en>.

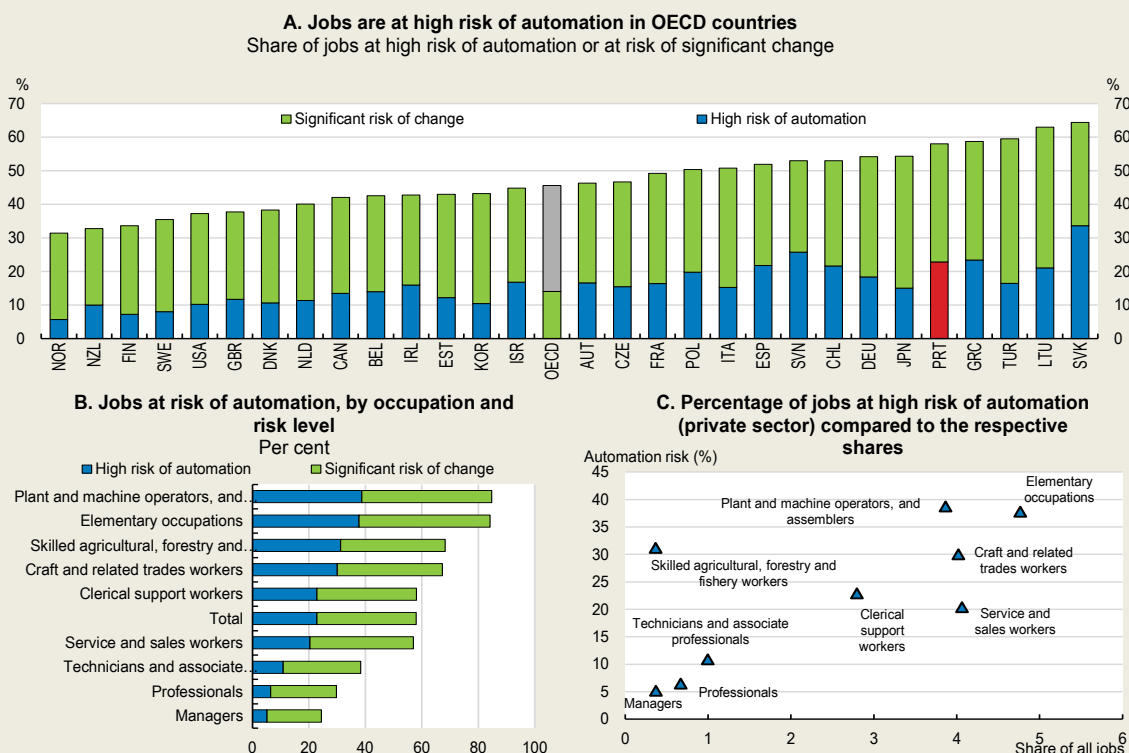
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Digitalisation significantly transforms the labour market, changing skills requirements and inducing large job reallocations in the economy (OECD, 2019a and 2019b). Digital technologies, such as artificial intelligence, allow for the automation of jobs and tasks that require low-level, routine skills. Across OECD countries, 14% of current jobs are at high risk of becoming fully automated, and more than 30% of current jobs will change significantly over the next 10 to 20 years (OECD, 2019c; Quintini and Nedelkoska, 2018; Box 2.1). In Portugal, job automation could affect 20% to 25% of the total numbers of jobs, especially in manufacturing and commerce (Nova SBE and CIP, 2019). The COVID-19 crisis may accelerate the automation of jobs as employers are likely to start looking for more technology-intensive solutions to strengthen their capabilities of withstanding similar future shocks (Espinoza and Reznikova, 2020).

Box 2.1. Job automation risks in Portugal

The risk of job automation over the next 10 to 20 years is found to be relatively high in Portugal (Figure 2.2, Panel A). Estimates suggest about one out of four jobs in the private sector are at high risk of automation (i.e. more than 70% of tasks in these jobs are automatable). This is one of the highest shares among all countries and well above the OECD average (14%). 35% of jobs may experience a significant change in tasks (i.e. have between 50 and 70% of automatable tasks), close to the OECD average (32%).

Figure 2.2. Estimates point to large automation risks



Note: Data for Portugal have been estimated based on the average automation risk probabilities for the peer countries, Greece, Italy and Spain, applied to the occupational structure (ISCO08-2-digits) of Portugal.

Source: OECD calculations based Quintini and Nedelkoska (2018), Quadros de Pessoal database (2018).

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There are large disparities in automation risks by skill level. Jobs in occupations with low skill requirements, such as plant and machine operators, and assemblers, are more at risk (Figure 2.2, Panel B). Workers in elementary occupations that account for about 5% of total employees in the private sector are highly exposed (Figure 2.2, Panel C). The risk of automation also varies across regions, between 54% in the Metropolitan Area of Lisbon and 62% in the region of Alentejo.

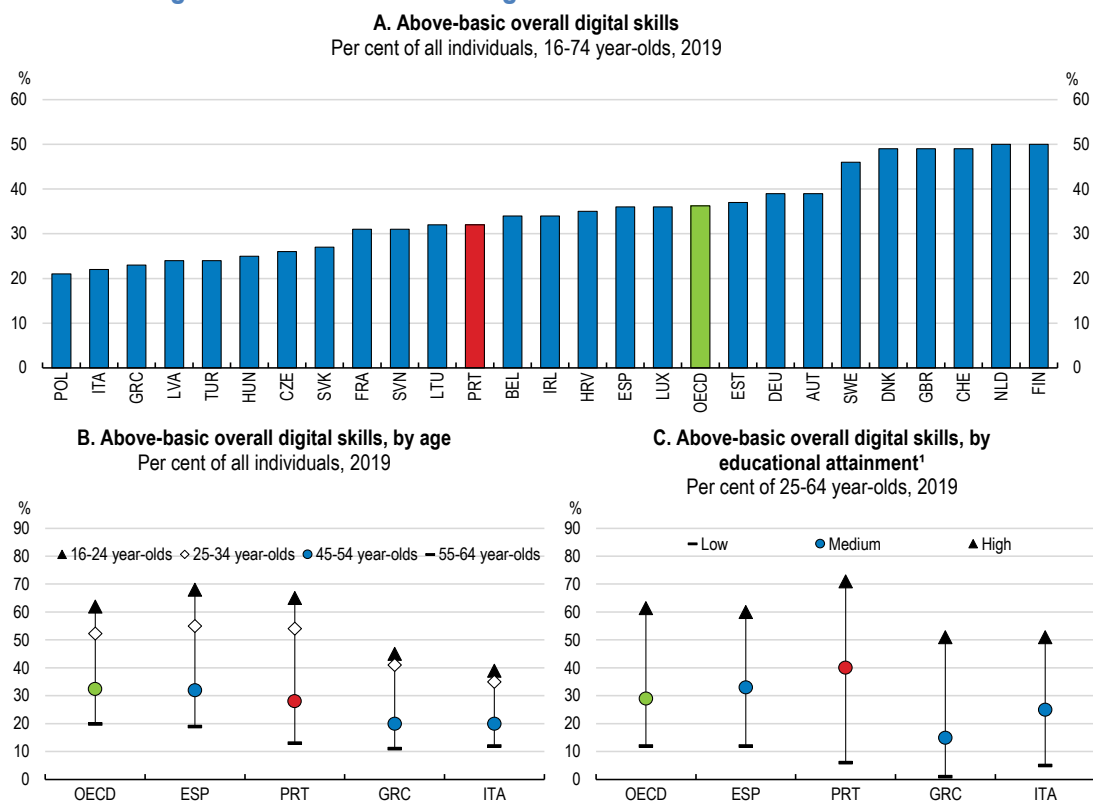
Estimates are based on the methodology used in Quintini and Nedelkoska (2018). Using the share of automatable tasks within each occupation, they estimate the share of jobs at high and moderate risks of automation for most OECD countries, based on country-specific jobs' task-content surveyed in the OECD Survey of Adult Skills (PIAAC). Such data are not available for Portugal, which is not covered in PIAAC. For Portugal, automation risks are calculated by using the average of automation probabilities per occupation of peer countries (Greece, Italy and Spain) and applying them to the occupational distribution of individuals employed in the private sector in 2018 (extracted from the Quadros de Pessoal database).

Like in all OECD countries, the digital transformation of the labour market risks accentuating pre-existing inequalities in Portugal. People with the lowest educational qualifications, who are more at risk of being unemployed, work in jobs that are at greater risk of being automated (Arntz, Gregory and Zierahn, 2016). Digitalisation has already contributed to the polarisation of the labour market and the continued up-skilling of job profiles (OECD, 2018a). Going forward, middle-skilled automatable jobs can be replaced by new jobs in emerging occupations with relatively high skills requirements, such as systems developers, cloud computing specialists, transport network engineers, medical device consultants, data analysts, and electrical engineers for smart grids (OECD, 2019a; Autor, 2015; Autor and Salomons, 2017). Digitalisation also risks deepening regional disparities, as regions with a relatively high share of jobs at risk of automation are also those with less digital intensive sectors.

A large share of the population lacks digital skills

A significant share of the Portuguese population is not equipped to thrive in a digitalised world. By international norms, the educational attainment level is relatively low and the percentage of people with general digital skills (basic or above basic) is below the OECD average, with very large discrepancies across groups. The lack of above-basic digital skills is particularly pronounced among the low educated and the elderly, while the share of young people with above-basic digital skills is high (Figure 2.3). This explains the relatively low take up of digital technologies. Around one out of five Portuguese did not have Internet at home in 2019 and less than 80% used internet in the last 12 months (Figure 2.4, Panel A). In addition, among Internet users, only a minority uses it for a large range of activities and the take up of online services (i.e. banking, e-commerce, job search) is low by international norms (European Commission, 2020a).

Figure 2.3. Adult digital skills are below average

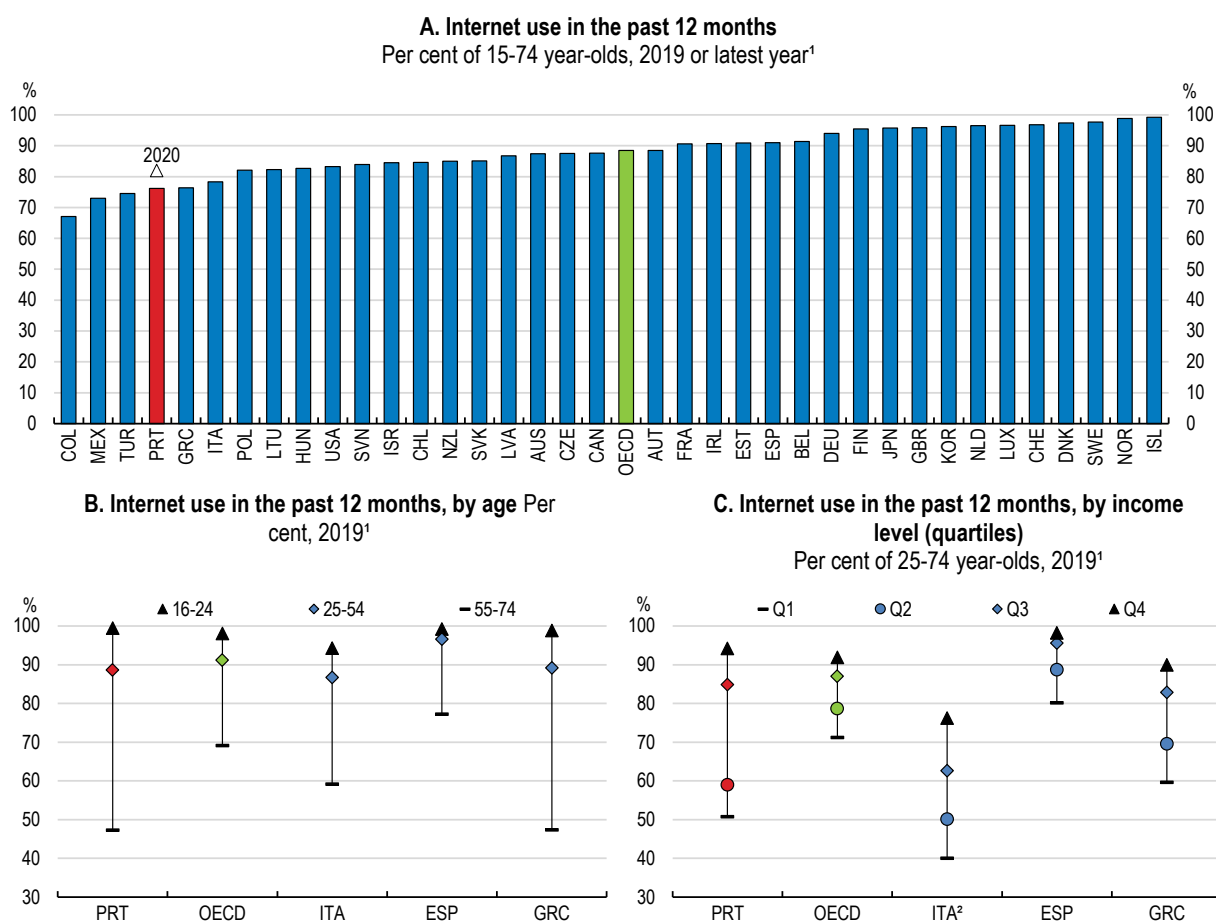


Note: 1. Low education refers to level 0-2, medium education to level 3-4 and high education to level 5-8 of the ISCED-A 2011 classification.
Source: Eurostat (2021), Individuals' level of digital skills.

Reflecting differences in digital skills, disparities in Internet access and use by income and age are large (Figure 2.4, Panels B and C). While 94% of the richest people had used the Internet over the past year in 2019, only 50% of the poorest did so, the second largest gap in the OECD. Older people are also less likely to use Internet, with only 38% of users among retirees in 2019. Advanced population ageing in Portugal only partly explains low Internet penetration, as countries with a similar demographic profile fare much better as regards Internet use (i.e. Finland, Germany). This likely reflects low educational attainment levels in the old age population. Disparities across regions are also large by OECD standards, with broadband penetration ranging from 89% in the Lisbon region to 77% in Alentejo in 2020, reflecting differences in demographics and broadband coverage.


In 2020, in response to physical distancing rules, the use of online services accelerated significantly, but remained below the OECD average (Figure 2.4, Panel A for internet use). The percentage of Internet and e-commerce users increased by three and seven percentage points respectively, among the highest annual increases over the last decade (INE, 2020). Following school closures, online communication through educational portals and the uptake of online courses more than doubled (reaching around 31% and 18% in 2020 respectively). Finally, the gap between high and low-income people in Internet use has declined, but remained among the highest in the OECD.

Figure 2.4. Disparities in Internet use are large



Note: 1. Data for Israel and the United States refer to the Internet use in the past 3 months. 2. Data for Italy refer to 2013.

Source: OECD (2021) ICT Access and Usage by Households and Individuals (database).

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Firms' uptake of digital tools remains uneven

Before the pandemic, the uptake of digital technologies by many Portuguese firms had been slow and uneven, reflecting and contributing to the limited use of digital technologies by the population. While Internet penetration has been high, with 41% of firms connected to high-speed broadband network in 2019 (increasing further to 60% in 2020), the adoption of other ICT tools has remained well below the OECD best performing countries (Figure 2.5, Panel A; Box 2.2). The structure of the economy plays a role in this slow adoption. Digital intensive sectors, especially the information and communication sector, account for a small share of the economy (respectively 18.7% and 3.5% of total value added in 2019, compared to 22% and 5.2% respectively on average in the EU).

The high prevalence of micro-firms in the Portuguese economy also plays a role in the technology gap. SMEs lag behind large firms across all technologies, as in other OECD countries (Figure 2.5, Panel B). Disparities by firm size have been persistent and even increased for the same technologies. They are large for the adoption of basic tools, such as having a website, or tools that are found to have a positive impact on firms' performance, and are important for the use of other IT technologies. In particular, SMEs have not caught up to large firms for the adoption of cloud computing. This is unfortunate as cloud computing services are essential for many data-intensive applications and offer firms flexibility by limiting costly investment in large IT infrastructure (Gal et al., 2019).

Box 2.2. ICT tools and technologies

Digitalisation is defined as the use of digital technologies and data as well as their interconnection that results in new activities or changes to existing activities (OECD, 2019d). Digital technologies are very diverse, from basic to more advanced ones. They include:

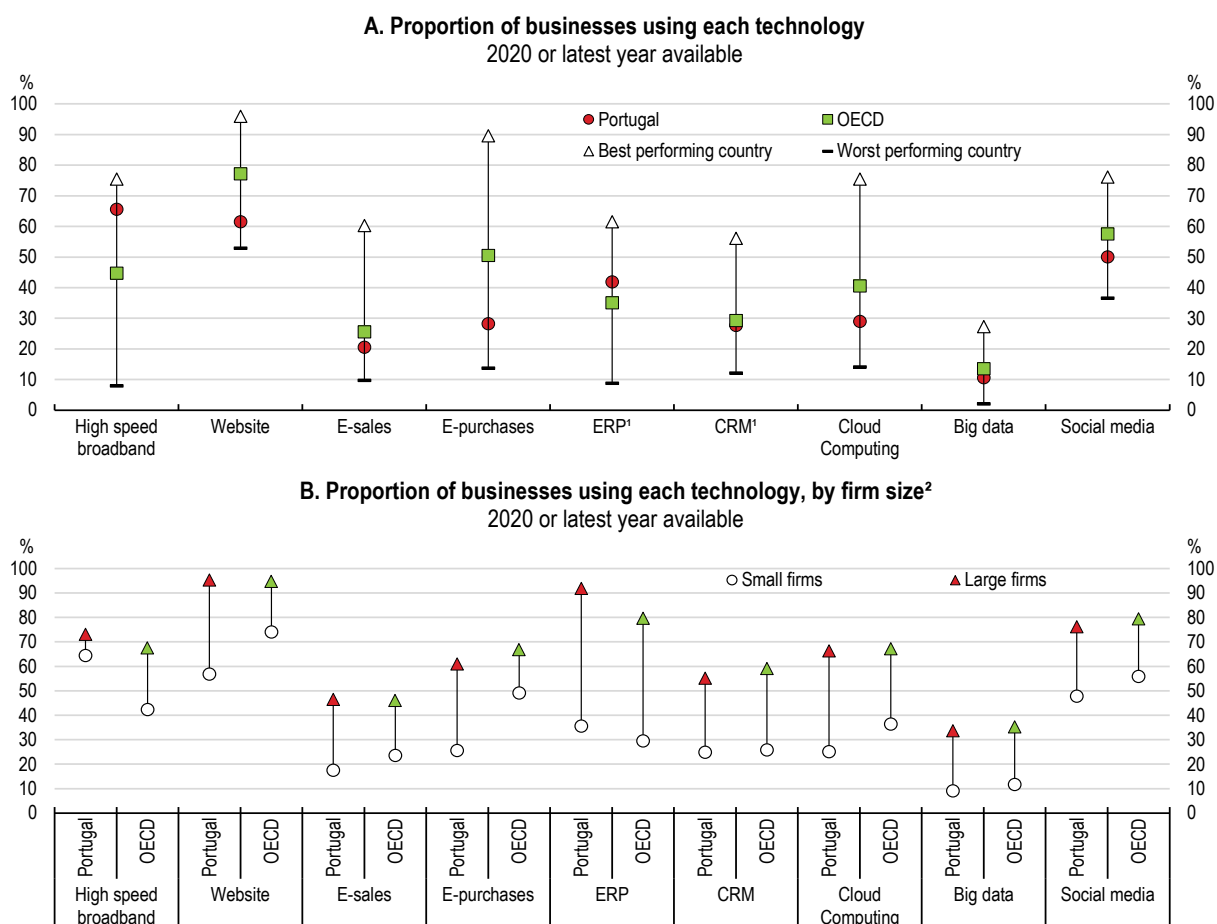
- Basic ICT tools such as broadband and websites that enable firms to digitise information and establish a presence online.
- Tools like Customer relationship management (CRM) software and Enterprise Resource Planning (ERP) that enable firms to digitalise and optimise processes. CRM tools allow firms, through intensive use of ICTs, to collect, integrate, process and analyse information related to their customers. ERP allows firms to benefit from a higher integration of information and processing across their various business functions.
- Cloud computing, which refers to ICT services used over the Internet as a set of computing resources to access software, computing power, storage capacity services. It is useful for advanced process optimisation and for many data-intensive applications in firms.
- Big data analysis that encompasses the use of techniques, technologies and software tools for analysing big data. This, in turn, relates to the huge amount of data generated from activities that are carried out electronically and from machine-to-machine communications.
- Social media, which refer to applications based on Internet technology or communication platforms for connecting, creating and exchanging content on line with customers, suppliers or partners, or within the enterprise.

