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DIGITALISING THE ECONOMY IN SLOVENIA

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ABSTRACT

Digitalising the Economy in Slovenia

This paper discusses key priorities and policy recommendations to accelerate Slovenia's digital transformation. The government's ambitious digitalisation strategy (Digital Slovenia 2030 Strategy) aims at putting Slovenia among the five most digitalised countries in Europe. Achieving this objective would foster productivity growth and help offsetting the negative effects of a declining labour force. While Slovenia performs well in several areas of the digital transformation, further efforts are needed to achieve the government's ambitious objective. These include reducing the urban-rural gap in high-speed broadband access, supporting the digital transformation of businesses, fostering digital innovation, improving digital government, upgrading ICT-related skills and attracting foreign ICT specialists.

Keywords: digital transformation, productivity, skills, labour market, connectivity, innovation, Slovenia

JEL codes: O43, O52, O33, O38, J24, L96, I25, J31

This Working Paper relates to the 2022 OECD Economic Survey of Slovenia https://www.oecd.org/economy/slovenia-economic-snapshot/).

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RÉSUMÉ

La transformation numérique de l'économie en Slovénie

Le présent document examine les priorités et recommandations d'action clés soutenant une accélération de la transformation numérique en Slovénie. La stratégie ambitieuse de montée en puissance du numérique élaborée par les pouvoirs publics (Digital Slovenia 2030 Strategy) vise à placer la Slovénie parmi les cinq pays d'Europe dans lesquels la transformation numérique est la plus avancée. Atteindre cet objectif favoriserait la croissance de la productivité et aiderait à compenser les effets négatifs du déclin de la population active. Si le pays obtient de bons résultats dans plusieurs domaines de la transformation numérique, davantage d'efforts sont nécessaires pour atteindre l'objectif ambitieux des pouvoirs publics. Cela implique notamment de réduire l'écart entre les zones urbaines et les zones rurales en matière d'accès au très haut débit, de soutenir la transformation numérique des entreprises, de favoriser l'innovation numérique, de renforcer l'administration numérique, de perfectionner les compétences relatives aux technologies de l'information et des communications (TIC) et d'attirer des spécialistes étrangers des TIC.

Mots clés: transformation numérique, productivité, compétences, marché du travail, connectivité, innovation, Slovénie

Codes JEL : O43, O52, O33, O38, J24, L96, I25, J31

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Table of contents

Tables

Figures

Boxes

Digitalising the Economy in Slovenia

By Lucia Russo, Jens-Christian Hoj and Martin Borowiecki [1]

The government's ambitious digitalisation strategy (Digital Slovenia 2030 Strategy) aims at putting Slovenia among the five most digitalised countries in Europe. Achieving this would bolster income convergence as the associated optimization of work processes and operations lead to higher productivity and new business models, important developments to offset the negative growth effects of a declining and ageing labour force.

The COVID-19 pandemic accelerated the pace of digitalisation, but to a lesser extent than in other European countries, as the share of workers teleworking during the first and second waves of the pandemic was below the EU average (Ker, Montagnier and Spiezia, 2021[1]). Similarly, only 7% of businesses started or increased efforts to sell online during the pandemic, as compared with an average of 12% in the EU. In the education sector, the shift to distance learning during the first wave of the pandemic made more evident the digital divide in rural areas, and the limited readiness of teachers and students to teach and learn online. Looking ahead, further digitalisation progress will hinge on the ability of the population to connect and use digital technologies, both privately and professionally, and on the government to be the digitalisation leader.

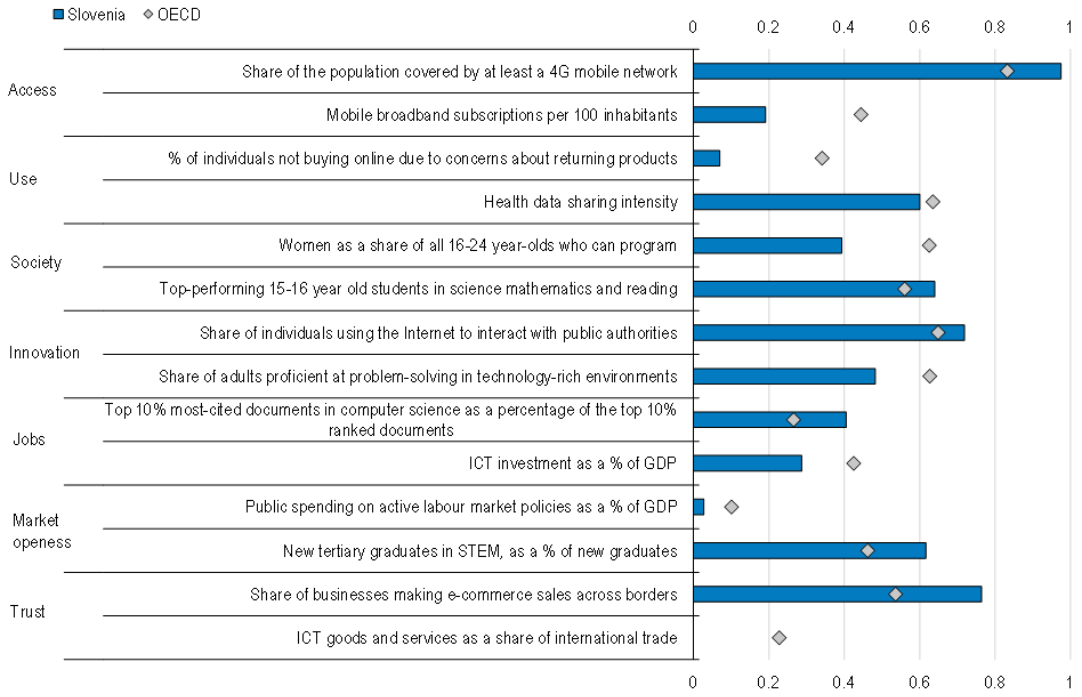
Supporting a coherent and efficient digital transformation

In many respects, Slovenia performs well in the digital transformation, notably in terms of broadband coverage and young people's human capital (Figure). However, the country is underperforming its OECD peers in a number of areas. In terms of access, the digital divide in connectivity between urban and rural areas is high (see below). A low level of basic digital competencies in the population affects the share of Internet users, particularly those among the older population and in the poorest groups. This also manifests itself in a relatively low share of employment in digital-intensive sectors. Most indicators related to digital innovation and market openness are lagging those in other countries. Slovenia ranks in an intermediate position in the EU Digital Economy and Society Index (DESI) – a position it has maintained over the past decade (IMAD, 2020[2]; European Commission, 2022[3]). In sum, digitalisation efforts need to be stepped up to achieve the government's ambitious digitalisation objective.

[1] Lucia Russo is a member of the OECD Directorate for Science, Technology and Innovation. Jens-Christian Hoj and Martin Borowiecki are members of the OECD Economics Department. The authors acknowledge valuable contributions and inputs received from Alexia González Fanfalone and Vincenzo Spiezia (OECD Directorate for Science, Technology and Innovation), Viktoria Kis (OECD Directorate for Education and Skills), Maria Sobron Bernal (OECD Centre for Entrepreneurship, SMEs, Regions and Cities), Marieke Vandeweyer (OECD Directorate for Employment, Labour and Social Affairs), Benjamin Welby (OECD Directorate for Public Governance) and Peter Papež (Slovenian Ministry of Finance). The paper has benefited from comments and suggestions by Mame Fatou Diagne (OECD Economics Department) and by members of the OECD Economic and Development Review Committee. Research assistance was provided by Federico Giovannelli, and editorial support by Gemma Martinez (OECD Economics Department).

The digital transformation affects several policy dimensions in an interrelated way. For instance, by matching labour demand and supply online, digital work platforms create opportunities to develop new business models, and for workers to find new sources of income, influencing both innovation and labour market policies. Thus, policies to foster digitalisation should be addressed by a coherent approach across government (OECD, 2020[4]). The digital transformation policy objectives over the period 2016-2020 were formulated in a national digital strategy, Digital Slovenia 2020. The associated implemented policies and investment were limited in scope, leaving key remaining gaps, such as insufficient human capital development, low use of Internet and integration of digital technologies in businesses (MJU, 2020[5]). In particular, public investment in digitalisation is highly dependent on EU funds and its level as a share of GDP has been on a declining trend in the past two decades. Currently, Slovenia invests 0.5 percentage points of GDP, less than the EU average and 2 percentage points of GDP less than the top five countries in smart, digital-innovation transformation (IMAD, 2022[6]).

Figure 1. Slovenia needs to progress in a number of areas of digital transformation



Note: Indicators normalised to 0-1, 1 = top OECD country and 0 = bottom OECD country.
Source: OECD Going Digital Toolkit, https://goingdigital.oecd.org/.

The new digital transformation strategy, Digital Slovenia 2030, still has to be adopted. Since 2022, the preparation of the strategy is coordinated by the new Government Office for Digital Transformation. This Office, led by a Minister of Digitalisation, was created to enhance coordination and delivery of measures for digitalisation. However, as the responsibility for the development of sectoral strategies lies with line Ministers, this setting may potentially lead to a lack of coherence across policies, measures and sectors. For instance, the Ministry of Economic Development and Technology already adopted in January 2022 the strategy for the digital transformation of the economy, which was before the publication of the Government Office's guidelines (Government of Slovenia, 2022[7]). For the time being, a strengthened mechanism for governance was developed only for the digital transformation of public administration (with the re-establishment of the Council for Informatics Development), while it is unclear what system of checks and incentives will be adopted to ensure implementation of measures within the individual strategies. Furthermore, responsibility for implementation, including the required budget, sits outside the Government Office. To strengthen cooperation and to avoid silos between the Government Office and line Ministers,

formal institutional and budgetary arrangements will be necessary to ensure that the sectoral agendas work coherently with one another and are implemented as planned.

Digital Slovenia 2030 will be aligned with the overall EU objectives for the digital decade (the Digital Compass and the Digital Policy Programme) and will reflect commitments set out in the National Recovery and Resilience Plan (NRRP). As with the previous strategy, EU structural funds will constitute a main source of funding. Through the NRRP, EUR 532.7 million will be channelled to finance measures supporting the green and digital transitions (Table 1). In the plan, EUR 315.4 million (12.5% of the total envelope of about EUR 2.48 billion) are allocated to measures directly contributing to the digital transformation and the rest to measures in other areas which also partially contribute to digitalisation. Compared to neighbouring and comparable countries in terms of GDP, Slovenia will invest relatively less in the human capital for digital transformation, while largely focusing on the digitalisation of the public sector (Figure 2).

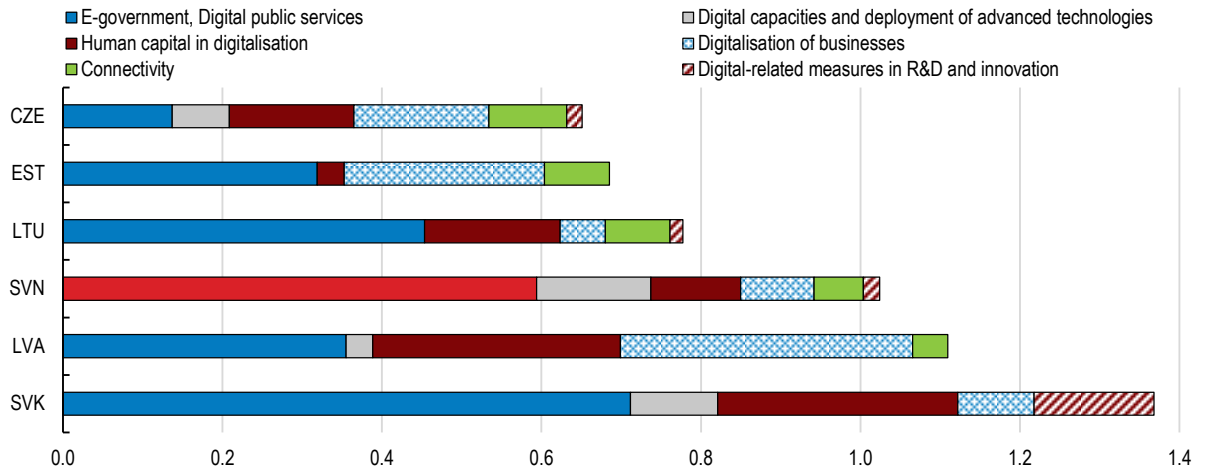
Table 1. Components contributing to the digital transition within the Slovenian NRRP

Component	Funding (EUR million)	Primarily contributing to digital transition	Partially contributing to digital transition
Digital Transformation of the Public Sector and Public Administration	260.2	x	
Digital transformation of the economy	56.5	x	
Renewable energy and energy efficiency	32.0		x
Sustainable mobility	30.1		x
Clean and safe environment	0.9		x
Research, development and innovation	10.0		x
Transformation of Slovenian tourism and investments in infrastructure in the field of tourism and cultural heritage	1.0		x
Strengthening competences, in particular digital competences and those required by the professions of the future and the green transition	60.3		x
Health	83.0		x
Total contribution to digital transition	**532.7**		
Total funding Slovenian NRPP	**2 480.0**		

Note: the acronym NRRP refers to the National Recovery and Resilience Plan for Slovenia
Source: (European Commission, 2021[8]), Commission Staff Working Document: Analysis of the recovery and resilience plan of Slovenia, European Commission.

Figure 2. Investment focuses on the digital transformation of the public sector

Planned expenditure in digital objectives of the NRRPs per policy area 2021-2026, as % of GDP



Note: GDP at market prices, 2021.
Source: OECD based on (European Commission, 2022[9]), *Recovery and Resilience Scoreboard*, and National Recovery and Resilience Plans.

A key objective of digital transformation policies is to enhance the resilience of the economy and society against possible disruption brought about by digital security incidents. In 2019, 13.6% of firms experienced digital security incident, just above the EU average. In contrast, the 84% share of firms using one or more ICT security measure was 8 percentage points lower than the EU average and well below the near universal use in the top-5 EU countries. In 2021, the Government Information Security Office (GISO) was established, succeeding the Information Security Administration of the Republic of Slovenia, and is responsible for national information and cyber security. GISO connects stakeholders in the national information security system and coordinates the operational capabilities of the system. In addition, the office supervises the implementation of the digital security measures set by the Information Security Act (ISA) for essential services providers, digital service providers and state authorities. Moreover, GISO finances partly or fully two national awareness programmes. The Safe on Internet programme focuses on the general public and SMEs (https://www.varninainternetu.si/). This is complemented with Cybersecurity vouchers for SMEs. The Safer Internet programme targets children, youth, parents and teachers (https://safe.si/).

These initiatives are welcome, but digital security risk management should play a more prominent role in the government's strategy. This requires elevating digital security from being merely a technical issue to the top of the decision making process. Therefore, programmes to raise awareness and promote risk assessment should be scaled up to reach a much larger number of individuals, firms and public bodies. In addition, measures are needed to incentivise critical infrastructure and services operators to adopt advanced technologies, e.g.: IoT, artificial intelligence, big data and blockchain, to strengthen their digital security. Likewise, the growing shortage of digital security skills in terms of technical security experts and business managers should be addressed. Such a development could also encourage digital security innovation and help foster a vibrant digital security industry. This should be supported by stronger cooperation with private sector stakeholders and work on the development of digital security services and solutions.

Expanding high-quality connectivity at affordable prices

Ubiquitous access to fixed and mobile high quality broadband at competitive prices is key for the digital transformation, as illustrated by the COVID-19 pandemic: Mobility restrictions due to the health emergency caused a surge of traffic on communication networks and Internet traffic exchanged at Internet Exchange Points (IXPs) soared by more than 58% in the OECD area. In Slovenia, 20% of employees reported to have worked partially or completely from home during 2020, which would have not been possible without connectivity and Internet traffic grew by 52% (Eurostat, 2021[10]) (OECD, forthcoming[11]).

Connectivity further underpins the use of all advanced digital technologies, such as artificial intelligence (AI) and the Internet of Things (IoT). The development of such digital technologies will increase data traffic, which will require policies and regulatory measures to promote investment, reduce barriers to broadband network rollout, and increase affordable access to high quality networks. .

Expanding high-quality connectivity and bridging existing divides

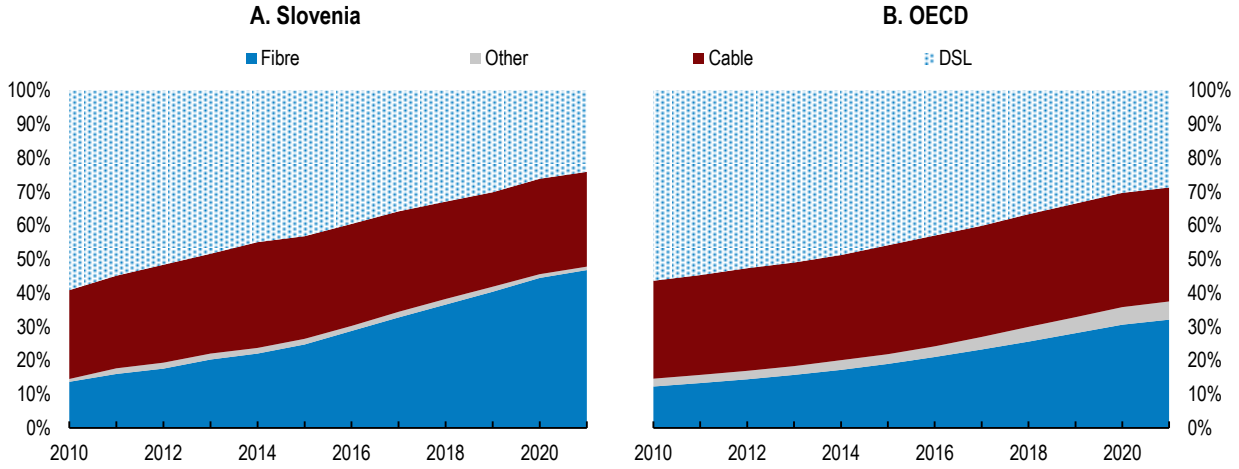
To foster mobile and fixed broadband connectivity, a key element is deploying fibre deeper into networks to bring advanced digital technologies, such as the IoT and AI, to their full potential. Fibre is also required for 5G networks as it connects cell sites through what is called "backbone" and backhaul" connectivity, making fixed and mobile broadband infrastructure complementary.

Fixed broadband penetration was, at 31.3 subscriptions per 100 inhabitants in June 2021, lower than the OECD average of 33.8, and much lower compared to the top five European Union (EU) performers (43.9).

On the other hand, access to high speed fibre networks was much higher than the OECD average, as the share of fibre-to-the-home (FTTH) subscriptions over total fixed broadband reached 46.8%, above the OECD average of 32.1% (Figure 3), but well below the top five EU performers (74.7%). Moreover, only half of all firms have a high-speed broadband subscription, just above the OECD average, but well below leading countries (e.g. 80% in Denmark and 73% in Sweden).

Figure 3 The quality of broadband has increased

Technology mix of fixed broadband subscriptions in Slovenia and the OECD

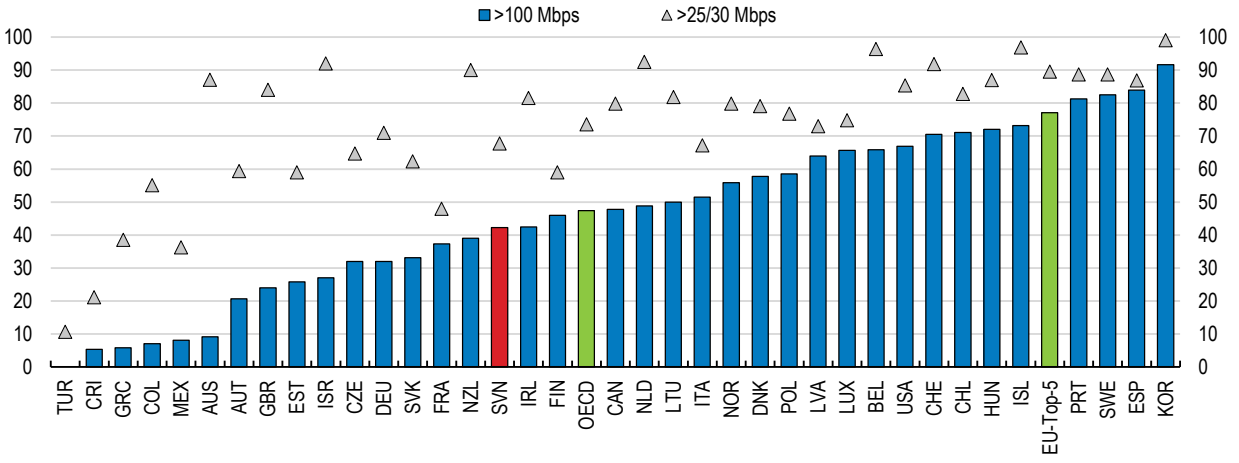


Note: Data for 2021 refer to Q2 2021.
Source: OECD Broadband Portal database, https://www.oecd.org/sti/broadband/broadband-statistics.

Still, a concern is that the quality advantage in fibre deployment is not reflected in actual experienced and advertised speeds, which lags behind the OECD average and peer countries. The share of subscriptions in the higher advertised speed tiers was lower than the OECD average, and significantly lower than the EU top five performers (Figure 4). In addition, actual download speeds experienced by users for fixed network is below the OECD average, and lags behind OECD leading countries, according to three different providers of speed tests (Figure 5).

