Chapter 3

FOSTERING DIGITAL UPTAKE AND USE AMONG PEOPLE, FIRMS AND IN GOVERNMENT

The Brazilian Digital Transformation Strategy recognises that "digital transformation is an opportunity for the entire nation to take a leap forward. Digital technologies provide the tools for a profound transformation in government actions, in competitiveness and productivity in the private sector, and in empowerment and inclusion in society, so that everyone can develop economically and socially, and thrive in quality of life" (MCTIC, 2018). The Brazilian Civil Rights Framework for the Internet (Marco Civil da Internet) recognises that "access to the Internet is essential to the exercise of citizenship". For Brazil to realise these premises, policies have to ensure inclusion, so that digital divides do not reproduce the "analogue" divides of the Brazilian society.

This chapter examines access to and use of digital technologies in Brazil. It first looks at how Internet use by individuals and households hinges on socio-economic and geographic conditions, and examines the government programmes that aim to overcome these barriers. It then explores the use of digital technology by firms and at the government policies devised to foster greater adoption. The third section looks at how government uses digital technologies to increase efficiency, provide services and increase transparency.

Internet use by individuals and households

More people are connected, but important gaps remain

Brazil has made progress in recent years in improving the population's access to the Internet, with 67% of households and 72% of the population (16-74 years old) being connected in 2018, compared to 40% and 50% in 2013. However, while Brazil compares well with Latin American, Caribbean and upper middle-income countries, it lags behind OECD countries (Figure 3.1). Despite progress in Internet penetration, there is ample room to enhance digital inclusion, as 42 million people, or 23% of the population, have never used the Internet (CGI.br, 2019a).

Figure 3.1. Internet users in Brazil and the OECD, by education level, 2019 or latest available year

As a percentage of individuals using the Internet in the last three months
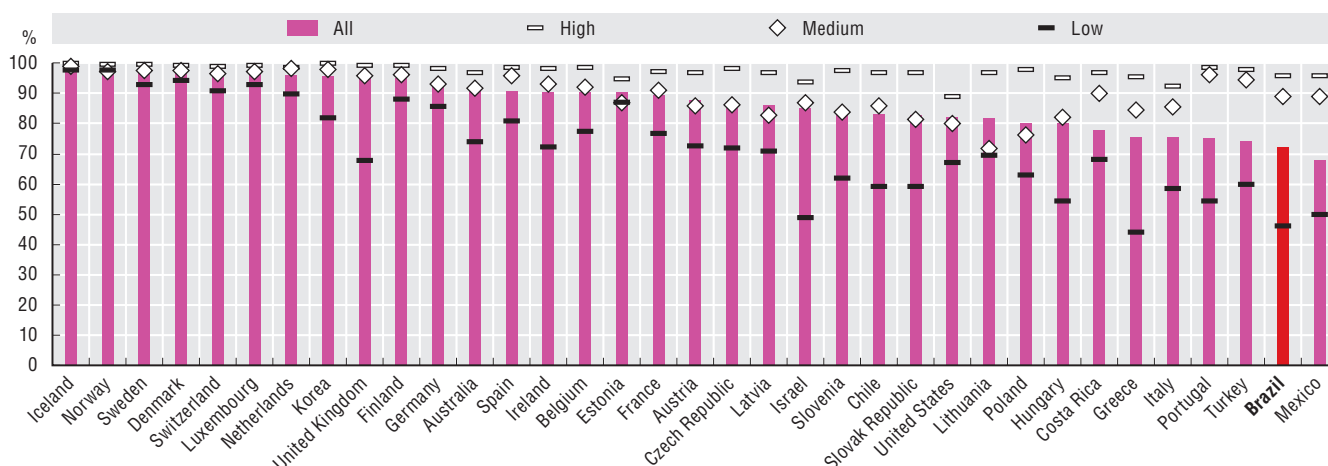
Note: Data for 2016 for Australia; for 2017 for Chile, Israel and the United States; for 2018 for Brazil, Costa Rica, Korea and Mexico.

Source: OECD (2020a), *ICT Access and Usage by Households and Individuals* (database), *http://oe.cd/hhind* (accessed in February 2020).

The digital divide tends to reflect the "analogue" divides of the Brazilian society, with education being the most important factor affecting Internet use. The highly educated use the Internet at rates comparable to most OECD countries, whereas usage by people with lower educational levels is considerably below the OECD average (73%) (Figure 3.1). Age is another key determinant for Internet use, as the gap between the younger and the older cohorts of individuals has been widening over time. Income also plays a very important role, as there is a particularly wide gap between high- and low-income individuals (Figure 3.2). The rural-urban divide is also considerable, with 75% of the urban population (aged 16-74) using the Internet, compared to 49% in rural areas (CGI.br, 2019a). People living in the Northeast region,

in particular, are at risk of digital exclusion. While the digital transformation provides opportunities to foster inclusive growth, the current patterns of digital uptake point to a risk that the digital divide may aggravate the existing social divide, thus deepening social exclusion.

Figure 3.2. Internet users in Brazil, by region and socio-demographic group

As a percentage of individuals, aged 16-74, having used the Internet in the last three months
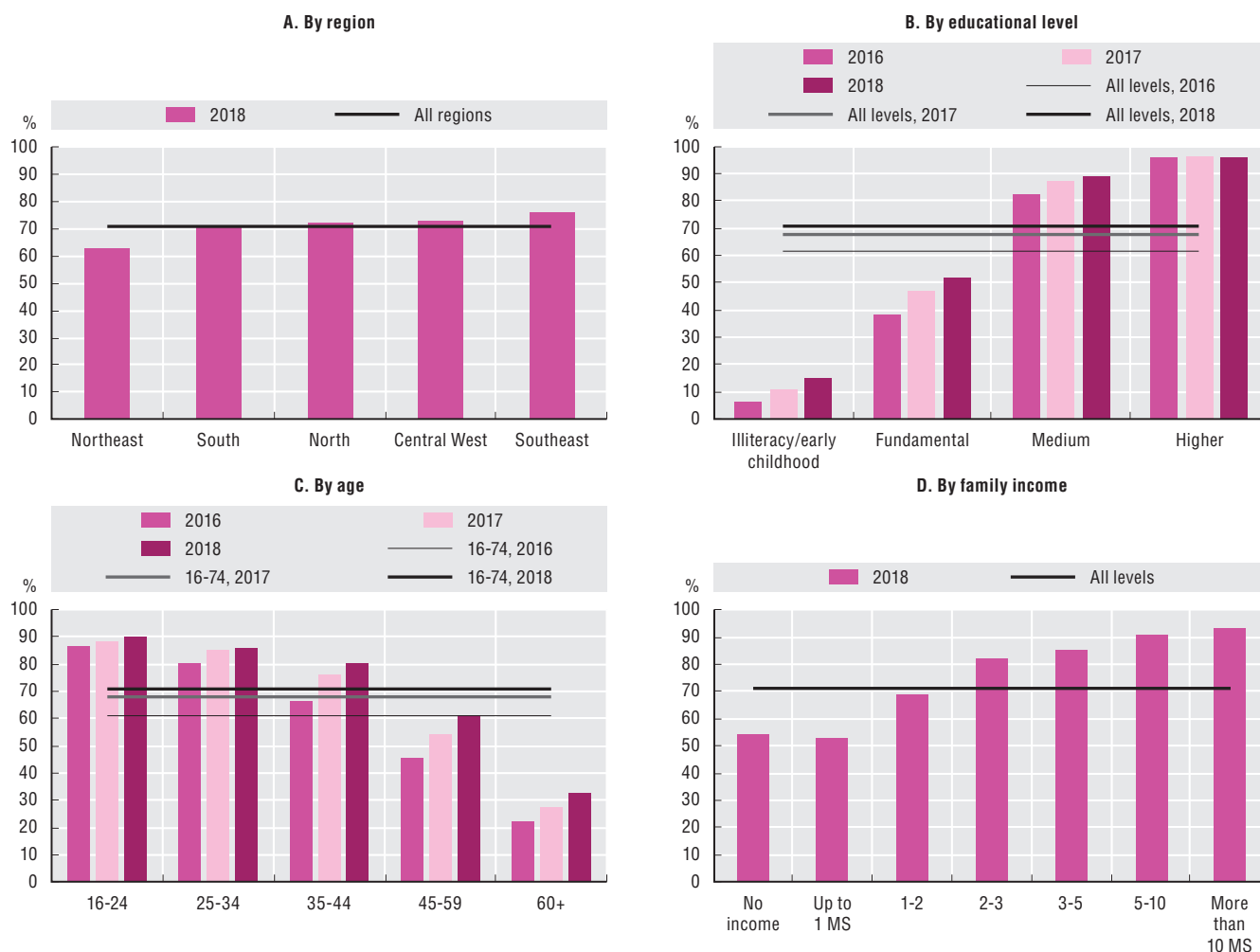
A. By region

B. By educational level

C. By age
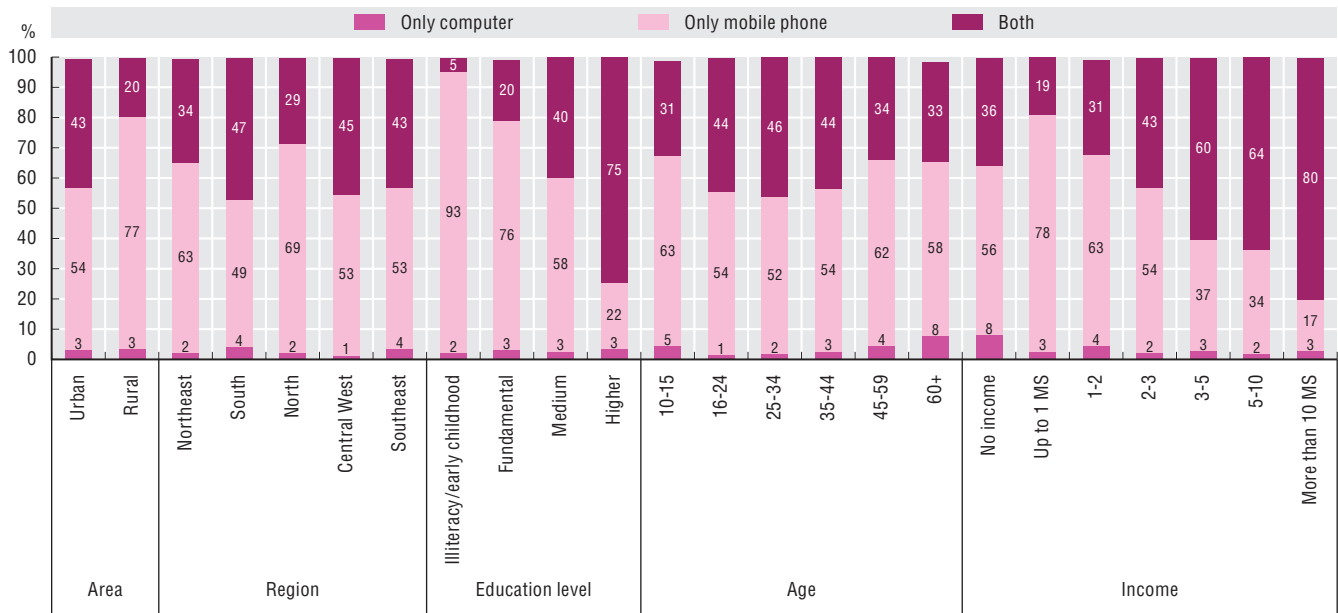
D. By family income

Note: MS = minimum salary.

Source: CGI.br (2019a), *ICT Households 2018: Survey on the Use of Information and Communication Technologies in Brazilian Households* (database), *https://cetic.br/en/pesquisa/domicilios/indicadores/* (accessed in February 2020).

Rapid diffusion of mobile technology is one of the key factors explaining the increase of Internet access among the Brazilian population. Mobile broadband subscriptions more than tripled in the 2012-18 period (see Chapter 2) and mobile phones are nowadays the primary device to connect to the Internet. In 2018, 122.5 million Brazilians accessed the Internet through a mobile phone, representing 97% of Internet users, up from 76% in 2014 (CGI.br, 2019a). Furthermore, the mobile phone is increasingly the only device used to access the Internet, especially among the most vulnerable groups (low income and low skills), in rural areas and in the North (Figure 3.3). This may have led these segments of the population to consider mobile phone applications and the Internet as different platforms, thus not recognising they are using the Internet when they use mobile phone applications (based on differences between indicator "Internet users" and "Internet users – expanded indicators"; CGI.br, 2019a). On the other hand, fixed broadband subscriptions, although increasing, have been growing at a slower pace. Currently 40% of households have access to fixed broadband (MCTIC, 2018). Computer access is also limited, with only 42% of households declaring having a computer, notebook or tablet. Thirty per cent of households have neither a computer nor access to the Internet (CGI.br, 2019a). The exclusive use of a

mobile phone to access the Internet has implications on the activities individuals can carry out on line, preventing them from performing more sophisticated activities. This is leading to the emergence of different classes of users, with a small share of the population having more access at a higher speed, using the Internet on different devices and performing a range of activities on line, with a second, wider group with reduced and slower access, limited to one device, mostly performing communication activities on line (CGI.br, 2019b).

Figure 3.3. Internet users in Brazil, by type of device used to access the Internet, 2018

Note: MS = minimum salary.

Source: CGI.br (2019a), *ICT Households 2018: Survey on the Use of Information and Communication Technologies in Brazilian Households* (database), *https://cetic.br/en/pesquisa/domicilios/indicadores/* (accessed in February 2020).
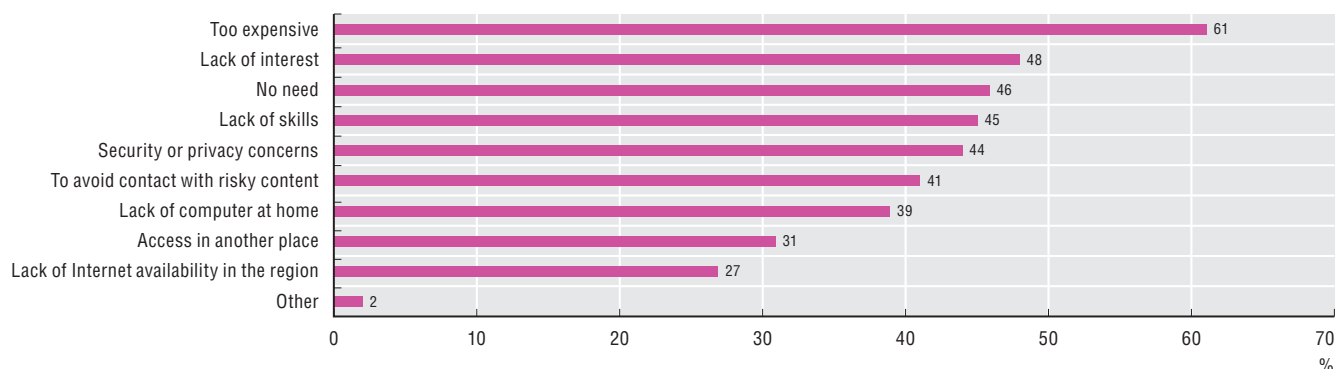
Affordability is still the primary reason for households not having a connection at home (Figure 3.4), pointing to the need to increase Internet access at affordable prices (see Chapter 2). Lack of interest or need, lack of skills or of a computer are also important. Increasingly, concerns about security and privacy also prevent households from having the Internet at home (reported by 44% of households in 2018, up from only 5% in 2008).

Within its policies for digital inclusion, Brazil has programmes in place aimed at increasing access to the Internet in public places free of charge or at a lower price (Table 3.1). In addition, until 2016, the federal administration incentivised the purchase of digital routers, modems, tablets, PCs, laptops, chipsets, keyboards and mouse devices by establishing a federal tax exemption through the Good Law (Law 11.196/2005, known as Lei do Bem) for retail sales of these devices. Until 2018, the same law also incentivised mobile access to the Internet, through subsidised smartphone (and other devices) prices. Article 28 provided for a federal tax exemption for smartphones sold in retail for a price of up to USD 410 (BRL 1 500), manufactured according to a basic manufacturing process defined by the government, and meeting a minimum set of technical requirements developed in Brazil. A total of 17 companies participated in the programme, covering 425 different smartphone models and 429 applications.