Source: (OECD, 2020a).

Disparities in the digital uptake, across different technologies and across firms, might have put a drag on productivity growth in Portugal by increasing productivity dispersion between best-performing firms and less productive ones, like in the average OECD country (Sorbe, Gal and Millot, 2018). The productivity gap between Portugal and comparable countries has been substantially larger for small firms (OECD, 2019e). For instance, the average labour productivity level of micro-firms in manufacturing amounts to about only


a fourth of the average productivity in benchmark countries, less than half the level seen in large firms. It is thus crucial that policies continue to address barriers to enable SMEs to embrace digitalisation.

Figure 2.5. Technology uptake by firms is limited, particularly in small firms



Note: 1. CRM stands for Customer Relationship Management software and ERP for Enterprise Resource Planning software. 2. Firm size is defined as small firms (10-49 employees) and large firms (over 250 employees).

Source: OECD (2021), ICT Access and Usage by Businesses database.

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The COVID-19 crisis has accelerated some changes in firms' business models

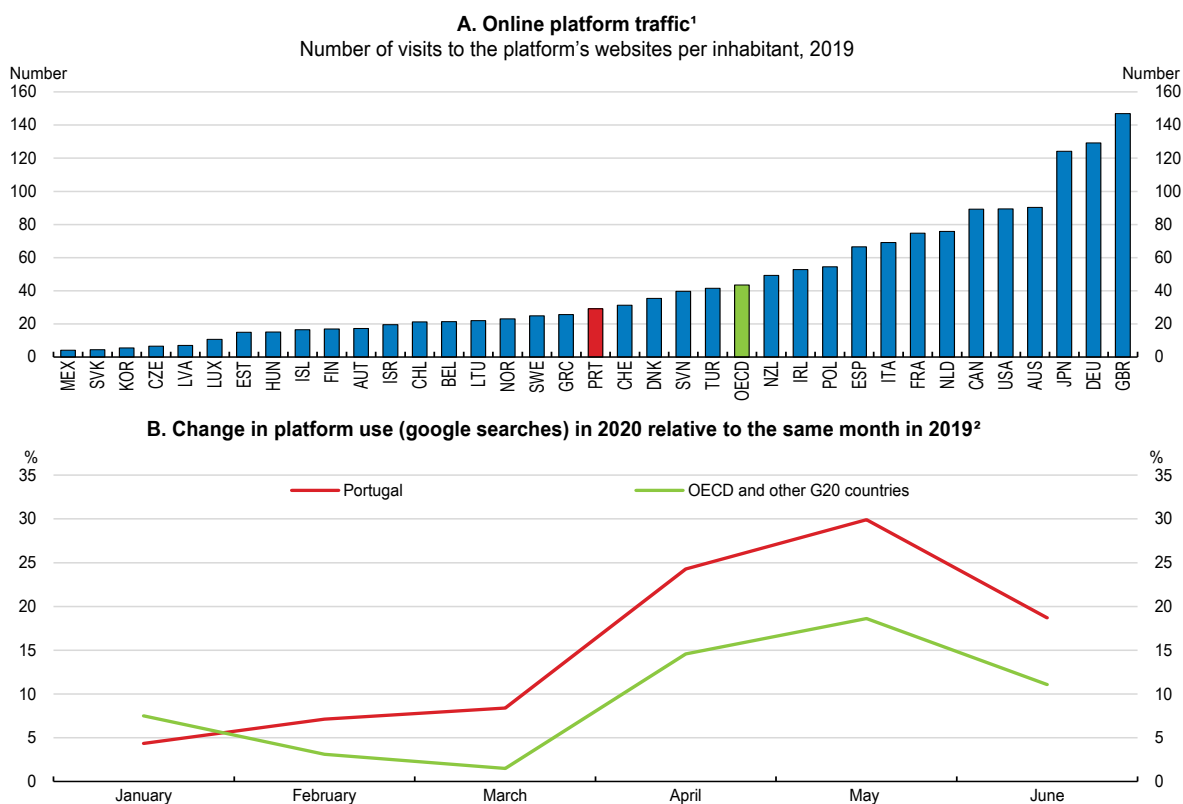
Before the pandemic, digital organisational innovations, such as e-commerce or teleworking, were not widely used in Portugal. In 2019, only 11% of firms had a website allowing for online ordering or booking and 17% received orders through computers. Over the past decade, the development of e-commerce was faster in some sectors (e.g. accommodation and food) than in others, with retail and wholesale trade lagging behind. Furthermore, the gap between large and small firms selling through e-commerce has widened considerably. In 2017, more than half of online business-to-business purchases in Portugal were made to foreign countries, the highest share in Europe (ACEPI, 2017).

The COVID-19 crisis accelerated the adoption of e-commerce, as firms tried to deal with containment measures (i.e. physical distancing measures) and maintain their economic activity (ACEPI, 2020). About 21% of firms used e-commerce in 2020 (from 17% in 2019). The government strengthened public support to e-commerce by ramping up the program, *Comércio Digital*, launched in 2019 with the objective to reach 50 000 SMEs. It includes incentives for businesses to set up a webpage (voucher "3 em 1" for free website registration, webmail access, and tools for website creation), the creation of a quality stamp for online

businesses to increase consumer trust (“Selo de Confiança”), and online courses to increase the knowledge of various tools available for digitalisation (“Academia do Comércio Digital”). The registration of websites under this programme tripled since the beginning of the pandemic. The share of SMEs using e-commerce increased to 18% (from 14%) converging to the EU average and the total turnover from e-commerce sales in SMEs reached 16% in 2020 (from 15% in 2019), the fourth highest among EU27 countries.

Selling through online platforms eases e-commerce by providing firms with tools they would not necessarily have access to, such as rating systems and online payment systems. Online platform diffusion is also associated with productivity growth for traditional firms, especially for SMEs (Costa et al., 2021). In Portugal, online platforms are less used than in the average OECD country (Figure 2.6, Panel A), reflecting that a relatively low share of the population shops online. In 2019, a relatively low number of firms used e-commerce marketplaces (Eurostat, 2020a). At the same time, a growing interest of Portuguese consumers for platforms indicate new market opportunities for Portuguese firms (Figure 2.6, Panel B).

Figure 2.6. The crisis has increased interest in platforms



Note: 1. The following activity areas are considered: accommodation, marketplace to consumers, marketplace b2b, mobile payments, personal services, professional services, restaurant booking, restaurant delivery, and taxi. 2. The following activity areas are considered: mobile payments, marketplace to consumers, professional services and restaurant delivery.

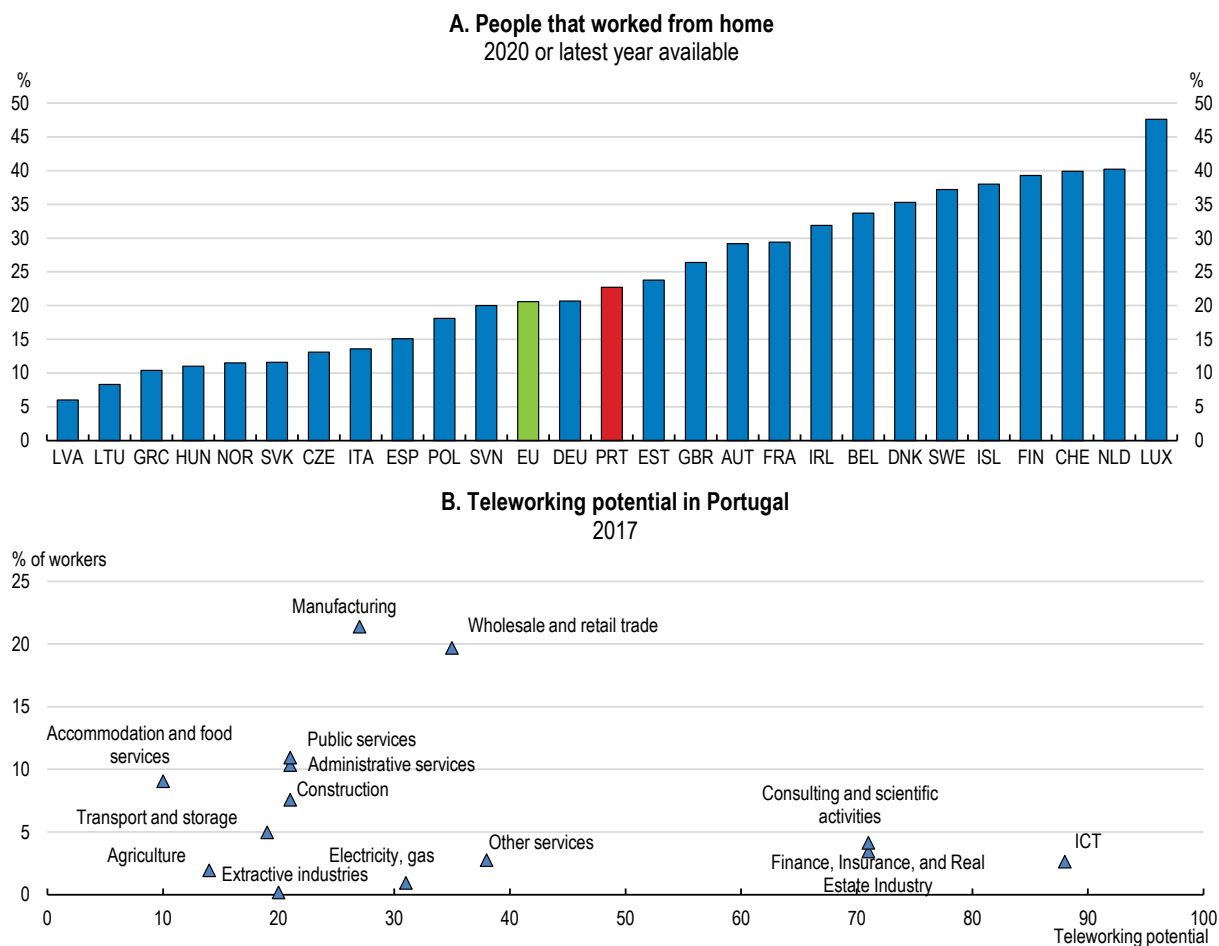
Source: Panel A: Costa, H. et al. (2021) Welcome to the (digital) jungle: a new cross-country measure of online platform diffusion; Panel B: OCDE (2021), « The role of online platforms in weathering the COVID-19 shock », OECD Policy Responses to Coronavirus (COVID-19), OECD Publishing, Paris, <https://doi.org/10.1787/2a3b8434-en>.

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The pandemic triggered a rise in teleworking. In 2019, less than 40% of employees used a computer with Internet access at work and teleworking was used by 16% of the employed persons despite having increased significantly since 2010. In 2020, around 23% of people have worked from home at least once during the year (Figure 2.7, Panel A). The potential for teleworking is estimated to be limited in several


sectors, with 64% of employees having a low or very low teleworking potential (Martins, 2020; Figure 2.7, Panel B). At the same time, teleworking potential is deemed higher in Portugal than in other OECD countries, such as France, Spain or Italy (ILO, 2020a). Updated regulation on remote work conditions has been put forward in 2021 after negotiations with the social partners.

Figure 2.7. Teleworking has increased significantly, but its potential is uneven across sectors



Note: Panel A shows the percentage of people (employed or self-employed) who have worked from home at least once during the reference year (calculated as 100 minus the percentage that has never worked from home).

Source: Eurostat (2021); Martins, P O potencial do teletrabalho em Portugal, Ensaios do Observador, <https://observador.pt/especiais/o-potencial-do-teletrabalho-em-portugal> (accessed on 19 December 2020).

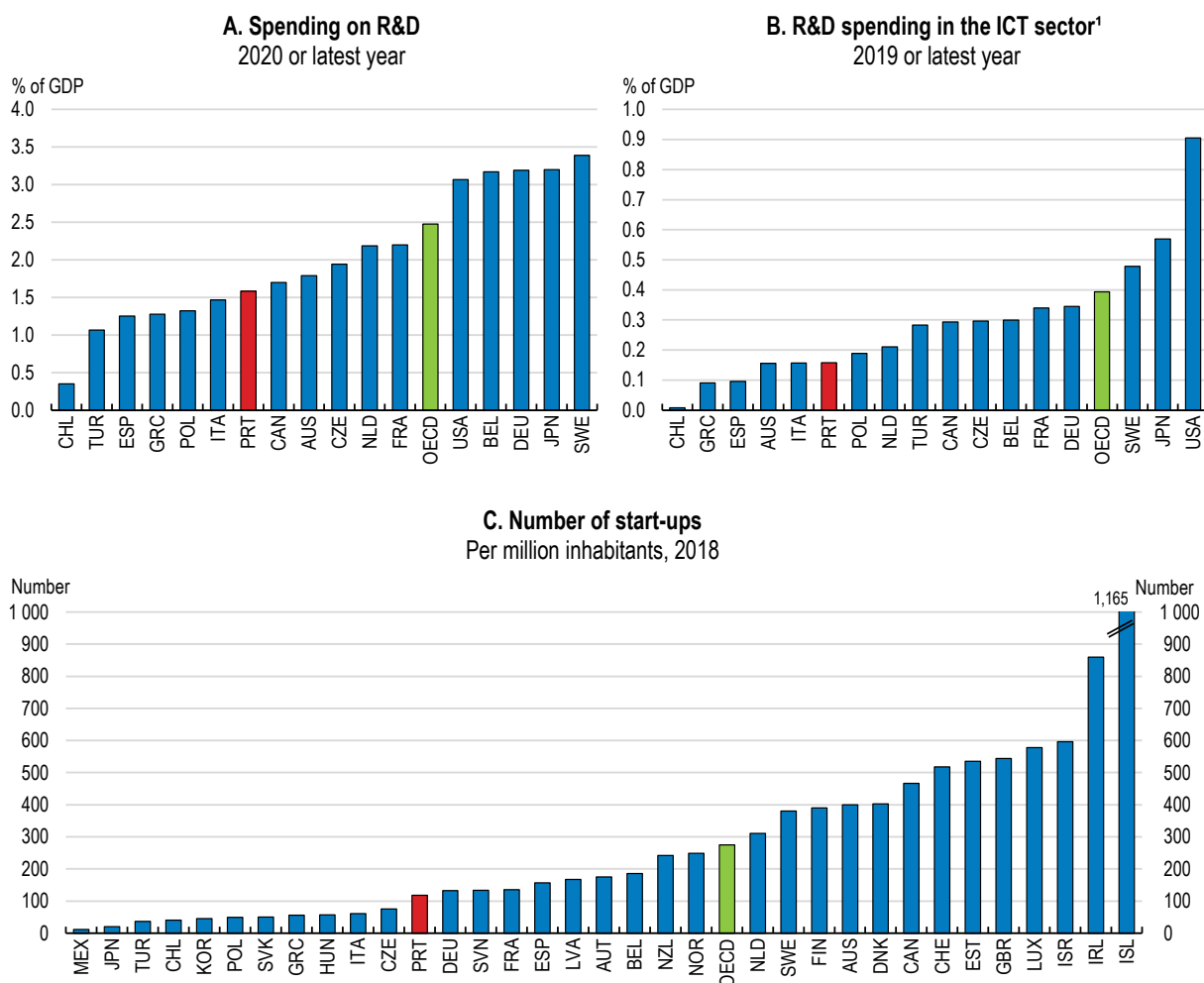
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The COVID-19 crisis can exacerbate existing gaps in digital innovation


Research and development (R&D) is important in driving advances in the uptake of digital technologies. Firms in the ICT sectors are among the most R&D intensive firms in Portugal. The share of business having either introduced an innovation or have any kind of innovation activity in the ICT sectors, is large by international standards (OECD, 2020a). The number of PhD graduates and researchers has picked up, the latter growing by 30% since 2015. However, despite strong increases since 2015 (from 1.2% of GDP to 1.6% in 2020), R&D expenditure has remained relatively low, especially in ICT sectors (Figure 2.8, panels A and B). Only around 15% of patents and 20% trademarks patents were ICT related over the period 2014-17, well below the 30% OECD average (OECD, 2020a). Furthermore, R&D spending in the ICT sector has stagnated despite growth opportunities, including in artificial intelligence or cybersecurity. Going forward, the pandemic risks limiting the available resources for business research and exacerbating

existing gaps in business research and innovation activities between “leading” and “laggard” sectors, large and small firms, and geographical areas (OECD, 2021a). At the same time, Portugal’s Recovery and Resilience plan, European Structural Investment Funds through the Multiannual Financial Framework 2021-27 and Centralized EU funds through the new European Research and Innovation Framework for 2021-27 are expected to support the government objective to raise R&D spending to 3% of GDP by 2030.

Figure 2.8. Innovative activities remain below the OECD average



Note: 1. ICT sector refer to ISIC Rev.4 categories 26 and 58-63. OECD excludes Colombia, Luxembourg, Mexico, New Zealand and Latvia.
Source: OECD (2021), ANBERD (database) and MSTI (database); Ministro Da Ciência, Tecnologia E Ensino Superior; Crunchbase and World Bank (2021).