Figure 4. Slovenia has a relatively low share of broadband subscriptions in higher speed tiers

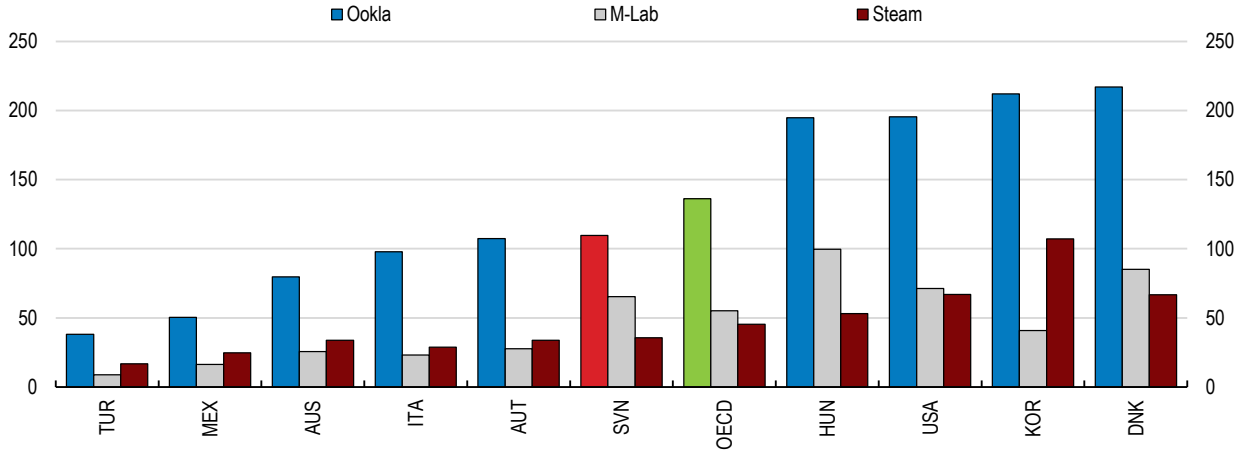
Fixed broadband subscriptions with contracted speed faster than 25/30 Mbps and 100 Mbps, June 2021



Source: OECD Broadband Portal database, https://www.oecd.org/sti/broadband/broadband-statistics.

Figure 5. Slovenia lags behind OECD leading countries on experienced fixed broadband speeds

Average experienced download speed of fixed broadband connections, Mbps, 2021



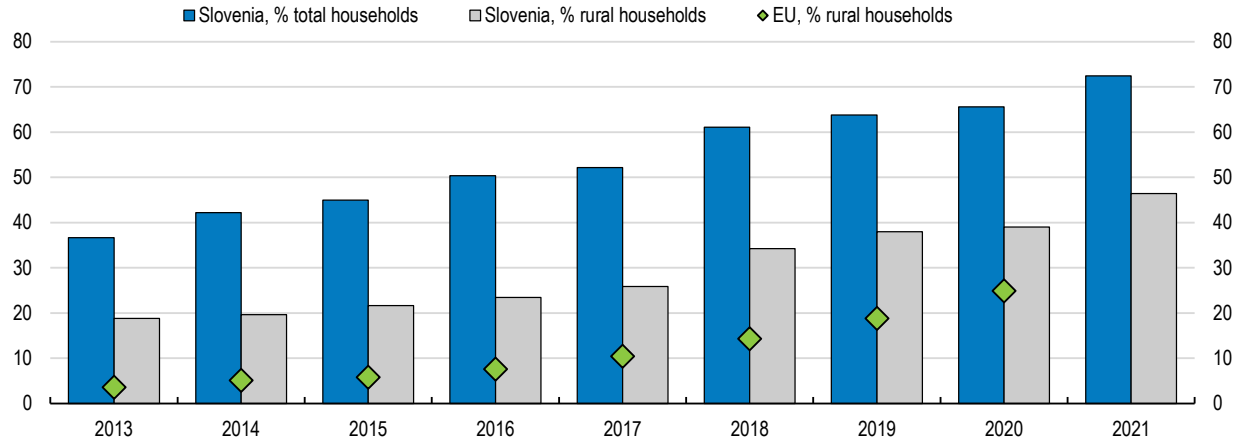
Note: Speedtest (Ookla) data are for June 2021; M-Lab (Worldwide Broadband Speed League) speeds were measured from 1 July 2019 to 30 June 2020; and Steam data are for February 2021.
Source: Ookla (2021), "Speedtest Global Index", www.speedtest.net/global-index ; M-Lab (2021), "Worldwide Broadband Speed League", www.cable.co.uk/broadband/speed/worldwide-speed-league; Steam (2021) "Steam Global Traffic Map", https://store.steampowered.com/stats/content.

A key element to improve the speed performance experienced by users is to entice operators to invest in upgrading communication networks. To that end, the regulator, AKOS, should continue to encourage operators to extend fibre backbone and backhaul connectivity, either through wholesale access remedies, or via infrastructure-based competition (see below). An additional way to entice operators to invest in upgrading their networks is by increasing transparency for end-users on the broadband performance they receive from operators. AKOS sponsors a broadband performance measurement tool relying on volunteer tests (AKOS Test Net), which could be complemented by periodically publishing actual broadband performance results per provider (AKOS, 2022[12]).

The availability of fibre-to-the home (FTTH) connections, associated with very-high capacity and symmetrical speeds, varies across the country, notably between urban and rural areas. In 2021, only 46% of rural households were located in areas where such connections were available, compared to 72% of households overall (Figure 6). Policy efforts to bridge territorial connectivity divides are paramount to ensure an inclusive digital transformation, where fostering competition and promoting investment are key to expand broadband. In areas where market forces have not proven able to fulfil all policy objectives, such as in rural and remote areas, a range of approaches are available and are currently used (i.e. coverage obligations in spectrum auction and public funding to expand connectivity in rural/remote areas).

Figure 6. Persistent connectivity divides between rural and urban areas in Slovenia

% of households (rural vs. total) living in areas where fibre-to-the-home (FTTH) connections were available



Note: FTTH refers to fibre-to-the-home. The EU average is not available in 2021.
Source: European Commission (2021[6]), Broadband Coverage in Europe 2020, a study by IHS Markit, Omdia and Point Topic for the European Commission, https://digital-strategy.ec.europa.eu/en/library/broadband-coverage-europe-2020; EU Digital Agenda Data Visualisation Tool - Data & Indicators – https://digital-agenda-data.eu/datasets/digital_agenda_scoreboard_key_indicators/visualizations.

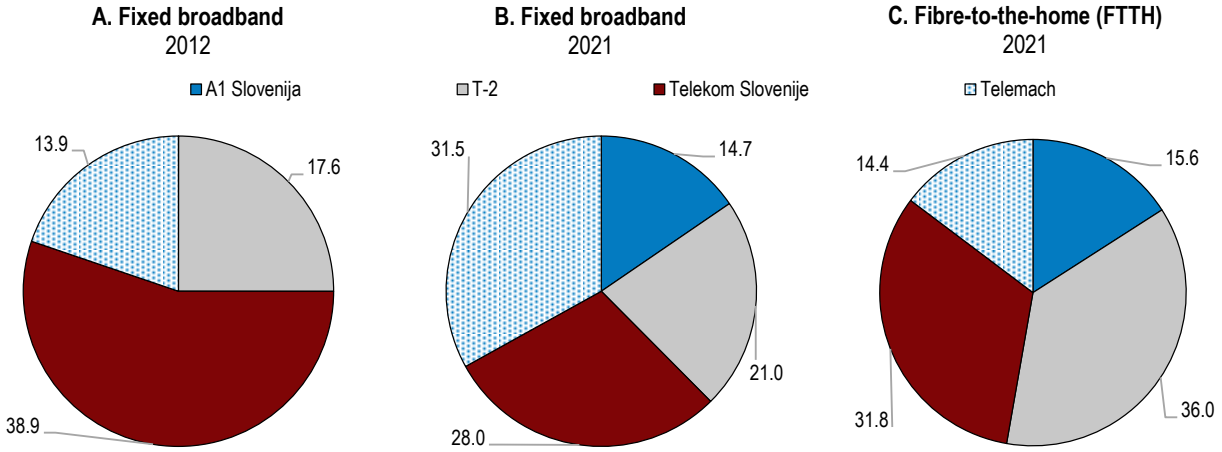
Mobile broadband services have been a major driver of increasing connectivity. Nonetheless, mobile broadband penetration lags behind the OECD and peer countries. In June 2021, the 88.8 mobile broadband subscriptions per 100 inhabitants was well below the OECD average of 121.4 and the average of the top EU performers of 137.1 (OECD, 2022[13]). Faster mobile broadband is being introduced with the first launch 5G commercial services in 2020, reaching a third of the population by the end of the year. Important prerequisites for a wide 5G deployment are spectrum availability and the deployment of fibre deeper into mobile backbone and backhaul networks (OECD, forthcoming[11]).

In April 2021, a successful (5G) multiband spectrum auction took place, distributing the market frequency bands coined as “5G pioneer bands” (the 700MHz, 3.6 GHz and 26 GHz bands) in the EU. This will eventually allow faster rollout of 5G networks by all mobile network operators in the market. Network operators need to deploy more fibre in their networks to enable 5G, and as such, the regulator could take further measures to incentivise fibre rollout by all operators (see below).

The fixed broadband market has become more competitive over the past decade. The incumbent’s (Telekom Slovenije) market share has fallen from 38.9% to 28%, as the main competitor (Telemach) became the largest player (Figure 7). In 2021, the mobile market had four mobile network operators (MNOs) – three with roughly equal market shares and a small operator. In addition, several mobile virtual network operators (MVNOs) have a combined market share of 6% (AKOS, 2021[14]).

Figure 7. The incumbent's market share in the fixed broadband market has been declining

Market shares of the Slovenian fixed broadband market in terms of subscribers, %

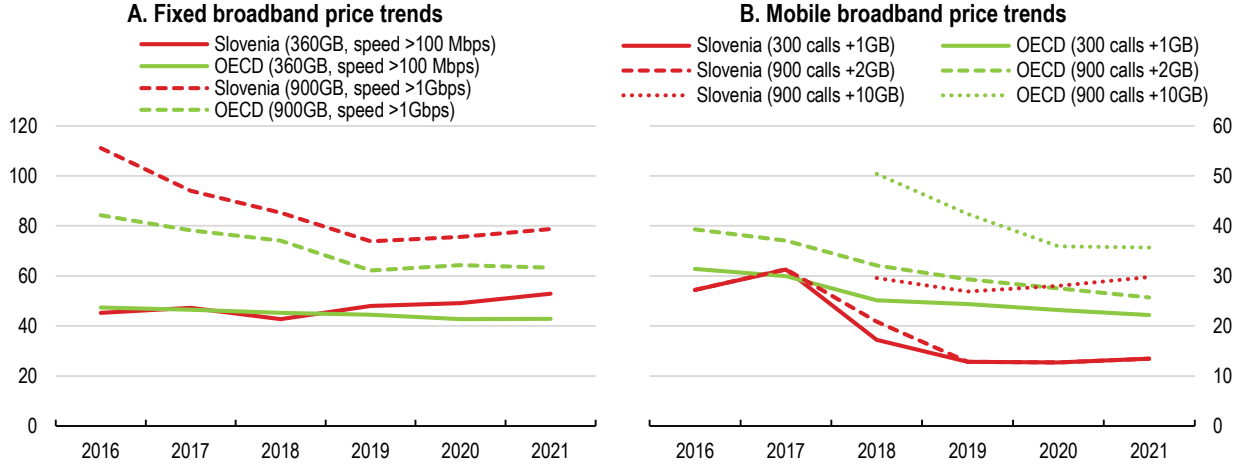


Note: Data are for Q4 2012 and Q3 2021.
Source: AKOS (2021[14]), "Portal e-Analyst on n the electronic communications market in the Republic of Slovenia", Home: PORTAL eAnalitik (akos-rs.si).

Mobile broadband prices for most baskets are lower than the OECD average. However, packages with a high data content are still relatively expensive compared with best practice in Europe. On the other hand, prices in the fixed broadband market are more expensive compared to the OECD average (Figure 8).

Figure 8. The prices of fixed broadband services remain higher than the OECD average

Fixed broadband and mobile broadband price evolution, USD PPP



Note: For mobile broadband baskets: From May 2018, the 900 calls+ 10GB profile became available.
Source: OECD and (Strategy Analytics, 2021[15]).

Comparatively high fixed broadband prices tend to reflect high deployment costs. Slovenia has sparsely populated regions, where 58% of the population lives in cities with less than 50 000 inhabitants, a third more than the OECD average. This may lead to relatively high investment costs, playing a role in terms of positive business cases for broadband rollout (OECD, 2020[16]). The regulatory framework could include measures to lower operators' network deployment costs (see below).

Communication market regulatory developments and key challenges ahead

Several approaches have been taken by OECD countries to promote broadband development and foster competition, including the promotion of end-to-end infrastructure competition and the promotion of common wholesale infrastructures with regulated or non-regulated wholesale access focusing on competition at the retail level (i.e. "last mile" or access part of the network) (OECD, 2021[17]). The approach in Slovenia has been dual, with both asymmetric regulated wholesale access of the incumbent's network to foster retail-based competition, as well as a push for infrastructure competition.

Competition in the telecommunication market has progressed to the point where prices in many instances are below the OECD average (i.e. in the mobile market). However, not all prices are at competitive levels and infrastructure-based competition has not progressed sufficiently. Barriers remain for a competitive communication market in terms of infrastructure access and incentives to invest in network deployment. Moreover, given that market players undertake the vast majority of the investment for network rollout in the communication sector, policies that reduce barriers and costs of network deployment and provide incentives to invest are key to extend higher quality networks. This reduces the need for public investments to areas where business cases are not likely to be viable, and where alternative approaches (e.g. through public-private partnership or public funding) might be needed.

Barriers to broadband network deployment include the difficult coordination of digging and trenching works and obstacles getting access to rights of way due to a decentralised nature of granting these permits that rely on municipal authorities. This issue may be even more acute than in other OECD countries due to the low population density in the many municipalities. To provide further incentives to invest in broadband network rollout and upgrades, AKOS should focus on measures to reduce rollout costs as slow administrative process regarding permits and rights of way and inefficient dispute resolution processes hamper the speed of broadband deployment.

Measures to shorten administrative approval times and streamline rights of way processes, respecting the responsibilities of relevant entities at different levels of government, are being implemented. For example, the sectoral legislation accelerated approval procedures for rights of way (Electronic Communication Act "ZEKom-1", article 20) whereby the first operator or utility provider to obtain the access of rights of way could allow the joint use by any other network operator. However, in practice, this is a complex and lengthy process. The proposed amendments to the Electronic Communications Act (ZEKom-2) include that any rights of way should be extended automatically to all operators, which is a welcome development.

Fibre deployment is being fostered via co-investment agreements. AKOS has made important steps to facilitate investment in broadband networks by providing maps of underlying wholesale infrastructure, so that operators can plan their deployments (through the public portals "Geoportal AKOS", and the "Infrastructure Investment Portal"). "Geoportal AKOS" could be improved with additional features, such as the identification of available public assets to be used for infrastructure rollout (e.g. public buildings available to place cellular base stations), and by displaying the prices of usable assets directly to network operators.

Infrastructure sharing is an additional measure to reduce network deployment costs. AKOS encourages voluntary passive infrastructure agreements by providing guidelines. In addition, the dominant fixed operator is subject to ex-ante infrastructure sharing obligations. During the process of adopting the Electronic Communications Act in 2022, a proposal to extend the joint use of passive infrastructure as a symmetrical regulation to all players in the market was discussed; however, views on this matter differ. Regardless of whether symmetrical regulation is established, settling disputes among operators in a timely manner appears to be an obstacle. A dispute resolution mechanism among operators would be helpful to avoid further administrative delays.

Closing down of legacy networks, such as copper, would boost the deployment of high-capacity networks. One of the main challenges that AKOS faces is how to adapt the regulatory framework to transition away

from legacy networks and provide incentives to boost the deployment of "future proof" access technologies, such as fibre. Concerning the decommissioning of the copper network, the historical incumbent is allowed to switch-off parts of copper network, if a parallel fibre network is deployed or another open access network is available. To boost infrastructure-based competition, the regulator could consider furthering relaxing ex-ante regulation on the incumbent in the fixed wholesale market in areas deemed as competitive (such as larger urban areas), while relying on infrastructure sharing obligations in areas where there is no business cases for rolling out fibre (i.e. rural and remote areas).

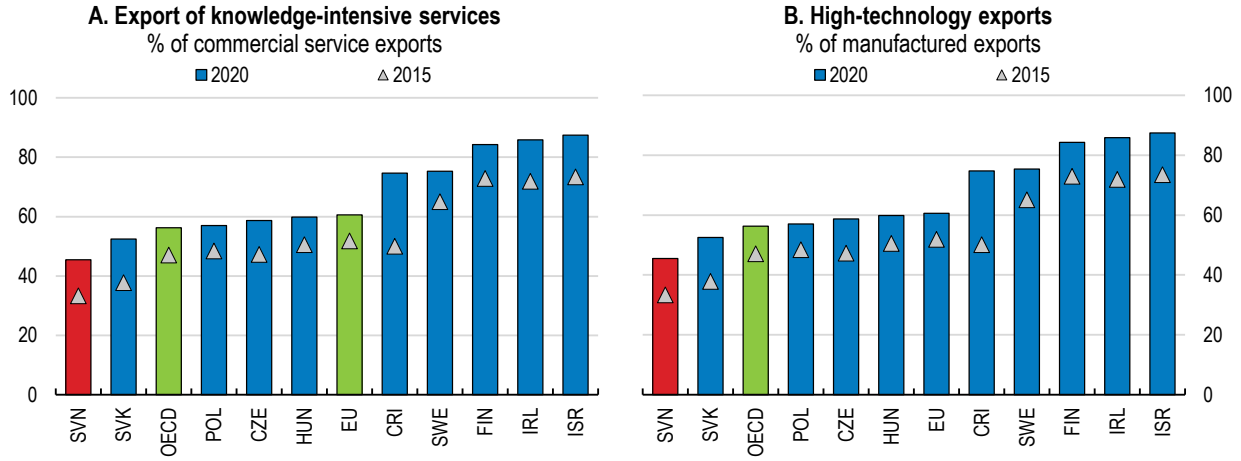
A growing number of OECD countries, including Slovenia, consider access to the Internet as a basic right for citizens and have changed their legal frameworks to include broadband as part of their universal service framework. In addition, as most OECD countries, Slovenia established connectivity targets in the National Broadband Plan, the 2020 NGN Next Generation Broadband Network (NGN). This plan was updated in 2018, and allocates public funds to co-finance broadband deployment in "white areas", i.e. in sparsely populated areas where broadband service is underserved or lacking as they are commercially unattractive for private players (Government of Slovenia, 2021[18]).

An important policy issue is how to design public funding tenders to co-finance the expansion of broadband networks in "white areas". A concern with respect to current co-financing, raised by market players, is that effectively the state co-finances 50% in most "white areas", which does not sufficiently take into account the actual cost of providing fibre to individual locations, in particular in rural areas. A new public tender to co-finance the rollout of open high-capacity broadband networks (through a programme called "GOŠO 5") was closed in December 2021 and is currently being implemented (Government of Slovenia, 2021[19]). Nonetheless, two calls for public tenders were left unanswered in the past. Thus, there seems to be room for improving the public tender design, for example by the use of cost-benefit analysis and detailed cost models to target state aid successfully. Therefore, granular data on broadband access should be used for calculating co-financing rates for each "white area".

Accelerating the digital transformation in the economy

Income convergence vis-à-vis richer OECD countries requires stronger productivity growth supported by higher value-added production and exports. However, the share of high and medium-high tech manufacturing in total manufacturing has been declining in the years 2015-2019. Other weaknesses include a relatively low high-technology intensity of merchandise exports. A recent positive development is an increase in the share of knowledge-intensive exports of total service exports during the pandemics (Figure 9). More broadly, productivity growth has been insufficient to accelerate income convergence. Indeed, increasing low labour productivity is one of the main challenges for closing the income gap.

Figure 9. Slovenia lags behind in exports of high-tech goods and knowledge-intensive services



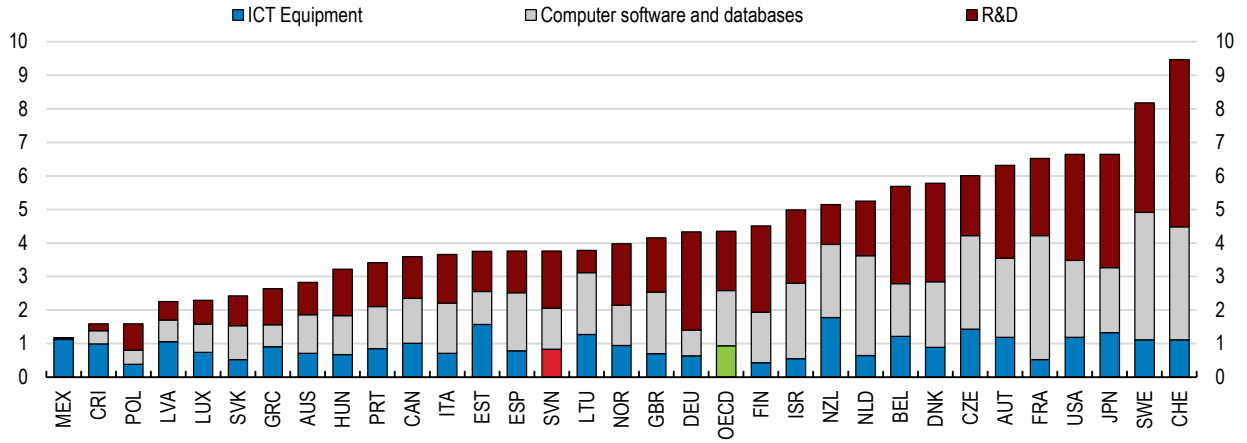
Note: Knowledge-intensive services are computer, communications and other services. High-technology exports are products with high R&D intensity, such as in aerospace, computers, pharmaceuticals, scientific instruments, and electrical machinery.
Source: World Bank (2022), World Development Indicators.