When looking at Internet use by individuals, instead of households, affordability is no longer the main obstacle. Lack of computer skills was the most frequent reason (74%) reported by individuals for not using the Internet, followed by lack of interest (64%) and lack of need (48%) in the fourth position. High cost of the Internet services still matters when considering use (49%) but it is only the third most frequent reason (Figure 3.5). These findings point to the need for policies to increase digital literacy in the population and to raise awareness on the benefits of using the Internet, as well as for the development of specific content, services and applications that meet the needs of the groups of the population still off line. The government has a role to play here, by creating content and providing online services associated with education, health and other public services (UNESCO, 2017).

Figure 3.4. Barriers preventing Brazilian households from having Internet at home, 2018
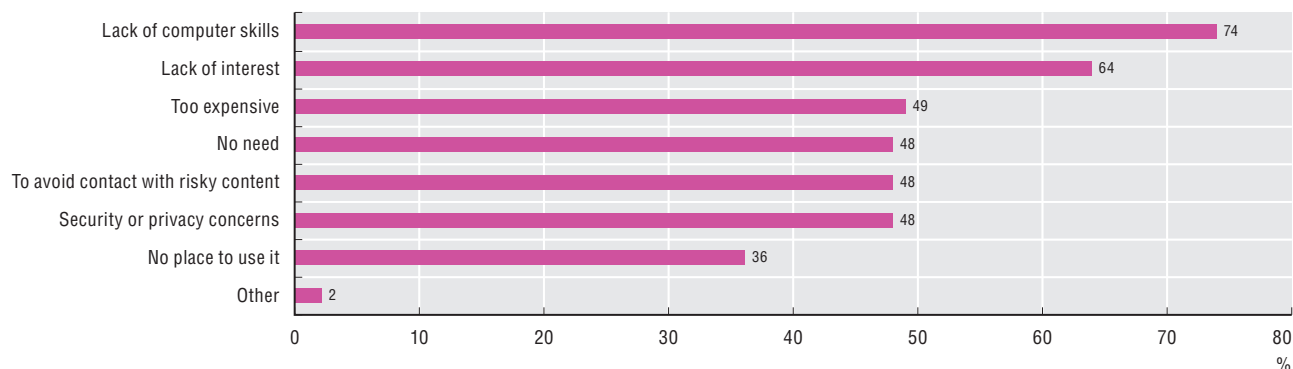
As a percentage of households without an Internet connection, by reason declared for not having an Internet connection

Barrier	%
Too expensive	61
Lack of interest	48
No need	46
Lack of skills	45
Security or privacy concerns	44
To avoid contact with risky content	41
Lack of computer at home	39
Access in another place	31
Lack of Internet availability in the region	27
Other	2

Source: CGI.br (2019a), *ICT Households 2018: Survey on the Use of Information and Communication Technologies in Brazilian Households* (database), *https://cetic.br/en/pesquisa/domicilios/indicadores/* (accessed in February 2020).

Figure 3.5. Barriers preventing individuals in Brazil from using the Internet, 2018

As a percentage of individuals aged 16-74 who never used the Internet, by main reason declared for not using the Internet

Barrier	%
Lack of computer skills	74
Lack of interest	64
Too expensive	49
No need	48
To avoid contact with risky content	48
Security or privacy concerns	48
No place to use it	36
Other	2

Source: CGI.br (2019a), *ICT Households 2018: Survey on the Use of Information and Communication Technologies in Brazilian Households* (database), *https://cetic.br/en/pesquisa/domicilios/indicadores/* (accessed in February 2020).

Improving digital skills among the population is necessary to avoid a second-level digital divide

Among the activities performed on line, those related to communication prevail, with connecting to social networks being the most frequent (58%), followed by calling/sending messages (55%), and looking for information about goods and services (46%). With the exception of following online courses and telephoning/making a video call, Brazil scores below the average of other OECD and Latin American countries in all activities performed on the Internet, in particular in e-banking, sending emails and online purchases (Figure 3.6).

Beyond the digital divide, between those that have access to digital technologies and those who do not, a second-level digital divide has been growing among Internet users in relation to their ability to use digital technologies effectively and benefit from them. Several factors may shape digital inequalities in use, such as age, gender, socio-economic background and geography. Skills appear to be one of the most important factors behind these differences (OECD, 2019a).

More than a half of all Brazilian adults have not reached secondary education levels; 17% have not even completed primary education, a figure well above the OECD average (2%). Despite the increase in education expenditures and the widespread access to free-of-charge primary and secondary education, educational attainments have remained low. The country's results in the OECD's Programme for International Student Assessment (PISA) suggest that challenges exist in achieving a quality education (Figure 3.7) and indicate vast disparities in outcomes depending on socio-economic background (OECD, 2019b).

Figure 3.6. Diffusion of selected online activities among Internet users in Brazil and the OECD, 2019 or latest available year

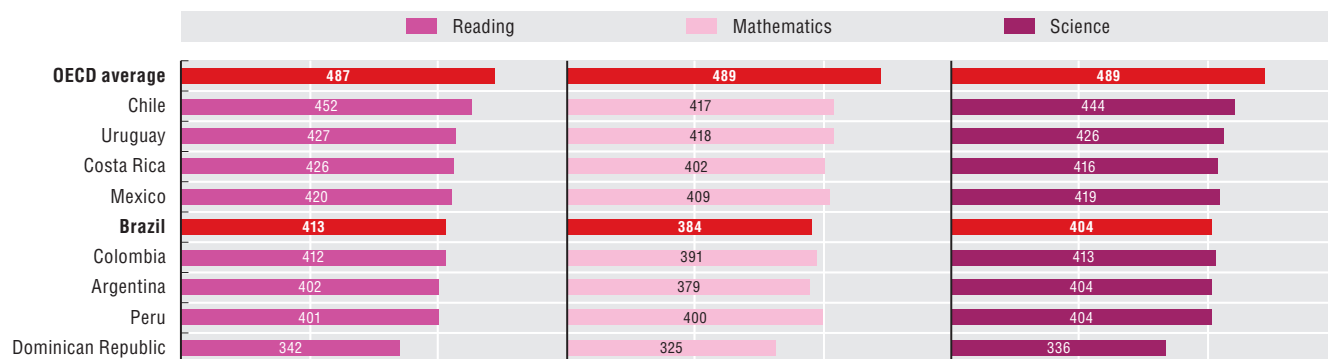*As a percentage of Internet users performing each activity*
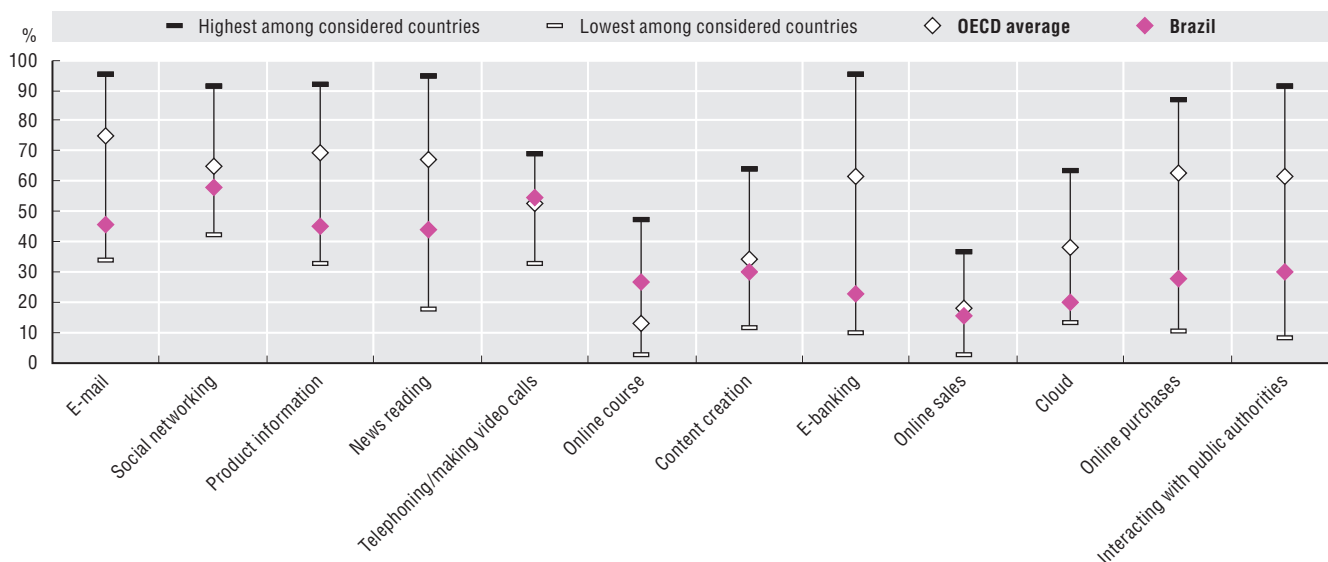
Notes: Data for 2018 for Brazil.

Source: OECD (2020a), *ICT Access and Usage by Households and Individuals* (database), *http://oe.cd/hhind* (accessed in March 2020).

Figure 3.7. Results in the OECD's Programme for International Student Assessment (PISA) in Brazil, the OECD and selected Latin American countries, 2018

Mean results

	Reading	Mathematics	Science
OECD average	487	489	489
Chile	452	417	444
Uruguay	427	418	426
Costa Rica	426	402	416
Mexico	420	409	419
Brazil	413	384	404
Colombia	412	391	413
Argentina	402	379	404
Peru	401	400	404
Dominican Republic	342	325	336

Source: OECD (2019b), *PISA 2018 Results (Volume I): What Students Know and Can Do, https://doi.org/10.1787/5f07c754-en.*

Based on the activities performed on line – i.e. communication, information searches, multimedia, education and work, content creation and sharing, and downloading – Brazilian Internet users can be grouped into four clusters: 1) instrumental; 2) interactive; 3) limited; 4) advanced (Araujo and Reinhard, 2018). Members of the instrumental group, which account for 17% of Internet users, are characterised by higher skill levels related to information searches and education and work-related activities. They tend to access the Internet through multiple devices (desktops, laptops and mobile phones), are mostly female, have higher educational levels and are 16-44 years old. The members of this group use the Internet as a tool for personal, professional and educational development. Users from the interactive cluster, accounting for 28% of total users, have higher skill levels in content creation and multimedia, belong to a younger age group (10-24 years old), prefer to access the Internet via mobile phones, are male and from the lowest socio-economic classes. Users from the advanced cluster, accounting for 20% of users, have higher skill levels in all six of the domains examined, whereas users with limited digital competencies, representing the majority of Brazilian users (35%), have the opposite profile, i.e. lower digital skill levels across all domains. In these two groups, social class appears to be the main discriminating factor and digital skills are correlated with the level of income and education.

Government policies for digital inclusion are mostly supply-side

Brazil has several initiatives in place to increase access to and use of ICTs and the Internet among its population. The Digital Inclusion Department in the Ministry of Science, Technology, Innovations and Communications (Ministério da Ciência, Tecnologia, Inovações e Comunicações, MCTIC) is responsible for executing and co-ordinating these initiatives, which may be grouped into four broad categories: 1) free public access to the Internet in public places and telecentres; 2) availability of digital services in public places; 3) support to telecentres; and 4) training and capacity building (Table 3.1). In the past, the government also provided incentives for the purchase of ICT devices (see above), which have, however, been discontinued. These policies are analysed in the following sections, except those related to access, which are discussed in Chapter 2.

One of the primary objectives of the Brazilian public policy for digital inclusion is to extend Internet access to remote areas and isolated communities of the country. Since 2002, Brazil has been running the Electronic Government Citizen Services programme (Governo Eletrônico – Serviço de Atendimento ao Cidadão, GESAC), established by the Ministry of Communications (2002) and lastly amended by the MCTIC (2017), with the objective of making Internet access universal throughout the country's vast territory, primarily targeting the most vulnerable groups. The programme is co-ordinated by the MCTIC, and is ran in partnership with the Ministry of Education (Ministério da Educação, MEC) and the Ministry of Health.

The GESAC programme aims to provide free-of-charge broadband Internet satellite and terrestrial connection to schools, public health clinics, indigenous villages, international border stations and "*quilombola*" communities (historical African-Brazilian communities), as well as telecentres (see below for a description) with difficult access. Participants in the GESAC programme are institutions earmarked by the public administration (either local or national) which have signed a co-operation agreement with the MCTIC. The telecommunication services are paid by the federal government and supplied by private companies, which benefit from an exemption of the tax on the movement of goods, transport services and telecommunication services (Imposto sobre Circulação de Mercadorias e Serviços, ICMS). To date, GESAC provides a connection to approximately 6 000 institutions and public places. The programme is implemented through a service provision contract, which is currently executed by Telebras (this is the fifth contract related to the programme). The current contract foresees the installation of 15 000 points. As of January 2020, 10 000 of them had already been installed. The largest majority of these points (80%) are schools, some of them with the connection paid for by the MEC's Connected Education (Educação Conectada) programme. Others are maintained with the MCTIC's own budget.

Smart Sustainable Cities and the National IoT Plan should be aligned

Providing high-speed networks in municipalities is the objective of the Digital Cities (Cidades Digitais) programme, established in 2011 (Ordinance 376/2011). It installed digital local networks in 160 municipalities, connected public offices and equipped them with digital tools for digital government services. Those networks are freely available to the population. Almost half of local governments with Internet access reported providing Wi-Fi connections in public spaces in the municipalities (45%), while the possibility was even more common among Brazilian state capitals (81%) and municipalities with more than 500 000 inhabitants (73%). It is, however, unclear whether the programme is also meant to include assistance and training in the use of the digital government services, and the degree to which it has contributed to the increase in the use of such services in these municipalities. Overall, the programme has been found to achieve modest results (CCT, 2017).

The Digital Cities programme is being replaced by the new Smart Sustainable Cities (Cidades Inteligentes Sustentáveis) programme. Based on the Smart Sustainable Cities Maturity Model and the Assessment Framework for Digital Transformation of Sectors in Smart Cities (ITU, 2016), Brazil is building a framework to evaluate the degree of maturity of cities. Further on, Brazil has created the Chamber of Cities 4.0, inside the structure of the IoT Chamber. When devising the policy and the implementation strategy, it will be important to align it to the National IoT Plan (Decree 9.854/2019; see Chapter 5), as Smart Cities is one of the four vertical sectors selected as priorities for the application of IoT in Brazil, so to not duplicate actions and exploit synergies among the two strategies. The programme should, for instance, foresee actions in support of the deployment of IoT solutions in municipalities, as a follow-up to the pilots funded by the Brazilian Development Bank (Banco Nacional de Desenvolvimento Econômico e Social, BNDES) (see Chapter 5), such as technical assistance or funding for those cities.

Table 3.1. Programmes for digital inclusion in Brazil

Year	Programme	Objective	Main activities/instruments	Budget
Availability of free and public access to Internet in public spaces and telecentres				
2002	E-government Citizen Services programme (GESAC)	Ensure universal Internet access across the Brazilian territory.	Free-of-charge broadband Internet connection, terrestrial and via satellite, to public institutions and telecentres. Tax incentives for companies to provide Internet connections to these places.	About USD 6 million (BRL 24 million)/year.
2017	Internet for All (GESAC's extension)	Internet connections at reduced prices.	Tax incentives for companies to build broadband infrastructures and provide Internet connections.	USD 208 million (BRL 663 million) to connect 15 000 points.
Deployment of high-speed municipal networks, digital government applications and Internet access points in public spaces				
2011	Digital Cities	Increase access to ICT and public services.	Install digital local networks connecting public offices and services with digital tools for digital government services and making them available for free use by the population.	USD 127 million (BRL 212 million) for 262 cities – it will not all be spent.
Support to telecentres				
2009	Telecentros.BR	Develop joint actions (among federal government, states, municipalities and civil society) enabling the large-scale installation and maintenance of telecentres.	Installation and maintenance of public and community telecentres.	
2014	Community telecentres	Promote digital and social inclusion in the communities they are located in.	Training and financial support of monitors.	
Training and capacity building				
2007	Computers for Inclusion	Training of low-income young people on reconditioning computer equipment.	Workshops, courses and training, focusing on reconditioning and maintenance of computer equipment, which is then provided to digital inclusion points.	
2017	National Digital Inclusion Agent Training Program	Provide training as digital inclusion agents for youth and adults who then will give support to users in telecentres.	Capacity building of young people and adults to act as knowledge multipliers in telecentres.	USD 246 000 (BRL 785 000).