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Innovative start-ups are other key drivers for digital innovation and diffusion (Lassébie et al., 2019). In particular, digitally enabled start-ups can provide solutions to adapt to the pandemic, including innovations in tele-medicine, remote personal care, medical equipment, home delivery, teleworking, online education, and contact tracing. Portugal’s start-up ecosystem gained momentum in recent years, with major hubs in Lisbon, Porto, Braga, and Coimbra (EIT Digital, 2020a). Since 2016, Lisbon hosts the Web Summit, one of the biggest tech conferences worldwide, with a significant positive impact on the economy (Cerejeira, 2018). Innovative start-ups have contributed to 1.1% of GDP in 2018, compared to 0.7% in 2016 (Start-up Portugal, 2019) and six Portuguese start-ups have recently achieved the unicorn status, i.e. are valued over USD 1 billion. Nevertheless, the start-up ecosystem can be further developed. The number of start-ups is still below the OECD average and a relatively large majority remains early stage ventures

(Figure 2.8, Panel C). While the COVID-19 crisis has provided opportunities for digital innovative firms, start-up creation has declined during the first phase of the pandemic (EIT Digital, 2020a). The crisis can undermine their survival and growth prospects, not least by reducing available financing sources (see Chapter 1).

A successful digital transition hinges on the effective implementation of the Action Plan for Digital Transition

To seize the opportunities and ensure that everyone benefits from the digital transformation, OECD countries need a national strategy that ensures policy coherence and tackles multiple barriers to the digital transformation (OECD, 2020b). However, Portugal has a vast range of measures that lacked coordination in the past (Box 2.3). The digital transition is now under the responsibility of the Minister of State, Economy and Digital Transition, with political coordination ensured by the Secretary of State for the Digital Transition. It is also welcome that an Action Plan for Digital Transition, approved in April 2020, aims at identifying priorities and creating synergies between different initiatives. A task force “Portugal Digital” is in charge of coordinating and monitoring the 57 initiatives defined in the Plan, but implementation will be challenging. In particular, data that are crucial to assess progress and to orient policy action still need to be collected.

Effective implementation of the Digital Transition Action Plan and on-going programs, such as Incode.2030, using available EU funds can contribute significantly to the digital transition. A successful strategy requires a clear timeline for implementation, quantifiable targets with related indicators to monitor progress, and a long-term budgeting strategy to ensure continuity of well-performing initiatives. Providing the coordination entity with a budget to incentivise co-operation among different actors can also be envisaged (OECD, 2020b). As discussed in Chapter 1, improving the management of public funds will also be crucial to get the most out of the EU funds, including those provided for the implementation of the Recovery and Resilience Plan that is set to dedicate EUR 3.7 billion to the digital transition (around 2% of 2020 GDP).

Box 2.3. Main initiatives promoting the digital transition

Building up on a digital society has been high in the Portuguese agenda for some time, with a range of policy plans (e.g. the Digital Portugal Agenda in 2015, the ICT Strategy 2020 in 2017, and the Action Plan for Digital Transition in 2020). Main on-going initiatives include:

- The Strategy **Industry 4.0** aims at promoting a fast and generalised uptake of digital technologies in the industry. Its first phase launched in 2017 focused on raising awareness. Its second phase launched in 2019 aims at developing training and offering financing options for investment in digital equipment.
- The national initiative on digital skills, **INCoDe.2030**, aims at broadening digital literacy, promoting employability and professional training in digital technologies and raising participation in R&D networks (see Box 2.5).
- The **Digital Commerce Programme** (*Comércio Digital*) aims at developing digital marketing in 50 000 SME by 2021. It includes a platform to share best practices, the provision of vouchers for training, free website, mailbox, and website accreditation.
- The **SIMPLEX Programme** for the simplification and modernisation of the public administration is based on a bottom-up approach for the identification of stakeholders’ needs and expectations, including for the development of the digital government.
- Other national initiatives that include an important digital dimension comprise the Strategy for State and Public Administration Innovation and Modernisation 2020-2023, the Strategy of Technological and Business Innovation 2018-2030, Artificial Intelligence Portugal 2030, and

Advanced Computing Portugal 2030. Initiatives for the digital transformation in healthcare are detailed in Box 2.4.

Under the Portuguese Presidency of European Council important achievements regarding the digital transformation have been agreed upon, such as, the e-Privacy Regulation, the EU Start-up Nation Standard of Excellence (Ministerial Declaration), the European Data Gateways as a key element of the EU's Digital Decade (Ministerial Declaration) and the Green and Digital Transformation of the EU (Ministerial Declaration). Likewise, relevant progress has been made on other digital files, such as the Digital Services Act and the Digital Markets Act. The Portuguese Presidency encompassed also a number of initiatives to promote the digital transformation at the EU level, such as the Lisbon Declaration, which includes a framework of digital rights.

Securing a safe and high-quality digital environment for all

Providing affordable access to high-quality communication infrastructure

Affordable and high-quality fixed and mobile broadband is a prerequisite for the digital transition. It is paramount to develop data-driven activities, for cloud computing, and data-intensive applications (i.e. industry automation, medical imaging). High-speed broadband encourages the adoption of digital tools as cross-country evidence shows that firms that have access to high-speed broadband tend to adopt more ICT tools and engage in digital activities (Andrews, Nicoletti and Timiliotis, 2018).

The demand for high-speed broadband communication services such as online education, teleworking, and communication services (TV over the Internet, instant messaging, video calls) has increased during the pandemic. In 2020, average fixed traffic per line increased by almost 50%, and average mobile data by user increased by around 27%, compared with 2019. In the more critical period of the COVID-19 crisis, tests by customers of the quality of Internet service surged, indicating increasing attention to the quality of services. Going forward, the development of digital technologies will increase data intensity (Cisco, 2018), and thus will require high quality broadband networks. Policies and regulatory measures that seek to promote investment and reduce obstacles to infrastructure deployment will be key for an inclusive and successful digital transformation.

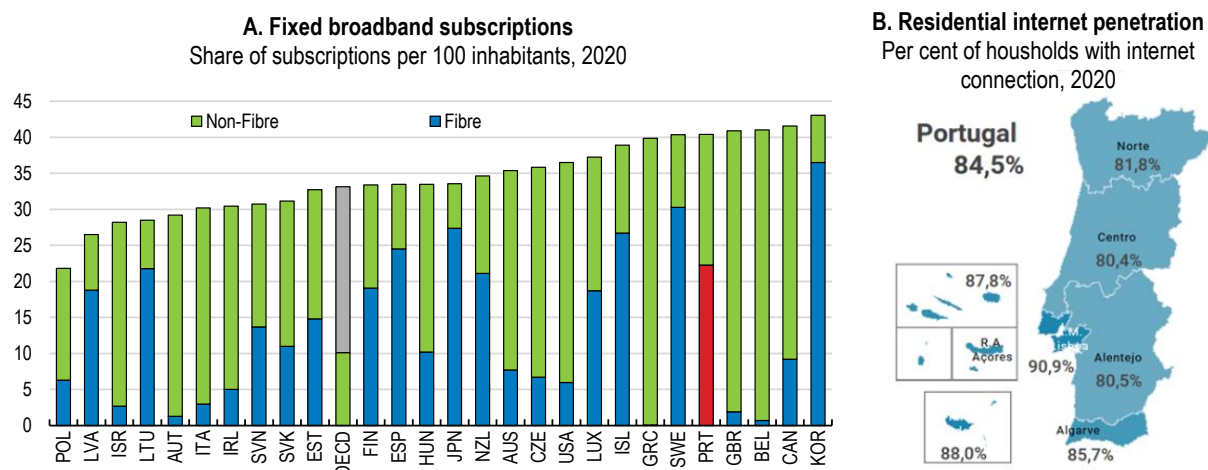
Portugal's communication infrastructure is well developed with fast and ultrafast broadband connectivity in most areas. In 2019, fast broadband and fixed very high capacity network covered 83% of the households (European Commission, 2020a). The take up of fixed broadband has increased fast and the number of fixed broadband subscriptions has reached high levels by international norms (Figure 2.9). The share of high-speed fixed broadband subscriptions (above 100 Mbps) in total subscriptions is among the highest in the OECD, reaching around 80%, compared to less than half on average in the OECD.

Investment in high-speed fixed broadband must keep its momentum, while increasing focus in remote areas. In 2018, around 67% of households in rural areas had access to high-speed fixed broadband (minimum 30 Mbps), above the EU average of 53%, but still lagging best performing countries (OECD, 2020a). In addition, fibre to home connections account for around half of subscriptions and needs to expand further to increase the quality of services.

There are only few regulatory barriers to fibre deployment in Portugal. Like in France and Spain, all operators can have access to civil engineering (ducts, poles, masts, street cabinets etc.). Transparency on existing infrastructure is high, thanks to a centralised information system. Nevertheless, lengthy administrative procedures – mainly from municipalities – to access public property, to obtain the way rights and construction permits can delay infrastructure investment. This calls for harmonising and improving coherence in the rules and requirements to access infrastructure at the municipal level.

Expanding coverage in rural areas requires public intervention when not attractive for private operators, given deployment costs and uncertainty on future investment returns. The creation of a "Connectivity Working Group" in October 2021 tasked with analysing the existing needs in the national territory regarding the coverage of fixed and mobile networks, as well as the availability of public funding funds, in particular from the European Union, and private funds for investment in connectivity infrastructures is a welcome step. EU funds should be used to support local initiatives for fibre deployment in rural areas following identified best practices (European Commission, 2020b; OECD, 2018b). Finally, when transposing the new European Electronic Communications Code, Portugal should also envisage changes to its regulatory framework to encourage fibre deployment, like done in the UK.

Figure 2.9. Connectivity to fixed broadband is good, with some regional disparities



Source: OECD (2020), Broadband Portal, <http://www.oecd.org/sti/broadband/broadband-statistics/>; INE, Inquérito à Utilização de Tecnologias da Informação e da Comunicação pelas Famílias, 2019-2020.

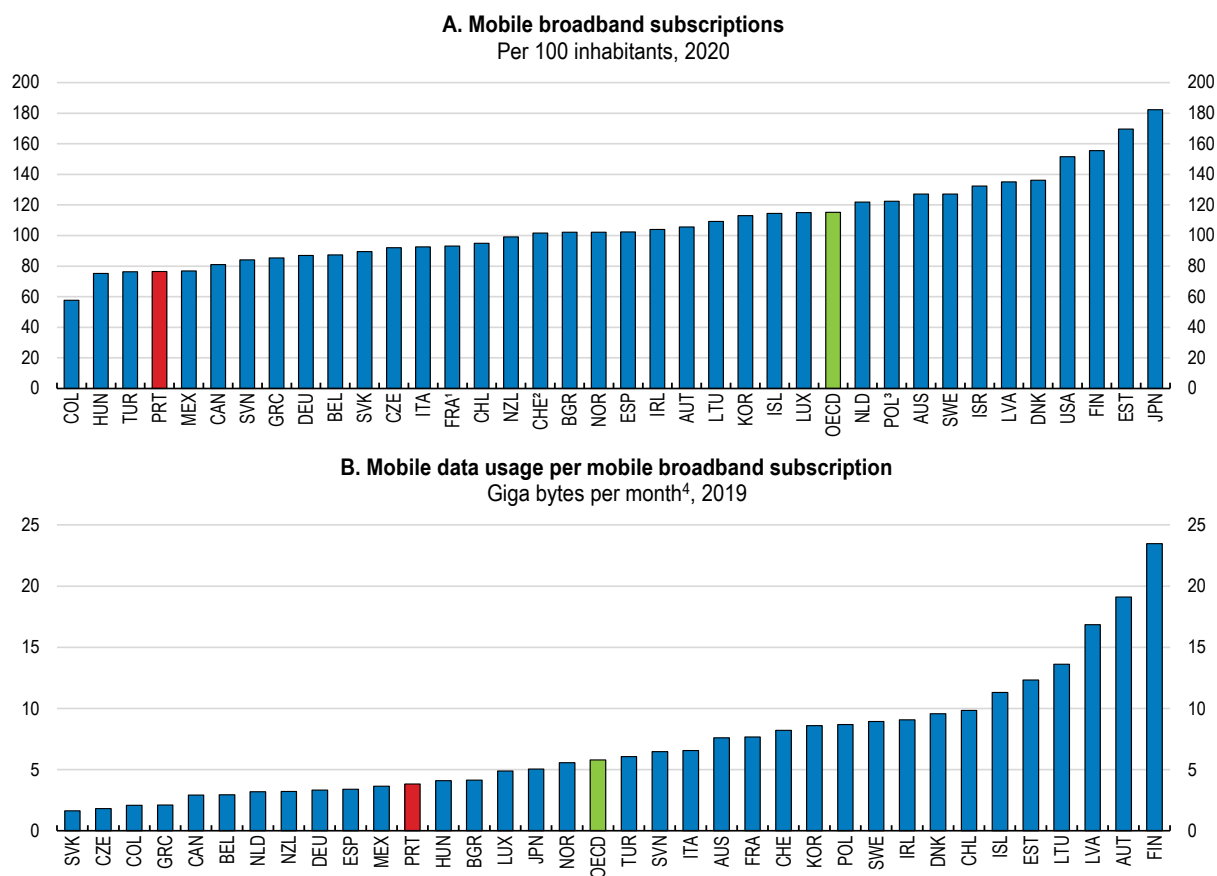
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Mobile broadband constitutes an alternative in areas where fixed connection is not good or non-existent, like rural areas, and thus can play a role in decreasing inequalities in broadband coverage across different regions. However, the uptake of mobile broadband in Portugal remains low by international norms. Mobile broadband subscriptions per 100 inhabitants and data use by mobile broadband subscriptions are around 30% lower than the OECD average (Figure 2.10).

Mobile network performance measured by the average download speed and 4G availability is below the OECD average, according to speed tests (42 Mbps) (Speedtest, 2020) and (26.3 Mbps) (OpenSignal, 2020). In 2018, more than 5% of households living in rural areas did not have 4G mobile coverage, one of the highest shares in the OECD (OECD, 2020a). Existing deficiencies of mobile networks in coverage and capacity are particularly acute in low-density areas and the Autonomous Regions of the Azores and Madeira.


Deployment of 5G has been lagging behind other OECD countries. In November 2021, 32 out of 38 OECD countries offered 5G commercial services, but not mainland Portugal. Multiband auctions, initially planned for spring 2020, started in December 2020, and have been completed in October 2021, after 1,727 rounds and significant delays. The regulator offered reduced fees to speed up infrastructure investment and imposed, on the future holders of frequency rights of use, 4G coverage obligations, especially in low-density areas, as well as 5G network development obligations. Two suppliers entered the retail market, but with a relatively low share of the auctioned rights.

Figure 2.10. The use of mobile broadband lags behind



Note: 1. Data for France are active subscriptions that have only made 4G connections in the last three months are not included. 2. Data for Switzerland are preliminary. 3. Data for Poland are OECD temporary estimates. 4. The multiplier 1024 is used to convert TB into GB; the total amount of GB is divided by the yearly average number of Mobile broadband subscriptions.

Source: OECD (2021), Broadband Portal, <http://www.oecd.org/sti/broadband/broadband-statistics/>.

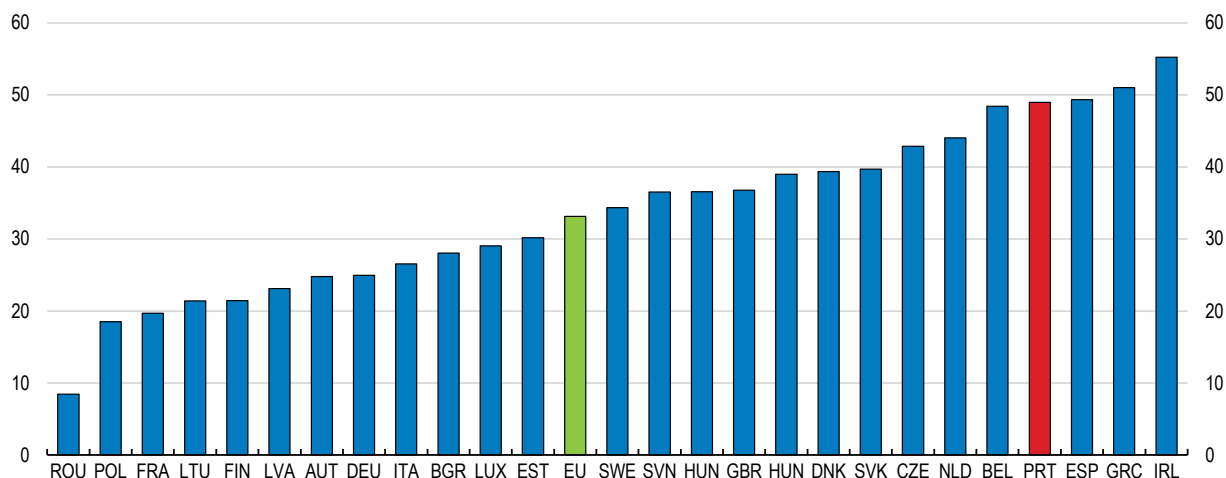
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While they stand around the EU average for some services, prices of electronic communications are relatively high in Portugal overall (Figure 2.11; ANACOM, 2020a; empirica/TÜVRheinland, 2020). This might partially explain the relatively low take up of mobile services and the large gap for Internet penetration by income level: only around half of the poorest households had a fixed broadband connection at home in 2019. A social tariff for broadband will be in place starting January 2022. Nevertheless, underlying causes for high price levels should be investigated further. Competition issues in the telecommunication sector certainly play a role, suggesting market forces could help to improve affordability of broadband.

Competition can spur investment and drive up the quality and speed of broadband, including of the underserved population groups (OECD, 2020a). However, competition pressures are relatively low in Portugal. The telecommunication markets are concentrated with three operators holding significant market shares (Figure 2.12). Profit margins are high compared to other European countries (ANACOM, 2020b). Operators mainly offer bundled services and when doing so tend to mimic competitors' offers (package and prices) or try to upgrade offers to higher-priced services rather than decreasing prices. The Competition Authority found evidence of market sharing and price fixing of mobile and fixed telecommunications by two providers in 2020, resulting in higher prices and decreased quality of services (including lower geographical coverage). The largest provider was sentenced to pay a EUR 84 million fine. Efforts to uncover collusive behaviours should intensify to foster competition in the sector.