Investing in digital technologies is key to spur productivity growth

Key to achieve faster productivity growth is investment in new technologies. However, in the past decade, investment in information and communication technologies (ICT) has been on a downward path, leaving current investment in ICT below the OECD average (IMAD, 2020[2]) (Figure 10). A factor behind the low investment may be that SMEs, and particularly domestically oriented ones, have limited access to external funding for investment in ICT. Higher ICT investments are also needed to achieve the government's digitalisation objectives.

Figure 10 Investment in ICT is lower than in OECD countries

Investment in gross fixed assets, as % of GDP, 2020 or latest available year

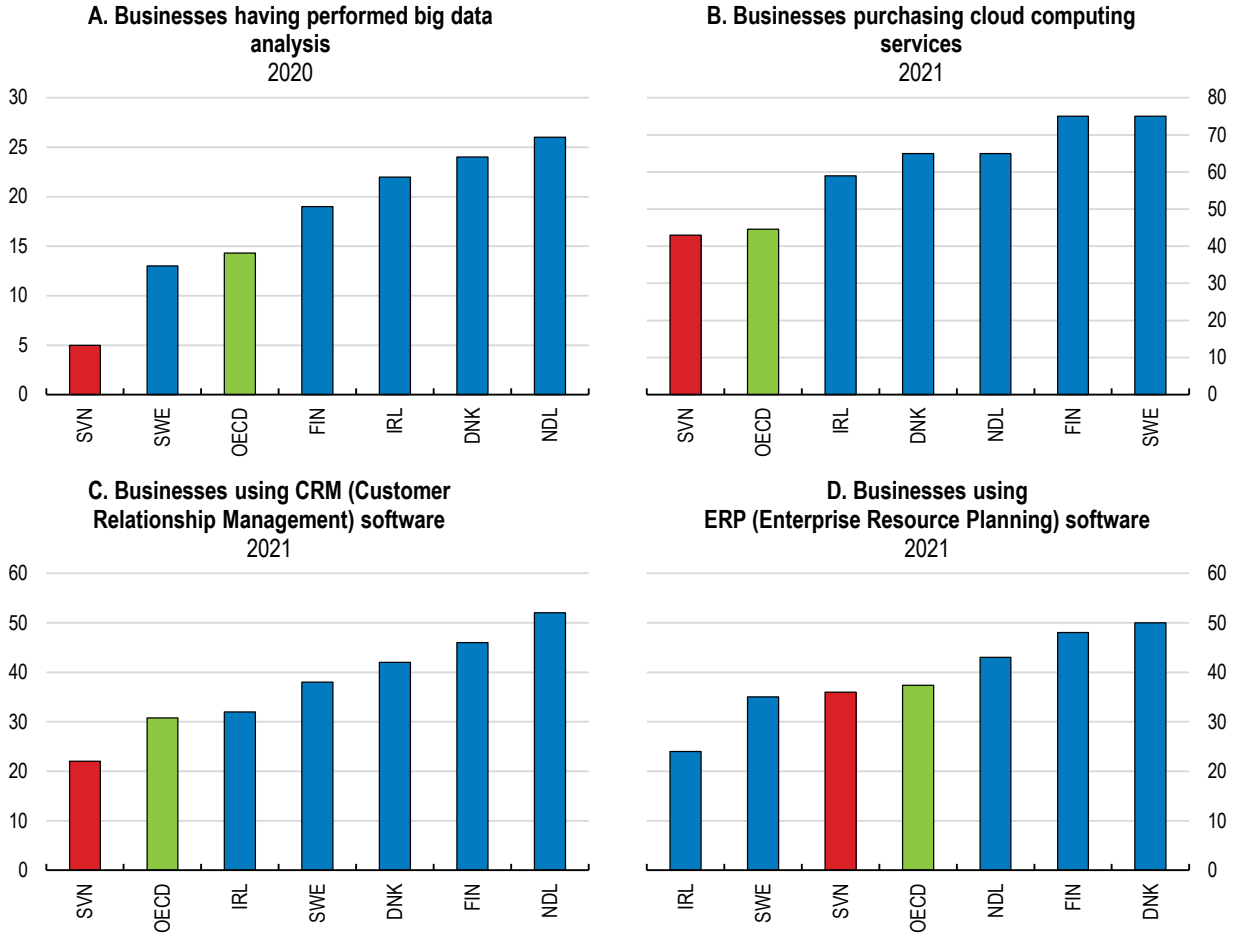


Note: Investment in other fixed assets, i.e.: non-ICT equipment, machinery and building are not shown. OECD is an unweighted average of available countries.
Source: OECD National Accounts database.

On average, firms have adopted digital technologies to the same degree as in other OECD and EU countries. Basic ICT tools such as broadband and websites, which enable firms to digitise information and establish a presence online, are widely diffused. The COVID-19 pandemics boosted adoption of advanced technologies, such as the Internet of Things (IoT) and Artificial Intelligence (AI). The use of these technologies among all enterprises jumped by 33 and 10 percentage points, respectively, from 2020 to 2021, bringing Slovenian firms among the top users in the EU. The share of firms using industrial robots is also well above EU average. However, firms lag behind in tools enabling higher integration of information and processing across business functions, i.e. Enterprise Resource Planning (ERP), and tools allowing firms to collect, integrate, process and analyse information related to their customers, such as Customer-Relationship-Management (CRM) (Figure 11).

Figure 11. Firms lag behind in adoption of several ICT tools

As % of enterprises with 10 or more employees



Note: Firms with 10 or more employees, excluding financial sector. ERP stands for enterprise resource planning, CRM for customer relationship management. Data on Cloud Computing refer to purchase of cloud computing services used over the Internet. OECD is an unweighted average of available countries based on the latest available year.
Source: OECD ICT Access and Usage by Businesses database, http://oe.cd/bus..

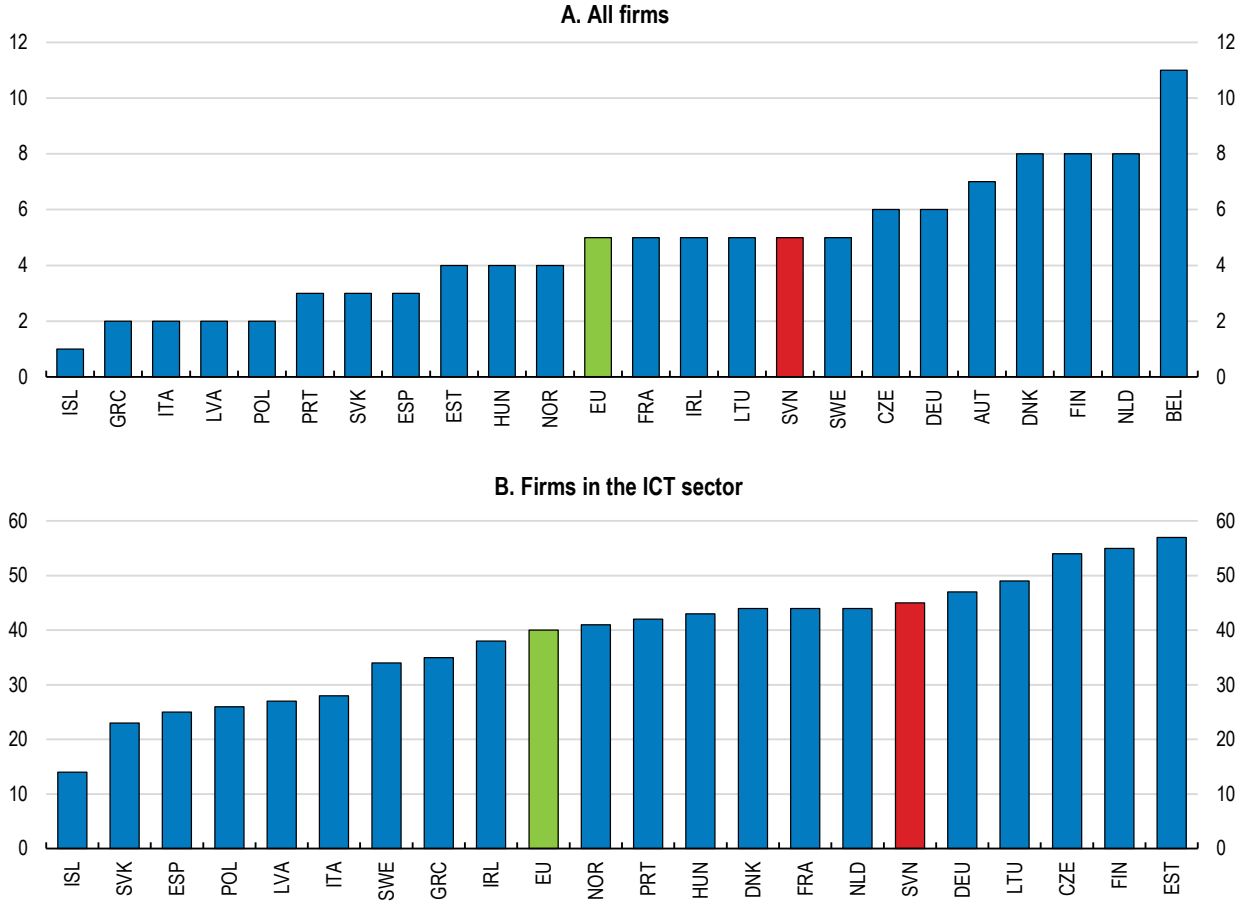
Creating value with data is at the core of the digital transformation, enabled by the convergent use of advanced technologies. IoT, for instance, can provide streams of real time data that can be made actionable thanks to big data analytics and AI. Data help explore new areas of product and service development, helping to gain critical insights about market trends, consumer demand and the behaviour of competitors. Data analysis also allows to optimise development, production and distribution processes; tailor the product and service offering to specific demands; and rapidly adjust to changes in demand (OECD, 2020[20]). For more comprehensive digital transformation and data-driven innovation, firms will need to adopt those ICT tools and activities that enable them to collect, store, exchange and process data. Firms lag behind their counterparts in leading EU countries in the adoption of these tools and activities, notably big data analytics and cloud computing (Figure 11). The share of firms that purchase cloud computing is 23 percentage points below the best performing countries, whereas only 5% of firms perform big data analysis, well below the OECD average and far behind the best performers.

Firms need highly skilled workers to use advanced digital tools, but only 17% of firms employ ICT specialists, 4 percentage points below the OECD average and 13 percentage points less than the best OECD performing countries (Belgium and Ireland). Moreover, demand for ICT specialists outstrips supply

and particularly firms in the ICT sector have hiring problems (Figure 12). Investing in human capital is key to move forward with a comprehensive digital transformation of the economy. To support an accelerated digitalisation of enterprises, the government should favour broad-based policies aimed at tackling skills shortages for workers in general and for ICT specialists.

Figure 12. There is a lack of ICT specialists

Firms that find it hard to fill vacancies for jobs requiring ICT specialist skills, as % of firms, 2020

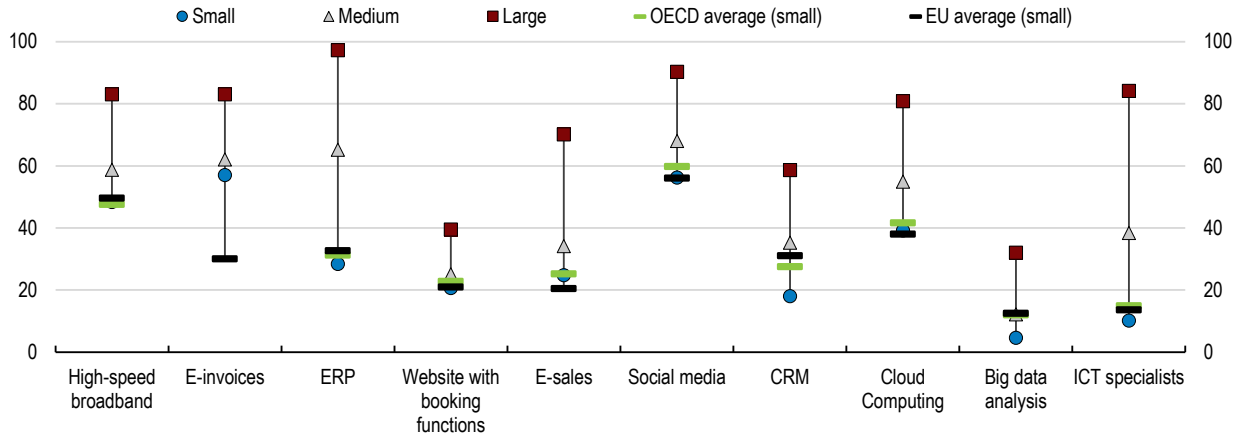


Note: In Panel B, 2019 for Greece and Portugal.
Source: Eurostat.

The digitalisation gap between SMEs and larger firms is relatively large. On average, SMEs use digital technologies to a degree comparable to OECD and EU peers, but well below best practises (Figure 13). Furthermore, the sizable gap with larger enterprises reflects low use of, particularly, human capital, ERP, e-sales and cloud computing. SMEs face several size-related barriers in terms of awareness, skills and finance for adopting new digital tools and implementing complementary organisational changes. These barriers are a symptom of imperfections in product, credit and labour markets. They may also reflect the disproportionate impacts of regulatory complexities, administrative burdens and policy inefficiencies on this business population (OECD, 2019[21]). SMEs report that their main barriers to faster digitalisation are a lack of human and financial resources, excessive costs of digitalisation and lack of knowledge (Digital Innovation Hub Slovenia, 2020[22]). An example of the lack of awareness is SMEs' low use of cloud computing -- a technology facilitating access to a range of low-cost computing services, such as extra processing power and storage capacity, reducing costs of up-front investments in hardware.

Figure 13. SMEs lag behind in use of digital tools and technologies

As % of enterprises in each employment size class, 2021 or latest available year



Note: "All", "Small", Medium" and "Large" refer to enterprises size categories of respectively 10 or more employees; 10 to 49; 50 to 249; and 250 or more. ERP stands for enterprise resource planning, CRM for customer relationship management; high-speed broadband are subscriptions with 100+ Mbps. Data for big data analysis, e-Invoices and ICT specialists refer to 2020. Data on website refer to businesses with a website allowing for online ordering or reservation or booking. Data on Cloud Computing refer to purchase of cloud computing services used over the Internet. OECD is an unweighted average of available countries based on the latest available year.
Source: OECD ICT Access and Usage by Businesses database, http://oe.cd/bus.

The government provides a range of measures to promote digitalisation in enterprises, particularly SMEs that appear well suited to the needs of SMEs (Table). However, these measures are small in scale and not system-oriented. Support measures consist broadly of vouchers and of consulting services. The latter are supplied by the Digital Innovation Hub (DIH) – the "one-stop-shop" where businesses can access all government programmes for digitalisation. With the exception of training and selected digital marketing tools, however, the vouchers do not finance the actual implementation of the strategy or the investment in equipment. Thus, their impact on digital adoption may be limited. In addition, the range of tools that can be financed is narrow (marketing, cybersecurity), hindering adoption of a broader set of technologies. Slovenia may look at the examples of other OECD countries to enlarge the range of policies to help SMEs digitalise (Box 1). A further problem is a lack of systematic evaluation of public programmes to assess whether the allocated funding has effectively achieved the expected outcomes (OECD, 2012[23]).

Table 2. Programmes supporting digitalisation of enterprises in Slovenia, 2018-2023

Instrument	Description	Budget (EUR million)	Type of support provided	Implementing body
Digital Innovation Hub (DIH)	The "one stop shop" for digitalisation. It creates the ecosystem, enables information and promotion, advice and mentoring and prepares analysis.	2.6	DIH Slovenia provides, connects and supports knowledge, business expertise, technologies, and exchanges best practices.	Digital innovation hub Slovenia (chosen through a public tender) https://dihslovenia.si/
"Digital" vouchers	Vouchers for raising digital competences, preparing digital strategy, enabling cyber security and implementing digital marketing for SMEs	8.5	Support for SMEs, up to 10 000 EUR/voucher	Ministry of Economic Development and Technology is the intermediary body. Slovene Enterprise Fund implements the public calls. Digital Innovation Hub Slovenia prepares the catalogue of mentors and trainings. Regional SPOT points help SMEs applying the public call (vouchers). https://podjetniskisklad.si/sl/razpisi
Support for SMEs e-business	SMEs going international and supports digitisation of fairs, e-exchanges among partners, web pages, internet trade and strengthening competences	9.45	5 000 – 30 000 EUR/enterprise	SPIRIT Slovenia implements the public tender for E-business.
Support for SMEs implementation of digital transformation and Industry 4.0	Support to different fields (Big Data, Internet of Things, Block chain, AI, Machine Learning).	12.4	30 000 – 100 000 EUR/enterprise	Public tender for SMEs digital transformation.
Total		**32.95**		

Source: OECD, Digital Economy Policy Platform (DEPP), edition 12/12/2021, https://depp.oecd.org/

Box 1. OECD countries use a wide range of policies to help SMEs digitalise

OECD countries offer a wide range of policies to help SMEs digitalise, ranging from grants that subsidise investments in digital technologies to training to help firms implement investments at their own cost.

Australia's Small Business Digital Champions project supports 100 small businesses. The project has a total budget of AUD 8.9 million, and provides up to AUD 18 500 in assistance, with additional support from partner firms. Of these small businesses, 15 were chosen as Digital Champions and received mentoring from high-profile business people to guide them through the digital transformation. This process is then documented and showcased online. The programme is complemented by the "Digital Solutions" programme of the Small Business Advisory Service, which focuses on firms in regional locations. SMEs pay a (subsidised) fee for advice on implementing digital technologies, such as websites, e-commerce, social media and small business software. The programme also offers advice on online security and data privacy.

In Denmark, the Danish Business Authority distributes grants (valued at approximately EUR 1 300) to 2 000 SMEs under the SMV:Digital programme. The grants are used for private consultancy to help the SMEs identify digital opportunities with a special focus on e-commerce, prepare business cases for digital transformation and implement digital solutions.

Portugal also has a grant scheme to assist SMEs with the use of digital technologies in fields such as e-commerce, online marketing, website development and big data. The grant covers 75% of eligible expenses up to EUR 7 500 for projects that take up to one year to implement.

Austria does not offer grants, but does help SMEs digitalise through the KMU Digital programme. The programme includes: 1) an online tool to allow firms assess their level of digital maturity; 2) an individual consultation to examine what can be improved and how; 3) a consultation focused on the specific needs of the firm (in areas such as e-commerce, IT security, data protection and digitalisation of internal processes); and 4) digital skills training courses for entrepreneurs and employees.

Finally, Chile's innovation agency recently launched the Digitalise Your SME (Digitaliza tu Pyme) programme to provide e-commerce courses (78 hours of classroom experience), in which small business owners can learn about digital marketing, the use of social networks and electronic commerce. By the end of the programme, participants should understand processes associated with e-commerce such as the use of online platforms.

Source: OECD, Digital Economy Policy Platform (DEPP), edition 12/12/2021, https://depp.oecd.org/

An office for the Portfolio Management of projects is established within the Government Office for Digital Transformation. However, the office will not develop a common cost-benefit approach to prioritize and assess projects. Business support programmes lack an established set of indicators to track both input (spending) and output (effects) of their operation. This lack of benchmarking means that projects are difficult to compare, limiting programme monitoring and evaluation. The government should establish clear priorities and targets, enabling the use of benchmarking indicators for each spending instrument and its achievements to evaluate measures and monitoring programme implementation, allowing programme adjustments if necessary.

The strategy for digitalisation of the economy focuses on supporting firms with their combined uptake of advanced technologies (e.g. AI, IoT, big data analytics, cloud computing, Augmented Reality, Virtual Reality and block chain). Current plans are to finance 20 consortia bringing together large companies and SMEs. However, the economic rationale of providing direct subsidies to larger and well-advanced firms is unclear. There is also a risk of picking winners and losers, instead of favouring uptake of technologies generally among firms. Furthermore, the rationale of setting up consortia to receive funding is imprecise.

In principle, larger firms could enter into partnerships with smaller, less digitalised ones, to transfer technology and knowledge. However, this appears not in the programme's objectives. Better identification of the market failure intended to address, as well as the mechanisms to allocate funding, would allow more efficient spending of resources.

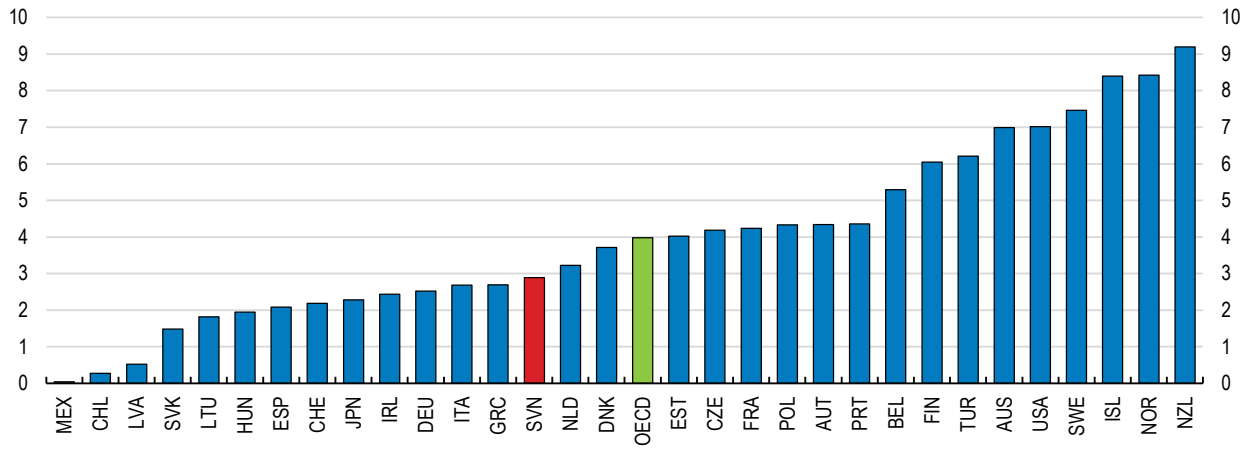
Organising, managing calls for proposals, and running the programme results in higher administrative costs than other forms of business support, such as tax credits. Italy, for instance, is using tax credits (under the plan currently named "Transition 4.0") to incentivise private investment in Industry 4.0 tangibles and intangibles. These credits are higher than the normal ones for equipment, and support training activities to gain or strengthen knowledge of relevant technologies (e.g. big data and data analysis, human-machine interface, Internet of Things, digital integration of business processes, IT security). The programme has had positive results in terms of investment in tangible assets and complementary skills (MEF, 2020[24]). In 2022, the government introduced general tax relief for investment in equipment and intangibles. The government should amend this measure by targeting advanced ICT technologies.