Note: USD figures are based on the exchange rate for the year the programme was launched.

Source: OECD, based on responses from the MCTIC to the review questionnaire.

Telecentres are important for digital inclusion, but require more resources

The GESAC also provides connectivity to telecentres. These are public spaces with computers and other IT equipment, as well as broadband Internet connection, which offer ICT activities to promote digital and social inclusion among the communities they serve. The main objective of telecentres is to foster social and economic development in participating communities, with a view to reducing social exclusion and to creating opportunities for the population. Two programmes have supported the installation of telecentres throughout the country: Telecentros.BR, launched in 2009 (Decree 6.991, 27 October 2009) and the Community Telecentres programme, which started in 2014, and provided, in addition to the equipment, connection through GESAC and training of young people. Between 2006 and 2014, the federal government installed about 10 000 telecentres in 5 200 municipalities throughout the country: 6 400 through the Community Telecenters programme and 3 300 through Telecentro.BR. Once those were established, the municipalities were handed the responsibility to maintain them. Over the years, the responsibility of the Ministry of Communication, now merged into the MCTIC, has shifted from providing equipment and connection to providing training and refurbished computers.

The Integrated Monitoring System (Sistema Integrado de Monitoramento, SIMMC), developed by the MCTIC in partnership with the Federal University of Paraná (UFPR), is an embedded software that collects data on telecentres, including network availability, network use and application software installed on the computers. In a 2018 audit, the Brazilian Court of Auditors (Tribunal de Contas da União, TCU) pointed to the fact that several municipalities have had their telecentres established by the federal government, as well as by the municipality, while several others have not had any

(TCU, 2018). The ICT Public Access Centers 2019 survey (CGI.br, 2020a) reported 5 396 telecentres in the country, 55% of which were functioning (2 989). A higher proportion of telecentres is unused, compared to the last survey of this kind (CGI.br, 2014), which found 78% of active telecentres in the country. This might reflect the fact that many of these telecentres were decommissioned at some point. The original telecentre programme stipulated that after an initial five-year period of continued support by the federal government, the telecentre equipment would be donated to the municipalities. In terms of maintenance, CGI.br (2020a) reports that access to the Internet is limited in most cases by problems related to the equipment, such as not functioning or low-quality computers, and lack of technical assistance or financial resources to maintain computers. In order for these centres to foster digital inclusion, municipalities should be obliged to ensure that the equipment is maintained and replaced as required, with funding and technical assistance provided also from central sources. This last issue has been addressed, in part, by the MCTIC's Computers for Inclusion (Computadores para Inclusão, see below) programme, which provides refurbished computers to the telecentres.

The share of users accessing the Internet via telecentres grew between 2008 and 2018, reaching 21.8 million people (17% of the individuals 10 years old and above) in 2018 (CGI.br, 2019a). At the same time, there has been growth in access to the Internet from home (Figure 3.8). This may be linked to the low availability of computers and fixed Internet connections for several groups and areas across the country. Access to Internet in telecentres (or other public centres with free access) is concentrated among young (aged 16-34) individuals, and is less prevalent among older adults (aged 60 and above). People living in urban areas tend to access the Internet in telecentres or public centres more often than those in rural areas, and so do those with a higher education. In cities like São Paulo, where digital inequality is high (CGI.br, 2019b), telecentres are the only opportunity to have a better quality connection, allowing for more sophisticated activities than communicating (e.g. looking for a job or following an online course). Telecentres, however, fail to reach groups with a lower Internet usage (i.e. the elderly, the rural population, as well as low-income and/or low-skilled individuals). Measures specifically targeted at these groups should be put in place in order to reduce digital exclusion.

Figure 3.8. Internet users in Brazil, by place of access, 2008 and 2018

As a percentage of Internet users
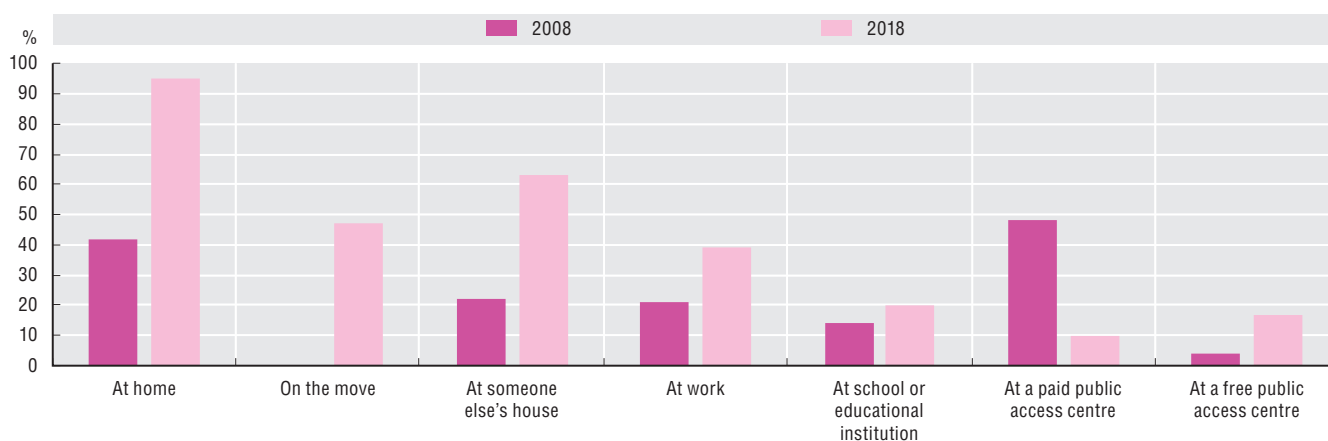
Source: CGI.br (2019a), *ICT Households 2018: Survey on the Use of Information and Communication Technologies in Brazilian Households* (database), *https://cetic.br/en/pesquisa/domicilios/indicadores/* (accessed in February 2020).

As accessing the Internet at home or from a mobile phone becomes more common, telecentres should become places where people can access computers to perform more sophisticated activities. They should therefore be equipped with better quality computers, and ensure Internet connections are functioning and their role in providing training should be strengthened. These centres are, in fact, important spaces for digital inclusion, where users receive support in accessing online public services and learning how to use digital tools (CGI.br, 2014). Training and assistance are key functions telecentres offer, although with great variations across the country and in terms of scope. In 2019, eight in ten telecentres had a monitor, guide or digital inclusion agents to assist its users (CGI.br, 2020a). Telecentres also offered courses on using a computer (55%), using the Internet (50%) and professional

training (39%). The telecentres of the Northeast and Central West regions, in general, were the ones that most offered those types of service. Half of the telecentres from those two regions offered professional training, compared to 30% in the South region. Courses on the use of Internet were also more common among the telecentres of the Northeast (62%) and Central West (56%) regions, whereas this figure was 38% in the North (CGI.br, 2020a).

Federal programmes supporting training should be scaled up

The Computers for Inclusion programme offers training to socially vulnerable young students and professionals in dismantling or reconditioning IT equipment used by federal institutions, which is then provided to the digital inclusion points (DIP) and public spaces with free Internet access, including telecentres. Currently there are centres for computer reconditioning in 11 Brazilian states, which offered training to about 5 200 young people during the period 2014-18; 10 000 computers were provided to DIPs. Although, in principle, the refurbished material can be provided to DIPs across the country, the programme seems to have a limited geographic outreach (Figure 3.9).

This programme allows recovering and giving new life to used material, thus reducing electronic waste, while training young people and providing new equipment to public access centres. Partners of the Computers for Inclusion programme also provide training courses for women and older people. The initiative should therefore be stepped up, by increasing the number of centres for computer reconditioning in the country, also in co-operation with the private sector. The training dimension could also be strengthened, for instance by standardising training material and providing certification of the training undertaken. Centres for computer reconditioning could also collaborate with firms with a view of increasing youth employment opportunities, for instance by establishing programmes for traineeships. The "Computers for Schools" in Canada, which has inspired the Brazilian programme and Colombia's "Computadores para educar", relies on partnerships with the private sector, including with retired volunteers from the telecommunications sector who provide training courses to the participants.

The 2017 National Digital Inclusion Training Programme (Programa Nacional de Formação de Agentes de Inclusão Digital, PNAID) (Ordinance 2801/2017) aims at increasing monitoring and training services in telecentres. It trains young people to become digital agents and to act as "multipliers" of knowledge. The Federal Institute of Education, Science and Technology of Rio Grande do Norte has designed the programme's training curriculum and provided the technological platform for the online training activities.

To be part of this programme, the MCTIC selects telecentres, which, in turn, indicate which agents should receive training. The National Digital Inclusion Training Programme has selected 792 telecentres to date, and will train 1 200 agents in 2020. Selected beneficiaries receive a USD 100 (BRL 400) scholarship, and a 10-month, 480-hour distance training. They have the obligation to attend two hours per day and to train telecentre users for the duration of their course. The beneficiaries must also present a project benefiting the community in which the telecentre operates. In order to ensure the training's sustainability, a minimum duration of courses to be provided by the agent should be set. The programme should include monitoring indicators and tools on the number of people trained by each agent, their socio-economic profile and the impact of the training activity, as well as specific targets. Prior to launching a new call for selecting the agents, the MCTIC should evaluate the programme, with a view to improving it as required, and scale it up to increase its outreach, which is limited to date (Figure 3.9). Furthermore, as the training material is already developed, the MCTIC may consider distributing it to a wider number of people as educational material.

Digital literacy programmes should be accessible to all

To date, there have not been any programmes for improving digital skills among adults (beyond those offered in telecentres; see above). Programmes for digital skills could be run on line, with the objective of training large portions of the population. They could cover topics such as Internet safety and security, online banking, access to digital government services, e-commerce, and content creation. Given the digital divide affecting specific population groups, specific tools could also be developed for reaching the most vulnerable groups, such as older people or low-income, low-educated groups. Considering the widespread use of smartphones, trainings should also be considered for people using smart devices, such as tablets or smartphones. Several countries have adopted initiatives to train citizens for digital skills development,

targeting citizens at large or specific segments of the population. Some national programmes are presented in Box 3.1. The MCTIC is considering launching a programme for improving the digital skills of the population along these lines. The programme will also count on co-operation with the private sector.

Figure 3.9. Percentage of telecentres participating in federal programmes in Brazil, 2018

As a percentage of functioning telecentres
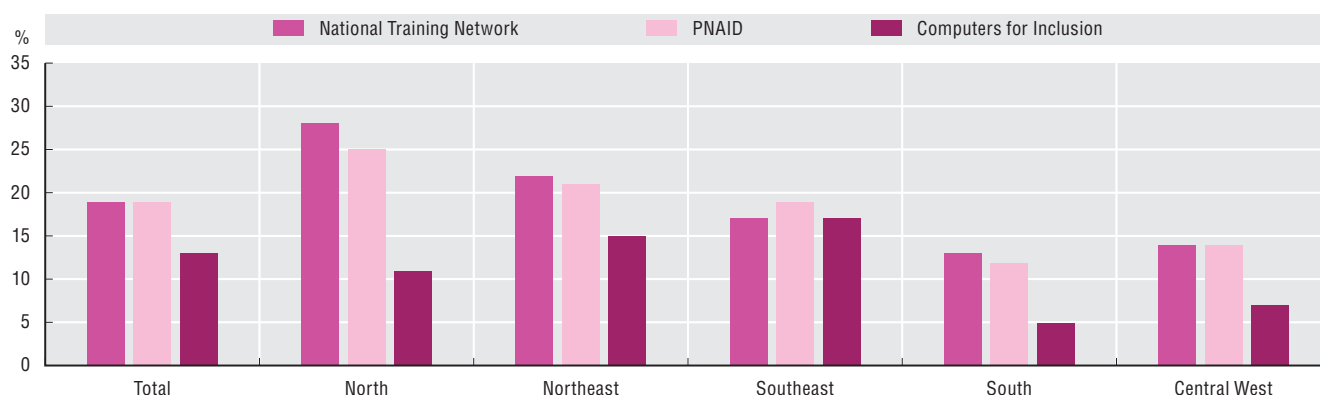
Note: PNAID = National Digital Inclusion Training Programme.

Source: CGI.br (2020a), *ICT Public Access Centers 2019: Survey on Public Internet Access Centers in Brazil* (database), *https://cetic.br/en/pesquisa/centros-publicos/indicadores/* (accessed in July 2020).

Box 3.1. Digital Skills for All: Programmes to bridge the skills gap

The **Australian** Be Connected programme aims to raise the digital literacy of older Australians. It takes a family and community centred approach to teach basic skills such as online shopping, sending email and using social media. It aims to reduce feelings of loneliness and increase community connection. The Department of Social Services is the lead agency, but provides grants to local partners and training for digital mentors. The programme received the support of 2 500 community organisations.

Israel has a National Programme for Digital Literacy, aimed at reducing the digital gap among citizens, with a special focus on disadvantaged populations, including senior citizens, the Arab population and the ultra-orthodox population. The programme focuses on finance, education, civil participation and use of rights, employment, health, transportation, and social life/communication.

Digidel 2017 was a national programme in **Norway** to strengthen co-operation and increase the efforts made by the public sector and information and communication technology sector as well as voluntary enterprises in the areas of digital competence and inclusion in Norway. Special focus groups included elderly people, women and immigrants that did not use ICT as part of their everyday life. The programme involved co-operation with a non-governmental organisation. A lot of training activities took place around the country, facilitated by local libraries, non-governmental organisations and industry.

Singapore has collaborated with non-profit organisations to set up senior-friendly infocomm learning hubs (Silver Infocomm Connections) island-wide, so that elderly people have access to affordable subsidised digital skills training. Digital clinics are also organised regularly in public libraries. Participants receive one-on-one assistance from corporate volunteers who help them with basic queries on phone usage, such as connecting to Wi-Fi hotspots, personalising accessibility tools on their devices and adjusting their phone settings to best suit their needs.

The **UK** Department for Education funds the Future Digital Inclusion programme, which supports adult learners to engage with digital technology and develop their digital skills in community settings through the 5 000 strong Online Centres Network.

Source: OECD (forthcoming a), *OECD Digital Economy Outlook 2020.*

Steps are being taken to prepare new generations for the digital world

Policies to increase digital skills in school fall under the responsibility of the Secretariat for Basic Education within the Ministry of Education. Brazil has programmes in place to increase the use of ICTs and Internet in schools, focusing on integration of digital literacy and skills in school curricula, the provision of infrastructures, training of teachers, and use of digital technologies (Table 3.2).

Table 3.2. Programmes for digital literacy and ICT use at school

Programme	Objective
National Education Plan 2014-2024	Includes goals for the development of digital skills, to make broadband access in schools universal and to triple the rate of computer/student in public schools.
National Common Curricular Base	Sets the general competences to be developed in basic education.
ProInfo (1997, changes in 2007) Broadband in Schools (2008-present)	To equip public schools with ICT and Internet access.
Connected Education Innovation Program (2017-present)	To structure a vision in schools on the use of digital technologies, develop pedagogical practices directed at innovation in classrooms, provide educational content and improve the infrastructure of technologies in schools.

Source: OECD, based on information provided by MCTIC.

The National Education Plan 2014-2024 (Plano Nacional de Educação, PNE), which states the 20 goals of the national education system, includes several objectives in relation to the development of digital skills and the use of ICTs, and considers innovation and technology as strategies to achieve the desired educational objectives:

- 5.3: Select, certify and promote educational technology for child literacy.
- 5.4: Encourage the development of educational technologies and innovative pedagogical practices that ensure literacy.
- 5.6: Promote and stimulate the initial and continued training of teachers for child literacy, building capacities related to new educational technologies and innovative pedagogical practices.
- 7.12: Encourage the development; select, certify and promote educational technologies for early childhood, elementary and high school education; and encourage innovative pedagogical practices.
- 7.15: Make high-speed broadband access universal, by the fifth year of the duration of the National Education Plan 2014-2024, and, by the end of the decade, triple the computer/student ratio in basic education public schools.

The National Institute for Research in Education (Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira, INEP) is responsible for evaluating progress towards achieving these goals and targets. This is also done through an observatory showing the outcomes of the different actions (*www.observatoriodopne.org.br*). However, the observatory only has results for the objective related to the last goal listed above (Goal 7.15). The results show that the objectives of making access to broadband universal and the one related to the availability of computers are far from being achieved, with only 62.2% of schools of the basic education[1] having access to the Internet (INEP, 2017).