Figure 2.11. Broadband prices are relatively high

Broadband Price Index 2020



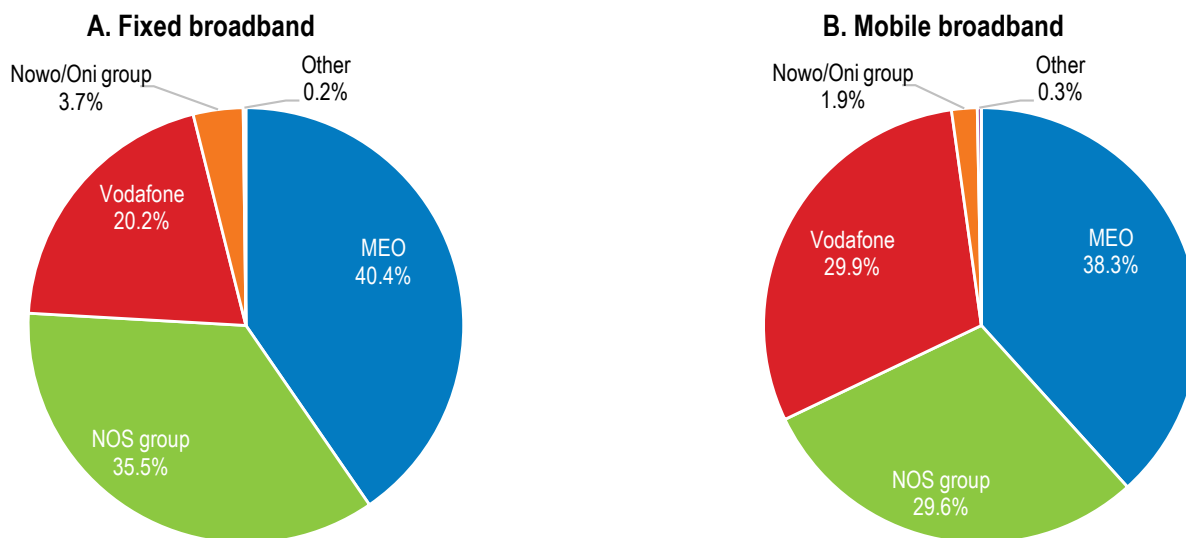
Note: The broadband price index measures the prices of representative baskets of fixed, mobile and converged broadband offers. The index is normalised to the range 0 to 100, with 100 being the worst score referring to the highest prices.

Source: European Commission, DESI 2020.

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Figure 2.12. The telecommunication markets are concentrated

Fixed broadband and mobile broadband market share by number of customers, first semester 2020



Source: ANACOM, Portugal.

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New entries on the mobile market can foster competition, diversify offer and business models, but barriers to new entrants in the telecommunication sector, such as difficulties for newcomers to get the necessary amount of spectrum to begin operations, is a main barrier. 5G auctions offer an opportunity to modify the market structure. The regulation for auctioning 5G licences included a reserved spectrum for new entrants (in the 900MHz and 1800MHz bands). New entrants will also have national roaming access for 10 years, regardless of their investment level, but subject to coverage obligations. The auction rules also include spectrum caps, reserve prices similar to those in other EU countries, and payment facilities (50% of the payment can be deferred over 7 years). Incumbents complained against 5G auctions rules, considering them unfair, and some of them threatened to cut investment and employment. Portuguese authorities should maintain measures to strengthen competition, while continuing to reinforce incentives to accelerate infrastructure investment.

Constraints to consumer switching reduce its disciplinary effect on market prices, innovation and service quality, weakening incentives to compete and making consumers more vulnerable to market power (OECD, 2020c). Loyalty clauses together with other factors, such as the complexity of the procedure for contract termination and the lack of transparent information, weaken competition in the telecommunication sector by limiting mobility of consumers in Portugal (AdC, 2020). New retail services contracts are bundled, including fixed and mobile services, and with a lock-in period clause (generally 24 months) and high termination costs for consumers cancelling the subscription within that period. Renewing loyalty clauses is a generalised practice.

Reducing switching costs would strengthen competition between providers to the benefit of consumers. The regulator has already limited the duration of loyalty clauses and imposed the obligation to offer contracts without a loyalty period. Recent changes in the legislation increased transparency with respect to contract obligations. Additional options to foster customer mobility include reviewing limits applied to charges payable by subscribers in the event of early termination of contracts with lock-in periods, and linking them with estimated costs to the operators. As recommended by the Competition Authority, the extension of lock-in periods should be associated with additional services.

Providing information on the quality of services could help to increase competition and encourage network improvement. Many OECD countries, including Austria, France, Germany and Korea, disclose information on network quality, providing incentives for operators to self-regulate (OECD, 2020a). Portugal's regulator could work with network operators to develop and publicise a set of comparable indicators relating to the quality of service or collect data from users for instance *via* online surveys (crowdsourcing). Further monitoring the quality of service of mobile telecommunications providers and making this information available could also help consumers compare signal strength, coverage, call quality and promote consumer mobility if framed in a way that makes choice easier.

Promoting the effective and inclusive development of digital government

Portugal has been among the frontrunners of digital government in the OECD (Figure 2.13, Panel A and B). It ranks well in the OECD Digital Government Index 2019 that measures the extent to which governments are becoming digitally competent to foster integrated and coherent operations as well as end-to-end transformation of service design and delivery (OECD, 2020d). In line with the OECD Recommendation of the Council on Digital Government Strategies (OECD, 2014), the development of digital government in Portugal has not only focused on improving efficiency and transparency of public sector organisations (e-government), but also on using digital technologies and data for further integration and coherence within the public sector to improve public services. Ongoing initiatives like the Centre for Innovation in the Public Sector (the Public Administration experimentation and innovation laboratory), and the SIMPLEX Programme (for the simplification of administrative procedures), have a clear focus on encouraging the participation of both citizens and companies, as enablers to redesign public services so that they respond to their needs in a more efficient, effective and satisfactory way.

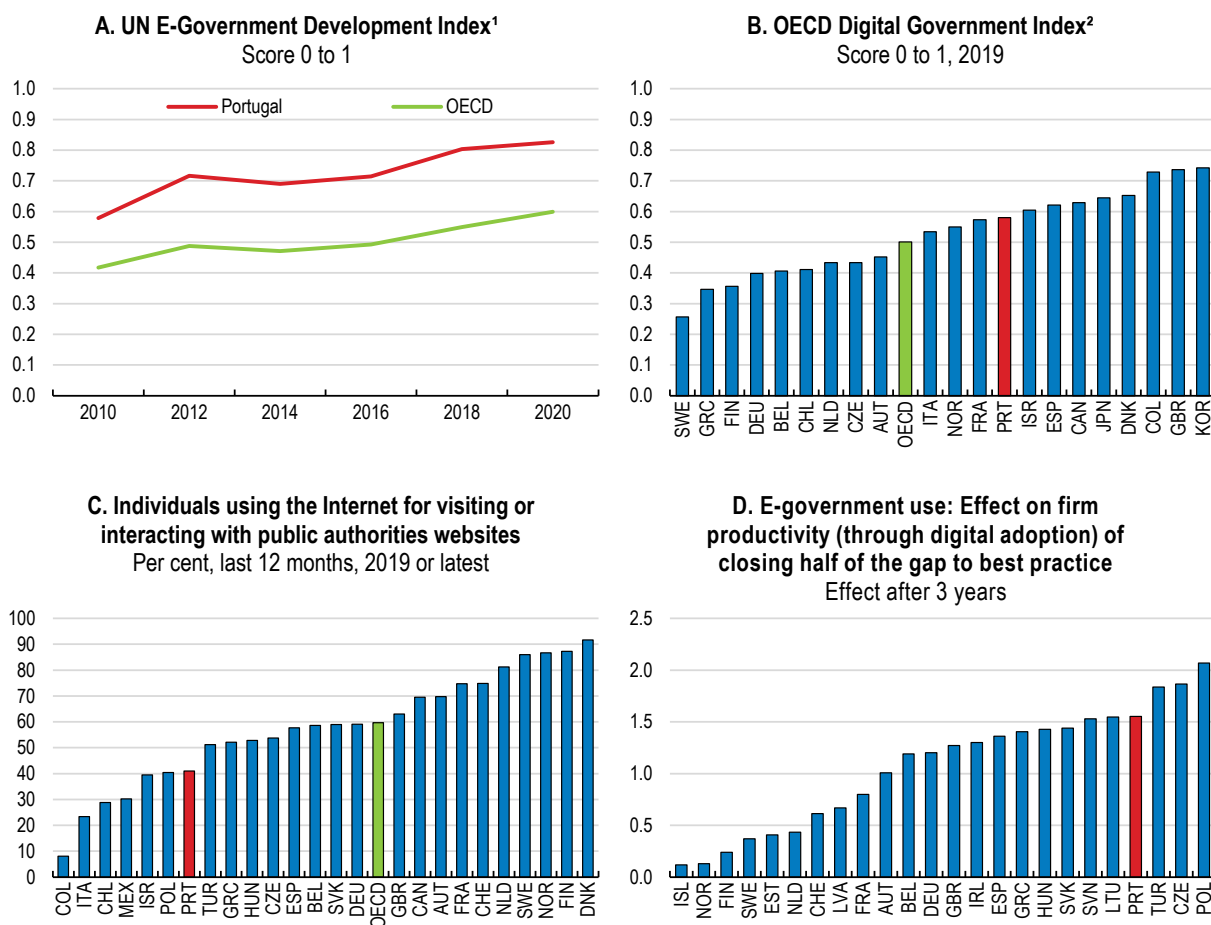
Citizens and businesses have access to a vast range of public services online portals. The Digital Mobile Key enables online authentication and signature to several public and private services speeding up processes and declarations. “id.gov.pt” - a public mobile application allows citizens to store on their smartphone, consult and share, at any time, the data of their identification documents that are available in the application (e.g. citizen cards, drivers’ licence). An interoperability platform for the public administration facilitates the exchange of service-related information within government and applies the “once only” principle, meaning citizens do not have to supply same information twice to the government. Effective information sharing across administrations allowed the automation of the provision of social energy tariffs. Finally, digital technologies have been widely used in the healthcare sector (Box 2.4).

Nevertheless, it is crucial Portugal continues its effort to develop digital government. In particular, while a wide range of public services are available online and despite efforts to integrate digital technologies in the development of these services, less than half of citizens and businesses use digital public services (Figure 2.13, Panel C). This is unfortunate as a large use of such services can stimulate the adoption of digital technologies in the private sector and trigger productivity gains (Sorbe, Gal and Millot, 2018). Closing half of the gap to the highest level of use in the OECD could increase firms’ productivity by 1.6% in 3 years (Figure 2.13, Panel D).

The low take-up of digital public services reflects the lack of digital skills and low trust in digital technologies (see below), but also accessibility issues. A number of promising initiatives aim at improving accessibility (e.g. online provision of guidelines and training for developers of digital services), which is one of the priority areas of the new Strategy for Innovation and Modernisation of the State and Public Administration 2020 – 2023 (Portugal Government, 2020). The centralisation and availability of resources for the digital government policy should enabled access and coherence of digital and data solutions across public agencies, and allow teams to concentrate on understanding users’ needs and ways to offer joined-up and effective end-to-end service experiences. Most of these measures aim at fixing existing systems though.

To limit the need for such costly ex-post measures in the future, all digital government projects should include a thorough ex-ante evaluation, adopt a user-centred approach in service design and delivery and involve stakeholders. The service delivery should places citizens and businesses at the core of the development process in order to meet their final needs (OECD, 2020e). Entrusting citizens and businesses with a central role in shaping processes, services and policies and adopting inclusive mechanisms for collaboration and a more knowledge-based public sector can help to increase the adoption and use of digital services. Integrated and long-sighted digital government programmes from Denmark and the UK could serve as a benchmark given their advance development of digital government policies (OECD, 2020d).

Figure 2.13. Portugal is among the frontrunners of digital government, but its use can improve.



Note: 1. The E-Government Development Index presents the state of E-Government Development of the United Nations Member States, and includes the provision of online services, telecommunication connectivity and human capacity. 2. The Digital Government Index aims to measure the extent to which governments are becoming digitally competent to foster integrated and coherent operations as well as end-to-end transformation of service design and delivery.

Source: UN (2021). Government Knowledgebase; OECD (2020), "Digital Government Index: 2019 results", OECD Public Governance Policy Papers, No. 03, OECD Publishing, Paris, <https://doi.org/10.1787/4de9f5bb-en>; Sorbe, et al. (2019) Digital Dividend: Policies to harness the potential of digital technologies, Economic Policy Papers, 26, <https://doi.org/10.1787/273176bc-en>.

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The digitalisation of the public sector went together with programmes to reduce the administrative burden on firms (one of the main priorities of the Simplex programme), but there is room to improve online public services for businesses (Martins and Veiga, 2018). The share of public services needed for starting a business and for conducting regular business operations that are available online remains below the best performing EU countries (European Commission, 2020a). In addition, efforts to streamline administrative procedures need to continue. For instance, despite availability of pre-filled forms, time to pay taxes remains much higher than in the OECD average (World Bank, 2020). The number of authorisations needed to run a business remain high, with long deadlines for approval (European Commission, 2020c). This calls for accelerating simplification efforts and exploiting digital technologies to achieve this objective, using international best practice (i.e. the UK, Denmark) as a source of inspiration. It is thus welcome the Resilience and Recovery Plan includes a reform of licenses procedures.

Box 2.4. The digital transformation in healthcare

Portugal is a frontrunner in the take-up of digital technologies in healthcare services. Telemedicine, artificial intelligence-enabled medical devices (i.e. health apps), and real-time patient data management are few examples of the digital transformation in the sector. Furthermore, the COVID-19 pandemic has led to an unprecedented increase in reliance on digital technologies in the healthcare system. Initiatives included the development of platforms to manage available hospital resources at the national level and applications to trace and communicate with COVID-19 suspects and home patients. Digital service infrastructures, such as telemedicine and the 24-hour telephone help desk, were reinforced to deal with higher demand (European Commission, 2020a).

Even before the COVID-19 outbreak, Portugal made strong efforts to promote and implement telemedicine (Hashiguchi, 2020). The number of users has been growing substantially from 12 127 in 2013 to 28 448 in 2017, thanks to special financial incentives (e.g. lower co-payments for patients). Patients can access their electronic health records, make appointments, and check vaccination cards online. Portugal is also leading in terms of e-prescriptions. 96% of the surveyed doctors use e-prescriptions, the second highest in Europe after the Netherlands (Deloitte, 2020).

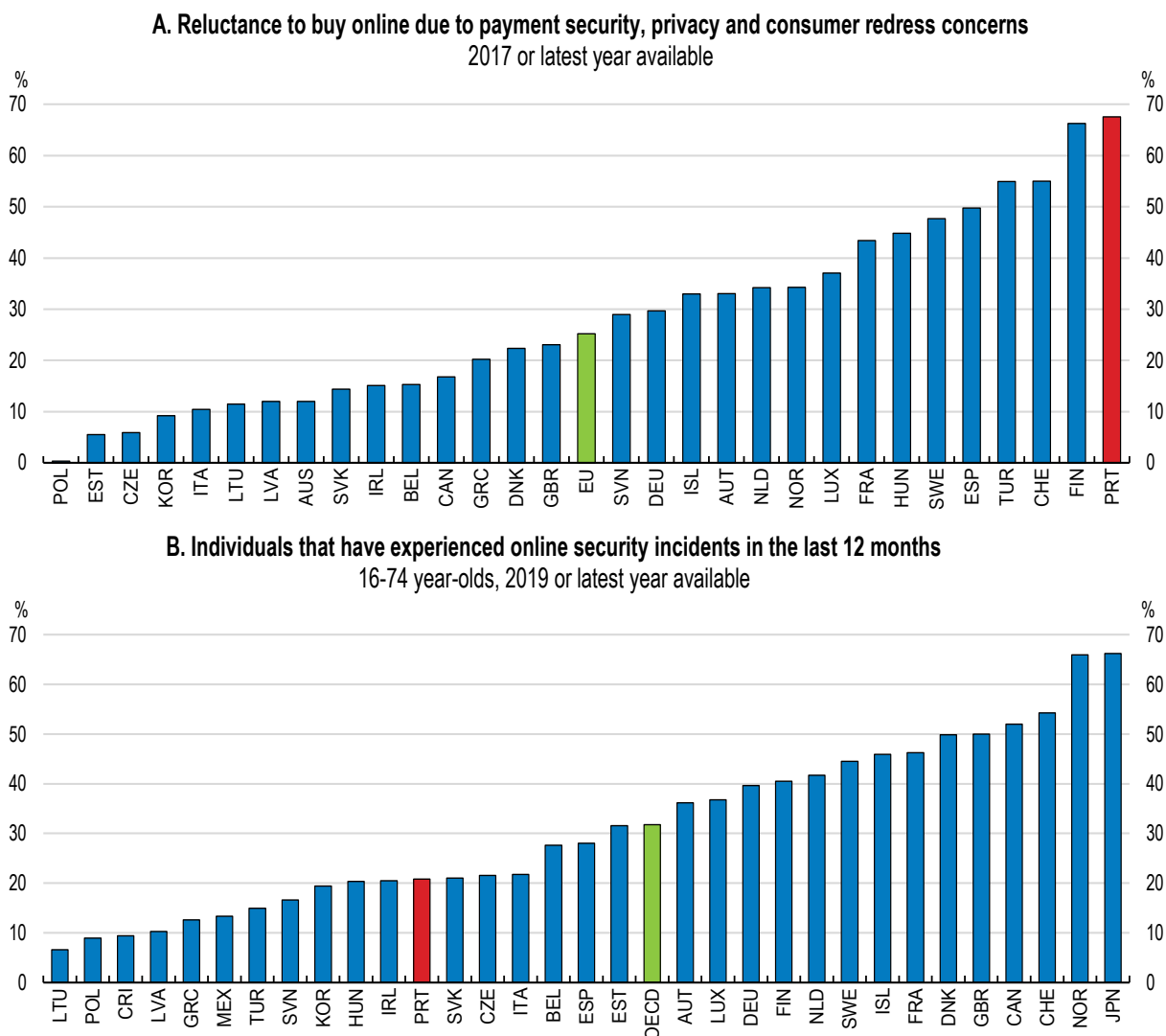
Portugal has the highest use of on-line platforms and tools in hospitals across Europe. It developed a real-time clinical management information system, known as '*ePatient*', which allows hospital doctors, nurses, social assistants and administrators to access patient information quickly across multiple systems (Deloitte, 2020). *ePatient* can also connect to different peripheral smart devices, enabling integrated vital sign monitoring. Doctors can access over 300 indicators of real-time patient data, such as heart rate and temperature. Patient data is centralised and analysed using AI to help improve the quality of services provided. Empirical evidence has shown that using *ePatient* has led to a more than 20 per cent reduction in the average hospitalisation time and more than 75 per cent reduction in the average shift handover time between doctors (Deloitte, 2020).

Source: Hashiguchi (2020), Deloitte, (2020), WHO, (2018).