Improving technology transfer and boosting support to the innovation ecosystem

Slovenia is lagging behind in a number of indicators on innovation in the digital field (Figure 1). The quality of the scientific research in computer science is comparable to OECD peers, but only 6.2% of IP5 patents (patents filed in at least two patent offices worldwide, including one of the five largest IP offices) were on ICT-related technologies – less than a third of the OECD average. The ICT sector also spends below the OECD average on Research and Development (R&D) (Figure 14).

Figure 14. Spending in R&D in the ICT sector is lower than the OECD average

Spending in R&D, as % of ICT sector value added, 2017



Source: OECD Research and Development Statistics database.

A major problem for commercialisation of digital innovation is the lack of a supportive environment for public research organisations to bring innovations to the market (OECD, 2012[23]). A particular difficulty is that most of ICT innovations (software) cannot be patented, leaving copyright as the only way to protect them. However, there is no mechanism for researchers to be remunerated for copyright, while they are entitled to receive about one third of income from licensing of a patent. Over the past decade, the technology transfer offices received non-stable funding and were not subject to a government strategy for technology transfers, reducing their effectiveness as intermediaries in the commercialisation of intellectual property rights (IPR) (Stres and Pal, 2020[25]). Until recently, researchers also lacked incentives to create spin-offs. The new Research and Innovation Activities Act, which entered into force in January 2022, allows institutions to become co-owners of spin-offs. However, the process may be quite lengthy and

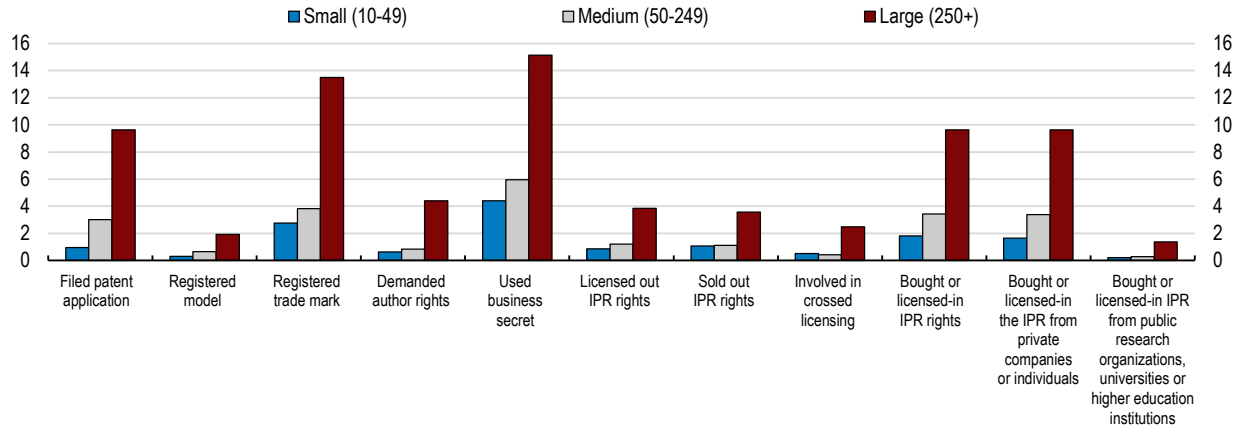
cumbersome, as the organisation needs the consent of the founder of the public research organisation, i.e. the Slovenian government, to establish a company, upon proposal of the board of directors. A more agile process, based for instance on tacit consent after a certain time lag, would help to achieve higher uptake of this measure and simplify spin-off formation from universities.

Many SMEs do not actively search for or explore new production processes and business practices. Less than 6% of SMEs are managing intellectual property rights, a trend that is common to SMEs across OECD countries (Kergroach, 2021[26]). In general, firms, and in particular SMEs, rely very little on intellectual property developed by public research organisations, preferring contract and collaborative cooperation to buying licenses and patent right (Figure 15) (Stres and Pal, 2020[25]). The underlying problem here is that knowledge on digital technologies cannot easily be transmitted, requiring adaptation to each specific application (Guellec and Paunov, 2018[27]). Some countries, such as Belgium, Estonia or Portugal (EC-OECD, 2022[28]), are responding to this need through subsidising innovation vouchers that companies can use to request R&D support from a public research organisation for the development of new production processes or the improvement of existing ones. A similar Slovenian innovation voucher programme was in place in the period 2007-2013 but was discontinued due to budgetary constraints. Such a voucher programme could be re-established to reduce cooperation barriers with academia and increase uptake of digital technologies.

The government is also promoting Industry 4.0, one of the smart specialisation areas defined in the context of the EU cohesion funds. The term refers to the interconnected use of advanced technologies (e.g. IoT, AI, big data analytics, cloud computing, Virtual and Augmented Realities) in production to enable new and more efficient processes and create new goods and services (OECD, 2017[29]). The government has created the Strategic Research and Innovation Partnership (SRIP) Factory of the Future (FoF) as a public-private partnership to develop new products and technologies with higher added value. Such initiatives in other countries also include a demonstration centre, providing an environment for the application and implementation of Industry 4.0 principles technologies, thus facilitating larger deployment in enterprises (Box). A demonstration centre for Industry 4.0 would allow enterprises to access new technologies and practical training as well as testing R&D knowledge in a real industrial environment, thus spurring higher uptake and innovation.

Figure 15. SMEs rely very little on IPR developed by public research organisations

As % of total firms in the firm's class, 2016-2018



Source: Statistical Office of Slovenia.

Box 2. Demonstration and testing facilities for digital technologies

Some countries have established new facilities for demonstration and testing of digital technologies to increase adoption. For instance, the SME 4.0 Competence Centres in Germany offer SMEs access to demonstrations of Industry 4.0 technologies and sector-specific applications (e.g. 3D printing, sensors). These demonstration facilities are often located at universities and allow simulation of business and production processes in a similar to real-world environment.

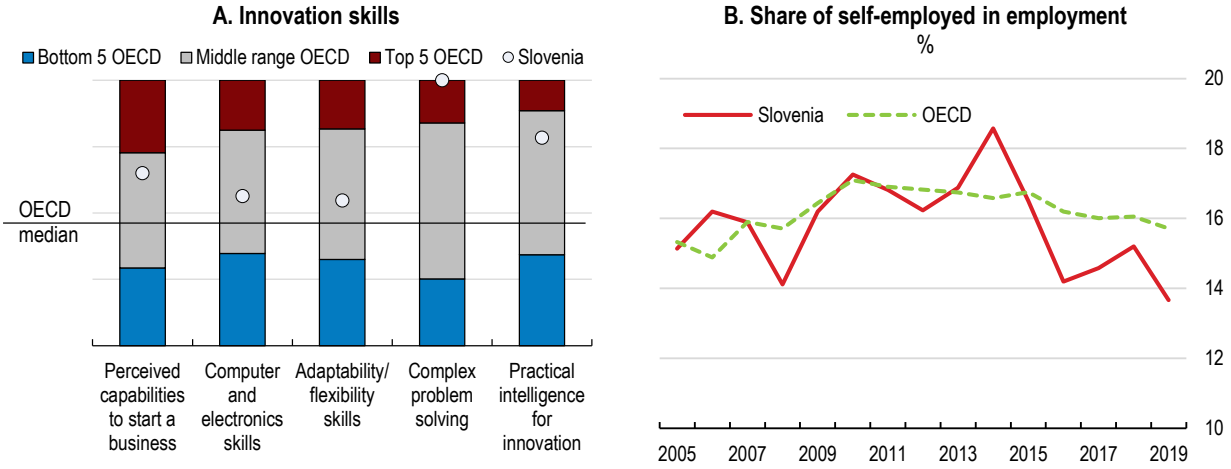
The Industry Platform 4 FVG, established in the Italian region of Friuli Venezia Giulia, offers access to testing equipment, prototyping tools and demonstration labs.

Several Austrian universities (TU Wien, TU Graz and Johannes Kepler University Linz) have also set up pilot factories, where SMEs have the chance to test new technologies and production processes without affecting production in their own facilities.

Source: OECD (2019), *Digital Innovation: Seizing Policy Opportunities*, https://doi.org/10.1787/a298dc87-en

Firm creation is relatively slow, although the population has the required skills to start a business, leading to a nearly 10% lower share of start-up firms (up to 2 years old) in the business population than the OECD average (Figure 16). A number of institutions are in place to support innovative start-ups, with the universities of Ljubljana and Maribor having technology parks and incubation programmes for start-ups (Box). Several other accelerators (ABC Accelerator), start-up schools and local incubation programmes exist in the country, supported by private and public funding.

Figure 16. Slovenians have innovation skills, but the share of self-employed is lower than in the OECD



Source: OECD (2021), OECD SME and Entrepreneurship Outlook 2021, OECD Publishing, Paris, https://doi.org/10.1787/97a5bbfe-en.

Box 3. Higher Education Institutions' entrepreneurship education for SMEs

The 2021 OECD review of the higher education institutions' support of innovation and entrepreneurship found that their entrepreneurship education was an important element in the government's entrepreneurship support (OECD/EU, 2021[30]). A key development was the 2020 establishment of a Strategic Council for Entrepreneurship in Education to bring together researchers and representatives from the private sector to formulate an action-plan to develop entrepreneurship education across all levels of education, including life-long learning training.

In 2017, performance-based funding was introduced, amounting to 3% of the total public funding of higher education, to stimulate collaboration activities in higher education. In addition, many HEIs have created technology transfer offices (TTOs) and research centres to support innovation and knowledge transfer (for instance in the Universities of Primorska and Ljubljana). Moreover, such offices and centres represent learning opportunities for researchers to develop cutting edge-technology to respond to the needs of industry. In addition, a knowledge and technology transfer (KTT) consortium (2017-2022) was created to associate TTOs from public universities and research centres to offer a pool of technologies and products to private companies. A further step to stimulate research and knowledge transfer involves internationalisation of the higher education system, although the number of international students and lecturers remain relatively low.

Education of entrepreneurship takes various forms. Higher education institutions are increasingly developing courses and organising extra-curricular activities (such as festivals) to foster students' entrepreneurial mind-sets. The latter encompasses soft and technical skills to allow creative problem-solver individuals to operate in complex contexts that helps individuals cope with globalisation and digitalisation. Entrepreneurship education connects to different objectives. While generating start-ups is always a popular objective, entrepreneurship training is delivered also in life-long learning activities (such as GEA College, a private HEI whose Centre for Vocational Schools delivers entrepreneurship courses). In addition, entrepreneurship education is tailored to prepare individuals that will work in local SMEs and/or take over a family business. Entrepreneurship education is also connected to digital research and teaching. For example, the University of Primorska's HICUP Lab (Humans Interacting with Computers) hosts a group of international researchers working on making digital resources more interactive and profitable for users.

A number of challenges remain. Funding was found to be too low to boost cutting-edge research, knowledge transfer and entrepreneurship development. Moreover, long-term funding mechanisms are lacking as most current funding is for time-limited projects and based on competitive bidding for grants allocated by the government, the EU, private donors. Perhaps more problematic, there are few incentives for researchers and teachers to carry out knowledge transfer activities as these are not recognised in HEI employees' job description or through remuneration and promotion criteria. Another area of concern is the lack of a national evaluation system to measure research impact and knowledge transfer activities as found in Australia, Italy, the Netherlands, and the United Kingdom. Even at the local level, such evaluation is limited, as most HEIs do not track progress in these areas. The exception is the University of Ljubljana, which has developed some key performance indicators to track the achievement of knowledge transfer objectives and start-up development (such as number of spin-offs, number of start-ups, patents, and license created).

Going forward, the government should increase performance-based funding, while requiring all HEIs to develop evaluation systems, which could be used for national assessments. Staff engagement could be promoted by considering knowledge transfer as criteria for evaluation, promotion and remuneration.

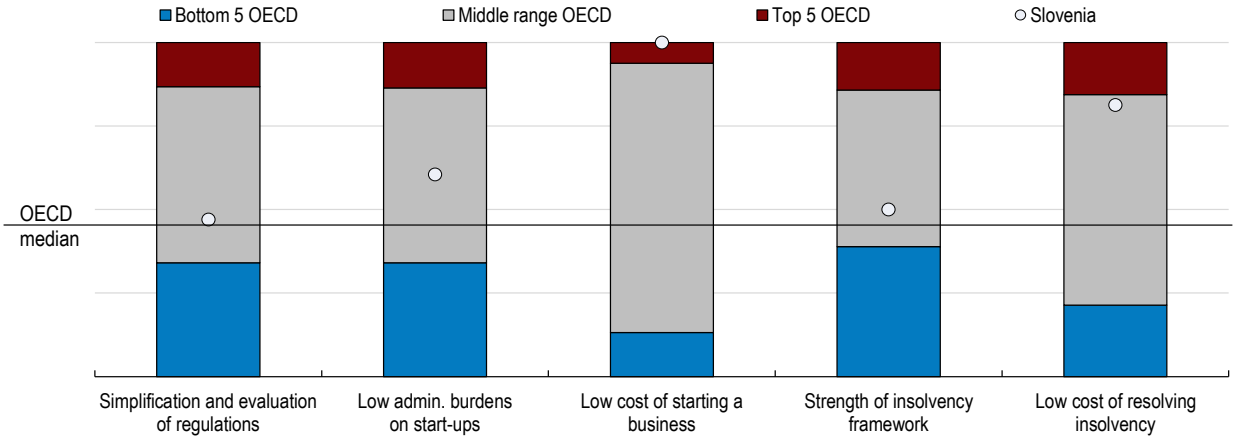
The government's Action Plan Slovenia - the Land of Innovative Start-up Enterprises identifies talent attraction as one of the main obstacles for further developing the start-up ecosystem (Ministry of Economic Development and Technology, 2018[31]). The high tax burden on labour increases barriers to young

innovative enterprises to hire high-skilled workers, putting Slovenia at a disadvantage in the global race for digital talent. Internationally, high-tech start-ups often use stock incentives schemes to recruit and retain talent. However, the lack of capital gains taxation means that exercised stock options are taxed as personal income. This typically means that the highest marginal tax rate is applied. In contrast, if the workers were remunerated with the same amount in the form of wage income over a number of years, the average tax rate would be lower. Thus, stock options could be treated as wage instalments (Demmou and Franco, 2021[32]). In 2020, France introduced changes to stock option rules, including introducing friendlier taxation for stock options granted by non-French issuing companies, and with a flat tax 30% applying to income from capital and an employer social security contribution rate of 7.5% of the initial value of the share option. Likewise, Slovenia could introduce capital gain taxation with the possibility of favourable treatment of stock options, while ensuring that tax planning and arbitrage opportunities are not created.

The business environment is in many respects favourable (Figure 17). The one-stop-shop business Point SPOT provides all the information related to setting up and operating a business for EU, EEA and Swiss entities. Any EU citizens online can carry out the registration of a sole trader or a single-member limited liability company, but legal and organisational forms that include multi-member limited liability companies require founders to appear before a notary. Recapitalising a company also requires investors to be physically present. Such barriers reduce investment incentives. To increase the attractiveness to foreign firms and investors the need for in-person verification should be replaced by an eNotary function that allows online registering.

Figure 17. Further progress could be made to ease the regulatory burden on entrepreneurs

Entrepreneurship regulatory framework, benchmark index



Source: OECD (2021), "Sources of SME&E resilience in Slovenia", in OECD SME and Entrepreneurship Outlook 2021, OECD Publishing, Paris, https://doi.org/10.1787/5a4a6e0d-en.

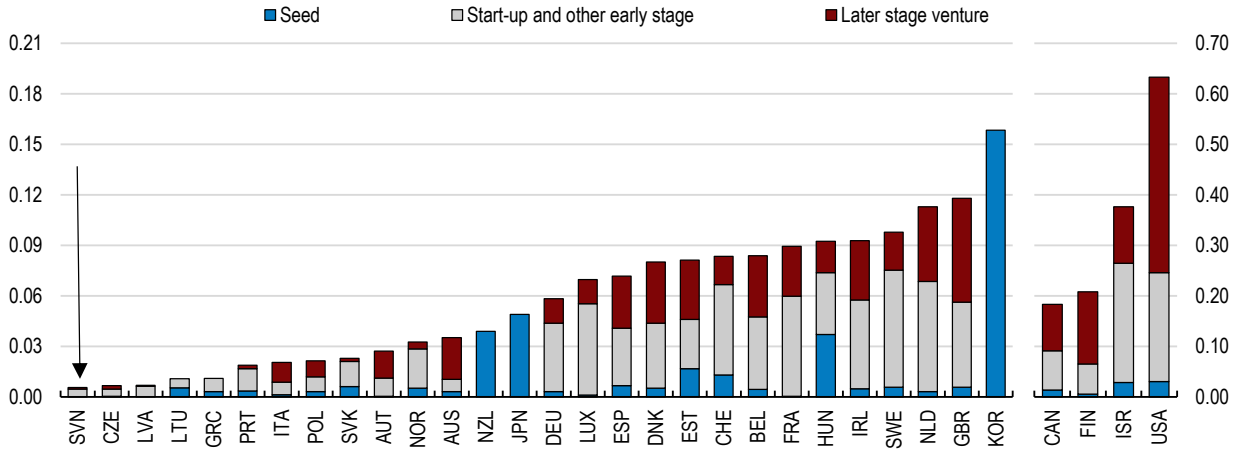
One of the largest challenges for establishing a new business is access to finance. Bank financing constitutes almost the exclusive source of external funding for SMEs (EIB, 2021[33]). Stock market capitalisation and venture capital (VC) investments remain among the lowest in the EU and OECD (World Bank, 2022[34]) (Figure 18).

The government, through the Slovene Enterprise Fund, provides financing at favourable conditions to micro, small and medium-sized enterprises, through guarantees for bank loans with interest rate subsidies. In addition, a variety of programmes support young enterprises (start-ups) in different development stages. These include grants for innovative start-ups and seed capital in the form of convertible loans and equity investments, as well as an equity financing for fast-growing innovative start-ups (Slovene Enterprise Fund, 2022[35]). However, high-risk financing for later stages of growth is largely absent. In the UK, the Seed Enterprise Investment Scheme (SEIS/EIS) provides tax reliefs to individuals who invest in certain companies, social enterprises, or Venture Capital Trusts (UK Government, 2022[36]). Spain has also

introduced a reduction in the corporate tax rate for venture capital companies and exemptions from capital gains for those investing in smaller, younger and unlisted firms (OECD, 2021[37]). Following these examples, Slovenia should introduce tax deductibility of start-up and growth financing for innovative start-ups and SMEs. Other options to bolster finance for start-ups include increased entry of Fintech companies.

Figure 18. Venture capital investments are very low

Venture capital, as % of GDP, 2020 or latest available year



Note: For Korea, Japan and New Zealand, breakdowns of venture capital by stage are not available.
Source: OECD Entrepreneurship Financing database.

Increasing availability and uptake of digital services

Digital government is a cornerstone in the government's effort to digitalise the economy (Box). Slovenia performs slightly above the OECD in the development of digital government, scoring well in the provision of open data (OECD OUR Data Index), but lagging behind in data-driven orientation (Figure 19). The latter could be instrumental in using data to anticipate and respond to the needs of users to help deliver better services and policies. This could be supported by better promotion of data integration, access, sharing and use across the public sector (OECD, 2020[38]).

Box 4. Digital government can be further improved

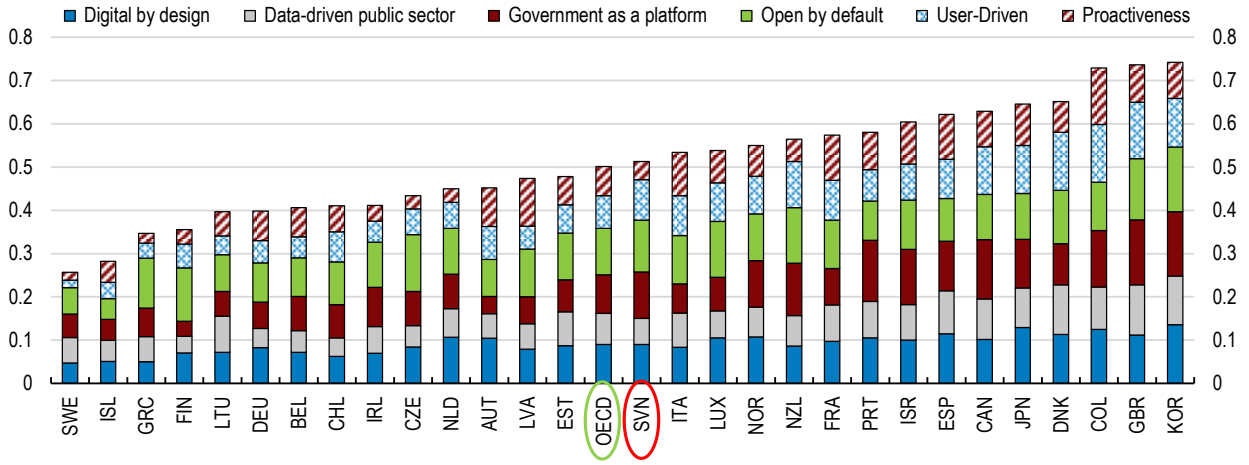
The 2021 OECD review of digital government in Slovenia identified an ongoing commitment for using digital technologies and data to provide more effective and efficient public services, putting the country above the OECD average for both Digital Government (15th) and Open Government Data (10th) (OECD, 2020[39]; OECD, 2020[40]; OECD, 2021[41]). Other important achievements include consolidating central government websites into GOV.SI (https://www.gov.si) as the primary destination for information, and eUprava (https://e-uprava.gov.si) as the main entry for accessing public services. In addition, the growing maturity of tools to manage digital identity was critical in enabling increasing numbers of citizens to access the services they needed when the COVID-19 pandemic made online channels the only option. Finally, the public sector has made great strides in the access, sharing and use of data. This is reflected in efforts made to foster a strategic approach towards publishing Open Government Data (*Odprti Podatki Slovenije OPSI*, https://podatki.gov.si) as well as the development of the infrastructure to support data interoperability within government, in the form of the common application building block TRAY *(Skupni aplikacijski gradnik Pladenj*).