The National Common Curricular Base for Basic Education (Base Nacional Comum Curricular, BNCC) on the essential skills, attitude and values for the 21st century was approved in 2017 by the MEC after a long and comprehensive consultation process. All schools in Brazil had to implement the BNCC by the end of 2019. The BNCC defines a set of ten general competences to be developed throughout basic education. These competencies are cognitive and social-emotional, and include the exercise of intellectual curiosity, the use of digital communication technologies and the appreciation of individuals' diversity. Furthermore, in December 2018, the National Education Council – a government advisory body with representatives from schools, academia, local governments and civil society in the educational field – approved a resolution to include the theme "computational thinking" in elementary, secondary and high school curricula. Computational thinking, or the ability to frame problems in ways that computers can help to solve them, is increasingly put forward as an important skill for a growing number of jobs and a way to develop wider skills, such as creativity or critical thinking (OECD, 2019a).

The adoption of the BNCC is an important step in the attempt to improve education in the country and reduce the great variations in performance observed across regions. By providing uniform standards, it sets a clear framework for schools and teachers on what students should know and be able to do at different grade levels. Improving equity in education is the first and the most important step to reduce inequalities in the ability to benefit from digital tools (OECD, 2015). However, guidelines set by the federal government are not sufficient to promote convergence in educational outcomes, as primary and secondary education are the responsibility of states and municipalities. In order for the national guidelines to be effective in improving the performance of Brazilian schools and students, schools should align their performance assessments to such standards. Furthermore, instruction materials, such as textbooks, should be redesigned in line with the BNCC, and teachers should be given adequate training to acquire the content knowledge and pedagogical skills to bring the new standards into practice (Lemann Centre, 2016). A strict monitoring and evaluation system should be put in place to ensure that it is implemented equally across the country.

The main policy to improve the use of digital technology and the availability of ICT infrastructure and equipment in schools is the ProInfo programme, a government programme set up in 1997 and updated in 2007. Its main objective is to promote the use of digital technology as a pedagogical tool in public elementary and high schools (primary and secondary education levels). It focuses on enhancing students' digital literacy and includes trainings for teachers. In 2007, the programme was reformed ("ProInfo integrado") and basic education schools (including kindergarten for children up to five years old) were included among the programme's targets. ProInfo finances the purchase of computers, digital resources and education contents for public schools across the country, in co-operation with state and municipal administrations. The programme is jointly run by the MEC and the National Fund for Education Development (Fundo Nacional de Desenvolvimento da Educação, FNDE); the MEC is responsible for teacher training, curriculum design, teaching practices and evaluation, while the National Fund for Education Development is responsible for ICT infrastructure and resource development. There is no available evaluation on the results of the programme to date. One of the actions foreseen in the E-Digital Strategy (MCTIC, 2018) is a new national policy of educational technology to replace ProInfo, articulating the strategic dimensions of infrastructure, competencies, content and digital educational resources.

Several programmes support the provision of computers and Internet access in schools, particularly in rural areas (Figure 3.10). These include ProInfo, GESAC (see above), the Broadband in Schools Programme (Programa Banda Larga nas Escolas, PBLE), the recently launched Connected Education programme (see below) and the Direct Money in School programme (Dinheiro Direto na Escola, PDDE), providing financial assistance to schools to maintain or improve physical and pedagogical infrastructures. Furthermore, new draft legislation aims to approve the use of resources from the Universal Telecommunications Service Fund (Fundo de Universalização dos Serviços de Telecomunicações, FUST) – a fund financed through sector levies with a budget of USD 255 million (BRL 1 billion) per year – for broadband deployment in urban and rural schools. The bill (PL 172/2020) is currently scheduled for vote in the Senate. If approved, it would still have to be submitted to presidential approval.

Despite such programmes to finance the purchase of ICT equipment in schools, in 2015, the number of computers per 100 students in Brazil was much lower than the OECD average (20 vs. 77) (Figure 3.11). In addition, inequalities along regional, urban/rural and socio-economic lines persist. Internet usage, connection speeds and teacher training differ significantly depending on the type of school and geographic location (CGI.br, 2019c).

While nearly all schools in urban areas are equipped with computers and are connected to the Internet, on average only 34% of schools in rural areas are on line, with great differences across regions and according to the type of school (public or private). In the North, only 14% of rural schools are connected to the Internet. Overall, 94% of private institutions in rural areas have Internet access, compared with 34% of public institutions (Figure 3.12). In 45% of schools in urban areas, connection speed is 5 Mbps or more, compared to 11% of schools in rural areas. The difference is even larger for speeds greater than 11 Mbps, which are achieved by 21% of schools in urban areas and 1% in rural ones (CGI.br, 2019c).

Figure 3.10. Programmes financing technological infrastructures in Brazilian schools, 2018

As a percentage of schools, by programme of implementation of technological infrastructure
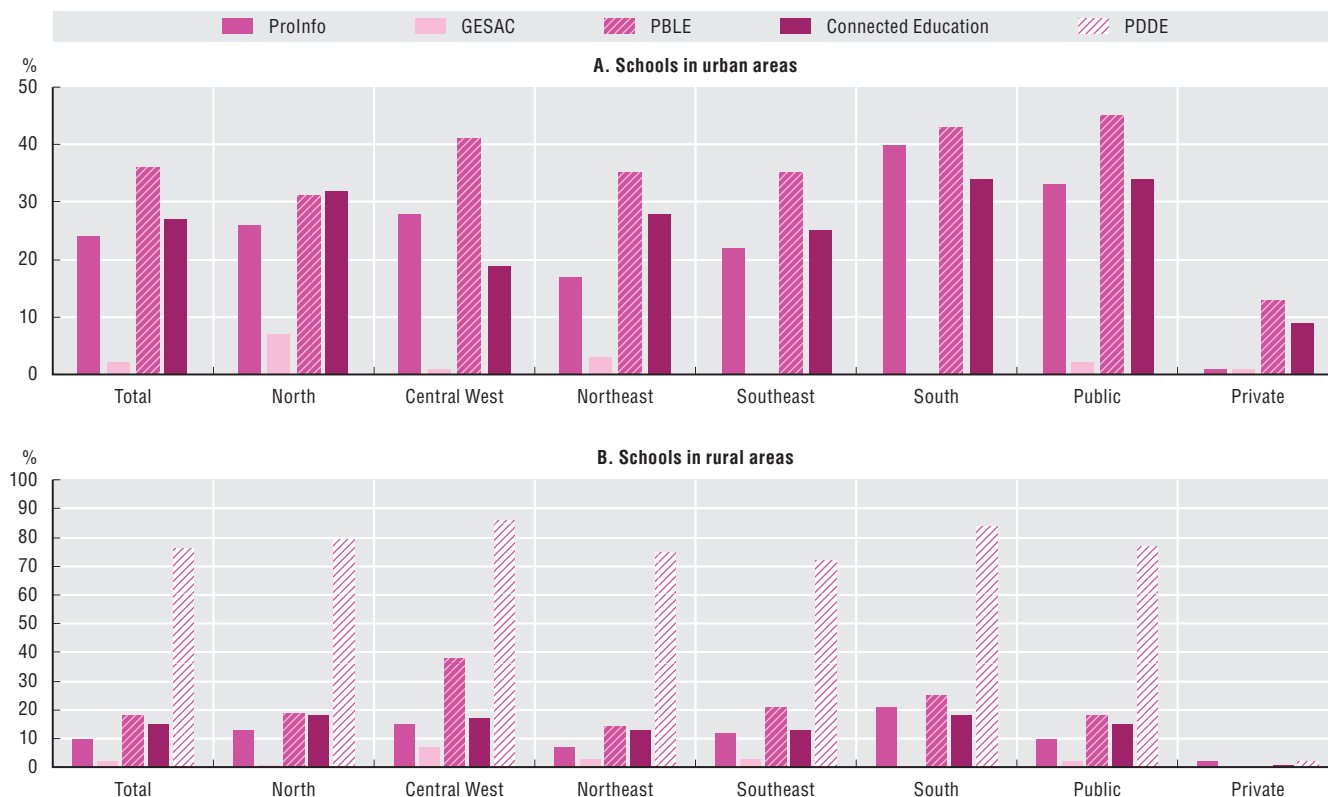

Note: ProInfo = National Educational Technology programme; GESAC = Electronic Government Citizen Services programme; PBLE = Broadband in Schools Programme; PDDE = Direct Money in Schools programme.

Source: CGI.br (2019c), *ICT Education 2018: Survey on the Use of Information and Communication Technologies in Brazilian Schools* (database), *https://cetic.br/ en/pesquisa/educacao/indicadores/* (accessed in February 2020).

Figure 3.11. Number of computers per student in Brazil and the OECD, 2015

Results based on school principals' reports
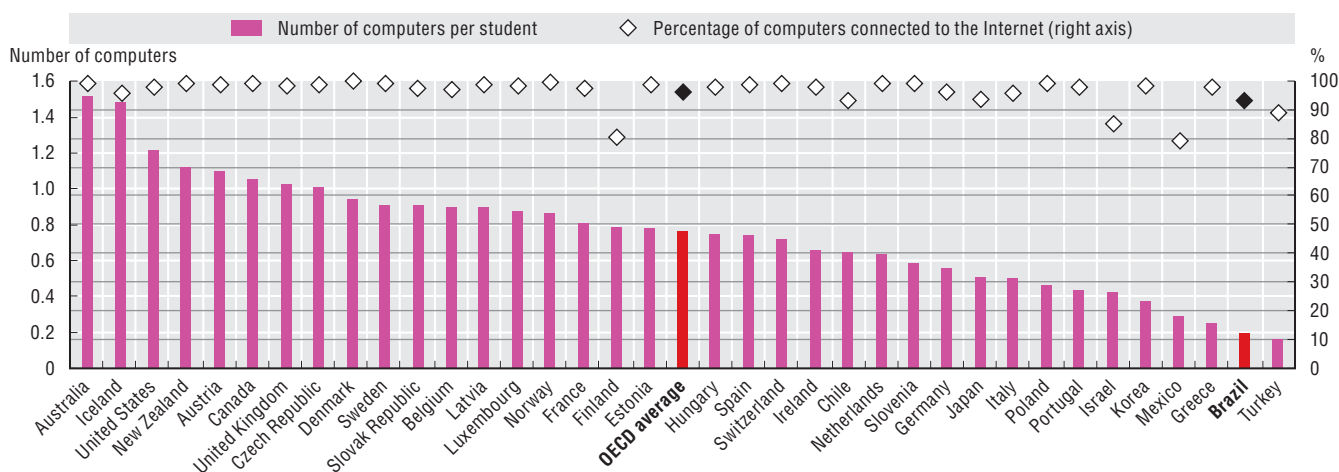
Source: OECD (2016), *PISA 2015 Results (Volume II): Policies and Practices for Successful Schools, http://dx.doi.org/10.1787/9789264267510-en.*

Figure 3.12. Connectivity in Brazilian schools, 2018

As a percentage of schools with Internet access in urban and rural areas

Source: CGI.br (2019c), *ICT Education 2018: Survey on the Use of Information and Communication Technologies in Brazilian Schools* (database), *https://cetic.br/ en/pesquisa/educacao/indicadores/* (accessed in February 2020).

According to teachers in schools in urban areas, the low number of computers per student, the low number of computers connected to the Internet and the quality of connections are the main barriers to the effective use of technologies in education (CGI.br, 2019c). Only above one-third perceive there is a lack of pedagogical support for teachers for the use of computers and the Internet, but about 60% believe the absence of a specific course for the use of computer and the Internet in classrooms is a barrier. In rural schools, the development of training programmes for teachers and the development of new teaching practices, which include the use of computers and the Internet, are perceived as priority actions to improve and increase the use of Internet in schools (CGI.br, 2019c).

Overall, the pedagogical use of ICT in Brazilian classrooms remains below its potential. The programmes supporting diffusion of technology in education did not result in improvement in social inclusion in Brazilian public schools. This is due to physical and structural conditions, difficult access to equipment and, especially, insufficient or inadequate training of teachers on the use of digital technology resources. Technology will make a positive difference in education only if teachers are ready and able to use it effectively, and if schools and school systems sustain an atmosphere that promotes innovation. In addition to having access to the required hardware and software, teachers should be properly trained in the use of ICT – for instance, through communities of practice – and be encouraged to take risks (OECD, 2018a). It is also important for teachers to interact with peers, so as to spur real innovation in pedagogical practices (Brasilino et al., 2018). Improving initial and continuing training of primary, secondary and high school teachers is one of the strategic actions listed in the E-Digital Strategy concerning education, these insights should be taken into account while devising courses and guidance for teachers.

Connected Education is based on a holistic view of the use of ICTs in schools

The Connected Education programme, launched in 2017, complements the Proinfo and Broadband in Schools programmes. The programme, a joint venture between the MEC, the MCTIC, BNDES and the Internet Steering Committee (Comitê Gestor da Internet, CGI.br), is designed to combine efforts among public institutions at all levels of government, schools and civil society. The programme is built around four dimensions: 1) vision; 2) training; 3) digital educational resources; and 4) infrastructure. In order to benefit from federal funding, municipalities have to set their own vision on how digital technologies will be used in the school or network of schools. The programme makes use of local "articulators" (6 000 throughout the country), who assist municipalities in the implementation of the programme. In terms of teacher training, the programme foresees actions for initial and continuing education of teachers, including on the pedagogical use of technology. The federal government has set up an online platform, offering more than 20 000 educational multimedia resources for students and teachers of the basic education system. Through a contract with four universities, additional content is being developed in line with the BNCC and to include computational thinking. Looking forward, the MEC plans to also include courses on entrepreneurship, coding, robotics, cyberbullying and online

behaviour. A second platform, AVAMEC, provides a virtual environment where teachers and students can follow online courses and interact with their peers. In terms of infrastructures, the programme provides the upgrade in speed, which is needed to use the interactive content, thus complementing other programmes which provide connectivity (Figure 3.10). The Connected Education programme is therefore much more comprehensive than ProInfo, as it has a more holistic view of the process through which digital technologies can be effectively integrated into education. Municipalities and schools should provide the right incentives to teachers to make use of the educational resources, both for their own learning and teaching, and to share them with students. Furthermore, despite online availability of education material and the virtual community enabled by AVAMEC, in-person courses where teachers can also exchange and learn from each other should be promoted. The Senate is currently discussing a bill which would formally make Connected Education the national policy for innovation in education.

Start-ups are also offering innovative solutions to provide schools with the tools for education in the digital age. There are presently 364 EdTech start-ups in Brazil (ABStartups and CIEB, 2019). Arco Educação, one of the Brazilian unicorns (see Chapter 5) focuses on educational solutions for basic education, providing technology, content and services from early childhood to high school. Mundo4D brings Education 4.0 to schools through experimentation of new technologies, whereas Faz Game provides teachers with a proactive and motivating way of teaching where students learn by creating educational games of diverse content, developing skills such as creativity, collaboration and resilience (BrazilLab, 2020). Other start-ups, such as QEDU, make use of publicly available data to provide in-depth analyses and present information in an innovative manner, so as to provide evidence for policy makers to improve schools.

Procuring services from start-ups is, however, not straightforward for the government. The general Procurement Law (Lei da Licitação, 8.666/93) does not formally exclude start-ups from public procurement. However, start-ups are often not capable of competing in public calls, as they lack experience or do not reach the turnover thresholds. The Innovation Law (Law 10.973/2004) and the Legal Framework for Innovation (Decree 9.283/2018) foresee the "technological order" of an innovative solution and the actual delivery of the innovative solution previously ordered. To contract such orders, however, civil servants need to have a deep understanding of industries, technologies and markets. High risk aversion among civil servants, who are personally liable for decisions taken as part of their duty, coupled with an increasing scrutiny from the Federal Court of Accounts, have limited the application of this law. The proposal for a legal framework for start-ups aims to make procurement from start-ups more agile, by introducing a trial period during which the public administration can test the solution offered by the company before proceeding to a full procurement. Such a provision, while safeguarding diligence in spending public resources, would allow young innovative enterprises to offer their solutions. Looking forward, it may also be necessary for Brazil to make its public procurement rules more suitable for start-ups to provide their services. Subsidies for schools to finance such solutions may also be envisaged.