Fostering digital security and improving users' perceptions

Low trust in digital technologies is a barrier to their adoption and the use of digital services. Fear of cybersecurity risks, like phishing, denial of service, and ransomware attacks, can deter people from taking advantage of the benefits that the digital economy offers (OECD, 2020a). EU Survey data suggest that almost 70% of respondents in Portugal were reluctant to buy online due to payment security and privacy concerns in 2017 (Figure 2.14, Panel A). Concerns around data integrity and security is one of the main obstacles to the adoption of cloud computing in OECD countries, especially by SMEs (OECD, 2019f). In 2014, the shares of individuals and businesses that did not use cloud computing due to security concerns were among the highest in the EU (OECD, 2017a). Perceptions of low digital security is also a barrier to the use of e-government. In 2018, 26% of individuals submitting official forms chose not to do it online due to security and privacy concerns.

Figure 2.14. Trust in digital technologies is low, despite a limited number of cybersecurity incidents



Source: Eurostat (2021); OECD (2021), ICT Access and Usage by Households and Individuals database.

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Cybersecurity incidents in Portugal have been relatively infrequent by international norms. Only 20% of surveyed individuals and 8.5% of businesses had experienced an online security incident in 2019, well below the EU average (Figure 2.14, Panel B). Less than 20% of Internet users stated knowing someone that had been victim of a cybercrime (CNCS, 2019). However, the number of cybercrimes increased exponentially with the COVID-19 crisis in the OECD and in Portugal, as malicious actors took advantage of the surge in the use of technologies (OECD, 2020a; Agostinho and Luz, 2020). Stepping up efforts to promote digital security is key to ensure citizens and businesses can safely use digital services, such as e-commerce and e-government, needed for the continuation of activity despite physical distancing measures.

Raising awareness on cybersecurity risks is crucial. The percentage of Internet users in Portugal that follow basic digital security rules (e.g. changing passwords regularly, installing antivirus software) is below the EU average (CNCS, 2020a). While almost all firms have ICT security measures, only 28% had defined an ICT security policy, below the EU average and only around half make employees aware of their obligations in ICT security related issues (Figure 2.15; Eurostat, 2020b). SMEs are not as prepared as large firms to

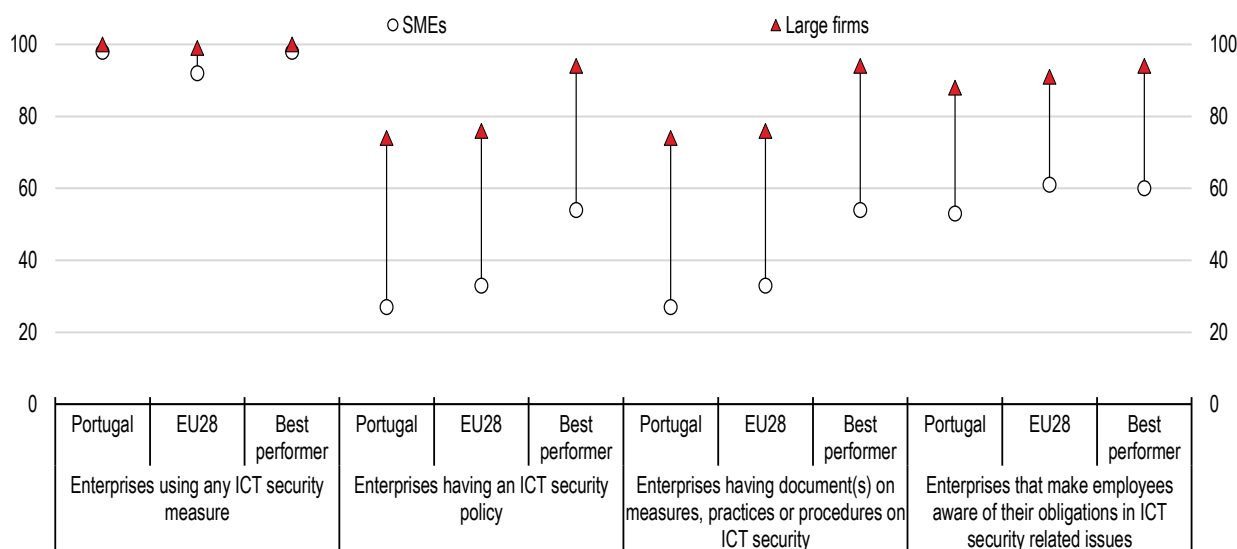
face cybersecurity threats, as they lack the resources for effectively assessing cyber-risks and implementing appropriate prevention and management measures (OECD, 2019f). Only 37% of small firms made ICT risk assessments in 2019, above the EU average of 29%, but still lagging behind best performing countries (OECD, 2020a).

Portugal lags behind most OECD European countries in the 2020 National Cyber Security Index (E-governance Academy, 2020). A weak cybersecurity culture, an insufficient digital maturity to address security needs in both the public and private sector, and difficulty in training, maintaining and attracting human and financial resources have been identified as the main areas for improvement (Council of Ministers, 2019). The second National Cybersecurity Strategy (2019-2023) aims at addressing these issues and rightly focuses on digital literacy among others.

The National Cybersecurity Centre provides a range of tools, including an evaluation framework to measure and increase cybersecurity capacity (i.e. a National Cybersecurity Framework, a Cybersecurity Capacity Maturity Model, a Roadmap for Minimum Cybersecurity Capabilities, with a special focus on SMEs, and a Framework for Assessment of Cybersecurity Capabilities for organisations). It also provides free online training, with almost 50.000 participants so far (NAU, 2021; CNCS, 2020b). Nevertheless, to encourage firms and citizens to invest in cybersecurity, it should also provide more information on economic benefits of cyber risks management through targeted awareness campaigns. Including security issues in existing digital training initiatives should be prioritised. Introducing economic incentives and funding mechanisms to SMEs to accelerate the adoption of digital security measures should also be considered (ENISA, 2020).

Figure 2.15. Small firms lag behind in the adoption of digital security measures

Per cent, 2019



Source: Eurostat, Security policy: measures, risks and staff awareness.

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The increase in the quantity and quality of data, technology developments like AI and big data analytics, and in the use of third-party data storage services raise concerns of privacy and personal data protection. The EU General Data Protection Regulation (GDPR) governs processing of personal data in Portugal. Citizens and businesses have the right to access, edit, delete, and restrict processing of their data (OECD, 2019g). Online courses are provided to inform citizens and public workers on the existing privacy regulation and its enforcement, with over 40.000 attendees by November 2021 (NAU, 2021). The 20-21 Simplex edition includes an initiative (My Data) that will allow citizens and businesses to monitor and validate the use of their personal data by the public administration. However, there have been a relatively low number of measures to support SMEs in their compliance with the GDPR, compared with most other European countries (EDBP, 2020). Stepping up the efforts to provide seminars, workshops, and trainings directed at SMEs, as well as implementing hotlines for consultations, as in Denmark, Poland, or Spain, are paramount to ensure personal data protection. In the Recovery and Resilience Plan, Portugal envisages cybersecurity and privacy measures targeted at SMEs, including the introduction of certification stamps covering cybersecurity, privacy, usability and sustainability.

Equipping workers with the skills needed in a digital economy

Individuals need a broad mix of skills – strong cognitive, socio-emotional, and digital skills – to participate in the digital society. Skills are also key for the adoption of new technologies in businesses (Gallego, Gutierrez and Lee, 2015; Andrews, Nicoletti and Timiliotis, 2018). A large share of the population does not have general digital skills with large disparities in the population. Addressing large skills gaps in the population is crucial to ensure all reap the benefits of the digital transition (OECD, 2019a).

Improving the digital skills of individuals has been high on the political agenda. The Portuguese National Initiative on Digital Competences 2030 (INCoDe.2030), launched in 2017, aims at broadening digital literacy, promoting employability and professional training in digital technologies and raising participation in R&D networks (Box 2.5). Nevertheless, policy action should tackle inequalities in learning opportunities, both in initial and adult education. Evaluation reports pointed to the need to increase resources allocated to the initiative and to establish medium term strategic plans to ensure continuous reviews (Crouzet et al., 2019). The 2020 Action Plan for Digital Transition and the Recovery and Resilience Plan, which have a strong focus on digital skills, offer a great opportunity to address the skill divide and raise the effectiveness of related measures.

Box 2.5. Portugal's initiatives for the development of digital skills

The Portuguese National Initiative on Digital Competences 2030 (INCoDe.2030) supports the development of a wide range of skills, from basic digital literacy to software development. It aims at providing Internet access to all Portuguese and having 90% regular users by 2030. Other objectives include almost tripling the share of ICT specialists in employment to 8% and increasing the share of SMEs with a high level of digital intensity to 40%. It takes a broad view of digital competences, including skills to effectively use digital technologies and manipulate data as well as information processing, communication and digital content production skills (Governo de Portugal, 2017).

- The Eu Sou Digital (I'm Digital) programme, launched in 2020, aims to train, by 2023, more than 1 million adults in basic digital skills, involving a national network of 30 000 young volunteers and 1 500 formation centres, with a focus on 45+ year olds. The development of Comunidades Criativas para a Inclusão Digital (Creative Communities for Digital Inclusion) promotes digital inclusion of vulnerable groups through community projects.
- The “Escola Digital” programme aims at improving ICT equipment, connectivity, and ICT teacher training in the public-school system. Early 2021, the programme delivered more than 400 thousand computers and mobile broadband internet access, covering around 40% of the

total student population and nearly 70% of the total of teachers, with an objective to reach full coverage by early 2022. Additional funds to equip schools with internet and ICT equipment and provide personal equipment to all teachers and students by 2023 will be allocated via the Recovery and Resilience Plan. The programme includes other digital educational resources (digital schoolbooks, collaboration tools digital contents). Plano de Capacitação Digital dos Docentes (Active Teachers Learning) aims at providing digital skills for approximately 100 000 teachers in Schools Association Training Centres (CFAE), by 2023.

- The “Emprego + Digital” programme focusses on the specific digital reskilling and upskilling needs in different business sectors. Over 25 000 employees are expected to participate in specialised short training in the digital area by end 2021. The objective is to reach a minimum of least 200.000 employees in 2025.
- The “Upskill” programme should reskill 3 000 people in advanced digital skills needed on the labour market.
- “Digital Guarantee” aims to ensure that, by 2023, all unemployed people receive a digital training offer appropriate to their level of qualification and skills profile. It covered 52 500 people in 2020.
- The “Jovem + Digital” has been set up to improve the digital capacities of young unemployed adults.
- “Academia Portugal Digital” will provide an online platform for digital skill assessments, personalised training plans and training courses, connected with other public and private online training platforms. The objective is to reach at least 800.000 users

Concomitantly, two main projects promote digital skills in the public administration “Info exclusion Zero” (assessment of basic digital skills and design of training plans) and “AP Digital 4.0” (training in advanced digital skills for ICT workers).

Source: <https://www.incode2030.gov.pt/en/goals>, Ministry of Labour, Solidarity and Social Security.

Providing foundational and digital skills to all

While digital skills are crucial for the use of ICT technologies, foundational skills (including basic literacy and numeracy skills and cognitive skills) are also important for workers to adapt to the digital transition (OECD, 2019c; Schleicher, 2018; OECD, 2020a). Foundational skills allow people to thrive better in a digital world, by facilitating adaptation to new technologies and occupations. For instance, using the Internet in diversified and complex ways and getting non-routine tasks jobs require good reading and problem-solving skills (OECD, 2019a). Furthermore, foundational skills are a pre-requisite for developing specific competencies and for participating in lifelong learning (Rammstedt et al., 2013). Those who lack foundational skills are most likely to bear the costs of the digital transformation (OECD, 2019a).

In the past decade, Portugal has made tremendous progress in upskilling the younger generations. Between 2009 and 2019, the share of young adults aged 25-34 year-olds with low education level halved. The share of graduates with higher education in the resident population between 30 and 34 years old reached 43% at the end of 2020, exceeding the EU target of 40%. In 2020, the number of new entries in higher education grew by 13%. Learning outcomes of young students improved significantly. According to PISA, the Programme for International Student Assessment assessing the proficiency of 15-year-old students in reading, mathematics and science, Portuguese students have made significant progress in all three domains since 2003 and now score close to the OECD average (OECD, 2019h; OECD, 2019i).

Nevertheless, despite the efforts to raise educational attainment levels, the share of low educated young adults remains 10 percentage points higher than the OECD average. Furthermore, the difference in educational performance between students from different socio-economic backgrounds remains large. The

performance gap between disadvantaged and advantaged pupils in reading equals about two years of education and about one in three disadvantaged pupils does not attain a minimum level of proficiency in reading (OECD, 2019j).

The suspension of face-to-face teaching for the large majority of pupils during the COVID-19 pandemic has likely increased these inequalities as children from a disadvantaged background are less likely to benefit from online learning (OECD, 2020f). Despite the distribution of electronic devices, and the provision of host schools and of tutorial support among others, Portugal only partly addressed the needs of vulnerable students, as many pupils still lack adequate equipment. Plans to accelerate the provision of personal computers or tablets are welcome (Box 2.5), but will not be sufficient to mitigate the impact of the lockdowns on inequalities in educational outcomes. Targeted initiatives to respond to the special needs of vulnerable students are key to provide quality learning opportunities to all (OECD, 2020f). Education policies, such as the 2019 inclusive education law, the 2020 Strategy to combat school dropouts through monitoring of children and young people considered at risk of dropping out, and the Learning Recovery Plan 21/23 Escola+ are important milestones, whose success hinges on the provision of adequate resources and continuous monitoring.

Introducing computational thinking to the majority of students at early stages of education can empower people in the digital world. When students are exposed to computational thinking through programming, they can increase both their problem-solving and digital competencies, as well as acquire a deeper understanding of the underlying mechanisms and concepts of new technologies (OECD, 2019a). Portugal has recently reformed the national curriculum by including digital competences in primary and secondary education programmes and programming has been included in learning objectives. Introducing a mandatory upper secondary school course on computational sciences and technology, as in France for instance, should be envisaged to ensure all acquire solid digital skills (OECD, 2019a). Expanding the scope of successful local initiatives, such as “Make Code - Programa o teu futuro”, which aims at introducing students and teachers to coding and computer science, should also be considered.

Strengthening schools’ capacity for ICT use for teaching

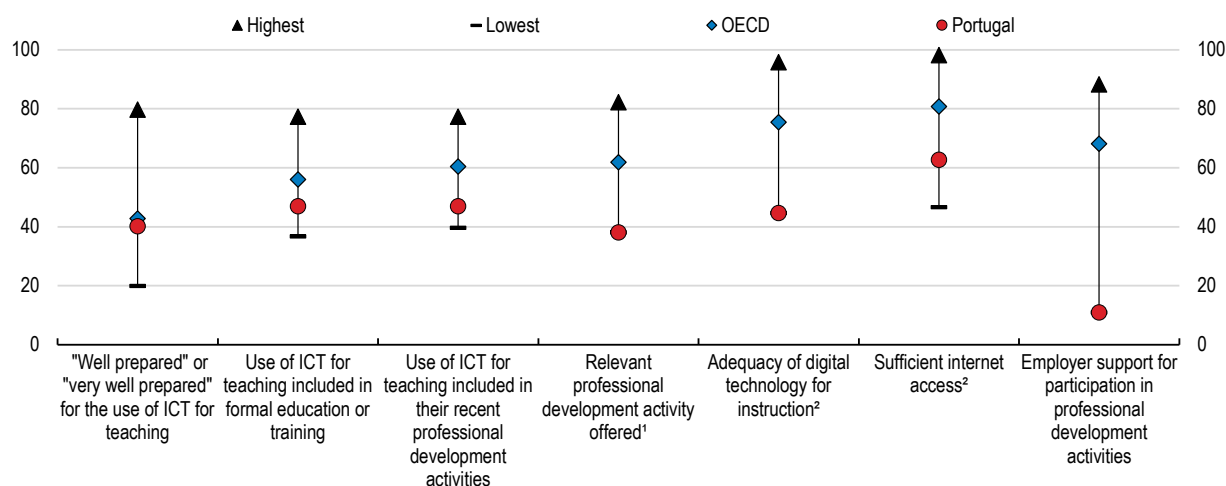
ICT use for teaching in schools is important for the development of digital skills at an early stage. Shifting from developing digital skills as part of stand-alone ICT classes to a more comprehensive approach in which digital skills are also fostered in other learning areas, as in Australia, can be challenging however (OECD, 2019a). Doing so requires providing adequate ICT equipment and high quality professional development programmes for teachers (OECD, 2019a). In Portugal, less than half of school principals report having adequate digital equipment for instruction, the lowest share in the OECD. In 2018, only 60% pointed to sufficient basic digital infrastructure, such as Internet access (Figure 2.16).

In the same vein, while teachers are willing to use ICT tools for teaching, a large majority does not feel sufficiently prepared to do so (Figure 2.16). Half of teachers point to the lack of “use of ICT for teaching” in teachers’ formal education or training, and almost two out of three teachers report a lack of relevant professional development activities. Furthermore, 90% teachers do not feel supported by their employers for participation in professional development activities, which is almost three times more than in the average OECD country.

To address these issues, the “INCoDe.2030 Strategy” includes programmes for the improvement of technological infrastructure in schools and the professional development of teachers (e.g. Formação de Professores em Serviço or Escola Digital, both launched in 2020, see Box 2.5). Portugal also rightly plans to use funds allocated in the Recovery and Resilience Plan to accelerate investment in ICT tools in schools (EUR 538 million) and teachers training. A digital training plan aims at providing almost all teachers of all cycles and grades of schooling above basic digital skills.


Figure 2.16. Conditions for ICT use and teaching in schools need to improve

Share of upper secondary teachers reporting about the "use of ICT for teaching", per cent



Note: 1. Refers to all professional development activities. 2) Reported by school principals.

Source: OECD, TALIS 2018 Database, Table I.3.63, Table I.4.13, Table I.4.20, Table I.5.18, Table I.5.36.