As a new digital government strategy is being prepared, the greatest challenge is to ensure a consistently high level of digital government maturity throughout the public sector. The OECD's Recommendation on Digital Government Strategies (OECD, 2014[42]), Digital Government Policy Framework (OECD, 2020[43]) and the recommendations contained within the Digital Government Review provide the basis for identifying the following priorities:

- Secure consensus in the creation of the new strategy among the most relevant actors (the Ministry of Public Administration and the newly formed Government Office for Digital Transformation) as well as throughout public sector institutions to ensure that the strategy is a collective endeavour with shared responsibility and sense of ownership.
- Support the new strategic efforts with the renewal of oversight of digital government procurement, delivery and design through, for example, standardising business cases or assuring quality against commonly agreed quality standards to help encourage collaboration, avoid duplicated effort, and solve cross-government challenges.
- Develop a people-centred service design culture throughout the ecosystem for designing and delivering public sector services to ensure greater consistency in the approaches and capability between different organisations and suppliers. Creating working environments that encourage digital transformation require strategic approaches to: leadership for championing user needs; organisational redesign for encouraging more flexible working; job families to distribute decision making; and training activities to equip all public servants with the core skills identified by the OECD as being necessary to support digital government (OECD, 2021[44]).
- Promote a comprehensive approach towards data management in the public sector that aligns with the OECD Framework for a Data-Driven Public Sector (OECD, 2019[45]) to ensure the governance and application of public sector data can unlock its full potential in contributing to proactive, seamless and above all, trusted, public services. Leadership is again particularly important both from the centre in the form of a Chief Data Office(r) but also at the level of public institutions through the identification of data stewards and resourcing of dedicated teams.

Figure 19. Digital government is average

OECD Digital Government Index, 2019, score 0 (worst) to 1 (best performer)



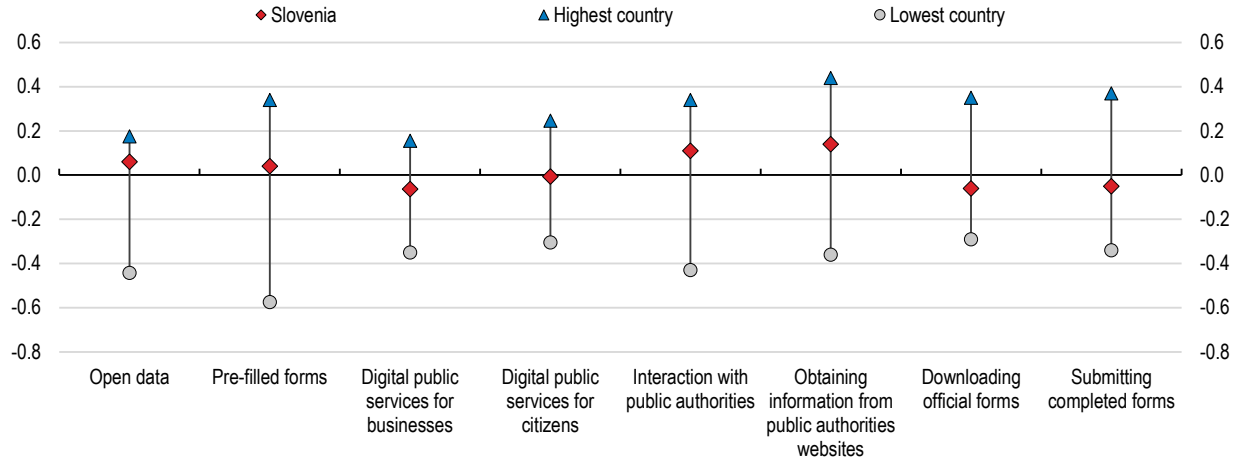
Note: Data are not available for Australia, Hungary, Mexico, Poland, Slovakia, Switzerland, Türkiye and the United States.
Source: OECD Survey on Digital Government 1.0.

The use of the Internet to interact with and obtain information from public authorities is commonplace. However, the share of users downloading and submitting forms through the Internet is below the EU average and far from the best performing countries (Figure 20). The migration to a single government platform GOV.SI is expected to simplify the user experience of accessing services. Nonetheless, user experience is impaired by the silo approach across government in the provision of digital services. Joined up services from different silos can result in savings for the public administration and for citizens, as shown by the electronic sick leave scheme (eBOL). Since February 2021, doctors share the eBOL with employers through the business portal SPOT. Employees do not receive paper forms, nor have they to share them with the employers, and have access to their own data through the portal of the Health Insurance Institute. This has resulted in estimated annual savings of EUR 11.5 million. In general, the scope for digitalisation in the health sector can be exploited further (Box).

The public administration has a common building block (TRAY platform) for electronic data enquires and collection from heterogeneous data sources, but several public organisations responsible for primary registers do not use it. The Financial Administration, for instance, has its own process for exchange of data with other bodies in the public administration. Improving data infrastructure and standardisation is a key factor to increase interoperability between databases and exchange of data among bodies of the public administration (OECD, 2021[41]).

Figure 20. Availability and use of digital public services can be further improved

EU = 0



Note: Open data is a composite indicator which measures to what extent countries have an open data policy in place, the estimated political, social and economic impact of open data and the characteristics (functionalities, data availability and usage) of the national data portal. Pre-filled forms (score 0-100) is the amount of data that is pre-filled in public services' online forms for the life events included in the scope (Regular business operations and Business Start-up, Moving, Owning and driving a car, Starting a small claims procedure, Family, Career and Studying); Digital public services for citizens (score 0 - 100) indicates the share of administrative steps that can be done online for major life events for citizen (Regular business operations and Business Start-up, Moving, Owning and driving a car, Starting a small claims procedure, Family, Career and Studying) birth of a child, new residence, etc.); Digital public services for businesses (score 0-100) broadly reflects the share of public services needed for starting a business and conducting regular business operations that are available online for domestic as well as foreign users. Indicators on use are expressed as a percentage of individuals.
Source: DESI (2021), individual indicators, https://digital-agenda-data.eu/; Eurostat Digital Economy and Society database, https://ec.europa.eu/eurostat/web/digital-economy-and-society.

The General Administrative Procedure Act prohibits administrations to ask citizens for the same information if data is already available in the competent agency. However, only guidelines for information solution development covering the Once-Only-Principle (OOP) are in place. Introducing compensations for households that have to provide data more than once would provide incentives for the administrations to apply the OOP more stringently.

Box 5. Digitalisation in the health sector needs a long-term strategy

There is a relatively large scope for digitalisation in the health sector and an ambitious e-Health programme has been in place over the last five years to improve service quality, integrate the existing disparate health information systems across the health care system and capture and optimize the use of enhanced health data. However, the e-Health programme lacks in comprehensiveness. For example, telemedicine is underdeveloped and which uses digital technologies to provide remote delivery of health care services. Such as allowing healthcare providers to evaluate, diagnose and treat patients without the need for an in-person visit, creating the opportunity to cut costs and save time for both providers and patients. However, such services are rarely reimbursed by the health insurance.

TeleKap (Telestroke) is among the few telemedicine programmes covered, which. contributes to the treatment of stroke. The system operates through audio-video conferencing in 12 hospitals and enables immediate treatment of patients, even in hospitals where the neurological service is not available, and is often decisive for a better outcome of this acute disease. Since 2021, telemonitoring of COVID patients is also reimbursed by the health insurance. Despite the potential cost savings and efficiency gains, most telemedicine services are not covered in the compulsory health insurance from the Health Insurance Institute of Slovenia (ZZZS) or are not fully developed.

The eConsultation (ePosvet) provides for electronic communication between healthcare professionals, family doctors and specialist. The service enables consultations between general practitioners and medical specialists about a specific patient, leading to gains in terms of reducing waiting periods and expending treatment processes. However, the eConsultation does not allow the patient to have direct contact with healthcare professionals. (DIGIT ZDRAV).

Another example of e-Health services with further development potential is the zVEM portal and its mobile application, which provide patients with full access to their healthcare documentation, referrals, appointments, prescriptions and records of medication dispensed, but does not provide access to their information about compulsory health insurance and complementary, voluntary health insurance. Such information is provided by ZZZS online. Incorporating health insurance in the ZVEM portal would create a “one-stop shop” where patients could book appointment and communicate with doctors as well access eBOL (electronic sick leave certificates) and other ZZZS documents online. Thus, to fully exploit the scope for digitalisation in the health sector, funding should be expanded to other e-health services and health technology assessments should be used to identify suitable e-health services to be eligible under the health insurance.

More broadly, there is a need for a comprehensive long-term digital health strategy to enhance cooperation among stakeholders and provide clear priorities and objectives.

About 38% of individuals not using government digital services state that they do not have to submit forms to authorities online, a much higher share than in other EU countries. This lack of need reflects that most public services are still provided in traditional forms. Moreover, when such services are offered digitally, there is no obligation or incentive for citizens to use them, reflecting an essentially opt-in approach. For example, in the personal income tax system, taxpayers receive as a default pre-filled personal income tax declarations by mail and return it as well by post. Only a third of taxpayers use the online possibility for their tax declarations, and only a quarter the mobile app developed by the Financial Administration. In contrast, businesses have the obligation to submit their tax declarations online through the national electronic tax management system (eDavki). Likewise, businesses are required to send invoices to the public administration entities only through electronic means. Moreover, all communication between government bodies is being switched to e-communications.

The recently adopted Debureaucratisation Act introduces the possibility for citizens to provide their email address and telephone number on a voluntary basis to receive government communications electronically,

including the possibility for replacing the current use of physical letters for the tax declaration with electronic communication. The coexistence of physical and digital government services increases cost of provision. Efficiency gains would increase with the share of the population only using digital government services. Moving from the opt-in approach to an opt-out approach in digital government services, progressively within a set schedule, would nudge a greater use of digital services. Such a shift would need to be accompanied by the provision of support and training to help the less digitally skilled part of the population. For example, Latvia promotes digital literacy among adults through the network of public libraries, which act as free Internet access points and centres for the development of basic digital skills (OECD, 2021[46]). This could be combined with introducing advantages for those using digital services to further incentivise uptake. In France, individuals that submit their tax declarations online benefit from automatic filling and calculations, and for a longer period of time for returning their forms.

Increased use of digital government services requires standardised electronic identification (e-ID). At present, a common national electronic identifier is lacking. Electronic identification is provided by private and public sector actors (Box). The government's SI-PASS is available on over 45 different websites. However, only 35% of public institutions use it. In addition, 7% of public institutions use their in-house developed solution (OECD, 2020[38]). For instance, the Ministry of Financial Administration recently released its own mobile application, adding to its existing mobile identification method. Fragmentation and legacy issues have to be solved to have a single national electronic identifier (OECD, 2021[41]).

Box 6. Electronic identification (e-ID) means in Slovenia

Currently, three e-ID means are in use:

- SI-PASS: a single account enabling online registration for a number of different electronic service providers and electronic signing of applications and other documents.
- Mobile identity smsPASS: a way of logging in to SI-PASS, based on two-factor authentication of the user that provides his or her unique identification, enabling electronic signing of documents and reliable identification of the user when using e-services
- Qualified Digital Certificates, issued by four different providers:
    - SIGEN-CA (for individuals and businesses); SIGOV-CA (for civil servants), issued by SI-TRUST, the National Trust Services Center of Slovenia (within the Ministry of Public Administration);
    - Posta@CA (issued by Pošta Slovenije);
    - AC NLB (issued by Nova Ljubljanska Banka);
    - Halcom CA (issued by Halcom).

The three e-ID means enable access to online services on the eGovernment portal (e-uprava.gov.si).

In order to use SI-PASS, the user needs to have an account on the SI-PASS website. This, together with a valid SIGEN-CA digital certificate or smsPASS mobile identity enables to access government services. SI-TRUST manages SI-PASS and issues smsPASS mobile identity certificates.

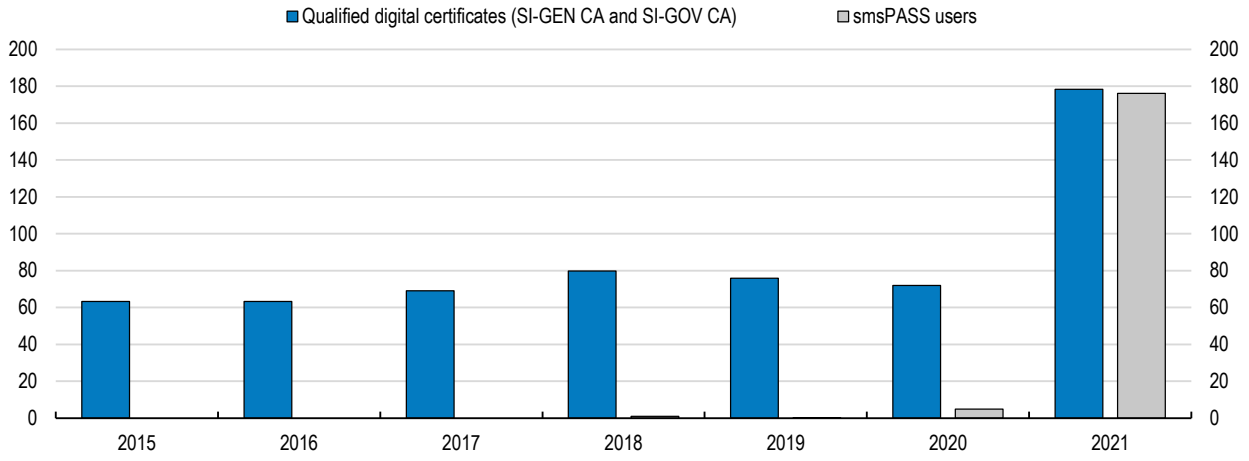
The new national biometric identification card, which was launched in March 2022, will serve as electronic identification to authenticate via SI-PASS.

Delays in adopting electronic identification and the fragmented offer have resulted in limited uptake of electronic identification. Indeed, only a fifth of the population uses the SI-PASS, even as the possibility to retrieve COVID-19 certificates online boosted the uptake of the SI-PASS (Figure 21). To obtain an electronic identity (activate the SMS Pass or a digital certificate), citizens need to visit an administrative unit or other registration point, creating an obstacle for adoption. For example, during the COVID-19

pandemic citizens needed the SI-PASS to access their health data on the zVEM digital health (ezdrav) portal, but despite additional registration capacity, the demand surge led to a backlog of applications. Electronic identification needs to rely on secure identification, but other countries do so via electronic means. In Italy, for instance, the national e-ID (SPID) can also be obtained through a video call with an authorised operator. In the same vein, Slovenia should replace the need for physical authentication with electronic methods.

Figure 21. The pandemic has triggered a quicker uptake of electronic identification means

Number of qualified digital certificates issued and new SmsPASS users, thousands



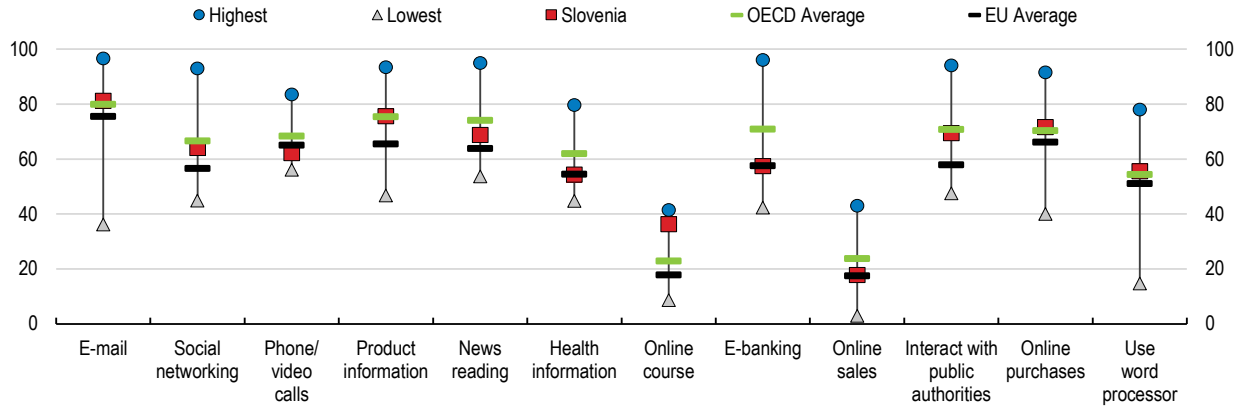
Source: Ministry of Public Administration of Slovenia.

Improving skills and the labour market for the digital transformation

Like their OECD peers, Slovenians use the Internet for a variety of purposes, although comparatively less for phone and video calls and e-banking (Figure 22). Among those not using the Internet, lack of digital skills is the third most cited reason, after lack of need and interest. Close to 18% of people that do not shop online express concerns about the security of online payments or privacy (e.g., the provision of credit card information or other personal data), also pointing to limited familiarity with the digital environment.

Figure 22. Slovenians have a varied use of the Internet, although they lag behind in e-banking use

As % of all individuals aged 16-64 years-old, 2021 or latest available year

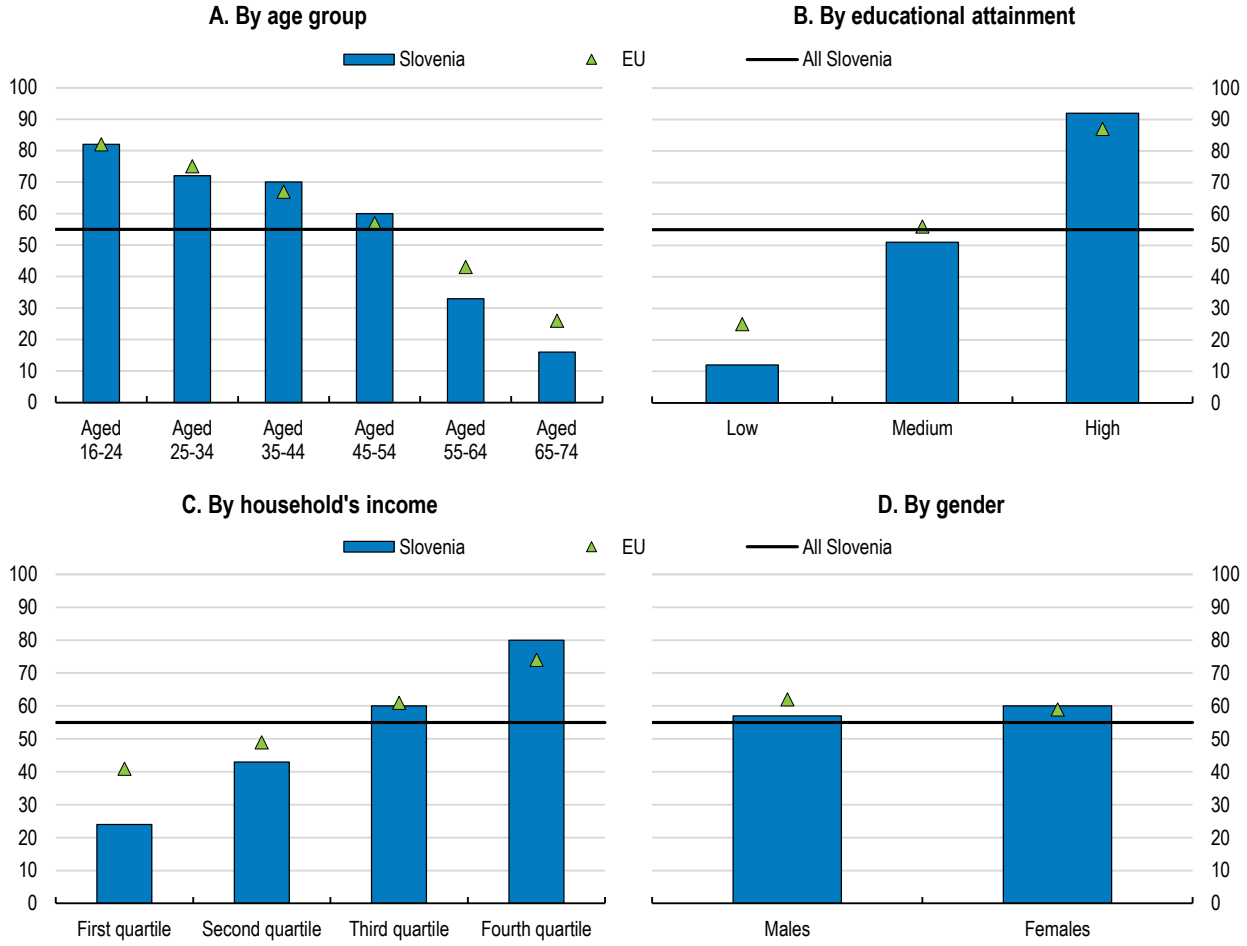


Source: OECD ICT Access and Usage by Households and Individuals database, http://oe.cd/hhind.