Box 3.2. Policy recommendations to foster the use of digital technologies by individuals

Establish a wider set of demand-side policies to balance existing supply-side measures for digital inclusion, so as to foster digital skills and address the digital divide:

- Raise awareness on the benefits of Internet use among all people.
- Develop specific content, services and applications that meet the needs of those with low digital uptake, e.g. low-educated, low-income and elderly people.
- Offer large-scale online courses on Internet safety and security, online banking, access to digital government services, e-commerce, content creation.
- Increase the role of telecentres as training providers and ensure adequate funding and technical assistance from the federal government.
- Scale up the National Digital Inclusion Agent Training and the Computers for Inclusion programmes, in co-operation with the private sector.

> **Box 3.2. Policy recommendations to foster the use of digital technologies by individuals** (cont.)
>
> - Adapt textbooks, train teachers and align performance assessments in schools to the new National Common Curricular Base. Establish a sound monitoring and evaluation system to ensure equal implementation across the country.
> - Develop a plan for regular monitoring and evaluation of the Connected Education programme.
> - Foresee teachers' training courses for the use of ICTs in education that favour interaction and peer sharing of experiences.
> - Reform regulation as to allow public procurement of innovative services and solutions from start-ups.

Uptake of digital technologies by firms

Digital technologies have the potential to increase productivity in firms and thus to boost economic activity across sectors. Online channels can increase exposure to a firm's products and services, therefore increasing their business potential. In embracing the digital transformation, different sectors may face challenges that are specific to their economic activity. Looking across sectors, however, there are also economy-wide factors at play. Brazilian enterprises operate within an economic environment that involves high costs, referred to as "Brazilian cost" (*custo Brasil*) (Dutz et al., 2018). This is the result of insufficient infrastructure, a complex taxation system with both high levels of taxation and compliance costs, high entry barriers and insolvency costs, and limited access to finance, especially for smaller enterprises. The lack of skills of the working population and the low quality of the education systems also hinder the development of more knowledge-intensive activities. Brazil's tariffs on imported goods, including for ICT goods, further increase the cost of inputs (OECD, 2019c). Finally, support of existing industry structures has been found to inhibit the reallocation of resources towards more productive uses and to reduce incentives for innovation (OECD, 2018b).

All of these factors tend to discourage competition, innovation and ultimately slow down the digital transformation of the country, as they favour incumbents and hinder experimentation with new ideas, technologies and business models, which are the drivers of productivity growth in the digital age (OECD, 2019d). For enterprises to invest in digital technologies, reforms are needed in the above-mentioned policy areas to strengthen incentives to innovate.

Brazil has recently approved new measures, such as the Declaration of Rights of Economic Freedom (Declaração de Direitos de Liberdade Econômica – Law 13.784 of 20 September 2019), the launch of the Growth Routes Plan (Rota da crescimento) in 2020, and Ordinance 2.023 of 12 September 2019 eliminating import tax on 34 IT and telecommunication goods. It is also discussing a comprehensive tax reform. These are crucial in fostering an environment conducive to innovation.

Brazilian firms are at an early stage of adoption of digital technologies

Internet connectivity and access to ICTs is quite widespread among Brazilian enterprises, as nearly all enterprises with ten or more employees had a computer (97%) and had accessed the Internet over the last 12 months (97%) in 2019, with no large differences across sizes, regions or sectors. However, among micro-enterprises, which account for the large majority of firms in Brazil, connections to the Internet (88%) and computer use (89%) were significantly lower (2017 data), pointing to a gap that needs to be closed. Micro-enterprises not using the Internet reported lack of skills as the main barrier to access, closely followed by lack of interest (CGI.br, 2018). These findings suggest a need for awareness-raising campaigns on the benefits of the Internet and digital technologies, as well as technical assistance and training for their uptake and use.

Enterprises tend to have quite slow connection speeds, with 52% (those with ten employees or more) reporting connection speeds between 1 Mbps and 30 Mbps and 42% above 30 Mbps. To ensure uninterrupted Internet connections, many enterprises contract more than one connection service. In 2017, this was the case of 76% of enterprises with 10 employees or more. This share increased to 91% in large enterprises and 82% in companies in the ICT service and telecommunication sector (CGI.br, 2018), which are also the

enterprises with the greatest adoption of sophisticated digital technologies, e.g. Customer Relationship Management (CRM) and Enterprise Resource Planning (ERP). These patterns confirm that access to fast and reliable connections is an important factor for the uptake of more sophisticated digital technologies. Public policies to improve connectivity are, therefore, key to promote digital uptake by businesses.

Despite widespread access to the Internet, Brazilian enterprises lag behind those in OECD countries for the use of the Internet and digital technologies. In 2019, only 54% of Brazilian enterprises (10 employees or more) had their own website, against the OECD average of 78%. The use of CRM (22%) and ERP (29%) was also below the OECD average (31% and 36%, respectively). However, these average figures conceal a wide gap among large and small enterprises, as digital uptake among large enterprises is in line with OECD countries, in particular for websites and ERP (Figure 3.13). Brazilian enterprises are also catching up in the adoption of cloud computing services.

Small and micro-enterprises are much more prone to using social network accounts rather than websites. Brazilian Internet users are heavy users of social networks, which businesses are increasingly using as a communication channel with costumers. Overall, Brazilian enterprises stand out well above the OECD for the use of social networks (76% and 57%, respectively).

Figure 3.13. Diffusion of selected ICT tools and activities in enterprises in Brazil and the OECD, 2019 or latest available year

*As a percentage of all firms with ten or more employees*
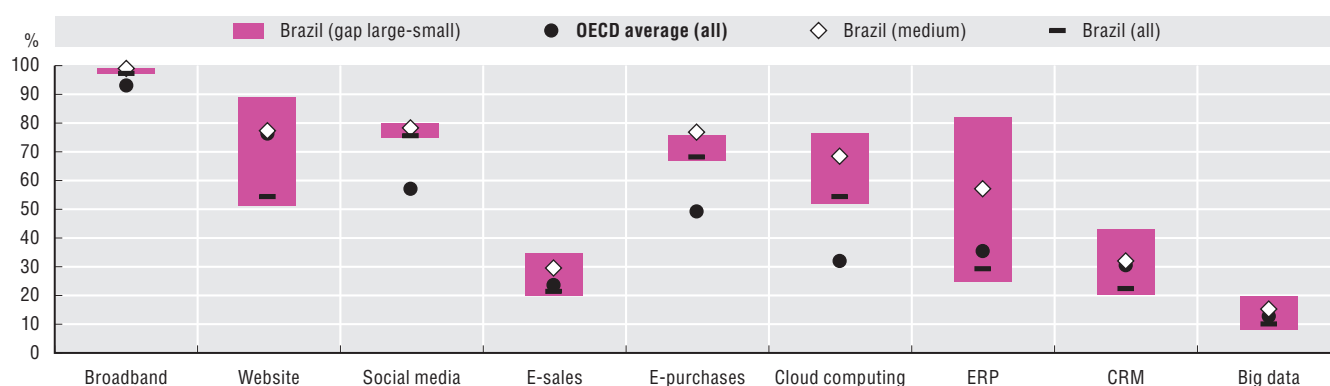
Notes: ERP = Enterprise Resource Planning; CRM = Customer Relationship Management. Average OECD is an unweighted average of available countries in each ICT tool and activity for all enterprises. Data for broadband for OECD countries refer to 2017. Data for e-purchases, cloud computing and big data for OECD countries refer to 2018. The indicator for cloud computing for Brazil is based on the use of four cloud services (e-mail, data storage, computing power and office software), instead of seven considered for the OECD countries.

Sources: OECD (2020b), *ICT Access and Usage by Businesses* (database), *http://oe.cd/bus* (accessed in March 2020); CGI.br (2020b), *ICT Enterprises 2019: Survey on the Use of Information and Communication Technologies in Brazilian Enterprises* (database), *https://cetic.br/en/pesquisa/empresas/indicadores/* (accessed in July 2020).

Based on the 2014 ICT Enterprises Survey microdata (Siqueira et al., 2017) calculated an ICT use index, showing that most small and medium-sized enterprises (SMEs) are still excluded from an effective use of digital technologies (Figure 3.15). Such a gap is likely to be even wider for the large number of informal enterprises, for which statistics are not available. Informality can inhibit digitalisation, as informal firms may wish to remain small to avoid detection. On the other hand, the government can use digital technologies to reduce informality, for instance by making electronic record keeping cash registers compulsory, as Latvia has done (OECD, forthcoming b). These findings point to the need for public policies to help smaller enterprises overcome barriers to the use of advanced digital tools, by providing technical extension services and targeted programmes to support skills development and investments.

The government can also provide incentives for the use of digital tools, for instance by offering a lower (or zero) fee for the completion of a compulsory service through online channels, as compared to the physical alternative (e.g. procurement of services). At present, for instance, paying taxes online is still used by only half of micro-enterprises and not by all bigger firms (Figure 3.16), and the proportion of firms using e-procurement services is even lower. Ninety-two per cent of firms (with more than ten employees) use the Internet to interact with public authorities or perform services on line, compared to 76% of micro-enterprises.

Figure 3.14. Adoption of digital technologies by Brazilian firms, by firm size, 2019 or latest available year

As a percentage of firms with an Internet connection,
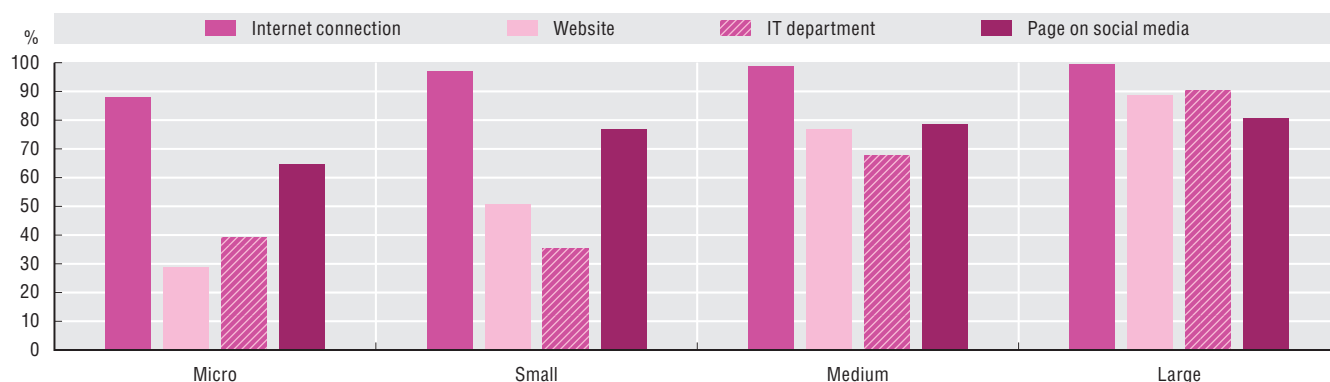
Notes: Data for micro-enterprises refer to 2017. IT department is one person for micro-enterprises.

Sources: CGI.br (2020b), *ICT Enterprises 2019: Survey on the Use of Information and Communication Technologies in Brazilian Enterprises* (database), *https://cetic.br/en/pesquisa/empresas/indicadores/* (accessed in July 2020); CGI.br (2018), *ICT Enterprises 2017: Survey on the Use of Information and Communication Technologies in Brazilian Enterprises* (database), *https://cetic.br/en/pesquisa/empresas/indicadores/* (accessed in February 2020).

Figure 3.15. ICT use index of Brazilian firms with ten or more employees, 2014
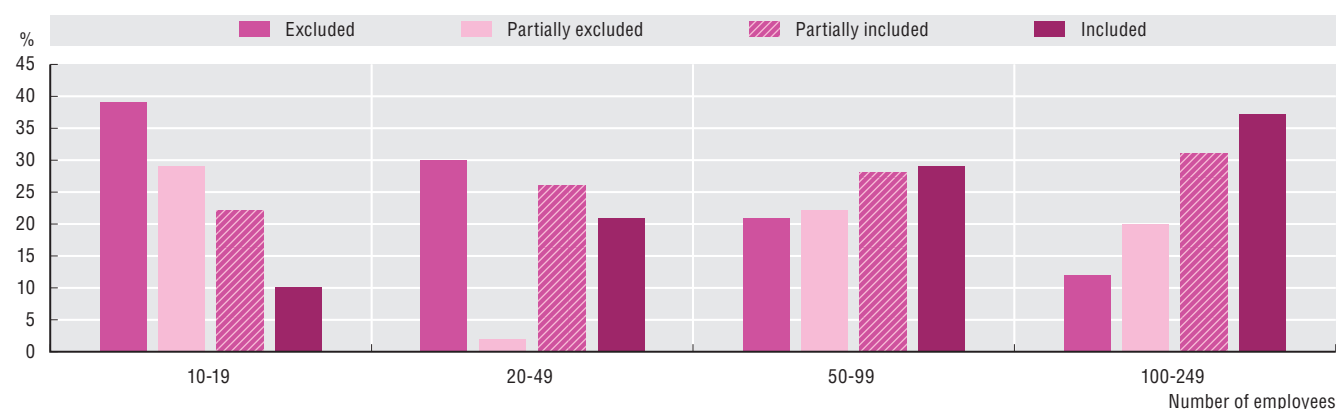
Source: Siqueira et al. (2017), "Using a Digital Divide Index among enterprises in the context of public policies in Brazil" *http://aisel.aisnet.org/confirm2017/41*.

Figure 3.16. Use of digital government services by Brazilian firms, 2019 or latest available year

Firms interacting with public authorities, by activity, as a percentage of firms using the Internet
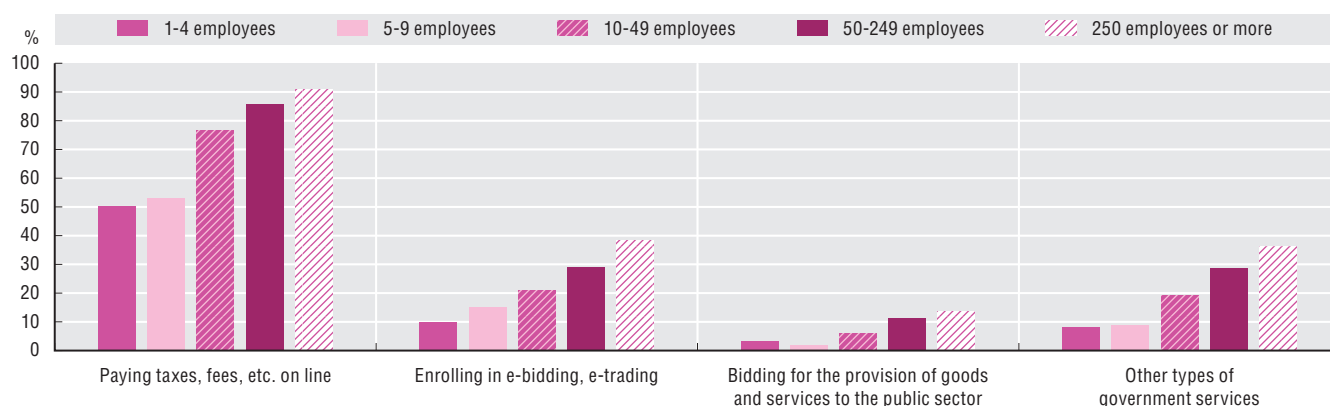
Note: Data for micro-enterprises refer to 2017.

Sources: CGI.br (2020b), *ICT Enterprises 2019: Survey on the Use of Information and Communication Technologies in Brazilian Enterprises* (database), *https://cetic.br/en/pesquisa/empresas/indicadores/* (accessed in July 2020); CGI.br (2018), *ICT Enterprises 2017: Survey on the Use of Information and Communication Technologies in Brazilian Enterprises* (database), *https://cetic.br/en/pesquisa/empresas/indicadores/* (accessed in February 2020).

Advanced manufacturing and the diffusion of the Internet of Things (IoT) are two key strategies adopted by the Brazilian government for digital transformation. Both require a set of technologies, such as sensors, software, data analytics and computing capacity, among others. Concerning IoT, in 2019, Brazil had a penetration of 10.6 machine-to-machine (M2M) SIM cards per 100 habitants, compared to the OECD average of 22. The number of M2M subscriptions was 22 million in 2019 (see Chapter 2).