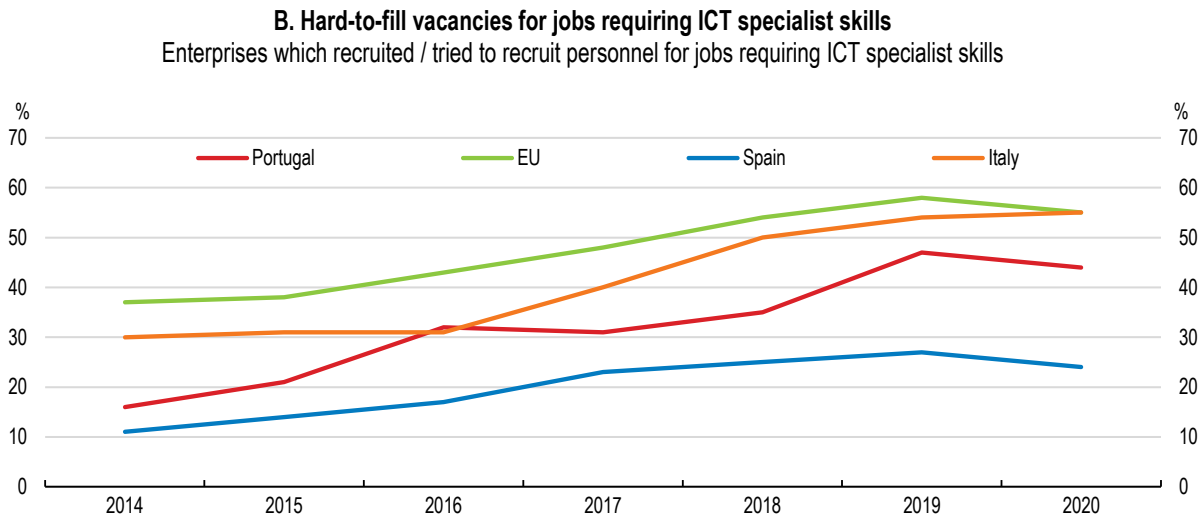
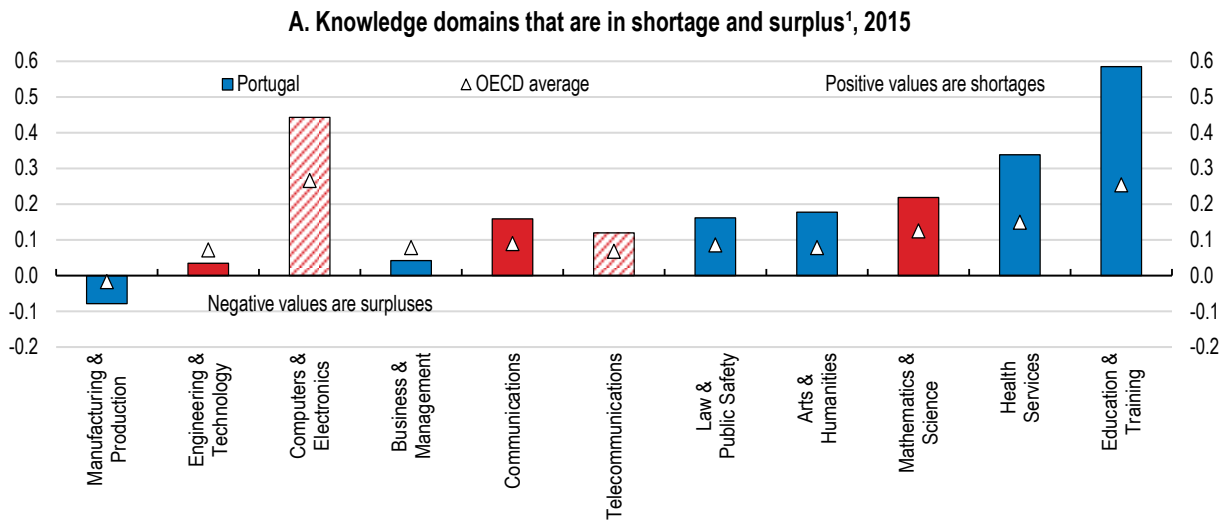
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When implementing the “Escola Digital” project, Portugal could also get inspiration from other OECD countries on programmes to develop ICT use for teaching. The creation of a [platform](#) in 2020 to provide information and educational material on the use of digital technologies in schools is welcome, and should be further developed and improved, benefiting from international experiences, for instance the French on-line teacher network, Viaéduc, or Wales’ network of Digital Pioneer Schools (European Commission, 2019).

Addressing shortages in ICT and other STEM fields

Shortages in Science, Technology, Engineering and Mathematics (STEM) fields, including in ICT skills, are large (Figure 2.17). Adults with a tertiary degree in engineering, manufacturing and construction and those with a degree in ICT related fields earn about double compared to those with upper secondary education, one of the highest premiums among OECD countries, reflecting high unmet labour market demand in those fields (OECD, 2019k). This calls for increasing the number of graduates in STEM fields, especially young ICT experts. Portugal has one of the highest share of young adults able to program across EU countries (Figure 2.18, Panel A). However, over the past decade, the share of tertiary graduates in ICT has remained low and the share in STEM fields has stabilised close to the OECD average (Figure 2.18, Panel B).

Figure 2.17. Significant shortages exist in ICT and other STEM related knowledge domains



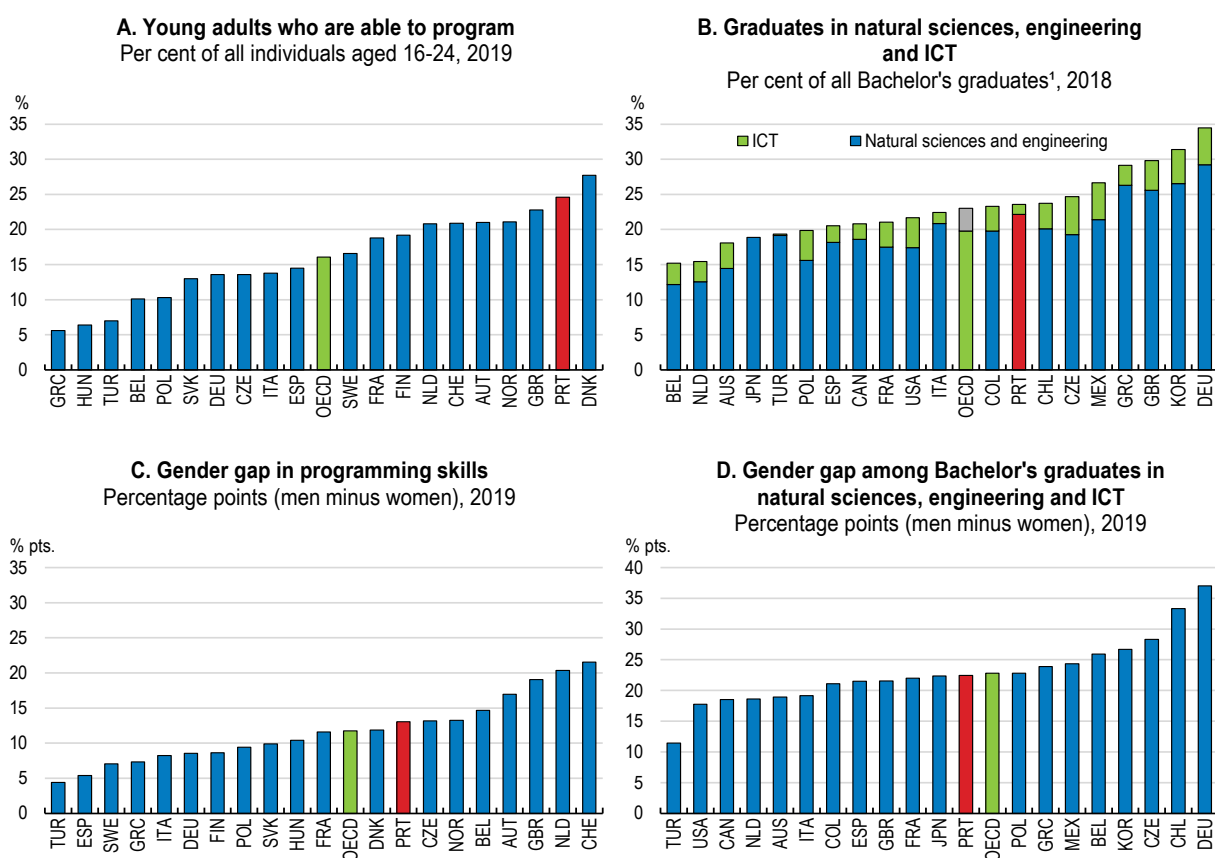
Note: 1. Positive values represent shortages, with the maximum and minimum values among OECD countries normalised to 1 and -1. STEM field related knowledge domains are highlighted in red. Selected subcategories are shown in line pattern.
Source: OECD, Skills for jobs database; Eurostat, Digital economy and society database.

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Tapping into the women’s talent pool will help address shortages in STEM professionals, ICT graduates and experts. The share of women among employed ICT specialists reached 21.8% in 2020, above the EU average of 18.7%. However, like in most other countries, the gender imbalance in the choice of studies and in computing programming is high (Figure 2.18, Panels C and D). At 15 years of age, less than 1% of girls in Portugal wish to become ICT professionals (e.g. software developer, applications programmer), compared with 6% of boys (OECD, 2019j).

Making female role models more visible, fighting gender stereotypes and providing girls with opportunities to interact with technology at the earliest ages could help change gender-specific perceptions about ICT (OECD, 2019j). For instance, giving first-grade girls an opportunity to try programming can eliminate gender differences in interest in technology (Master et al., 2017). In Italy, a coding course targeting female middle-school students resulted in a 10% increase in participants’ interest to become a computer programmer (Carlana and Fort, 2020). In the US, a large range of programmes, including one-to-one mentoring, STEM camps, experiential learning opportunities, aim at increasing underrepresented groups’, including girls’ participation in STEM education and career paths.

Figure 2.18. STEM fields attract many young adults, but with a large gender gap



Note: 1. Bachelor's or equivalent graduates refer to tertiary education attainment level 6 of the ISCED 2011 classification.
Source: OECD Going Digital Toolkit. <https://goingdigital.oecd.org/en/indicator/54/>; OECD (2020) Education at a Glance Database.

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Some initiatives (*Ciência Viva*, *Engenheiras por 1 Dia*) that provide contact with science and technology for children at younger ages, promote experimental science teaching, and deconstruct stereotypes about technological professions have been put in place in Portugal. The Recovery and Resilience Plan includes initiatives to tackle gender stereotypes and encourage a greater involvement of women in the field of digital

technologies. Besides early interventions, upskilling and reskilling initiatives can be also an opportunity to increase women participation in the ICT sector.

Diversifying the talent pool entering higher education could also help to increase the number of STEM young professionals. However, pathways to higher education had been limited and only few graduates from upper secondary vocational programmes had access to tertiary education in Portugal. In 2020, access to higher education by students from secondary vocational education almost tripled. The entrance system was revised and a special access channel to the students from upper secondary vocational education created. The impact of these measures on tertiary education outcomes should be carefully evaluated. Developing reskilling pathways in ICT for learners from diverse professional backgrounds like done in Ireland, would be another step in the right direction (OECD, 2020a). This type of measure is envisaged under the Recovery and Resilience Plan. The Youth STEAM Impulse Program and the Adult STEAM Impulse Program aim at increasing the number of STEAM graduates by fostering upskilling and reskilling through higher education short courses.

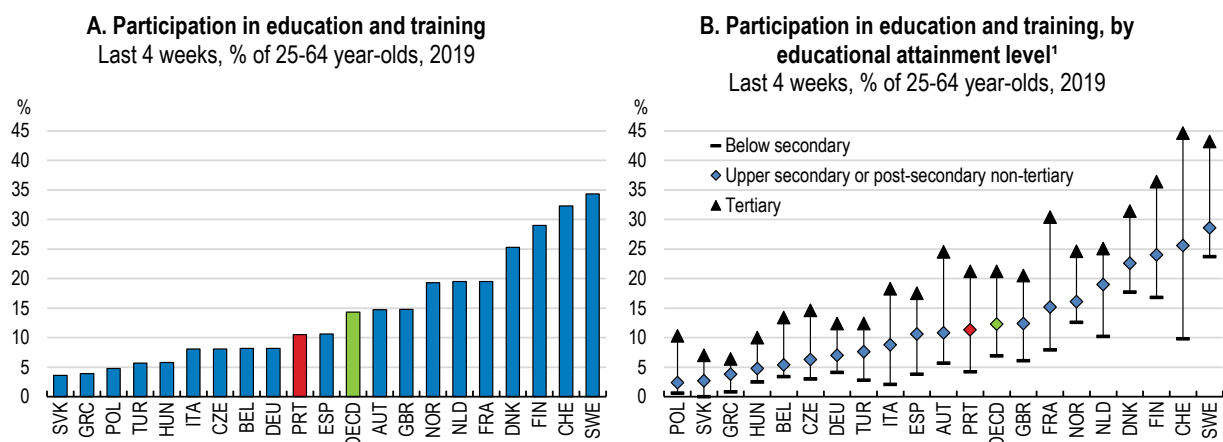
STEM related programmes in VET remain limited (less than 30%) (OECD, 2020g). Government plans to expand the offer of vocational courses in emerging areas of high technological intensity is thus welcome. Adapting the content of vocational education and training (VET) to the fast changing labour market needs will be challenging though. The VET offer is supposed to adjust on an annual basis, to local business needs and anticipated skills needs identified by the Qualification Needs Anticipation System (SANQ). Nevertheless, the SANQ faces several challenges, including an uneven commitment at the political level, a need for co-ordination between all relevant stakeholders and a lack of human resources with the relevant knowledge and experience. As recommended in the recent OECD Skills Study, in order to further strengthen the reliability of the assessments and projections for future qualification needs, Portugal should incorporate international best practices, for instance take a stronger sectoral approach, undertake complementary data collection exercises and offering employer and worker organisations a better defined, more active role (OECD, 2018a).

Promoting adult education

The extent to which individuals, firms and economies can thrive in the digital transition will depend critically on the readiness of adult learning systems to help people develop and maintain relevant skills over their working careers. Lifelong learning is crucial for workers to adapt to changes in job requirements, and participation in lifelong learning is found to foster the adoption of digital technologies by firms, with a stronger impact in firms with a number of low-skilled workers (Andrews, Nicoletti and Timiliotis, 2018). Providing reskilling opportunities is particularly important in Portugal, as adults have relatively low education levels and gaps in digital skills are large (see Figure 2.3). Around half of 25-34 year-olds have above-basic digital skills, compared to 30% among those aged 45-54. In the absence of policy action, this generational divide risks exacerbating inequalities between younger and older generations.

Despite strong political willingness to foster upskilling of adult population, participation in adult learning has remained well below levels seen in many OECD countries (Figure 2.19, Panel A). While other countries, such as Finland, Sweden and Switzerland, managed to increase participation rates significantly since 2011 and display participation levels of about 30%, participation rates remained stable over this period in Portugal. Furthermore, like in most other OECD countries, participation in adult education increases with the educational attainment level (Figure 2.19, Panel B), which can exacerbate inequalities. In 2019, only 5% of low educated participated in training over the preceding four weeks, four times less than those with tertiary education.

Figure 2.19. Participation in adult education is low, especially among low-educated adults



Note: 1. Below upper secondary refers to ISCED levels 0-2, Upper secondary or post-secondary non-tertiary refers to ISCED levels 3-4 and Tertiary education refers ISCED levels 5-8 of the ISCED 2011 classification.

Source: OECD (2020) Education at a Glance Database; Eurostat (2020), Participation rate in education and training (last 4 weeks).

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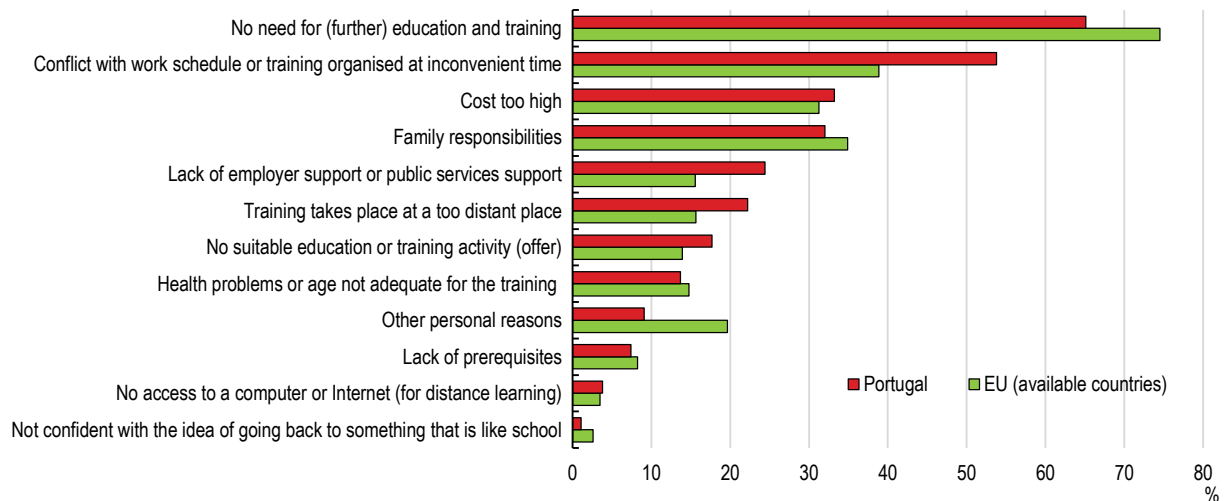
Portugal has taken a number of measures to reskill its adult population by encouraging participation in training, developing adult vocational education, and improving the lifelong learning guidance system (OECD, 2018a). It embarked on massive up-skilling of low-skilled adults and implemented processes of recognition, validation and certification of competences. The Qualifica programme set up in 2017 notably aimed at providing half of the population with upper secondary education and increase participation in lifelong learning to 15%, with more professional work related training and better screening of skills needs by 2020 (Düll, 2018). The INCode2030 initiative includes a vast range of programmes for the development of digital skills among the adult education (see Box 2.5). However, national training programmes with specific focus on enabling adults to understand the implications of artificial intelligence or to learn artificial intelligence methods are still missing (Ferreira, 2020). Portugal plans to allocate EU funds to support employee and business digital training in these areas.

Coordination between the Adult National Qualification Plan (PNLA) and programmes directed to adults in the Incode2030 initiative will be key to maximise the effectiveness of measures and avoid overlaps. As stressed in previous OECD reviews (OECD, 2019i; OECD, 2020h), improving governance of the adult learning system, especially coordination among training providers, can strengthen its impact, as the management of training programmes is now fragmented across different line ministries. Portugal should set up dedicated governance bodies to oversee adult learning, for policy design and implementation (OECD, 2018a).

There are multiple barriers to participation in adult education, that are more pronounced for under-represented groups (i.e. lack of time, financial constraints, lack of prerequisites, negative feelings about training often associated with difficulties experienced in initial education, etc., Figure 2.20). Low motivation is an important one. In 2016, around two thirds of adults reported they do not need further education and training. A comprehensive communication campaign can raise awareness of skills investments, including in digital skills, especially if tailored for specific groups, which are difficult to reach (i.e. youth Not in Education, Employment or Training, managers in SMEs, low-skilled older workers). Complementing past effort in the public sector, measures should also target the public administration and providers of social services to inform of the value of upskilling both for themselves and for their users (OECD, 2018a).

Figure 2.20. Improving information on and flexibility of adult training can raise participation

Obstacles to participation in adult learning as a percentage of total, 2016



Note: EU average based on available countries in 2016.

Source: Eurostat (2016), Adult Education Survey 2016.