Nearly half of the working age population lacks basic digital skills, a share that is below the EU average (Figure 23). Persistent disparities in Internet use reflect socio-economic and demographic conditions. The low-skilled and the inactive (retired or other inactive) are particularly at risk of digital exclusion. Internet use does not differ much by gender; although for lower levels of education females have lower usage than males. The youngest, the highly educated and those with higher incomes have rates of digital skills that are in line with the EU average. Individuals with a well-rounded skill set in terms of literacy, numeracy and problem solving in technology-rich environments can be expected to use digital tools more efficiently, carry out more sophisticated activities online and better adapt to digital transformation (OECD, 2020[47]). Nevertheless, data from the Programme for the International Assessment of Adult Competencies (PIAAC) show that Slovenians lack these foundational skills, as the large majority of adults have low proficiency in problem solving in technology-rich environments (see above).

Figure 23. Digital skills are low among people with low income and low education

% of individuals who have basic or above basic overall digital skills, 2019



Note: Data by educational attainment and by gender refer to individuals aged 25-64.
Source: Eurostat.

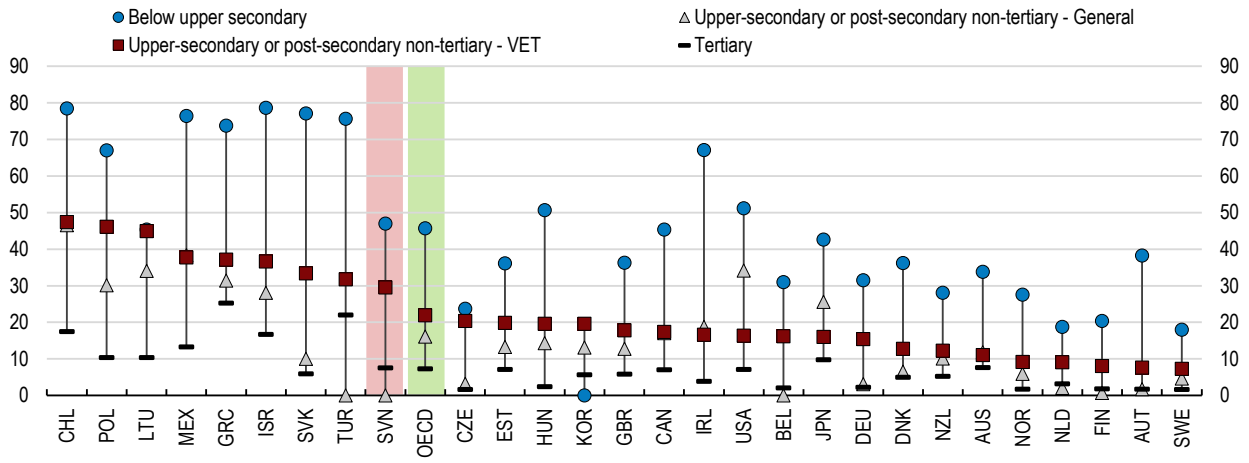
In February 2022, a Digital Inclusion Promotion Act was adopted and which aims to raise the share of the population (aged between 16 and 74) with basic digital competences from the current 55% to at least 80% by 2028. The Act provides vouchers for the purchase of ICT equipment to three groups of the population: individuals over 55 enrolled in non-formal education programmes to acquire basic digital competences, all high school and higher-education students as well as pupils in the last three years of primary school. The

Act also includes the provision of non-formal education programmes on basic digital skills for individuals over 55 and on advanced digital skills– mostly programming, artificial intelligence etc. - for all students. Promotion campaigns to stimulate acquisition of digital competence and occupation in ICT-related jobs will also be undertaken. While subsidising the purchase of ICT equipment and providing training on digital skills are useful measures, their effects should be closely monitored so as to ensure that less skilled individuals, who are less likely to enrol in training programmes and less capable to use digital technologies effectively, can benefit from these programmes. More generally, the mix of skills required in the digital society is wide-ranging, including among others, foundational numeracy and literacy skills, problem-solving skills and ICT skills, pointing to a need for the education system to better integrate the use of digital solutions in the teaching of pupils. A third of VET graduates lack solid digital problem-solving skills.

A third of young adults with upper secondary or VET qualification have weak digital problem solving skills, i.e.: the ability to access and interpret information in digital environments to perform practical tasks. This share is much higher than for those with a tertiary education (Figure 24). The VET sector is relatively large: 71% of upper secondary students pursue the vocational or technical track, against an OECD average of 42% (OECD, 2020[48]). Thus ensuring that all those leaving the VET system have the skills to thrive in a digital world is essential. Tertiary education offers additional skills development to some VET graduates: 35% of technical or vocational graduates enter short-cycle tertiary education. The share of those progressing to bachelor programmes is unknown, but close to half of bachelor level students have a VET background. However, VET graduates who do not enter tertiary education or drop out (two third of bachelor students with a VET background fail to graduate within three years after the theoretical duration of the programme) are left poorly prepared for succeeding in digital environments.

Figure 24. Young workers with VET qualifications have weaker digital problem solving skills

% of individuals aged 16 to 34 performing at PIAAC level 1 or below in problem-solving in technology-rich environments, by level and orientation of educational attainment



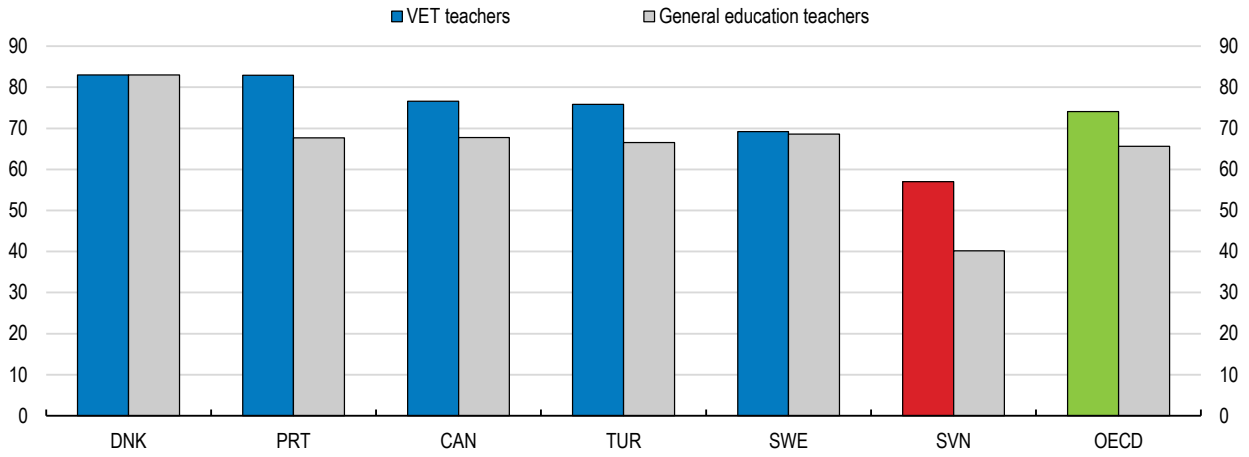
Note: Includes individuals aged 16 to 34 not in formal education. General and VET refer to upper-secondary or post-secondary non-tertiary education levels. Belgium refers to Flanders only, the United Kingdom to England and Northern Ireland. At or below level 1 in problem-solving includes adults with no computer experience and adults who failed the ICT core test.
Source: (Vandeweyer and Verhagen, 2020[49]) using data from the Survey of Adult Skills (2012, 2014, 2017).

Basic education is designed to develop generic digital competences and VET is expected to enrich these with subject-specific digital competences. However, the 2018 TALIS survey shows that VET teachers lag behind other countries in how much they let their students make use of ICT for coursework (Figure 25). The survey also found that 35% of VET teachers felt that were able to support their students learning through the use of digital technology only “to some extent” or “not at all” (OECD, 2021[50]). The COVID-19 crisis has given a new push for the use of digital tools, imposing the widespread use of distance learning

across the education and training system. There is now an opportunity to continue and further enhance the use of these tools, and address obstacles that prevent their widespread use. VET teachers should receive targeted technical support and training to be able to make full use of the potential of digital technologies in VET instruction. Denmark, for example, has established dedicated support centres to help VET teachers increase the use of technology in teaching (Box 7).

Figure 25. VET teachers make relatively limited use of technology

% of upper-secondary education teachers who let their students use ICT for projects and classwork "frequently" or "always"



Note: VET teachers are those who reported in TALIS that they were teaching practical and vocational skills in the survey year in upper secondary programmes (ISCED 3), regardless of the type of school where they teach. The reported average corresponds to the unweighted average for the six OECD member countries/regions in the sample.
Source: (OECD, 2021[50]) using TALIS 2018 data.

Box 7. Specialised centres to promote technology use in VET in Denmark

The "Knowledge Centre for IT in Teaching" promotes the use of digital technologies in VET by supporting teachers in the use of IT across all subjects. The centre also provides professional development for VET teachers, covering both theoretical and practical elements. The centre also has a network of pedagogical staff and a network of school leaders to facilitate the exchange of ideas, practical and technical knowledge, and help identify solutions to common challenges.

In addition, the government created two Knowledge Centres for Automation and Robot Technology, promoting innovation in education and industry and helping VET schools make use of advanced technologies. Each centre works with over a dozen nearby VET schools. They provide teachers with material, such as teaching tutorials or short courses in Industry 4.0 and robots. Specialised facilities in the centres demonstrates to teachers and students the use robots in workplaces.

The centres lend digital machinery to VET teachers, provide them with training materials, and technical support with the objective of enabling teachers to set up and operate these technologies and incorporate them into their teaching practice. The centres also provide technological resources for VET programmes in the areas of industrial automation, mechanics, electronics, welding, data and communication, and education.

Source: (OECD, 2021[50])

2.1. VET students in work place training have access to the latest technologies used in industry, helping them develop more advanced and applied digital skills, complementing basic skills developed in the

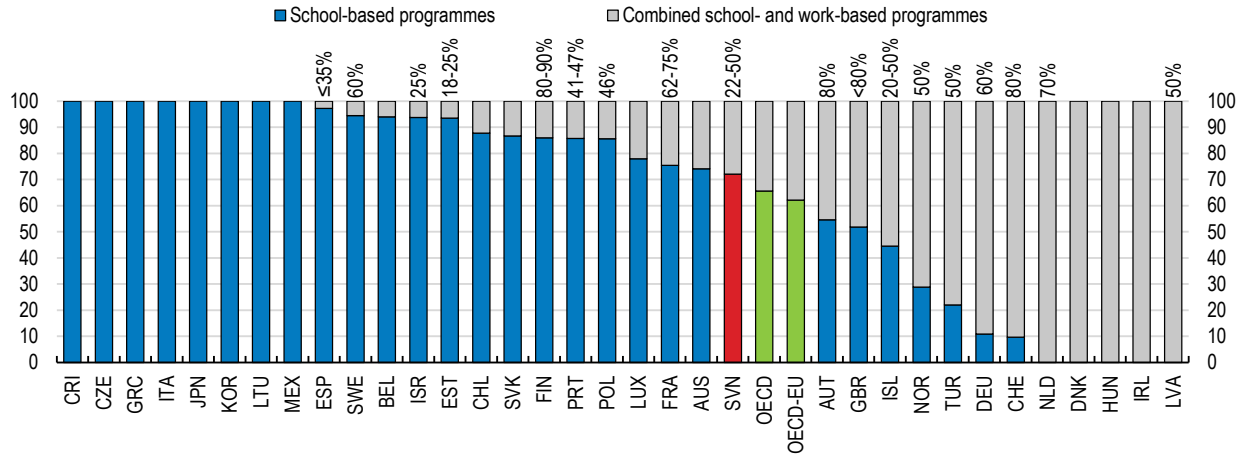
school-based part of VET. In addition, they can learn from professionals skilled in the use of those technologies and learn in real work situations. Admittedly, companies vary in their use of digital technologies. Nevertheless, building on the existing capacity in companies to train VET students is likely to be more efficient than replicating digital tools and work situations at schools. Schools tend to struggle to attract professionals acquainted with currently used technologies and hire them as teaching staff. Bringing students to workplaces, allowing them to learn from their colleagues helps solve that problem.

The potential of work-based learning as a vehicle for the development of digital skills remains unexploited. The use of work-based learning in technical and vocational programmes has increased, but only a quarter of upper-secondary VET students are in programmes with a substantial work-based component (i.e. accounting for at least 25% of the programme duration) (Figure 26). This is much lower than in countries with strong apprenticeship systems, such as Germany and Switzerland. The proportion of time spent in work-based learning in VET programmes with substantial work-based learning averages 22-50% against 60% in in Germany, 80% in Switzerland.

For the vast majority of upper-secondary vocational students work-based learning involves 24 weeks of placement over three years. In technical upper secondary programmes, work-based learning is much shorter: eight weeks over four years (OECD, 2020[51]). In addition, disruptions due to the COVID-19 pandemic have deprived nearly a quarter of students from benefitting from work-based learning (OECD, 2021[52]). The introduction of apprenticeships in 2017 is a welcome development. Nonetheless, the sector remains small with around 1% of vocational students pursuing this route, which remain limited to a small set of "traditional" vocational occupations (e.g. electrician, carpenter or toolmaker). Extensive work-based learning should be developed in all vocational and technical programmes, including those in highly technical areas that make use of digital skills.

Figure 26. VET students have limited access to work-based learning

Distribution of upper secondary VET students by type of vocational programme, %, 2018



Note: Full- and part-time students enrolled in public and private institutions. Figures on top of the bars refer to the most typical duration of the work-based component as a percentage of the total programme duration for combined school- and work-based programmes.
Source: (OECD, 2020[48]).

Technical programmes target occupations that are likely to use digital skills (e.g. electro-technician, computer technician). Apprenticeships were traditionally rooted in skilled trade and craft occupations in many countries, but international experience shows that it is possible to expand the approach well beyond. Countries, like Switzerland, that make extensive use of apprenticeships have successfully diversified its coverage (Box 8). For example, in Germany the most popular apprenticeship occupations are in the management and retail sector (BIBB, 2021[53]). Slovenia should introduce apprenticeships in technical

programmes to develop digital skills among VET students. Given the time involved in introducing and scaling up new apprenticeship programmes, such a measure should be combined with increasing the duration of the existing work-based learning component in technical programmes.

Box 8. Switzerland: a large and diversified apprenticeship system

Upper secondary level apprenticeships are offered in a diverse range of occupations in Switzerland. Programmes have diversified beyond fields traditionally targeted by VET (like construction and manufacturing), into all economic sectors. For example, programmes are available in commercial areas (e.g. salesperson, office assistant), healthcare (e.g. medical assistant), culture and media (e.g. interactive media designer), and transport and logistics (e.g. logistician).

Several apprenticeships are available within the field of ICT and "Information technologist" was the 5th most popular apprenticeship occupation in 2021. Other target occupations in ICT include ICT technician, ICT system operator and mediamatics technician. Upon qualification, various learning opportunities are available at tertiary level: pursuing a professional examination after obtaining several years of work experience (targeted titles include cyber security specialist and ICT manager) or studying for a bachelor's degree (e.g. informatics, business informatics) at a university of applied sciences or university.

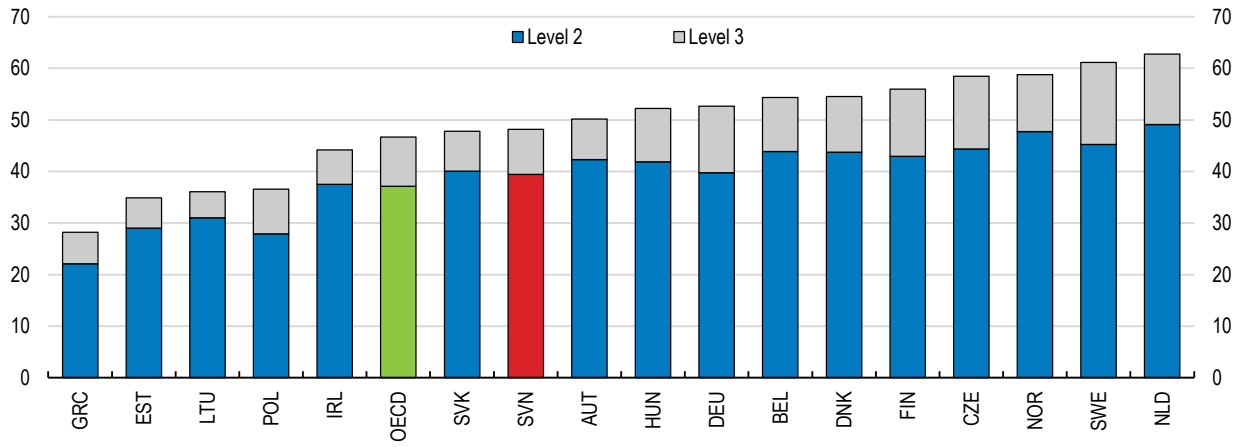
Source: (SBFI, 2021[54]) (SDBB, 2022[55])

Higher education could foster digitalisation

The higher education system equips graduates with basic digital skills that are broadly comparable to their peers in EU countries (Eurostat, 2022[56]). A similar picture emerges from the OECD Survey of Adult Skills that shows that half of higher education graduates aged 25-65 years have an intermediate or advanced level of digital problem-solving skills, close to the average of OECD countries (Figure 27).

Figure 27. Higher education provides graduates with relative good digital solving skills

% of 25-65 year-olds with higher education scoring at Level 2 or 3 in the problem-solving in technology-rich environments component of the OECD Survey of Adult Skills

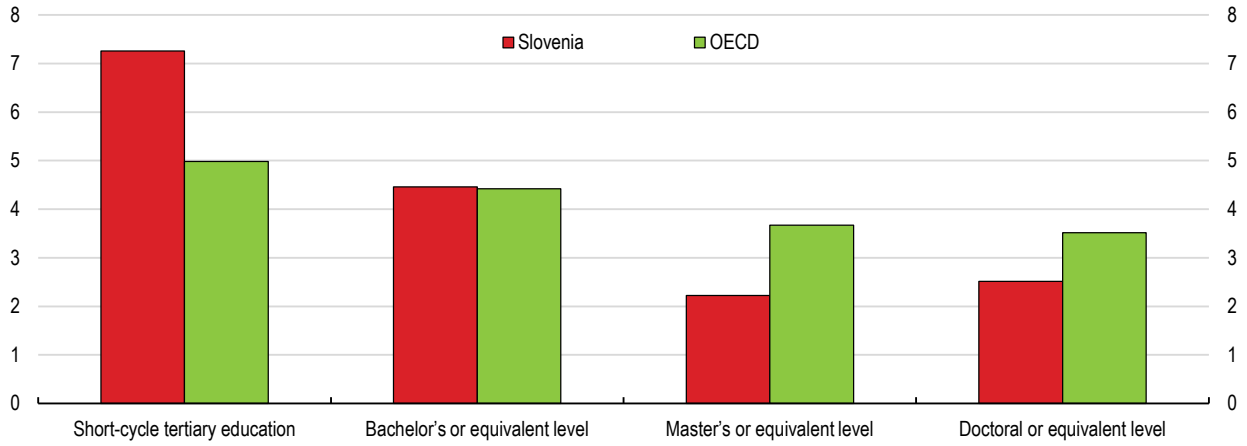


Note: The OECD Survey of Adult Skills defines problem-solving in technology-rich environments as "using digital technology, communication tools and networks to acquire and evaluate information, communicate with others and perform practical tasks".
Proficiency in this domain is measured at four levels [below level 1 (the lowest) to level 3 (the highest)].
Each country or economy participated in one (or two) of the three rounds of the OECD Survey of Adult Skills in 2012, 2015 or 2018.
Source: OECD (2019[57]), Skills Matter: Additional Results from the Survey of Adult Skills, https://dx.doi.org/10.1787/1f029d8f-en.

A concern, though, is that higher education is behind other OECD countries in developing advanced digital skills. The shares of ICT graduates at the short-cycle tertiary education and bachelor's levels are relatively high, but the shares of master's and doctorate graduates specialised in ICT are below the OECD average (Figure 28). This relatively low supply of ICT graduates is insufficient to meet current and future labour market demand for advanced digital skills (IMAD, 2021[58]). Indeed, improving Slovenia's international digital ranking requires increasing the high-skilled IT workforce.

Figure 28. Relatively few graduates with advanced digital skills

Share of higher education graduates in ICT fields among all graduates, by level of education, %, 2019

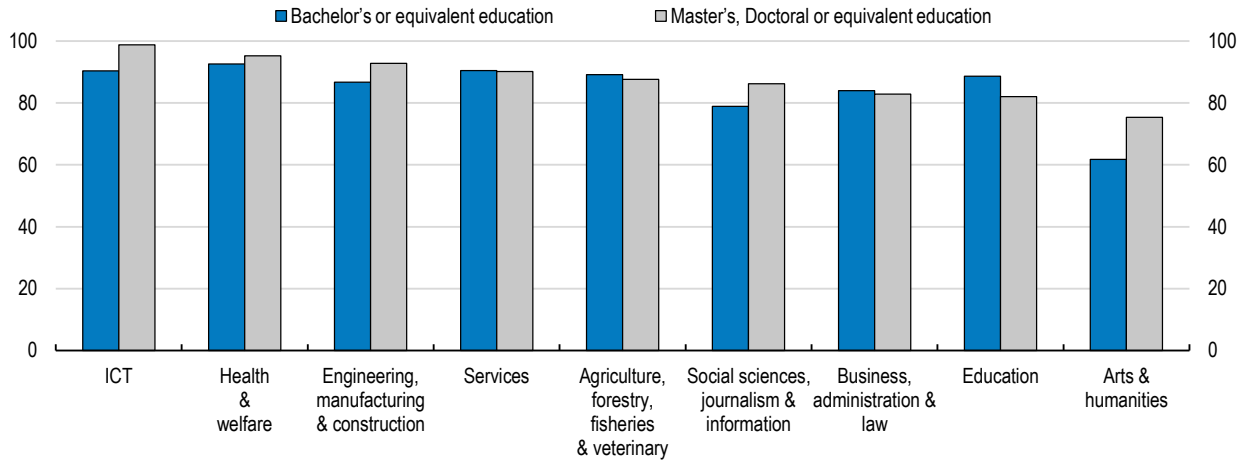


Source: OECD Education Statistics database.