For the manufacturing sector, the introduction of technologies related to the fourth industrial revolution is still at an early stage of development. Firms, especially large ones, report investing in these technologies or having the intention to do so in the near future (CNI, 2018). More than two-thirds of firms report high adoption costs as one of the main barriers. Other barriers, such as a lack of skilled workers (30%), inadequate infrastructure (26%), or difficulties to integrate new technologies and software (20%) were mentioned less frequently (CNI, 2016). The high cost of technology adoption is partly the result of high import tariffs on foreign ICT goods. Companies purchasing intermediate or capital goods are paying higher prices than in other countries (OECD, forthcoming c). Investments for Industry 4.0 need to be tailored to a firm's needs, while the technical solution has to be purchased by different suppliers. Integration companies play the role of intermediators between available technologies and enterprises. According to the National Confederation of Industry (Confederação Nacional da Indústria, CNI), only 50 such companies are currently operating in the country, mainly with a focus on large companies. A related issue is that, in most cases, SMEs lack a digitalisation plan. The recently launched Inovacred 4.0 programme by the Brazilian Agency for Innovation and Research (Financiadora de Estudos e Projetos, FINEP) aims to address these needs, by supporting investment in Industry 4.0 technologies, through the support of intermediary companies (see below).

E-commerce is growing, but structural problems hinder its development

E-commerce sales were valued at USD 14.6 billion (BRL 53.2 billion) in 2018, a 12% increase over 2017 and reflecting an estimated annual growth rate of 11% over 2015-19 (Figure 3.17). Several large multinational retailers and online platforms (e.g. MercadoLibre and Amazon) are active in the country. Although in 2015 Brazil accounted for about 40% of the e-commerce in Latin America (UNCTAD, 2015), the value of e-commerce in the country has not reached the full potential of a market of 107.5 million adult Internet users. Only 21% of enterprises sold on line in 2019. In 2017, e-commerce sales represented only 6% of total retail sales, compared to 20% in the People's Republic of China (hereafter "China"), 19% in Korea and 12% in the United States (McKinsey, 2019). Nonetheless, e-commerce sales in Brazil grew at an annual rate of 16% in 2019, far exceeding growth in the economy as a whole (Ebit Nielsen, 2020).

**Figure 3.17. E-commerce turnover in Brazil, 2015-19**
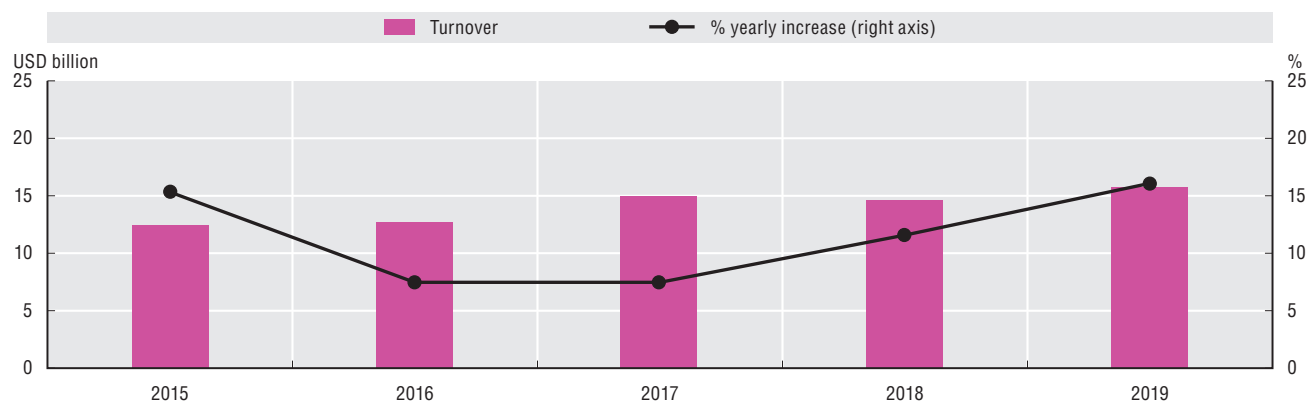
Source: Ebit Nielsen (2020), *Webshoppers 41ª Edição, www.ebit.com.br/webshoppers*.

Unlike most OECD countries, the gap between large and small enterprises in e-commerce engagement is not very wide (Figure 3.18). The gap with micro-enterprises is also small, with 19% reporting selling on line in 2017 (CGI.br, 2018). The rate of enterprises participating in e-commerce has grown for all sectors and regions. Some sectors, such as food and accommodation, stand out in terms of online sales (Figure 3.19).

Figure 3.18. Firm participation in e-commerce in Brazil and the OECD, by size, 2019

*As a percentage of firms with ten or more employees*
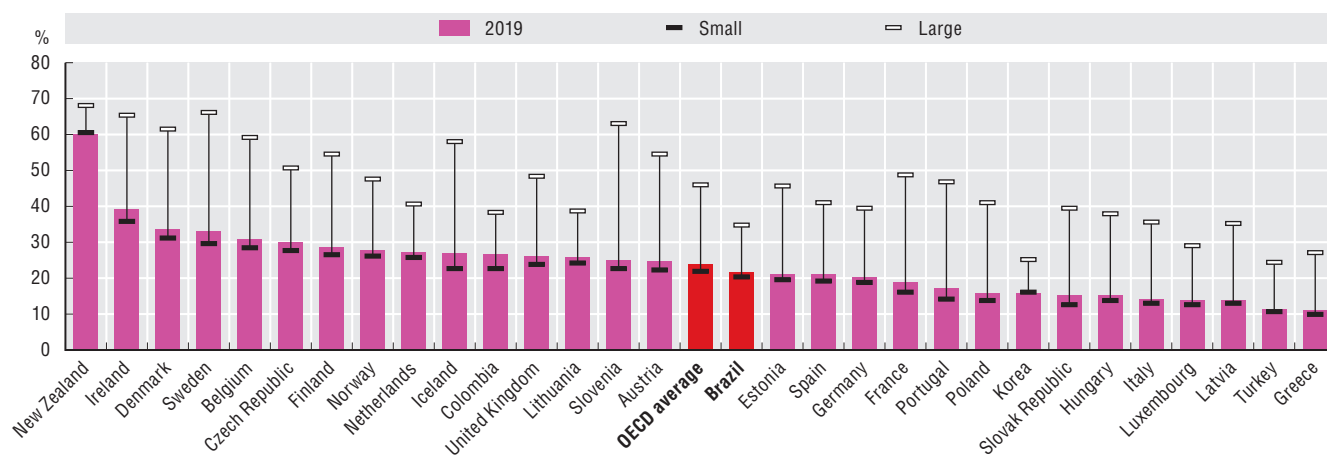
Notes: Firm participation is the percentage of all businesses employing more than ten employees receiving orders over computer networks. Small firms are defined as companies with 10 to 49 employees, and large firms as companies with 250 or more employees. Data for Colombia, Iceland, Korea and New Zealand refer to 2018.

Sources: Adapted from OECD (2019e), *Unpacking E-commerce: Business Models, Trends and Policies*, *https://doi.org/10.1787/23561431-en*. OECD calculations based on OECD (2020b), *ICT Access and Usage by Businesses* (database), *http://oe.cd/bus* (accessed in March 2020) and CGI.br (2020b), *ICT Enterprises 2019: Survey on the Use of Information and Communication Technologies in Brazilian Enterprises* (database), *https://cetic.br/en/pesquisa/empresas/indicadores/* (accessed in July 2020).

Figure 3.19. Evolution of e-commerce in Brazil, 2012 and 2019

As a percentage of firms with ten or more employees selling on line
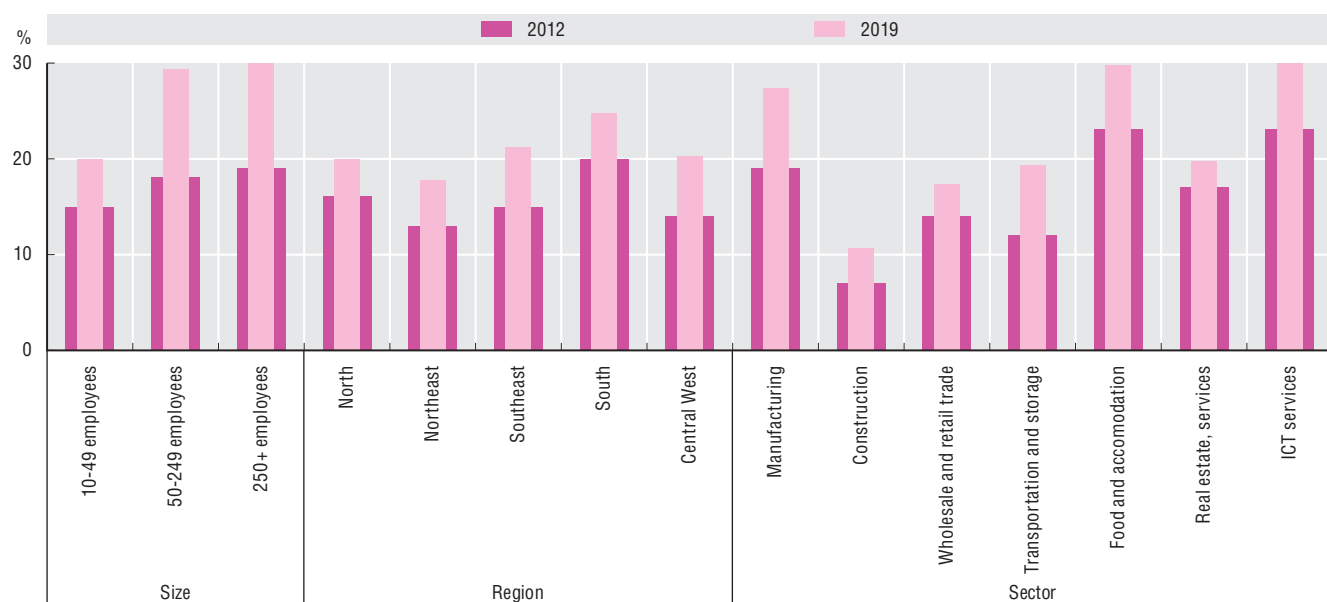
Note: ICT = information and communication technology.

Source: CGI.br (2020b), *ICT Enterprises 2019: Survey on the Use of Information and Communication Technologies in Brazilian Enterprises* (database), *https://cetic.br/en/pesquisa/empresas/indicadores/* (accessed in July 2020).

Enterprises in Brazil, and especially SMEs, still use emails as channels for concluding online transactions and increasingly use social media as marketplaces (CGI.br, 2020b). In a 2018 survey among SMEs engaged in e-commerce, email was the main service channel (90% of respondents), followed by WhatsApp (82%) and Facebook (64%) (SEBRAE and E-commerce Brasil, 2018). The share of enterprises engaged in e-commerce through Facebook was indeed found to be higher than the general population, as 67% of enterprises active on Facebook were selling on line (OECD, 2019e).

The market for e-commerce is concentrated, with the ten main marketplaces accounting for about 63% of total turnover (SBVC, 2018). Many SMEs use marketplace platforms to penetrate the market easily. By aligning themselves with a larger, known business, these stores can gain visibility and, in some cases, use the marketplace's options for payment. A majority (61%) of sellers on MercadoLibre (known as MercadoLivre in Brazil), one of the largest platforms operating in the country, are micro-enterprises or SMEs.

Among firms with Internet access, the main reasons reported for not selling on line are preference for their current business model (51%) and the perception that their products are unsuitable for online sales (49%) (Figure 3.22). Small enterprises also frequently reported high cost of development and lack of staff (CGI.br, 2018). Product suitability was reported as an obstacle to e-commerce in all sectors and is a challenge common to other countries (OECD, 2019e). This finding suggests that the perception about product suitability as an obstacle may be somewhat overrated among businesses and awareness-raising campaigns could increase their engagement with e-commerce.

On the consumer side, 38% of Internet users aged 16-74 had made purchases on line in the 12 months prior to the survey, with young (25-44 years old), wealthier and more educated consumers being more likely to shop on line. Brazil has the largest gap between the top and the bottom income quartiles (59 percentage points) among OECD countries and partner economies (OECD, 2019f). The main reasons among Internet users for not making purchases on line were the preference for seeing the physical product before buying it (86%) and trust-related issues (Figure 3.20).

Figure 3.20. Barriers preventing Brazilian Internet users from shopping on line, 2018

As a percentage of Internet users aged 16-74 who did not purchase goods or services on line in the last 12 months
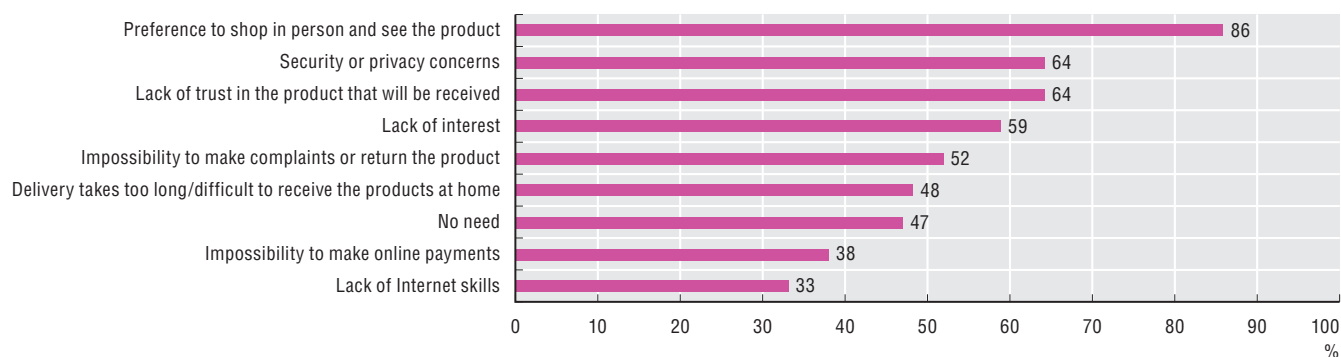

Source: CGI.br (2019a), *ICT Households 2018: Survey on the Use of Information and Communication Technologies in Brazilian Households* (database), *https://cetic.br/en/pesquisa/domicilios/indicadores/* (accessed in February 2020).

Financial inclusion is still low

Online financial services, including online bank accounts, credit, investments and insurance, are not widely diffused in Brazil (FEBRABAN/Deloitte, 2019). Financial inclusion is a challenge, as 30% of economically active people do not have a bank account and most payments are made in cash. Half of online shoppers in Brazil pay through a bank slip called *boleto bancário* and this is indeed one of the most diffused payment methods firms report on their online sales (Figure 3.21). Customers pay with cash banks, participating drugstores and ATMs and then send proof of payment to the company, with consequences on the business pace, as it takes a few days for these slips to be processed. The unbanked population, however, is driving the creation of new solutions, with many start-ups proposing financial services, thus breaking down barriers to financial inclusion (see Chapter 6). Platforms such as MercadoLibre have also introduced their own payment system, i.e. MercadoPago, which has developed from the platform-specific payment solution to a stand-alone online payment service available also for other online and off line stores.

Figure 3.21. Payment methods used for online shopping in Brazil, 2019

As a percentage of enterprises that sold on line in the past 12 months, 2019
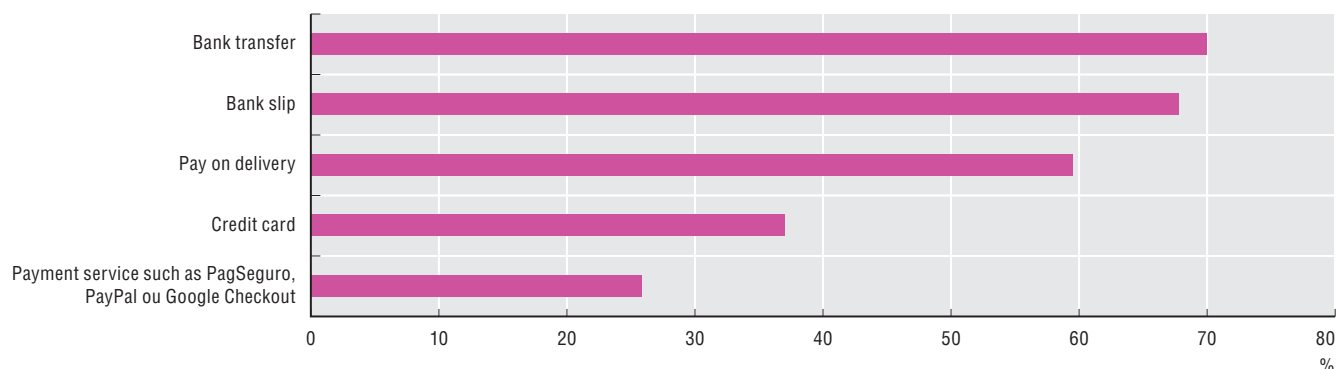
Source: CGI.br (2020b), *ICT Enterprises 2019: Survey on the Use of Information and Communication Technologies in Brazilian Enterprises* (database), *https://cetic.br/en/pesquisa/empresas/indicadores/* (accessed in July 2020).