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While workers might be aware of the importance of reskilling, they might have difficulty in identifying their specific skill needs and appropriate training. Portugal provides a large range of tools to address that issue. 310 Qualifica centres across the country provide information on training pathways and certification of prior learning acquired in formal, non-formal and informal contexts. Between 2017 and 2020, around 568 000 persons used the service (95% of the initial target for 2020). The Qualifica Passport allows individuals to record qualifications and skills online and identify further learning pathways (ANQEP, 2020). In addition, with the online platform “Academia Portugal Digital” citizens will be able assess their digital competencies and their development needs, based on the Digital Competence Reference Framework. While self-assessment tools for digital skills are helpful to help individuals understand their training needs, personalised training guidance, face to face coaching, like done in Australia or Colombia, would be a step forward to increase active participation in digital training (OECD, 2020a). Users of self-assessment tools should be directed to training centres that can provide personalised guidance and services. This can help to reach out individuals who need upskilling.

There is large scope to foster financial support to participation in adult education in Portugal (OECD, 2018a). Workers are entitled to at least 40 hours of continuous training that employers should provide. Workers have to finance the costs of training attended at their own initiative (except if the employer has not provided the training for up to two years, the worker can use equal number of credit hours to carry out training). Tax incentives are at place (30% of education and training expenses can be deducted from the personal income tax up to a maximum of EUR 800), but they do not benefit low-paid workers who do not pay income tax. Co-financing requirements and lack of replacement income when individuals take time off work likely hamper participation for the most disadvantaged groups. Portugal provides training subsidies, “Cheque Formação”, but their value is low and allow only training of short duration. Subsidies should increase and target workers for which training cost is a major barrier and those working in jobs with risk of job automation. Income support could be higher for training that helps the reallocation of workers from distressed sectors to sectors of high demand.

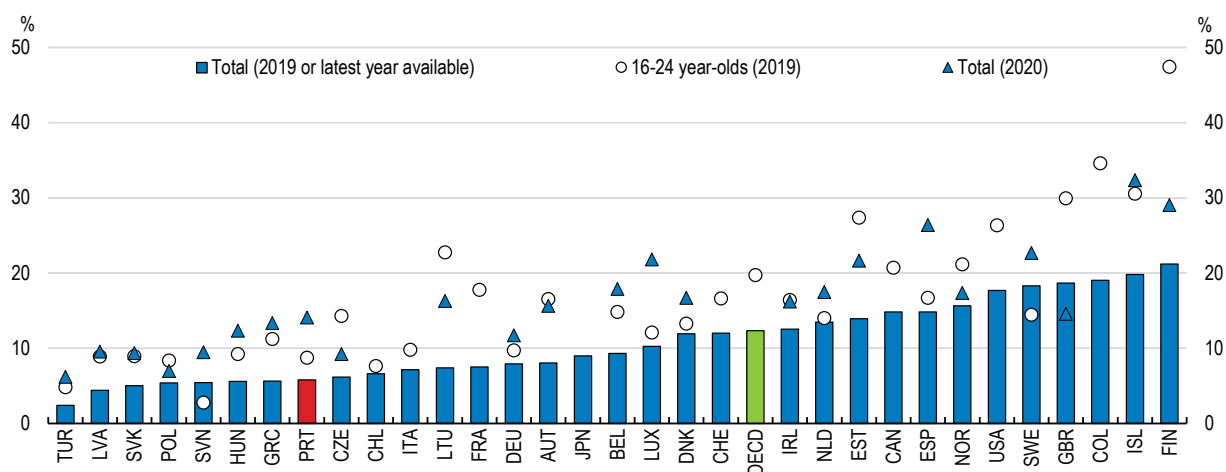
Training vouchers could be allocated *via* individual learning accounts, like done in France for instance. Such schemes present attractive features, as training rights can accumulate over time, are portable from one job to another and can be targeted (OECD, 2019m). For instance, the French “Compte Personnel de Formation” offers training credits that accumulate faster for the low skilled (individuals with at less than secondary education get 800 EUR per year vs. EUR 500 for the others). However, the schemes have a poor track record as far as participation of the low-skilled is concerned and need to be complemented by strong reach out mechanisms, clear and simple eligibility criteria for the use of funds, and good quality assurance (OECD, 2019m). In 2021, the Agreement for Vocational Training and Qualification between the Portuguese government and social partners identified the need to improve incentives for adults to train and plans to assess individual learning accounts.

Another important barrier to participation in adult learning, raised by more than half of adults, is the difficulty to combine training with work obligations (see Figure 2.20). Portugal should utilise digital technologies to overcome this barrier, for instance by developing distance and modular learning. Digital education systems, such as massive open online courses (MOOCs), provide a wide range of courses by top universities, the business sector, international institutions or independent experts. E-learning allows studying and working at the same time and even obtain full degrees with modular learning, providing flexibility to workers and savings to firms, especially in SMEs, where lack of time is the main barrier for workers to training (OECD, 2019a).

In Portugal, before the pandemic, participation in online courses was among the lowest in the OECD, even for young adults (Figure 2.21). To foster online learning, Portugal created MOOC courses in Advanced Digital Technologies as part of the INCoDe.2030 initiative, but their scope is relatively narrow, focusing on emerging new areas, such as artificial intelligence, cybersecurity, and big data. In 2020, containment measures forced the transition to online training for some programmes. In 2020, 14% of all citizens have participated in online courses, above the EU average. The abovementioned programme “Academia Portugal Digital” should contribute to facilitating access to online education. Online training directed to civil servants will also be developed in the public sector under the reform of the Public Administration Institute, partly financed by the Recovery and Resilience Plan. Nevertheless, Portugal should adopt a comprehensive strategy to expand online learning. It should take inspiration from Finland, Korea and Mexico, where participation rates exceeded 20% in 2019.


Figure 2.21. Room to develop online teaching is large

Per cent of individuals participating in online courses



Note: Participation in online courses last 3 months.

Source: OECD (2021) IICT Access and Usage by Households and Individuals Database.

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Making qualification pathways more flexible to suit individual needs can also facilitate participation in adult learning. Flexible pathways between different programmes can allow low-skilled adults to progress between different programmes more easily as they gain higher levels of skills. For instance, adults that have acquired post-secondary competences outside the formal education system should have options to participate in short-cycle tertiary education courses. Doing so would require facilitating the recognition of vocational education credits and competences, and ensure pathways exists between courses (OECD, 2018a). In line with the OECD recommendations, the operating conditions of the short-cycle tertiary education courses were changed, namely through the extension of the conditions for the recognition of professional experience, namely allowing the recognition of up to 50% of total credits of this study cycle to anyone who holds more than five years of professional experience. These efforts should continue. Breaking learning programmes up into self-contained certified modules, which allow individuals to gradually build up credits and qualifications over time, as done for example in France and in the United States, can also help.

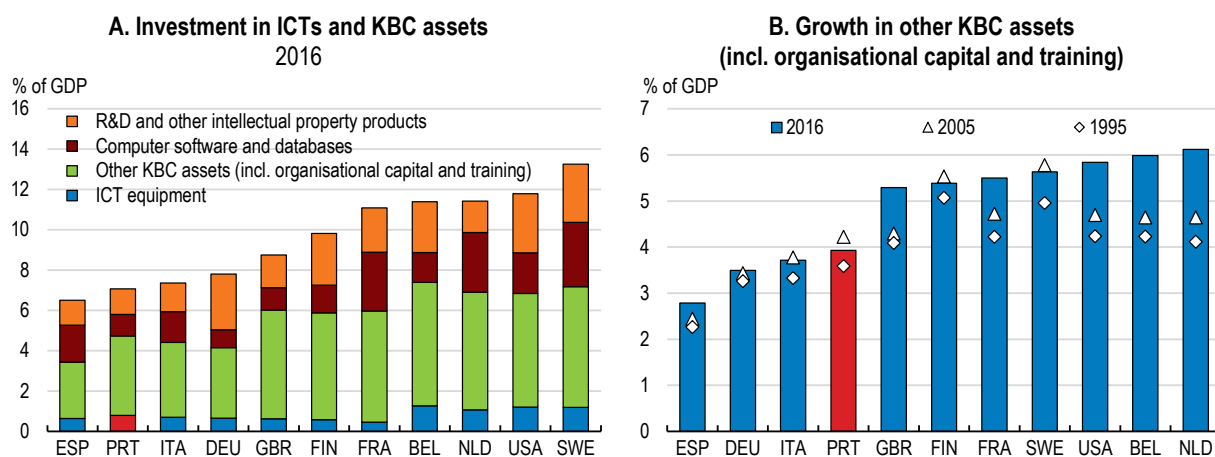
Providing information on the quality and outcomes of training courses can also enable adults to make informed choices about training and raise motivation. Portugal's adult education system lacks a proper quality assurance framework and its capacity to monitor and evaluate the performance of adult learning providers is limited, not least because it does not have a formal mechanism to track learning outcomes (OECD, 2021b). Developing a general monitoring framework would contribute to improving the efficiency and the quality of the adult-learning system. The Slovenian Monitoring framework could serve as an example. The Slovenian Institute for Adult Education has developed comparable indicators to monitor quality of adult education providers. A complementary student satisfaction survey, like for instance in Estonia, could expand feedback on the quality of education. Introducing a unique ICT instrument to monitor training outcomes and a toolkit to help staff in implementing the tool, as planned in the Netherlands for basic skill training, would be helpful.

Addressing barriers to the successful digital transition of SMEs

Unleashing the potential of the digital transformation requires firms to invest in ICT equipment and knowledge-based capital (KBC), including R&D, intellectual property, software, data, organisational capital, design and training. Indeed, the impact of technology adoption on firms' productivity significantly hinges on complementary investment (OECD, 2019n). Investment in KBC assets has been low in Portugal (Figure 2.22, Panel A). Investment in ICT equipment and in software and database has been comparable to levels seen in peer countries (Spain, Italy), but 15% below of the OECD average (OECD, 2019o). Investment in organisational capital and training has increased in line with GDP growth over the past three decades, faster than total investment, but not fast enough to catch up with best performing OECD countries (Figure 2.22, Panel B).


SMEs face several size-related barriers in terms of awareness, skills and finance for adopting new digital tools and implementing complementary organisational changes (OECD, 2020a). According to the Portuguese businesses representatives, the lack of skilled employees, of knowledge of digital technologies, as well as the inability to cover large investment costs are the main setbacks to digitalisation (ACEPI, 2019). Imperfections in product, credit and labour markets and administrative burdens have a more pronounced impact on smaller firms and play an important role in their difficulty to adapting to technological change (OECD, 2019f).

Figure 2.22. Investment in ICT and knowledge-based capital remains low



Note: KBC stands for knowledge based capital. Other KBC assets are estimated on the basis of INTAN-Invest data and cover all industries excluding real estate activities, public administration, education, health and households.

Source: OECD calculations based on OECD National Accounts database and INTAN-Invest data, <http://www.intaninvest.net/>

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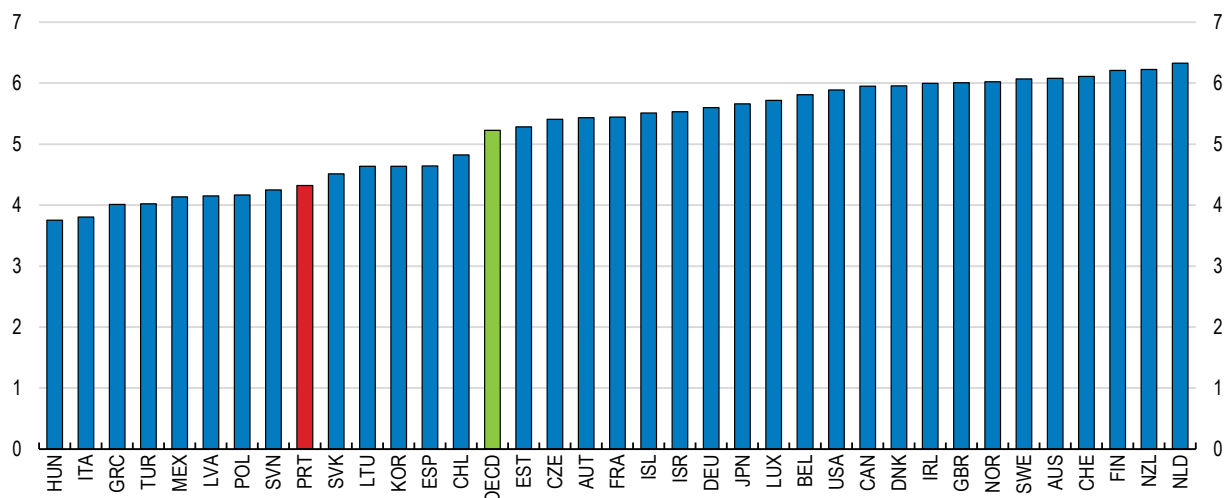
Increasing awareness and management competences

The lack of awareness of the benefits of digital tools, and competences on how to implement digital solutions limit firm digitalisation, in particular for SMEs. SMEs have difficulties identifying their needs and finding appropriate suppliers of digital solutions. In Portugal only around 30% of SMEs have a digital strategy (ACEPI/IDC, 2020). It is thus welcome that Portugal promotes access to consulting services and training for those who lack market expertise. For instance, the ‘Dinamizar’ project that offers on-the-job training and consultancy services to SMEs includes programmes for firms that want to implement digital strategies in their business models and increase their digital skills. In addition, the Industry 4.0 strategy includes vouchers for the digital transformation of 1 500 SMEs. Measures including Coaching Vouchers, Digital Transition Accelerators and Digital Innovation Hubs are included in Portugal’s Recovery and Resilience Plan. Collecting information on digital suppliers in one place would facilitate SMEs access to experts and match SMEs needs with existing offer, for instance *via* a centralised repository, like done in Singapore. Another example is the France Num platform that connects SMEs willing to digitalise with a network of specialised consultants (both public and private) across the country (OECD, 2021c).

Managerial skills play a significant role in the capacity of firms to effectively use digital technologies and innovate (Andrews, Nicoletti and Timiliotis, 2018; Galindo-Rueda, Verger and Ouellet, 2020). This is because the effective use of digital technologies requires the adjustment of business processes. In Portugal, the use of ICT is found to be lower in firms with less structured managerial practices (INE, 2018). Managerial skills that are needed to lead organisational transformations are low in Portugal: only a few firms are managed by professional managers, especially in domestic firms (Figure 2.23). Several institutions have developed entrepreneurship-training programmes in Portugal, but these have often had a strong focus on the initial start-up phase and lacked solid training in business management (OECD, 2018a). The new programme “Coaching 4.0” to support top and middle management in the process of integrating digital technologies in industrial businesses is a step in the right direction. Nevertheless, as recommended in previous OECD reviews (OECD, 2017b; OECD, 2018a), targeted training should be provided to managers and owners of SMEs, especially to those with management responsibilities but without specific prior training in management. Developing advanced management courses for professionals at higher education institutions that can be attended part-time could improve participation (OECD, 2017b).

Figure 2.23. Relatively few firms are managed by professional managers

Reliance on professional management, score from 1 (lowest) to 7 (highest), 2017-18



Note: Score based on responses to the question: "In your country, who holds senior management positions in companies? [from 1 = usually relatives or friends without regard to merit to 7 = mostly professional managers chosen for merit and qualifications]".

Source: World Economic Forum (2017), The Global Competitiveness Index Historical Dataset 2007-2017.

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Employers in small firms might not have the capacity to anticipate their future training needs or have little awareness of training benefits. Small companies are less likely to have a training plan (Kitching and Blackburn, 2002). In 2015, around 30% of small Portuguese firms regularly assessed their skills needs (80% in large firms). In 2020, 22% of SMEs using a computer provided training to their employees to develop ICT skills. While Portugal performs above the EU average, this calls for strengthening information, guidance, and staff capacity of advisory services (OECD, 2018a). Academia Portugal Digital will partially address these challenges through its digital skill assessment tool, that will provide training recommendations. Information gaps could also be addressed by building networks of employers to aggregate expertise and practical experience, as in Australia or Ireland. In Ireland, 70 sectoral "Learning Networks" managed by Skillnet Ireland, a public agency, assist businesses to identify and address their skills needs and mutualises training for firms operating in the same industry.

Public support to firms providing training has been patchy, mostly financed *via* EU programmes. In 2020, firms that had training plans validated by public employment services and covered by the short time working scheme could receive grants, with training costs covered by the public employment services, but the uptake has been low (see Chapter 1). Measures in place require application procedures that can be very burdensome for small enterprises and information on their outcomes is missing. Closely monitor performance of these programmes, especially their impact on small firms, would help to identify loopholes and concentrate resources on the more effective ones.

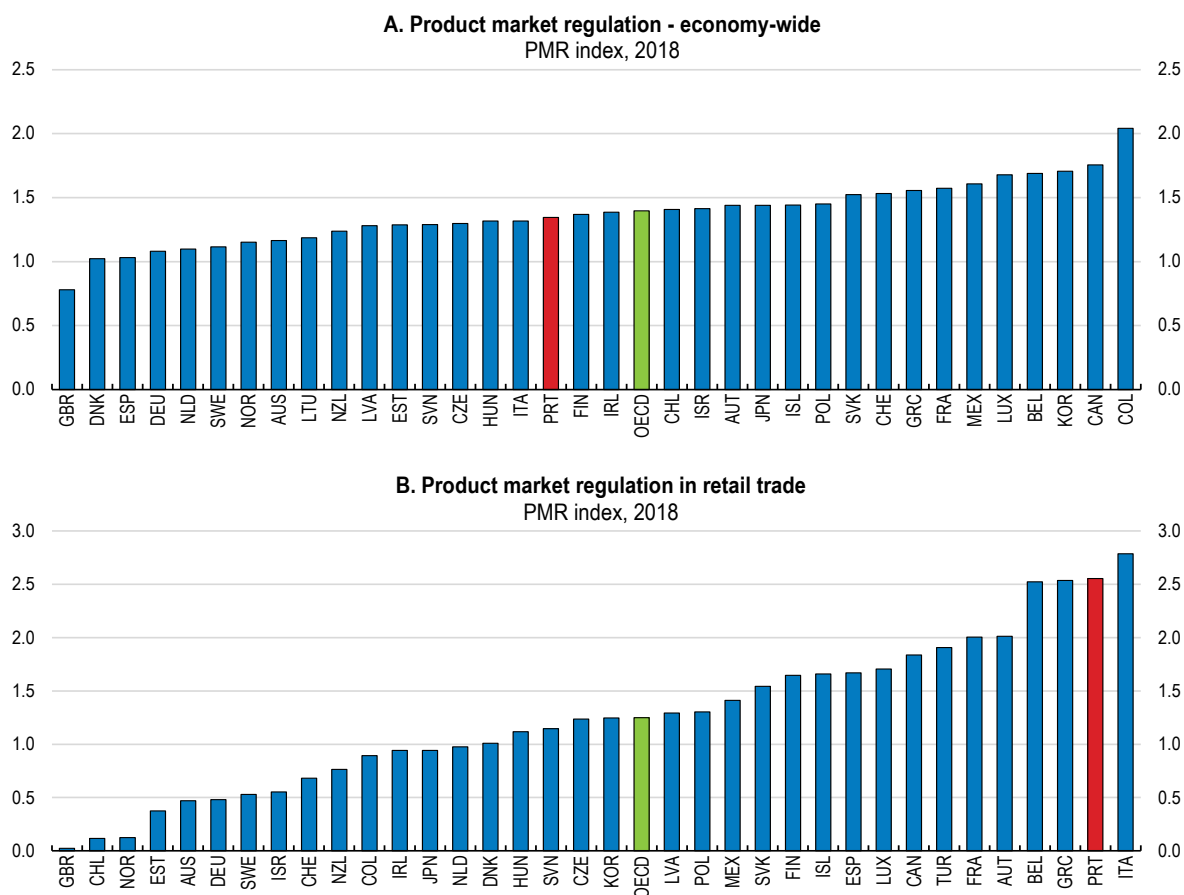
Removing barriers to firm growth

The small size of firms is a significant barrier to the use of costly technologies that require investment and expertise. New firms tend to grow less in Portugal than in similar OECD countries (OECD, 2021c). Firms creation in digital intensive industries is more dynamic than in their low-digital counterparts, in particular in services, but business growth was lower, indicating difficulties to break into new markets and upscale (OECD, 2021c). Policies could encourage co-investment or infrastructure sharing. For instance, some municipalities put in place platforms for local shops to sell online. Firms could also be encouraged to grow, by eliminating disincentives that prevent them from reaching optimal size and exploiting economies of scale. In particular, a transition from size-dependent to age-dependent policies may help boost firm growth over their life cycle. For example, the general exclusion from the labour code of businesses with fewer than ten workers or differences in fiscal reporting standards can contribute to keep firms small.