The relatively high employment rates for ICT graduates reflect the high demand for ICT specialists, which are at par or higher than for other graduates and nearly 100% for advanced degree holders (Figure). Indeed, most ICT students find employment immediately upon obtaining a bachelor's degree or even before completing it (OECD, forthcoming[59]). Despite the high employment rates, relatively few graduates in other fields fill the unmet demand for ICT specialists, unlike in other countries. A study of four US states shows that more than one-third of job postings in ICT occupations have job requirements that include other fields of study. Particularly in demand are graduates in business and engineering studies, who are often able to signal their advanced digital skills to employers through alternative credentials such as industry recognised IT certifications (Brüning and Mangeol, 2020[60]). Graduates in these fields constituted over one-third of all Slovenian higher education graduates in 2019 – a substantial potential of digital talents (OECD, 2022[61]). However, the employment rate of business graduates is below the overall employment rate for all graduates, suggesting that their potential may not be fully utilised, either because of their lack of advanced ICT skills or unsuccessful signalling of their skills to employers (OECD, 2022[61]).

Figure 29. ICT graduates have high employment rates

Employment rates of higher education graduates by field of study, 25-34 year-olds, %, 2018



Note: The figure does not include data at the short-cycle tertiary education level and data for natural sciences, mathematics and statistics as the number of observations was below the publication limit.
Source: OECD Education Statistics database.

Higher education could also help to address the increasing need for upskilling and reskilling of the workforce, since a relatively high number of jobs are at risk of automation or significant change in response to the adoption of new technologies (see below) (Nedelkoska and Quintini, 2018[62]). Moreover, the number of jobs at risk is likely to increase further as the digital transformation of the economy entails the introduction of advanced technologies and new business models, adding to the need for strengthening the skill base of the labour force. In 2019, around two-thirds of the labour force aged 25-64 had basic or higher digital skills, well below the share in the top five EU countries (Eurostat, 2022[56]).

A key to increasing the number of students in ICT-related studies is to improve study and career guidance for prospective students. This is already happening to some extent. Students and parents are provided information about future studies and careers through career advisors at schools, outreach activities organised by higher education institutions, and a nationwide information event called *Informativa* (OECD, forthcoming[59]). In many OECD member countries, public web portals with detailed labour market information supplement such information campaigns (OECD, 2021[63]). Ireland, for instance, launched *CareersPortal* in 2008 to support youth and adult learners to make informed study and career choices, helping users explore different career options and learn labour market demand, salary range and possible education pathways of various occupations (Hofer, Zhivkovikj and Smyth, 2020[64]). Introducing such a portal with detailed labour market information could help attract more students to the ICT field.

A special concern in this respect is that female students comprise the majority of higher education graduates, but relatively few of them pursue ICT programmes (OECD, 2022[61]). Other countries use information campaigns and targeted initiatives to assist female students in overcoming gender biases in occupational choices. For example, France's study and career information website *Onisep* includes testimonies from female workers in traditionally male-dominated professions (Hofer, Zhivkovikj and Smyth, 2020[64]). In Austria, the City of Vienna organises the *Vienna Daughters' Day*, where girls aged 11-16 years old spend a day at companies operating in the fields of science and technologies to get familiar with these fields (OECD, forthcoming[59]). Such targeted campaigns with role models could be conducive to raising the share of female ICT students.

Higher education institutions could also assist schoolteachers in fostering digital skill development at lower levels of education to increase students' interests in ICT careers. The low level of integration of ICT

activities in primary and secondary education has trigged a political discussion about the potential introduction of computer science and informatics as a compulsory subject early on (IMAD, 2021[58]). In 2017-18, the European Social Fund provided a budget of EUR 1.3 million to three universities to support the integration of ICT in teaching and learning at the school level, encompassing more than 3 000 higher education teachers and students in teacher education programmes (European Commission, 2020[65]). The continuation of this type of support to both new and experienced teachers could help foster students' digital skills and potentially increase their interest in continuing studies in the field of ICT.

Funding is another tool to promote enrolment in ICT programmes. At the secondary education level, *Scholarships for Shortage Occupations* are used to encourage students to enrol in VET programmes for shortage occupations, including ICT professions (Government of the Republic of Slovenia, 2020[66]). However, at the higher education level, there are no financial incentives for students to enrol in ICT programmes and for higher education institutions to increase their offerings in the field. Some OECD countries use such funding to promote the development of advanced digital skills. Estonia, for example, has established the *IT Academy* – a collaborative initiative among the government, education institutions and ICT companies – which provides scholarships to students and grants to higher education institutions to promote the development of digital skills (OECD, 2019[67]).

About 53% of bachelor students in Slovenia completed their programme in 2017, against 67% on average in the OECD countries for which data are available (OECD, 2019[68]). This includes bachelor students in ICT fields. Enticing them to return to higher education to complete or enrol in advanced degree programmes could bolster the number of high-skilled ICT specialists. Higher education stakeholders point to the need for more flexibility in the system that allows working adults to return to higher education. The government may consider increasing the flexibility of the system to facilitate the return to higher education among ICT workers, by allowing learners to follow smaller units of learning without enrolling in a full degree programme.

Upskilling and reskilling of the workforce is another area that needs more involvement of higher education institutions. Currently, there is some scope for targeted ICT learning in higher education, as all students have the freedom to choose 10% of their curricula, including short courses on digital skill development (OECD, 2021[69]). In addition, the government plans to integrate micro-credential programmes – short target learning courses – focusing on digital skill development into all higher education programmes. This may raise the base level of digital skills among higher education graduates, as well as equip non-ICT graduates to fill some of the unmet demand for ICT specialists upon graduation.

These efforts could be widened to support digital skill development in the workforce by strengthening higher education institutions' lifelong learning provision. However, higher education institutions receive no funding to develop short programmes targeting adult learners. At the same time, learners are unaccustomed to financing their studies, as there is no general tuition fee. Existing financial support for education - scholarships, tax benefits and training leave - mainly covers company-specific training for working adults or degree programmes for younger learners (OECD, forthcoming[59]). Some OECD countries support upskilling and reskilling of the workforce by developing micro-credential programmes with the collaboration between higher education institutions and industry partners. The Ontario government, for example, financed thirty-six micro-credential pilot projects developed through a partnership of higher education institutions and industry partners for the period of 2019-2021, nine of which focused on the development of digital skills (OECD, 2021[69]). The scope of the planned micro-credential programmes could be extended to include adult learning.

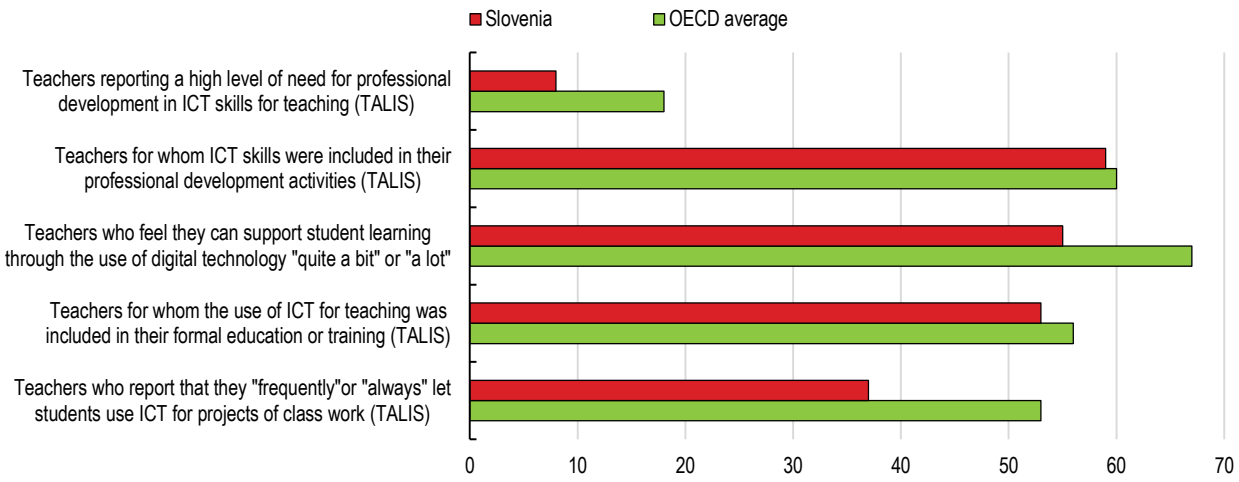
The Resolution on the National Programme (Master Plan) of Adult Education in the Republic of Slovenia 2021-2030 was adopted in March 2022. The Resolution aims to promote inclusive lifelong learning to all adults who have completed basic education or are at least 15 years old. The Master Plan includes targeted guidance and tailored learning, though a wide community partnerships at the local level and a network of

high-quality trainers, supported by the Slovenian Institute for Adult Education. In particular, short-cycle ICT courses, e.g.: 100 hours, will be offered to students and teachers, leading to micro-credentials.

Satisfying the demand for ICT specialists

Since 1994, Slovenia has adopted a number of ICT initiatives in education (Ministry of Education, Science and Sport in Slovenia, 2016[70]). Furthermore, digital education is included in the National Digital Strategy 2020. Moreover, ICT tools in schools appear as adequate in international comparisons, but important gaps remain in teachers' ability to use the tools effectively (OECD, 2020[71]) (Figure 30). Before the pandemic, teachers reported that they used ICT for projects of class work to a lesser extent than OECD peers. During the implementation of emergency measures in response to the COVID-19 pandemic, 70% of teachers evaluated the distance learning as less efficient than work in class and more demanding and stressful (Institute of National Education, 2020[72]). The closure of schools and shift to distance learning demonstrated the importance of addressing the digital divides in computer equipment and connectivity in rural areas, and of stepping up teachers' digital competences and improve readiness for online learning.

Figure 30. Teachers' preparedness for ICT-based teaching was limited prior to COVID-19



Note: The OECD average refers to the average of OECD countries participating in TALIS 2018.
Source: OECD TALIS 2018 database.

The National Digital Education Action Plan, developed by the Minister of Education, Science and Sport and the Digital Education Program Council, focuses on improving infrastructure, e-learning platforms, teachers' upskilling and support to schools' principles in developing digital transformation plans. This includes the introduction of compulsory study of computer science and informatics in elementary and high schools. Similar reforms to raise ICT literacy are taking place internationally, including in Canada, France, Portugal and the UK (OECD, 2020[47]). The inclusion of ICT subjects in schools signals the importance attached to students learning how to conduct a variety of tasks related to information processing in various digital contexts. However, it is equally important that schools and teachers create enough opportunities for students to use ICT and digital technologies in learning, so to foster digital skills in a more comprehensive approach rather than stand-alone ICT classes. The framework developed by the Australian Curriculum Assessment and Reporting Authority (ACARA) is an example to develop digital skills in this way (Box 9).

Digitalising the economy requires an increasing number of ICT specialists. The public employment services provides information on short-term labour market needs. However, there is no system for medium-term forecasting of knowledge and competence needs. This has contributed to the observed increase in the

mismatch between the qualifications of the labour force and the labour market needs. For example, the share of highly qualified people employed in occupations that do not require tertiary education has more than doubled to 15.6% in 2018. A rigorous and systematic method to assess current and prospective skill needs, such as the Skills Assessment and Anticipation (SAA) methodology, should be developed (OECD, 2016[73]).

Box 9. Learning digital skills at school through to a comprehensive approach

In Australia, ICT capability development is organised around the following dimensions:

- Managing and operating ICT (e.g. managing data, selecting and using software)
- Communicating with ICT
- Creating with ICT (e.g. using ICT to generate ideas or manage digital solutions for issues arising in learning activities)
- Investigating with ICT (e.g. finding and analysing information, verifying sources and reliability of digital data)
- Applying social and ethical protocols and practices when using ICT (e.g. recognising intellectual property, applying personal security protocols).

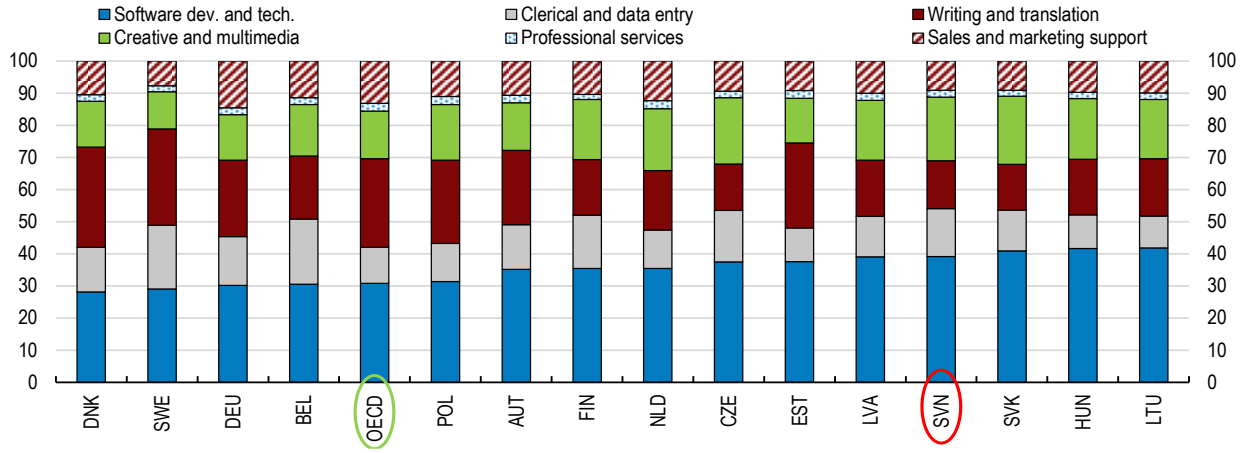
Students' proficiency is assessed in all these dimensions and across all school years as the development of ICT capability is considered a learning continuum. At the same time, ICT capability supports student learning in all subjects covered by the curriculum. For instance, students may use digital tools to create artworks, look for and critically analyse online information about historical events, or investigate mathematical concepts using multimodal technologies. A digital technologies learning area is also part of the curriculum, focusing on "understanding the characteristics of data, digital systems, audiences, procedures and computational thinking".

Source: (OECD, 2020[47]), *Digital Economy Outlook 2020*.

Currently, there are increasing shortages of ICT workers (Employment Service of Slovenia, 2021[74]). Data from jobs posted in freelance platforms show that software developers are most in demand, followed by writers and translators (Figure 31). Moreover, firms increasingly have troubles in filling vacancies, and more so than in other EU countries (Figure 32). The average share of graduates in ICT is slightly above the EU average in share of graduates in ICT. The inability of the education system to match the demand for ICT graduates reflects a relatively small wage premium in IT occupations (Figure 33). To a large extent, a small wage premium despite shortage of ICT workers is the result of the highly coordinated wage bargaining system, where the narrow wage distribution does not reflect changes in the relative demand for different occupations.

Figure 31. Software developers are in high demand

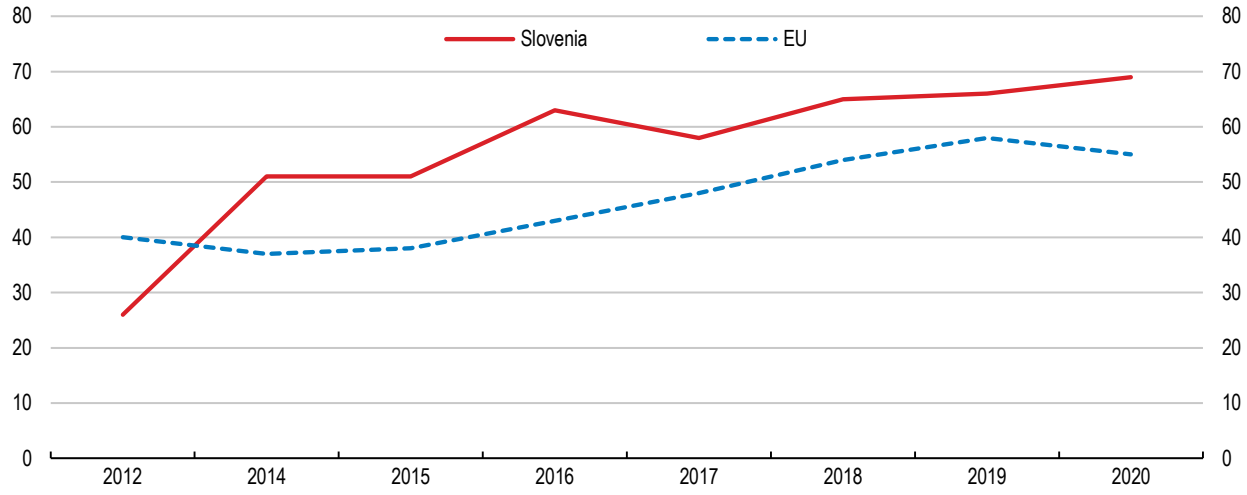
Main skills demanded in the online labour market, share of project/task occupations, %



Note: Each bar displays employer countries' share of projects/tasks posted on online labour platforms between January and July 2018 by the occupation of project/task. The Online Labour Index is based on tracking all projects and tasks posted on the five largest English-language platforms, which account for at least 70% of all traffic to online labour platforms. OECD refers to an unweighted average.
Source: Online Labour Index in (Kässi and Lehdonvirta, 2018[75]).

Figure 32. Slovenian enterprises have increasing difficulties in recruiting ICT specialists

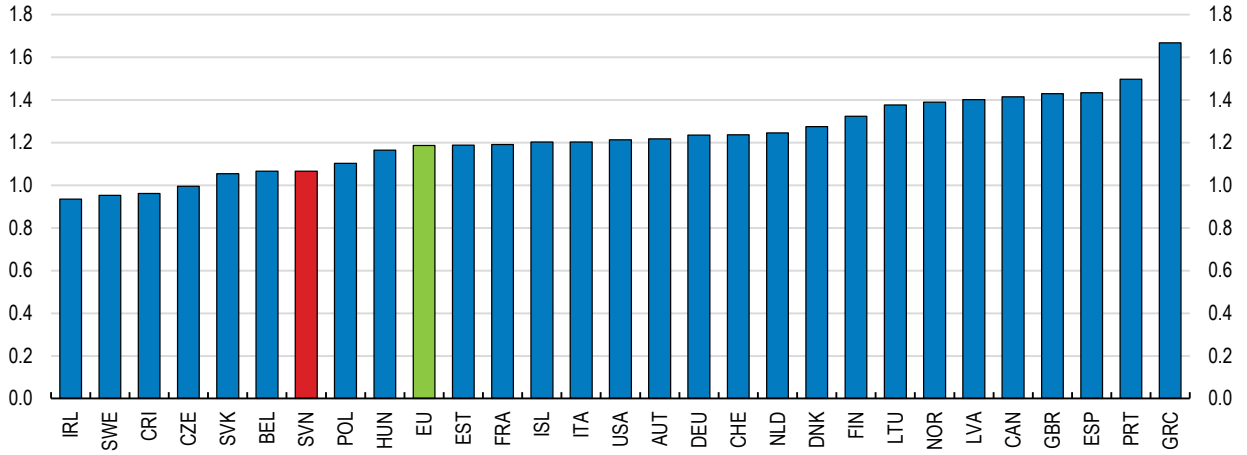
Firms that had hard time to fill vacancies for jobs requiring ICT specialist skills, as % of firms which recruited / tried to recruit personnel for jobs requiring ICT specialist skills



Source: Eurostat.

Figure 33. The wage premium for IT workers is among the lowest in OECD countries

Wage premium, ratio, 2020 or latest available year



Note: IT and other information services correspond to classes 62 and 63 of the International Standard Industry Classification (ISIC Rev. 4). The wage premium is defined as the ratio of the sector's wage relative to the average wage to the average labour productivity of the sector relative to the average productivity of the whole economy. A value above (below) 1 measures the wage premium (gap) for the employees in "IT and other information services". Data for Germany, Ireland, Latvia, Lithuania, Poland, Portugal, Spain, and the United Kingdom refer to 2019. Data for Canada, France, Norway, Sweden, Switzerland and the EU refer to 2018.
Source: OECD National Accounts database.

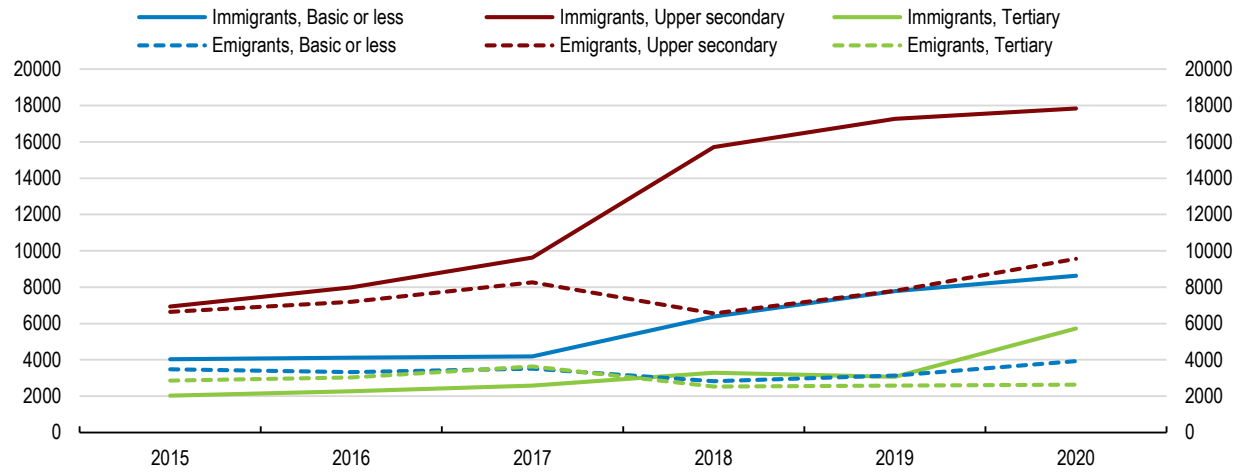
In 2021, a reform of the corporate income tax introduced a special tax relief for companies that employ professionals in shortage, as defined by the Ministry of Labour every year. However, this measure risks creating distortions in the market and subsidising employers for hiring certain categories of workers rather than those that are needed. For this purpose, other countries, such as Denmark and the Netherlands, use a special time limited flat income tax for foreign specialists with a salary above a certain level. Such a measure could help to overcome the barriers to hiring experts from the public sector's wage limitation rules.