The Central Bank of Brazil has also worked to implement an Instant Payment Ecosystem in Brazil (PIX), which will be implemented in November 2020. Work carried out in 2018 has resulted in a communication (Comunicado No. 32.927/2018, modified by 34.085/2019) on the fundamental requisites for the ecosystem. A permanent advisory committee, the Forum for Instant Payment (Ordinance 102.166/2019), has supported the Central Bank in defining rules for the instant payment ecosystem. In parallel, the Central Bank has developed the infrastructure and the centralised database. Importantly, Brazilians will be able to pay federal taxes through PIX, and all financial and payment institutions with more than 500 000 active customer accounts will be required to participate in PIX, offering their customers all their functionalities for initiating and receiving payments. The other financial and payment institutions, even those that have not yet reached the limits to request authorisation to operate as a payment institution, may, on an optional basis, participate in PIX since its launch. Instant payment will offer a quick and safe alternative for payments and is therefore expected to support e-commerce growth.

Logistics need to be improved

The other main factors hindering the development of e-commerce are logistics, particularly the high costs and long delays for last-mile delivery, and taxation, as consumption tax rates vary across states. Data from the Brazilian Micro and Small Business Support Service (Serviço Brasileiro de Apoio às Micro e Pequenas Empresas, SEBRAE) (SEBRAE and E-commerce Brasil, 2018) show that the main barriers for small businesses are the tax burden (43%), followed by logistics (42%), as well as marketing and competition/showrooming (30%). Interviews with large market players also confirmed that logistics and taxation are the main challenges faced by companies engaged in e-commerce.

Long distances, high traffic congestion in big cities and poor road conditions outside add up to long delivery delays (Figure 3.23).
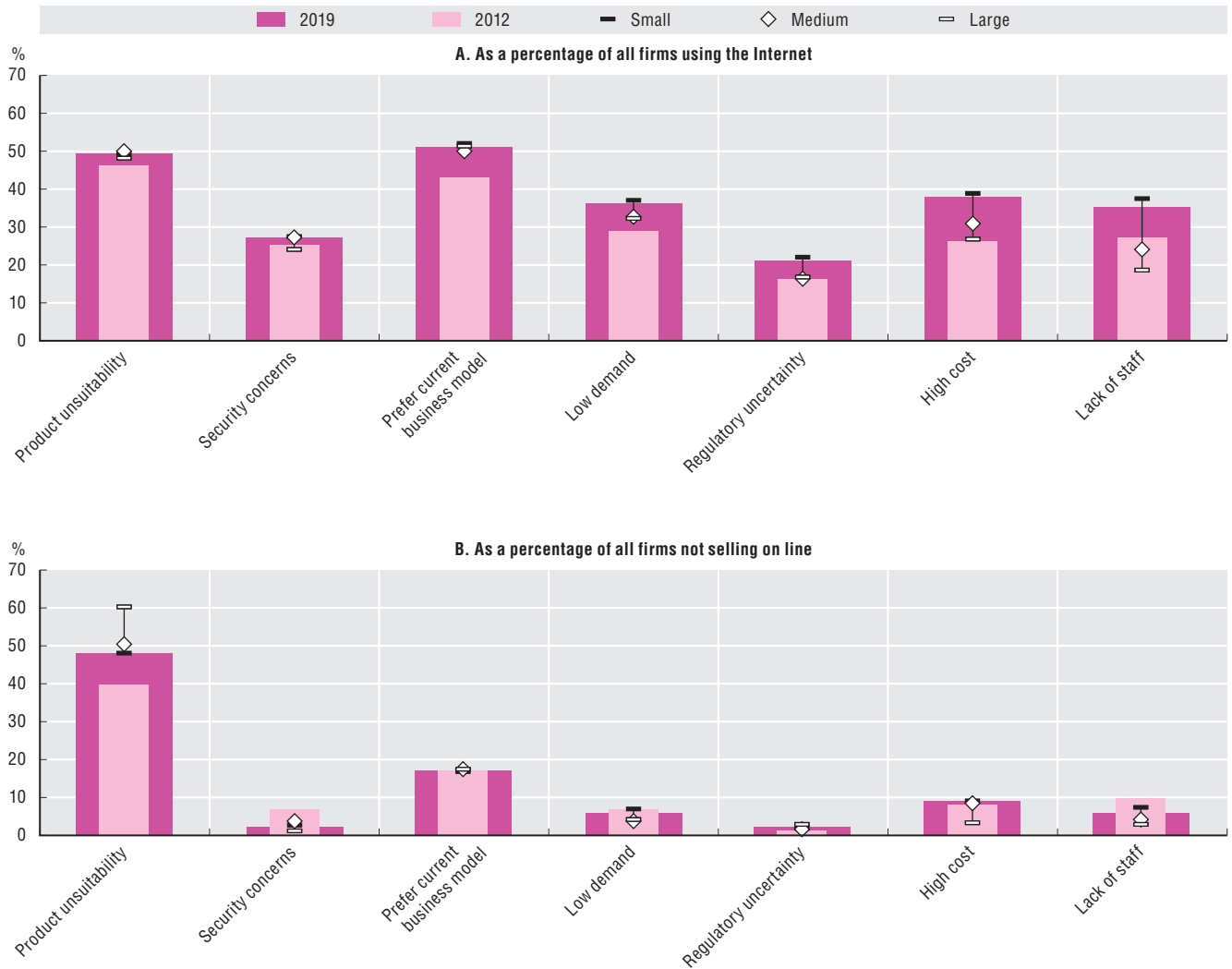
The market structure also affects the costs and delays for product deliveries. The government-owned national post, Empresa Brasileira de Correios e Telégrafos (ECT, hereafter "Correios") is the mostly used delivery system. Online retailers relied on Correios freight in 88.6% of cases in 2018, while only 9.8% had their own delivery system and 58.7% used other private carriers (ABComm and Comschool, 2019).

Correios has a monopoly on mail delivery (exclusive right to receive, transport and deliver in the national territory, and to expedite abroad, letters, postcards and group mail) as established by Article 21 of the Constitution and Article 9 of Law 6.538/1978 (the "Postal Law"). It does not have a monopoly on parcel delivery. The company benefits from reciprocal tax immunity (exemption from taxes on property, rent and income), is exempt of the interstate checks from the Department of Federal Revenue (Receita Federal), and is under the procedural regime of a public company. The above privileges are granted to Correios so to ensure universal service provision of mail across the country. However, these privileges should not act as a barrier for the development of a competitive parcel delivery market.

Figure 3.22. Barriers to e-commerce reported by firms in Brazil, 2019

As a percentage of firms with ten or more employees using the Internet

A. As a percentage of all firms using the Internet

B. As a percentage of all firms not selling on line

Source: CGI.br (2020b), *ICT Enterprises 2019: Survey on the Use of Information and Communication Technologies in Brazilian Enterprises* (database), *https://cetic.br/en/pesquisa/empresas/indicadores/* (accessed in July 2020).

Figure 3.23. Average time of delivery in Brazil, by region, 2013-19
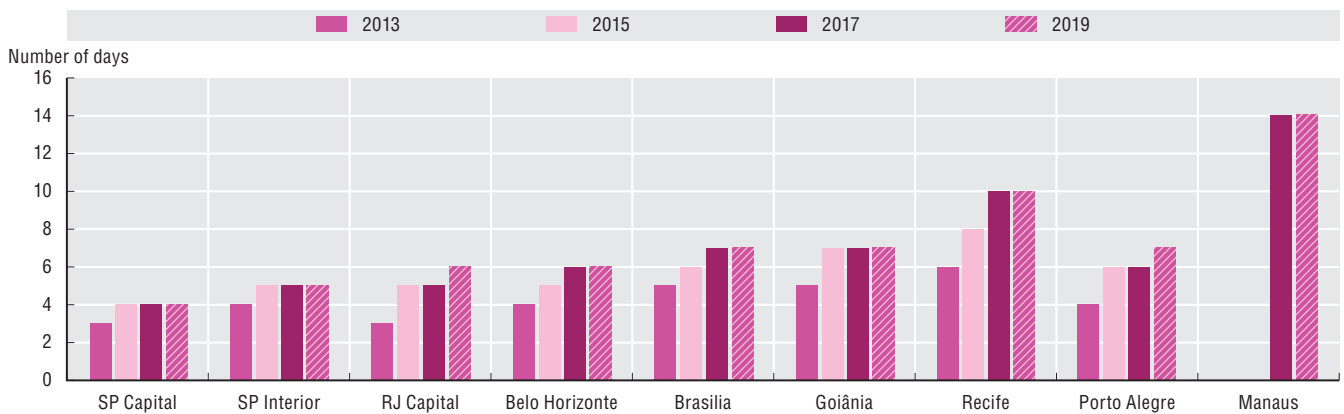
Note: SP = São Paolo; RJ = Rio de Janeiro.

Source: ABComm and Comschool (2019), *Pesquisa: Logística no E-commerce Brasileiro 2019* https://abcomm.org/noticias/pesquisa-logistica-no-e-commerce-2019/.

Postal services across the globe are all experiencing similar challenges, due to the decreasing volume of postal mail, and an increasing volume of parcel deliveries, spurred by e-commerce. In this context, universal service providers are struggling to ensure universal service obligation requirements, while facing increased competition. Particularly in large countries, new entrants usually cherry-pick the most profitable consumers, leaving the incumbent with those consumers who provide insufficient revenue to cover their costs. The Brazilian postal market shows some similarities to the Canadian one, a country which also includes remote, sparsely populated areas. The postal service is not fully liberalised in either of these countries, i.e. the state-owned operator has a monopoly for the letter segment, while it has to compete with private operators in the parcel delivery market. Both countries also lack a national regulatory authority for postal services. This restricts transparency, as competitors cannot be confident that competition is fair, i.e. that there is no cross-subsidisation from monopolistic activities to the other market segments. Canada uses several measures to prevent such cross-subsidisation. A major tool is the Annual Cost Study Contribution Analysis. It is drafted by Canada Post and audited by an independent company (ERGP, 2019). Lacking an independent postal regulator, Brazil may wish to ensure greater transparency through regular reporting by Correios, audited by an independent body.

In the European Union, postal markets have been opened to competition in the past 20 years. This has been done through regulation aimed at liberalising the sector, while ensuring consumer protection through universal service obligation. Some countries, such as Germany, have established that if universal service cannot be fulfilled by the market, then all licensed operators must provide the service jointly. In Brazil, standing regulations require that private delivery companies pay a fee of 0.5% of their revenues to help support the universal service requirement. However, the fee is applied unevenly, and it is unclear which private companies are required to pay (Syndex/Uni Global, 2019).

For e-commerce to further develop, Brazil should ensure greater competition in the parcel delivery market. This may require that the government carry out an in-depth analysis of the postal service market. In the meantime, the country may apply some measures, such as those outlined above, i.e. transparent reporting and private sector contribution to universal service obligation.

The taxation system limits e-commerce potential

The taxation system affects the development of e-commerce in Brazil. Goods sold on line are subject to a state-level tax, which is applied to the movement of goods, transport services and telecommunication services (the ICMS). ICMS rates vary across states from 17% (standard rate) to 18% (e.g. São Paulo) and 20% in Rio de Janeiro. Interstate sales are subject to an interstate ICMS, at a rate of 4% (for interstate transactions with imported goods), 7% or 12% (depending on the region where the goods are sent to) (Figure 3.24), plus the difference between the ICMS rate of the destination state and the interstate rate (Diferencial de Aliquotas do ICMS, DIFAL) (Convênio ICMS 152/2015). A company based in one state and selling to another has to pay the ICMS at the interstate rate to the state of origin and the DIFAL to the state of destination.[2] The variation of ICMS rate across states and the compliance costs related to the payment of the interstate ICMS are clearly an obstacle to the development of e-commerce in Brazil. Establishing a harmonised value-added tax (VAT) system across states is among the most urgent reforms the country should undertake to foster e-commerce.

Figure 3.24. Interstate ICMS rates, 2019
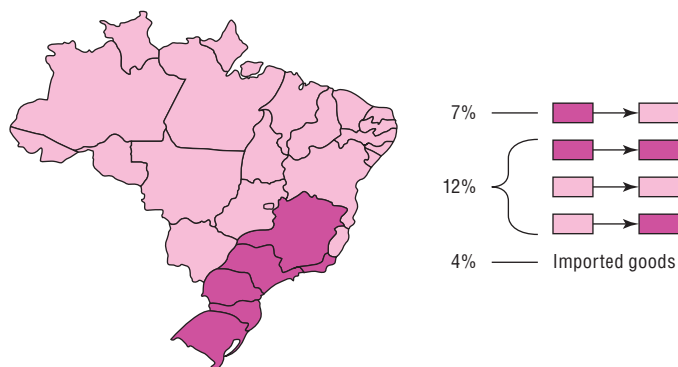
Note: ICMS = tax on movement of goods, transport and telecommunication services.

Source: MercadoLibre; original map by Koury Lopes Advogados.

Some of the ICMS rules may also be an obstacle to the development of multichannel e-commerce solutions, which combine buying on line with pick-up and return of goods in stores (multichannel e-commerce). The ICMS is applied to purchases and sales at the exit of merchandise from a company's establishment. Therefore, goods delivered to one's own or franchised stores for pick-up by the final consumer may be regarded by the fiscal authority as a resale and taxed again by the ICMS. Currently, there is a draft bill (PLP 148/2019) proposing an exception of the ICMS on the transfer of goods from the main seller to accredited product delivery stores. Additionally, the Secretary of Development of Industry, Trade, Services and Innovation of the Ministry of Economy (SCM/ME), which is part of the sub-committee on e-commerce and exports (see below), is interacting with the National Council on Tax Policy (Conselho Nacional de Política Fazendária, CONFAZ) – overseeing ICMS regulation implementation – to facilitate application of the current regulation. A resolution from this body would give legal certainty to operators, therefore providing a solution enabling omni-channel e-commerce.

The Digital Transformation Strategy has established a sub-committee on e-commerce and exports. Its main goal is to elaborate actions related to the promotion of domestic and international e-commerce activities, supporting the growth of Brazilian exports of goods and services, in co-ordination with different relevant Brazilian entities, including the Brazilian Trade and Investment Promotion Agency (Agência Brasileira de Promoção de Exportações e Investimentos, Apex), SEBRAE, the Brazilian Institute of Geography and Statistics, and CETIC.br. It is co-ordinated by the Secretary of Development of Industry, Trade, Services and Innovation of the Ministry of Economy and the Division for Technology Promotion of the Ministry of Foreign Affairs. The sub-committee is addressing some of the strategic actions, such as: data in e-commerce, the role of platforms, the measurement of e-commerce, taxation, logistics, international negotiations and digital payments. Up to September 2019, the sub-committee had supported the e-commerce negotiations at the World Trade Organization (Joint Statement on Electronic Commerce of 9 July 2019), and the negotiations of regional free-trade agreements with e-commerce chapters, such as Mercosul-Canada and Mercosul-Korea. In addition, it is working on developing statistics to understand how e-commerce takes place within and across states, based on invoices from the Receita Federal. It has also started a dialogue with the Central Bank of Brazil to support the organisation of a workshop on the Brazilian Instant Payments Ecosystem (see above). The sub-committee has also worked on policy actions for support to firms in domestic and cross-border e-commerce. In this context, the group could count on the participation of Apex and SEBRAE presenting their initiatives for e-commerce.