The corporate income taxation is linked with firm profitability and size. At 25.6%, the composite effective average tax was the ninth highest in the OECD in 2019. While the effective marginal rate at -20.5% is among the lowest by OECD norms, a tax surcharge applies to large and profitable companies: the top marginal rate is 10 percentage points higher than the average rate for 88 jurisdictions covered in the OECD tax statistics in 2018. The system may hamper investment and aggregate productivity growth (OECD, 2019). Recent introduction of tax exemptions on reinvested profits can mitigate this effect by reducing the tax burden. Nevertheless, the current corporate tax system should be evaluated and reforms to create incentives for corporations to expand and obtain a critical scale could be considered.

Portugal has a reasonably supportive regulatory and incentive environment for entrepreneurs, strengthened by recent reforms. Portugal ranks relatively well in the OECD Product Market Regulation (PMR) indicator, which measures how favourable national regulations are to economic activities (Figure 2.24, Panel A). Nevertheless, regulatory settings that do not sufficiently promote competition in important industries that produce intermediate inputs, such as professional services, can raise costs to firms and hamper growth (OECD, 2019). They include nationality requirements for owning and practicing in some professional services, protective powers of the regulatory professional bodies, the use of exclusive rights that reserve certain tasks for members of the profession. In 2018, the OECD Competition Assessment of self-regulated professions in Portugal provided recommendations to address these barriers. As stressed in the previous Economic Survey, their full implementation should be a priority for policymakers (OECD, 2019). In addition, regulatory settings in the area of retail distribution are more restrictive than in most other OECD economies due to relatively strict registration and licencing requirements (Figure 2.24, Panel B). The European Commission's Retail restrictiveness Index also points to retail specific taxes and para fiscal fees based on the outlet size for establishment or operation of the shops (European Commission, 2018). Further simplifying procedures by reducing the number of permits, the number of entities involved, shortening procedural deadlines by using more tacit approval, and reducing the cost of expanding businesses should contribute to supporting firm growth.

Figure 2.24. Regulation on retail trade is restrictive



Source: OECD (2018) PMR database.

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Diversifying financing sources for ICT and intangible investment

Providing diversified financial services that can facilitate both firm growth and investment in digital and complementary digital assets is key. Portuguese SMEs rely heavily on debt to fulfil their start-up, cash flow and investment needs, and bank lending is their most common source of external finance. However, the pandemic put a halt to past improvements in access to bank lending for SMEs. Despite low interest rates and increased public support during the pandemic through various credit lines (i.e. Apoio às Micro e Pequenas Empresa, Apoio às Médias Empresas), the financing gap for Portuguese SMEs increased from 3% in 2019 to 11% in 2020 and 13% in early 2021 (European Central Bank's Survey on the Access to Finance of Enterprises in the euro area). It remains well below levels seen during the sovereign crisis though.

A vast range of programmes is in place to facilitate access to finance by SMEs. Several credit lines through the *Capitalizar* programme offer preferential conditions, such as subsidised risk-sharing public guarantees. In response to the COVID-19 crisis, the government provided state loan guarantees. However, these measures do not support the supply of unsecured loans as banks continue to ask for personal guarantees, including for limited liabilities companies. The creation of the development bank, *Banco Português de Fomento*, that merged existing public financial institutions, in November 2020, can expand credit supply and streamline public support to finance. Nevertheless, the implementation of financing programmes has

been delayed and needs to accelerate as financing conditions might deteriorate further in the medium term (see Chapter 1).

Diversification of SME financing sources away from debt-related instruments towards long-term, market-based financing needs to gain momentum. Equity financing could play an important role in recapitalising firms, while at the same time mitigating debt overhang (European Investment Bank, 2019; Demmou et al., 2020). Improving access to equity finance for small and young firms could boost digitalisation by allowing more intangible investment (Demmou, Franco and Stefanescu, 2020). The use and availability of corporate bond financing could help lengthen maturities and facilitate long-term investments. However, alternative to debt financing is missing in Portugal. The equity market is underdeveloped despite recent efforts to reduce the asymmetric tax treatment of debt and equity, to encourage investors to invest in SMEs, and increases in public funds allocated to start ups. In 2019, the Portuguese share of European private equity investments was less than half of its share in the GDP of the European Union (OECD, 2020i).

Introducing schemes for equity-type capital injections directed to SMEs, as planned by the government, can contribute to developing equity funding. Several countries have recently started to develop equity-type instruments for SMEs (Box 2.6). In Portugal, a Capitalization Fund for Companies was created to help firms strengthening and recovering solvency. Reducing costs and streamlining listing requirements can also facilitate access to equity markets for smaller firms, as stressed in the 2020 OECD capital market review of Portugal (OECD, 2020i). A strategic plan for the development of corporate bond markets could include creating an appropriate credit rating mechanism and a special framework for private bond placements by small companies, following successful examples in Europe (e.g. the mini-bond market in Italy).

Box 2.6. Country examples on non-debt instruments for SMEs

- **Equity funds and convertible bonds in France:** A new fund, Bpifrance Entreprises, enables non-professional investors to invest in a group of 1 500 SMEs and young firms for a period of six years and thus bring a new source of equity funding to these businesses. In addition, the French Tech Bridge provides convertible bonds to firms that were expected to raise funds through venture capital investments. The scheme required co-investments from private actors and is aimed at high-potential start-ups, typically in the “high-tech” sector.
- **Convertible loans in the UK:** A convertible loan allows a loan to be converted to equity if a borrower is unable to repay it. The Future Fund in the United Kingdom has set up convertible loans for SMEs. To be eligible, SMEs need to meet some conditions such as a minimum of GBP 250 000 previously raised in equity investment (British Business Bank, 2020).
- **Equity crowdfunding in the US:** Crowdfunding instruments could potentially address finance needs of a slightly larger segment of the SME population compared to capital market instruments, allowing them to raise capital by selling securities in the form of equity, revenue share, or convertible notes. In the United States, the Securities and Exchange Commission (SEC) announced temporary rules that provide flexibility for issuers that meet specific eligibility criteria to accelerate the offering process and get faster access to funds as stated in the Regulation Crowdfunding.

Source: Boschmans, K. and S. Raes (Forthcoming), Policy measures to support SMEs in the context of the COVID-19 pandemic: Takeaways so far and implications going forward”, OECD SME and Entrepreneurship Papers, OECD Publishing, Paris.

Initiatives to improve awareness among entrepreneurs on equity instruments, such as the issuance of preferred shares that allow obtaining the additional financing without losing control of the company, can foster the take up of such instruments (Boschmans, 2017). In Portugal, *IAPMEI’s Portal do Financiamento* a platform available to entrepreneurs includes information on financial instruments. Granting more voting

rights to owners holding shares for a relatively longer period or actively engaged in companies' governance can also foster equity.

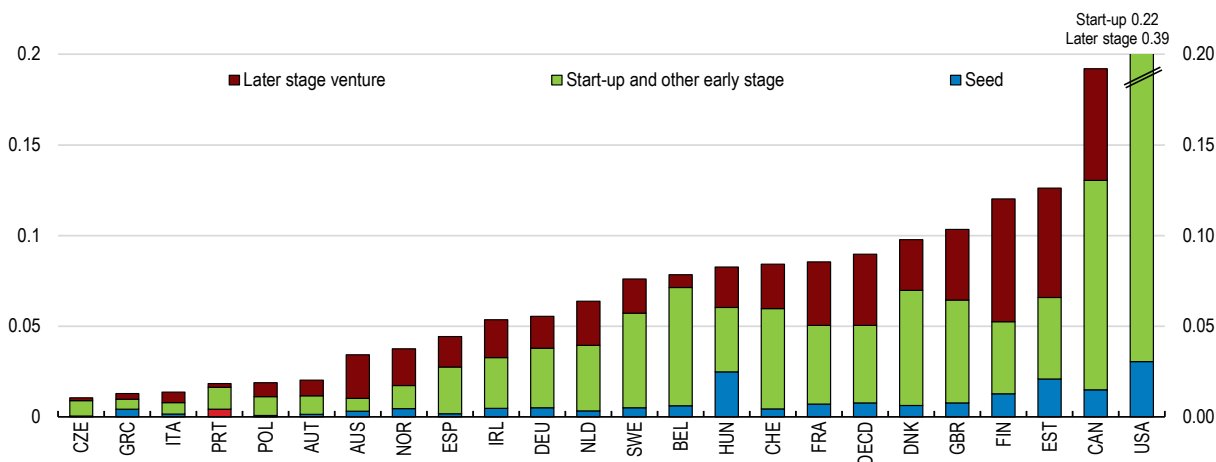
Supporting start-up activity

The COVID-19 crisis negatively affected start-up financing and start-up activity in some sectors. In response, the government has provided financial support to start-ups through credit lines totalling EUR 325 million (*Linhas de financiamento com Parcerias - Fundo de Coinvestimento 200M*) and furlough scheme for employees (*Start-up RH COVID19*). Around 90% of start-ups report awareness of the government support programmes, but only 66% resorted to these measures (Start-up Portugal, 2020). Administrative and bureaucratic hurdles hamper start-ups obtaining bridge financing. The government should step up short-term financial support with minimal bureaucracy, as done in other OECD countries, including France, Germany, and the UK (OECD, 2020j).

Venture capital is a valuable source of investment for innovative start-ups since they have few or no tangible assets that can serve as security for obtaining finance (Lassébie et al., 2019). Despite significant improvements in the past, namely through the Venture Capital Funds (e.g. Business Angels) and Co-investment Funds (e.g. 200M), the availability of venture capital financing is low in Portugal, (Figure 2.25). In addition, there is a wide gap in the availability of funds between early stage and later stage start-ups, that is significantly larger in Portugal than in other European countries (EIT Digital, 2020b), reflecting a lack of later stage financial options for start-ups to scale up.

Figure 2.25. Venture capital investment is low, especially in later venture stage

Percentage of GDP, 2019



Source: OECD (2021), Enterprise Statistics (database).

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Later stage financing is mainly limited to the public VC entity, Portugal Ventures, and foreign investors (with a share of 87.6% in the total investment in start-ups). Very few domestic investors invest in mature start-ups. Portugal provides tax incentives for individual investors through the *Semente* Program. However, little is done to increase the participation of domestic institutional investors from low levels (EIT Digital, 2020a; OECD, 2020i). The initiative Portugal TECH II launched in 2021 aims to support the development of the venture capital industry and to attract private and institutional capital for investment in technology-based companies headquartered in Portugal.

To foster innovative activities, the government offers generous tax credits to business R&D expenditures over a pre-defined amount and a preferential tax treatment to small firms. This is welcome since small firms are more responsive to tax incentives compared to large firms (Appelt et al., 2020). Unused tax

credits can be carried forward over the next 8 years, for young innovative firms, that often are unprofitable and do not pay taxes in first years. In line with past OECD recommendations, the government should allow unused tax credits to be indefinitely carried forward like in Belgium, Italy and the United Kingdom (OECD, 2019). Other options to strengthen support include allowing cash refunds for loss making firms like in Australia, Canada and France or reductions from withholding payroll taxes for labour inputs related to R&D. The benefits of such a reform should be weighed up against the associated fiscal cost and its impact regularly monitored ex-post.

Contrasting with fiscal incentives, and despite increasing since 2016, direct public support to business R&D is low by OECD standards (OECD, 2021a). Direct funding seems particularly important for encouraging basic research (Appelt et al., 2020). Moreover, compared to tax credits, R&D grants are, in principle better suited for young and innovative firms, as they lack the financial capacity against which decisions to award R&D loans are often made. Furthermore, they are direct and can be targeted to innovation with high potential for knowledge spillover. Portugal should increase the share of direct government funds by exploiting the synergies between different funding sources namely with the support of Portugal-Europe R&I Network – PERIN and develop performance-based funding.

Tailored advice on regulations relevant to new business models enabled by digital technologies would also be useful. With the Portugal FinLab project, ten innovative firms are selected every year to ask questions to the regulatory authorities on the regulatory requirements for implementing their projects and on how to operate within the applicable legal framework. These in-depth consultations should be used to identify main regulatory issues and lack of information in the Fintech sector and improve guidance services to innovative firms. In addition, the government has established the framework for the creation of regulatory sandboxes “Technological Free Zones” in 2021 to encourage experimentation on specified technologies and sectors, geographically located, with the support and monitoring of the competent entities. This is welcome as regulatory sandboxes allow the pilot testing of newly developed technologies within a well-defined space and duration, with safeguards to contain the consequences of failure.

Strengthening the link between companies and universities and research centres could facilitate access of small businesses to digital innovation. The Interface Programme has been giving support through collaborative laboratories working on innovative solutions with and for companies and creating, directly and indirectly, qualified employment and scientific employment through the implementation of research and innovation agendas. Pacts for Competitiveness and Internationalisation have been signed in 16 sectors, including Health, Automobile, Engineering & Tooling, Information Technologies, Communication and Electronics or Architecture, Engineering and Construction (EY, 2020).

Clusters and business incubators foster the collaboration across firms for them to mutualise fixed cost and benefit from knowledge spillovers through collaborative research (OECD, 2019p). 35 collaborative laboratories operated in 2021, with a total budget of EUR 40 million and staff of 435 agents. Several incubators and accelerators on the local level (e.g. Beta-I, BGI, Start-up Lisboa) focus on technological innovation and help entrepreneurs develop and test their ideas. For example, the innovation centre Hub Criativo de Beato, created in Lisbon, connects around 3000 entrepreneurs working on digital innovation. Portugal is building a national network of Digital Innovation Hubs, interconnected with the European network, within the scope of the Digital Europe Program.

The Recovery and Resilience Plan includes further measures, including i) reinforcing Start-up Portugal’s capacity to act as the main public policy implementation agency and ecosystem monitoring, including the development of a new platform that connects Start-ups and Investors; ii) bringing additional financial support to incubators and accelerators and iii) introduction Start-up Voucher’s to support the development of new digital and green innovative products and services. These initiatives should be expanded, if they prove effective in promoting innovation in small firms.

Table 2.1. Policy recommendations

MAIN FINDINGS	RECOMMENDATIONS (Key recommendations in bold)
Securing a safe and high-quality digital environment for all	
Coordination and monitoring of the 2020 Action Plan for Digital Transition will be challenging due to the significant number of initiatives, a lack of data and limited evaluation capacity.	Expand data collection and evaluation capacity to ensure an effective coordination and monitoring of programmes.
Access to high-speed broadband is good, but gaps remain in fibre deployment and coverage in rural areas.	Use EU funds and strengthen incentives for operators to expand coverage in rural areas and for fibre deployment.
The prices of broadband are relatively high. High market concentration in the telecommunication sector and low consumer mobility suggest competition pressures to reduce them is low.	Remove constraints to consumer mobility across telecommunication providers, for example by restricting the use of loyalty clauses in contracts and providing clearer information on the quality of services.
A vast range of public services is available online, but there is large room to increase uptake. Measures to promote accessibility of online public services are ad-hoc.	Ensure that future users are systematically consulted when designing and developing digital government projects.
Trust in digital technologies is low, hampering their diffusion. Many Internet users do not follow best practices for online safety.	Integrate cybersecurity in all digital training activities.
Equipping workers with the skills needed in a digital economy	
Schools and teachers are not well equipped to use and teach ICT. The government has initiated a range of measures to address this issue under the Recovery and Resilience Plan.	Accelerate and expand the provision of adequate digital resources to schools and teachers, including regular in-service training on ICT use.
The number of STEM and ICT professionals has to increase to address skill shortages. More women could engage in STEM and ICT studies. Improving gender equality one of the targets of the Recovery and Resilience Plan.	Further promote the enrolment of women in STEM fields, by reinforcing communication campaigns and early exposure to ICT projects, as planned.
Participation in adult learning is low, especially among low-skilled workers, more at risk of being affected by the digital transition. Ambitious programmes are in place to address that issue, but those not covered by these programmes have few incentives to train.	Consider introducing a personal training account for adults, with more generous vouchers for low-skilled workers.
Information on the quality of training programmes is limited, hampering informed choices by trainees and good allocation of resources in the adult education system.	Develop a general monitoring framework for all training providers.
Addressing barriers to the successful digital transition of SMEs	
Lack of awareness and expertise in digital technologies undermines the adoption of digital tools in small firms. Implementation of cybersecurity measures and data protection legislation is difficult for SMEs. The Recovery and Resilience Plan includes a range of programmes to support the digital transition in SMEs.	Expand the coverage of programmes for small companies to acquire digital training, advisory services and information on security and privacy after a thorough evaluation of their impact.
Many business managers of small firms lack the managerial skills needed to operate the digital transformation.	Provide management training targeted at small firm owners. Develop part time advanced management courses for professionals at higher education institutions.
Small firm size is a barrier to digitalisation. Some size contingent policies can discourage firms from growing. The corporate income tax rate system includes incentives for investment and a preferential tax rate for small and medium firms.	Review exemptions for small firms to the labour code. Assess the effectiveness of investment incentives in the corporate income tax and remove disincentives to small firms' growth.
Burdensome administrative procedures in the retail trade sector can hamper business growth.	Reduce red tape in the retail trade sector.
Direct public support to business R&D is low. Tax incentives are generous, but do not reach young innovative firms.	Expand R&D grants. Allow cash refunds for loss making firms or exemptions from withholding payroll taxes for labour inputs related to R&D.

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