Attracting skilled workers from abroad can help meet skills needs. However, most of the immigrant workers are medium-skilled workers, although more recently more tertiary educated workers are entering (Figure 34). Following the EU Single Permit Directive, non EU-nationals have to apply for a single permit for work and residence in Slovenia. High skilled workers may be eligible for an EU Blue Card, a temporary residence permit for the purpose of highly qualified employment. Blue Card criteria are a higher education degree and an employment contract of at least one year with a salary of at least 1.5 times the average annual gross wage. An additionally condition, for both the work permit and the EU Blue Card, is that there are no suitable candidates in the register of unemployed persons. This labour market test can be quite lengthy and cumbersome. On average, over the years 2019-2021, only 185 work permits per year were issued to foreign IT workers, out of total 23 665 permits issued every year.

Other countries, such as Germany, have simplified the hiring of skilled migrants from outside the EU, in particular ICT specialists. Workers from outside the EU with an appropriate qualification and a level of proficiency in the German language no longer need to have a work contract to reside in Germany, but can instead obtain a six-month residence permit allowing them time to find a job. Moreover, ICT specialists only have to prove work experience and there is no labour market test. The Slovenian schemes should be reformed along similar lines, by lifting the labour market test and reducing the salary threshold for ICT occupations. This could be supported by making work permit procedures available in other languages.

Figure 34. Slovenia attracts mostly workers with medium level of education

International migrants aged 15 or more, by education level

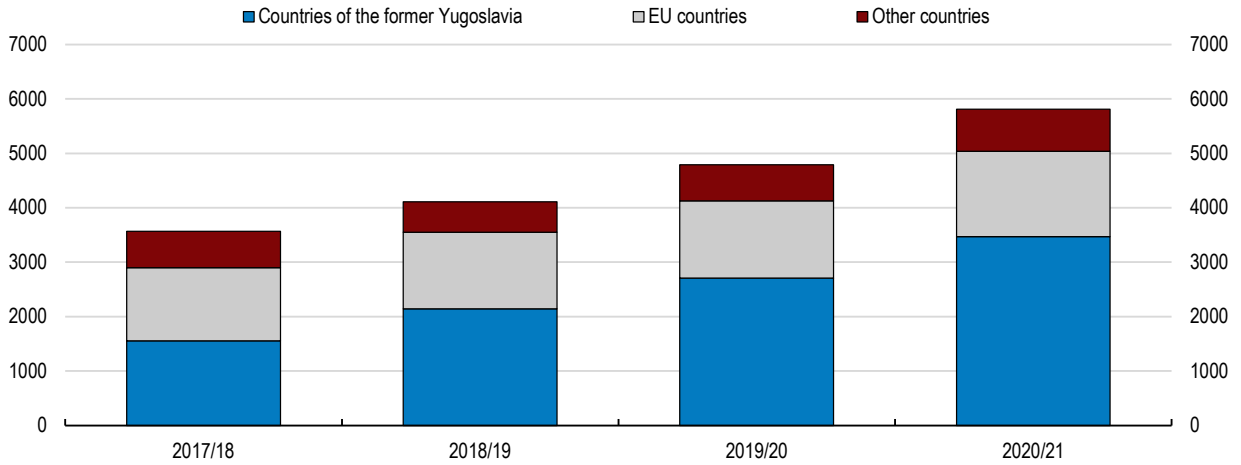


Source: Statistical Office of Slovenia.

Slovenia attracts a growing number of international students, particularly from countries from the former Yugoslavia (Figure 35) (Box 10). However, no measures are in place to facilitate obtaining of a work permit by non-EU foreign people who completed their studies in Slovenia can apply for a single permit to search for employment and work in Slovenia. The transition from tertiary studies to the domestic labour market could be facilitated further by automatically granting such permits.

Figure 35. Slovenia increasingly attracts tertiary students from the former Yugoslavia

Foreign students in tertiary education by group of countries, by academic year



Note: Data include students in undergraduate (academic higher education), graduate (master) and doctorate programmes.
Source: Statistical Office of Slovenia.

Digitalisation may bring many new opportunities for workers, but also an increased risk of job automation associated with digitalisation and other new technologies. Recent studies suggest that a quarter of workers face a high risk of seeing their jobs automated, almost twice as high as other countries (IMAD, 2020[2]) (Nedelkoska and Quintini, 2018[62]). Moreover, projections of labour demand in 2030 point few new job openings for workers with low skills qualifications, but nearly 50% more job offers for high- and medium-skilled workers (CEDEFOP, 2020[76]). Either way, maintaining full employment requires retraining and reskilling of workers.

Spending on labour market training is half of the OECD average and employees mostly rely on their employers to fund their training, as employers can deduct training expenses from their tax liabilities. However, workers in larger firms participate mostly in these trainings, including in ICT, reflecting that small enterprises often lack capacity to support training (Figure 37) (Table 2). The government is providing support, for instance through training vouchers for digital skills. This could be expanded by increasing support to firm-sponsored training in SMEs, e.g. increasing the scale of programmes for training vouchers, or by introducing measures at the individual level, e.g. tax deductions or tax credits, training vouchers, individual learning accounts and income-contingent loans (OECD, 2021[77]).

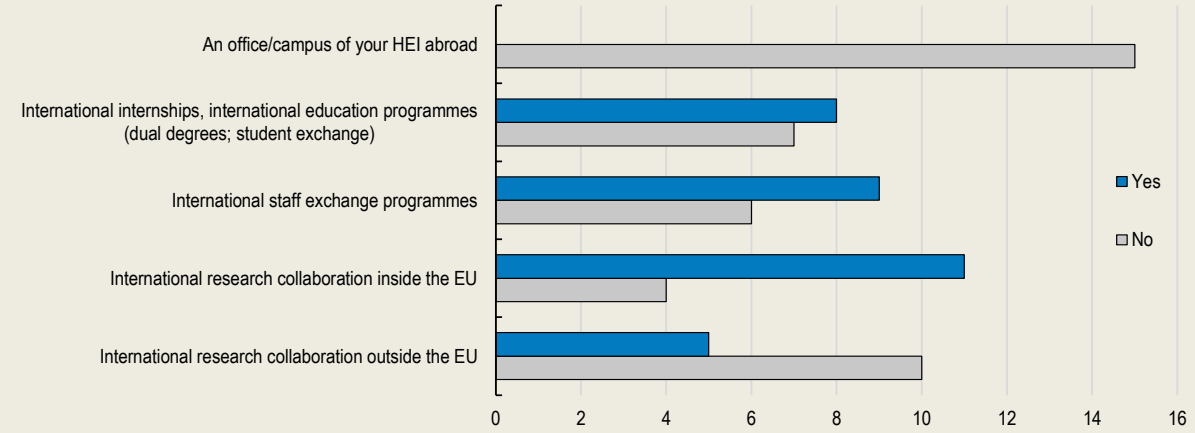
Box 10. Internationalisation of higher education is hampered by regulation

Over the past decade, the government has internationalised higher education system by stimulating research collaboration, modernising pedagogy and introducing new forms of learning (European Commision, 2022[78]). The 2016-20 strategy for internationalisation of HEIs had four pillars, including international mobility of students, researchers and staff (into Slovenia and abroad), international cooperation in research and development. In addition, it had a special focus on the Western Balkans as a targeted region for strategic partnerships and mobility programmes (Ministry of Education, Science and Sports of Slovenia, 2016[79]). The government has recently established a council with experts dedicated to internationalisation and the 2021-2030 National Programme for Higher Education includes strengthening internationalisation of higher education as a key pillar.

A review on entrepreneurship and innovation in higher education in Slovenia found that half of HEIs have put in place recruitment policies to attract international staff, while nearly all have internationalisation as a priority in their written strategies (Figure 36) (OECD/EU, 2021[30]). A good example of the implementation of the internationalisation strategy is the University of Ljubljana, which has several bachelor and master degree programmes in English (University of Ljubljana, 2022) (University of Ljubljana, 2022[80]). In addition, the doctoral school has 21 doctoral degree programmes in different fields open to Slovenians and external applicants (EU and non-EU members). Some of these programmes are interdisciplinary and coordinated with other institutions (for instance the doctoral programme in Biomedicine is done in partnership with the Josef Stefan Institute). Expanding the number of English language programmes is hindered by the requirement that the same programmes also have to be taught in Slovenian.

Figure 36. Internationalisation is a priority for nearly all HEIs surveyed

Number of responses



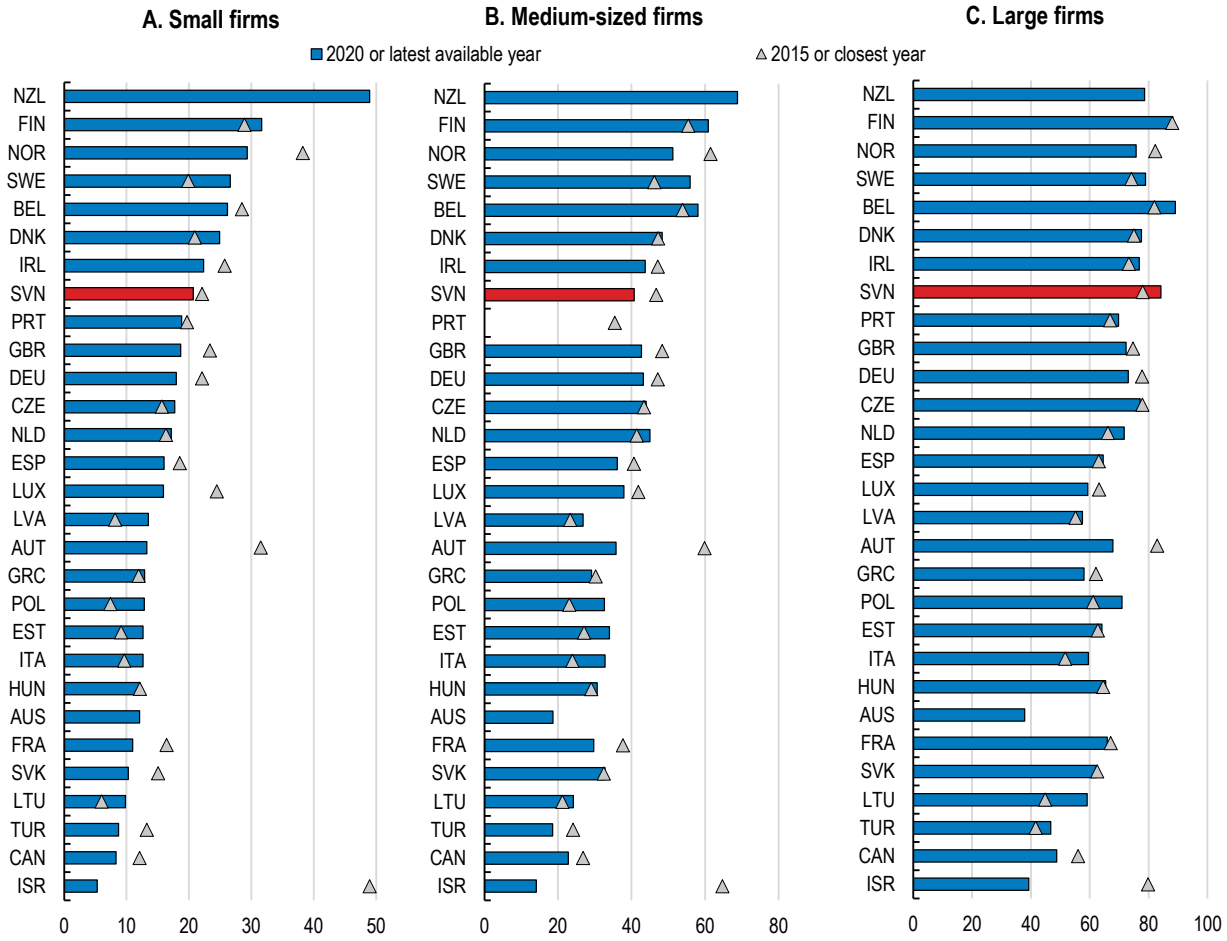
Note: Higher Education Institutions (HEIs) responded to the question: "Please indicate which of the following elements, if any, feature in your HEI's strategy".
Source: OECD (2021), HEI Leader Survey of Slovenia.

A problem, though, is that the link between internationalisation and entrepreneurship is relatively weak. Less than half of HEIs encourages internationalisation of entrepreneurial practices and fewer connect with international start-up networks and incubators abroad.

Internationalisation remains hampered by several factors. First, the Slovenian language first policy means duplication of teaching efforts, discouraging offering courses in English. Moreover, the policy also means that working papers are mostly published in Slovenian, although academic papers and research can be in English if required by academic evaluation. To attract further foreign students and researchers, restrictions on the use of English should be eased, particularly at master and PhD levels, while appointments and career advancements should be dependent on international recognised research and experiences.

Figure 37. ICT training is mostly provided in large firms

Firms providing ICT training, as % of all firms in each size group



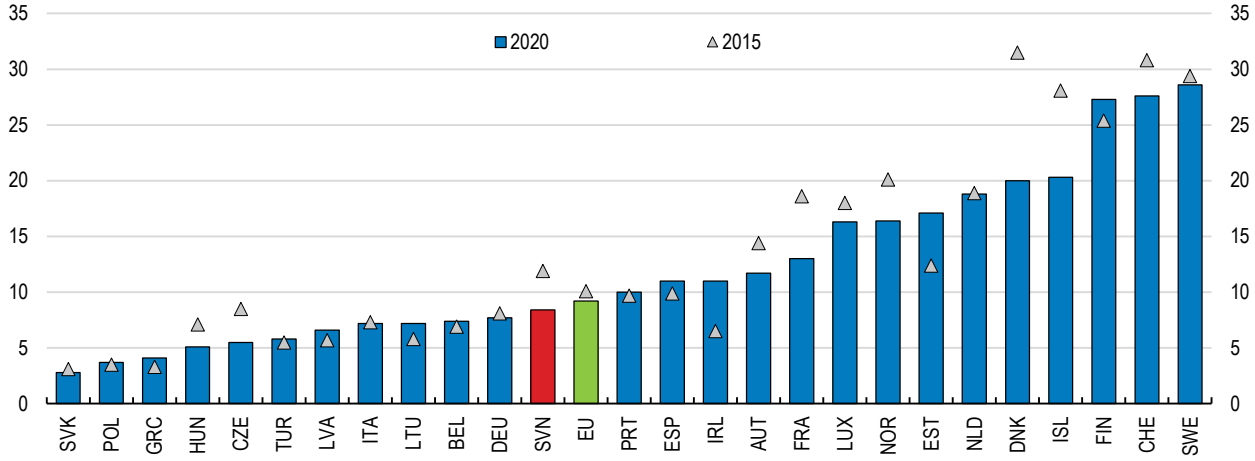
Source: Eurostat.

Outside firms, demand for adult training is low, as participation in lifelong learning is low and falling (Figure 38). The highly coordinated wage bargaining system has led to a narrow wage distribution, which do not reflect changes in the relative demand for different occupations, and thus provides few incentives for retraining. Indeed, this has led to one of the lowest wage elasticity to productivity, implying a weaker link between productivity and wages than elsewhere (Figure 39). Retraining incentives are further muted by the strong seniority element in wage increases, particularly as pathways, via unemployment and

disability insurance, into early retirements provides exit routes for workers whose productivity has fallen below their wages (OECD, 2020[81]). As recommended in the last *Survey*, more decentralised wage determination where wages are negotiated at the firm level and framework conditions are negotiated centrally could increase incentives for workers to upgrade their skills (OECD, 2020[81]).

Figure 38. Adult participation in learning has been decreasing

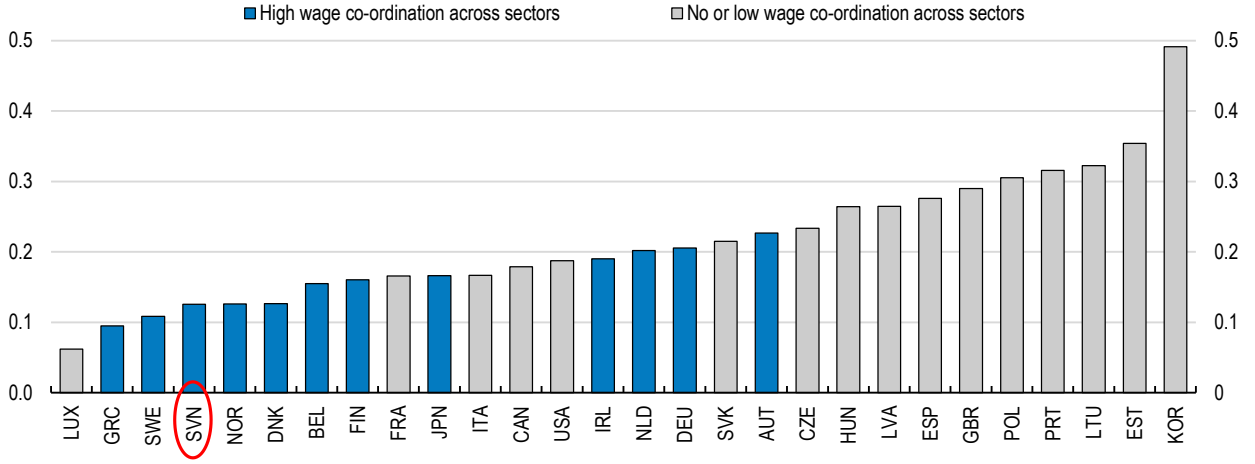
Adult participation in learning in the last 4 weeks, as % of the population aged 25-64



Source: Eurostat Adult Learning: Participation Rate in Education and Training database.

Figure 39. Misalignments of wages with productivity is strong in Slovenia

Wage elasticity to productivity



Note: Results are based on Ordinary Least Squares (OLS) regressions of the log hourly wage on log hourly labour productivity across sectors. The regressions include country-year dummies. Co-ordination is classified as high for a country if in the majority of the years in the sample it is classified as high.
Source: (OECD, 2019[82]), *Negotiating Our Way Up: Collective Bargaining in a Changing World of Work*.

Table 3. Recommendations

MAIN FINDINGS	RECOMMENDATIONS(key recommendations are in bold)
Expanding high-quality connectivity at affordable prices	
Slovenia lags behind the OECD average and peer countries in terms of advertised speeds and actual experienced speeds.	Periodically publish actual broadband performance results per provider to foster competition and improve the quality of networks.
The territorial connectivity divide between urban and rural areas persists.	**Align investment subsidies to reflect actual deployment costs, particularly in underserved areas.** Reduce network deployment costs by streamlining access to rights of way and dispute resolution mechanism for infrastructure sharing issues.
Accelerating the digital transformation of the economy	
Coordination challenges between the Government Office and line Ministries need to be addressed.	Strengthen formal institutional and budgetary arrangements to ensure that the sectoral agendas work coherently with one another and are implemented as planned.
Support programmes for the digital transformation of businesses have a top-down design, starting with EU funding.	**Introduce input and output benchmarking in program management to evaluate effectiveness.**
Technology transfers from academia to industry are limited.	Make government approvals for creating spin-offs tacit after a short period. Introduce innovation vouchers for SMEs to contract R&D support from academia. Establish a demonstration centre for new digital technologies.
There is a lack of risk capital for financing innovative start-ups.	Provide investors with tax deductibility for start-up and growth financing for innovative start-ups and SMEs.
Improving delivery of digital services	
The activation of the government e-ID (SI-PASS) requires in-person physical recognition.	Introduce digital recognition methods.
The use of most digital public services for households is voluntary, duplicating existing services	**Move from opt-in (voluntary-based) to opt-out (compulsory-based) systems in e-government services.** Ensure an inclusive transition to digital service through convenient and accessible public support places throughout the country. Use incentives for individuals, such as longer deadlines or prefilled forms, to adopt digital solutions for services.
Improving skills and the labour market for the digital transformation	
There is a growing shortage of high-skilled IT workers	Reduce requirements for high-skilled non-EU foreign workers to be able to work in Slovenia. Provide automatic work permit for foreign students after completing their Slovenian studies.
Apprenticeships are rarely available in technical programmes, where vocations typically have a relatively high ICT content. VET graduates have insufficient ICT skills	**Expand apprenticeships into technical programmes.** Provide technical support and training to VET teacher to use digital technologies in VET instruction. Increase the duration of work-based learning in technical programmes.
Higher education institutions contribute relatively little to the digital transformation of the economy	Improve study and career guidance for prospective ICT students Use information campaigns and targeted initiatives to attract more female ICT students. Offer scholarships to boost enrolment in master and doctoral ICT studies. Provide non-ICT graduates with more advanced ICT skills. Raise digital knowledge among higher education students through short targeted ICT learning programmes. These should also be open for lifelong-learning programmes.
Digitalisation will increase the number of SME jobs at risk	Increase subsidies for firm-sponsored training in SMEs, either as training vouchers or as tax credits or deductions.

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