SEBRAE helps micro and small firms to build their online retail place

SEBRAE is an autonomous non-profit private entity, directly funded by a mandatory contribution from larger enterprises. It offers several services to micro and small enterprises across all sectors to promote their digital transformation, including business consulting, value chain support and export training. Through the programme SEBRAETEC, SEBRAE subsidises consulting services across four different areas: design, quality control, innovation and sustainability. SEBRAE manages a national web portal, as well as 13 portals at the state level, where enterprises and consulting companies can both register to ease the match between the demand for and supply of technology services.

As part of the work carried out within the E-digital sub-committee for e-commerce, SEBRAE has extended the information and practical guidance on e-commerce on its website. Based on the topics discussed by the sub-committee, SEBRAE has revisited its strategy regarding e-commerce. To further encourage micro and small enterprises to engage in e-commerce, SEBRAE offers financial support to companies for tailored business consulting activities on how to make their business more digital, through its newly launched initiative Digital Commerce (Varejo Digital). SEBRAE brought together five affordable solutions to help businesses accelerate their digital transformation, from social networks to e-commerce, online stores and virtual tours. Small firms can assess their degree of digitalisation, then proceed to purchase the solution offered, with SEBRAE financing up to 70% of the cost. Through this service, SEBRAE offers therefore a sort of "digitalisation voucher", i.e. a small grant to help companies digitalise. OECD countries such as Australia, Austria (KMG Digital) and Denmark (SMV:Digital) also offer similar support (OECD, forthcoming a) to foster digital transformation of SMEs. Such support could be extended to encompass more than just e-commerce, such as data protection, big data or online security.

Apex supports the internationalisation of Brazilian firms active in e-commerce

In 2017, Apex launched the e-Xport Programme to raise awareness about business opportunities in e-commerce among Brazilian firms. The initiative attracted interest from 700 Brazilian companies. The programme includes training and mentoring on how to develop an appropriate global marketplace strategy, market intelligence studies, promotion of strategic partnerships with main e-commerce players and customised consultancies. It was aimed at SMEs interested in operating via e-commerce in the international market.

Initially, Apex targeted Argentina, China, Mexico and the United States as key markets with the largest e-commerce opportunity for Brazil. However, in 2018, the e-Xport Programme was revised to focus only on China and the United States. Over the last two years, the following actions have been developed under the e-Xport Programme: 1) negotiation of strategic partnerships with more than ten marketplaces in the target countries, including Alibaba and Amazon; 2) hiring companies specialised in the Chinese and US e-commerce markets to mentor Brazilian companies interested in operating via e-commerce in these markets. The two hired companies mentored 60 companies throughout 2018 and 2019 and individually monitored Brazilian companies interested in operating through e-commerce in these markets. 3) A prospective mission to the United States e-commerce market for 24 Brazilian companies. During the mission, the companies had meetings with professionals from areas important to a US e-commerce operation (accounting, law, payment security) and with Brazilian businessmen who already operate successfully via e-commerce in the United States. In addition, Brazilian companies visited US e-commerce companies and e-commerce logistics companies. For 2020, the e-Xport Programme will be revised in order to carry out more e-commerce qualification actions for Brazilian companies and to increase the capillarity of the e-Xport Programme.

Brazil is stepping up support to the diffusion of digital technologies across the economy

Brazil currently does not have a unified programme supporting the digitalisation of firms. Under the momentum created by the adoption of the E-Digital Strategy, several programmes were launched in 2019 to increase ICT diffusion in the economy, and in particular IoT and technologies for Industry 4.0, and others are under preparation. Some initiatives in support of e-commerce have also been launched or strengthened, as part of the work of the E-digital sub-committee for e-commerce (see above). This is a positive sign, which shows the engagement of several stakeholders and institutions towards the achievement of the strategy's objectives. Furthermore, since adoption of digital technologies spans from investment in ICT capital to software acquisition, website, e-commerce related activities, software development or IT maintenance (IT services), a number of general cross-sector support programmes in Brazil also include provisions, which are relevant for ICT adoption by firms.

Such support programmes are both of a financial and non-financial nature and take the form of credit at more favourable conditions, subsidised business consulting programmes and export training. They are presented in Table 3.3 and are discussed below. Only programmes aimed at increasing ICT use by enterprises are analysed in this chapter; others related to supporting the overall development of the ICT sector through R&D and support to start-ups are discussed in Chapter 5.

BNDES and FINEP are increasingly supporting investments in digital technologies

The two main providers of business support in the country are BNDES and FINEP. This section looks at the support these two institutions provide for ICT adoption by firms.

BNDES is a federal public company whose goal is to provide long-term financing for endeavours that contribute to the country's development. It has a range of financial products earmarked for investment projects, the acquisition of new machinery and equipment, exports of machinery, Brazilian equipment and services, and the acquisition of goods and production inputs (BNDES, 2019).

BNDES supports the ICT sector directly by providing credit at preferential conditions for innovation activities related to software, data centres and IT services, and support to broadband development. Over the past five years, the volume of credit disbursed for the ICT sector amounted to USD 4 billion (BRL 13 billion; figures provided by BNDES). This figure includes credit provided through Cartão (Card) BNDES (see below), and working capital (FINEM Giro), but also credit for innovation (BNDES MPME Inovadora and BNDES FINEM Inovação) and for broadband deployment (FINEM Telecom). These figures

also include credit for the digitalisation of the public administration (FINEM BNDES PMAT e BNDES PMAT Automático). The largest part of this credit was in support of large enterprises (gross annual operational revenue above USD 76 million, or BRL 300 million): 70% of the volume of credit (excluding telecom), 90% including funding for telecom. This is at odds with difficult credit market conditions faced by SMEs in Brazil, with low access to credit and an average interest rate of 25% per year (OECD, 2020c). In the past years, BNDES has increasingly focused its action on SMEs. In the first semester of 2018, spending on SMEs, including micro-enterprises, reached 48.6% of BNDES overall direct lending activities, up from 30.6% in 2016 (BNDES, 2019). Going forward, BNDES should further strengthen its focus on SMEs, in view of supporting their digital uptake.

Table 3.3. Business support programmes for the diffusion of ICT technologies in Brazil

	Support	Size of firms supported	Sector	Instrument specifically designed to foster ICT adoption
Credit at advantageous conditions				
BNDES				
FINAME	Purchase of machinery and equipment, including IT.	All	All	
FINAME Industry 4.0 (launched in 2019)	Purchase of machinery and equipment that contain the technologies associated with advanced manufacturing solutions and Internet of Things services (IoT) categories in the list of BNDES' accredited suppliers.	All	All	✓
Automático	Financing up to USD 38 million (BRL 150 million) for investment projects of companies from all sectors.	All	All	
Card	Pre-approved credit for the purchase of accredited goods and services (such as machinery and equipment, including IT, software, IoT solutions).	Micro, small, medium (turnover up to USD 76 million, or BRL 300 million) Individual entrepreneurs	All	
FINEP				
FINEP Inovação (technological diffusion for innovation)	Purchase of informatics and automation goods.	Medium and large	All	
FINEP Inovacred 4.0 (launched in 2019)	Development and implementation of strategic business digital plans.	Small, medium (turnover up to USD 76 million, BRL 300 million)	Manufacturing	✓
FINEP Software (launched in 2019)	Investments from USD 38 000 (BRL 150 000).	All	All	✓
Subsidised business consulting				
Ministry of Economy Brasil Mais (launched in 2020)	Consultancy services for the optimisation of production processes.	Small and medium (11-200 employees)	Manufacturing, trade and services	✓
SEBRAE Varejo Digital (launched in 2019)	Solutions for digital transformation are offered on a dedicated website. Firms can apply for purchasing the solution, which is financed up to 70% by SEBRAE.	Small and medium	All	✓
SENAI SENAI 4.0 portal	Training courses and a free assessment tool for enterprises to evaluate their degree of maturity in Industry 4.0.	All	Manufacturing	✓
E-commerce export support				
Apex e-Xport	Training and mentoring to develop global marketplace strategy.	All	All	✓

Notes: Apex = Brazilian Agency of Promotion of Exports and Investments; BNDES = Brazilian Development Bank; FINEP = Brazilian Agency for Innovation and Research; MCTIC = Ministry of Science, Technology, Innovations and Communications; SEBRAE = Brazilian Micro and Small Business Support Agency; SENAI = National Service for Industrial Training.

Source: OECD, based on BNDES, FINEP, MCTIC, Ministry of Economy and SEBRAE.

BNDES also provides indirect support to the ICT sector, by financing the acquisition of ICT capital goods and software through several of its products and financial lines. By limiting its credit to the acquisition of products made in Brazil, BNDES supports domestic production, as acquisition of imported goods is

financed only if the beneficiary firms can justify that equivalent products are not available domestically. IT and automation equipment are eligible for financing under the Financing Fund for the Acquisition of Machinery and Equipment (Financiamento de Máquinas e Equipamentos, FINAME), if acquired from suppliers accredited by BNDES. To be accredited, the supplier must prove that at least 50% of the value added of its product is produced in Brazil. Imported equipment with no domestic equivalent are eligible under the fund, as long as the payment does not imply international transfers. Since July 2019, BNDES has broadened the list of eligible products within the "BK Aquisição e Comercialização" line to include equipment related to advanced manufacturing and IoT solutions. BNDES offers more advantageous financial conditions (lower BNDES remuneration) to firms of all size investing in these assets, thus signalling its engagement for digital technologies diffusion in the economy.

An instrument which can also be used for purchase of machinery, equipment, software or software development services is the BNDES Card. This instrument, launched in 2003, is a pre-approved line of credit of up to USD 510 000 (BRL 2 million) to finance the acquisition of capital goods and is specifically designed for SMEs. The BNDES Card has subsidised interest rates – 1.3% per month in early 2019 – and is subject to a much simpler application process than other credit programmes. Since its launch, a total of USD 27.2 billion (BRL 68 billion) of credit has been disbursed through the card. Up to 2019, more than 36 000 companies had acquired ready-made software or software development services using the card, for total USD 273 million (BRL 999 million). As for similar BNDES instruments, there is a requirement for firms to buy machinery and upgrades by local producers accredited by BNDES. There are currently 2 500 recognised software vendors on the dedicated portal. The BNDES Card can also be used by micro, small and medium-sized companies from the ICT sector to purchase ICT goods and equipment, such as computers, security systems, furniture and technological services (including software certification). About 25% of the enterprises in the ICT sector (4 000) have used the card to date, for a total financing of over USD 118 million (BRL 464 million). The BNDES Card has proven to be one of the most innovative instruments for small enterprises in the country, thanks to its scope and its operational characteristics. Being primarily targeted at upgrading production processes, it has helped to increase productivity in SMEs (Noguiera, 2016). However, the local content requirement for ICT goods restricts firms' access to foreign technologies and inputs at the technological frontier, and may limit innovation and productivity gains (Pires and Russell, 2017).

BNDES is currently developing a new financial tool for the acquisition of services (e.g. for an IoT solution). A company can come to BNDES to propose a service solution. If approved, BNDES can finance the user and the provider, e.g. the monthly subscription. This would be also available to small producers and through the BNDES Card, as is already the case for software licences.

FINEP is a federal government organisation under the MCTIC, which funds science and technology in Brazil. It supports innovation through several credit lines, designed for firms of different sizes and for projects at different levels of technological readiness. One of the credit lines, FINEP Inovação, supports technological diffusion for innovation by providing support to all stages of innovation (from "critical" to diffusion), with different conditions and interest rates according to the stage of technological development. The highest interest rate is for the acquisition of informatics and automation goods.

FINEP has also recently expanded its offer in support of firms investing in digital technologies. In September 2019, it launched Inovacred 4.0. The programme is the result of collaboration with the CNI, the Ministry of Economy and the MCTIC and is the first initiative of the Brazilian Chamber of Industry 4.0 (see Chapter 6). FINEP Inovacred 4.0 aims to enhance productivity in Brazilian industry by fostering business innovation in areas such as IoT, big data, cloud computing, digital security, advanced robotics, digital and additive manufacturing, artificial intelligence (AI), and digitalisation. The novelty of FINEP Inovacred 4.0 lies in the use of an "integrating company", i.e. an intermediary who conceives and implements digitalisation plans in firms, by customising solutions, for example in terms of equipment, sensors, and software to be used to develop and implement a plan for adoption of enabling technologies tailored to the specific firm ("Strategic Business Digitalisation Plan"). The necessity of involving such a professional entity has been advocated by the CNI in several documents concerning Industry 4.0. SMEs generally lack awareness to estimate the impact of introducing business solutions which encompass technologies from Industry 4.0 in their processes, and even more so the technical information to identify and implement them. They also have lower investment capacity to finance Industry 4.0 digitalisation plans, whose costs for a large company are estimated at USD 380 000 (BRL 1.5 million) on average (estimate by the CNI).

The pilot programme has a budget of USD 50.9 million (BRL 200 million) and is targeted at SMEs in manufacturing (and soon agriculture), with annual revenues of up to USD 7.6 million (BRL 30 million). Each beneficiary will be supported with USD 1.4 million (BRL 5 million) to finance the development and implementation of the "Strategic Business Digitalisation Plan". Firms can only submit credit requests for their digitalisation plans if they are elaborated by FINEP-accredited integrating companies. As of January 2020, 7 companies had been accredited by FINEP and 4 loans had already been contracted, with the objective of reaching 25 accreditations and loans to 80 firms by the end of the year. Although the initiative will only benefit a limited number of firms, given the budget and size of each intervention, this is a promising initiative born from the collaboration between the private and the public sectors and could be an example for further actions aimed at implementing the E-Digital Strategy.

In June 2019, the agency also launched FINEP Software, which aims to support the acquisition of software and implementation services. The programme, which has a budget of USD 127.3 million (BRL 500 million) over three years, is open to Brazilian companies of all sizes and finances expenses above USD 38 000 (BRL 150 000) related to the acquisition and implementation of software, including training.

Brasil Mais aims at fostering productivity in firms, including through digital technologies

Brazil has recently launched a large plan – Growth Route – aimed at increasing productivity and improving the business environment. The plan is organised around six pillars, one of which is dedicated to Industry 4.0. The main initiative under this pillar is "Brazil More" (Brasil Mais), adopted through Decree 10.246/2020. Brazil More is the continuation and scale-up of the successful pilot programme "More Productive Brazil" (Brasil Mais Produtivo), which in 2016-18 supported about 3 000 manufacturing SMEs (11-200 employees) with consultancy services to optimise their production processes. With only about USD 14 million (BRL 50 million), the programme was found to be effective in increasing beneficiaries' productivity by 52% on average (ECLAC and IPEA, 2018).

The scope of the programme, which only included manufacturing, has been extended to the service and retail sectors, with the objective of reaching 220 000 SMEs by 2022. Co-ordinated by the Ministry of Economy, the programme will be managed by the Brazilian Industrial Development Agency (Agência Brasileira de Desenvolvimento Industrial, ABDI) and executed by the National Service for Industrial Training (Serviço Nacional de Aprendizagem Industrial, SENAI) and SEBRAE. In order to reach a greater number of firms, the programme will make use of an online platform; face-to-face consultancies will be reduced to 60 hours (as opposed to 180 in the previous programme). The programme does not have a new budget from the government, but will be financed through SENAI funds. Beneficiary firms have to contribute USD 380-1 500 (BRL 1 500-6 000). The programme recognises the potential that digital technologies have in boosting productivity, and 50 000 of the beneficiary firms will be supported to undergo more advanced stages of digitalisation of their processes and programmes.

Although it is too early to judge the programme, as its specific features and implementation aspects are yet to be defined, it goes in the right direction in actively supporting firms in their modernisation efforts and in a greater use of digital technologies. SMEs in traditional sectors need support to invest in technologies that are not necessarily new to the country but are new to them and can enable process and organisational improvements. Technical assistance programmes can help SMEs determine how to incorporate ICTs into their business model, acquire those technologies through supportive financing and learn how to use them effectively. To further increase the effectiveness of this programme, the government could also increase co-ordination with other existing initiatives to offer a full package of solutions, while also devising further mechanisms to promote technology adoption (see below).

Singapore's SMEs Go Digital programme could offer good practices. It supports SMEs in their digitalisation journey through a comprehensive suite of measures: enterprises can assess which digital solutions are suitable for them through sector-specific industry digitalisation plans and take up pre-approved solutions with grant support. Those that need advice receive support from an SME Digital Tech Hub and a network of SME centres (Box 3.3).

SENAI provides training and consulting activities for Industry 4.0

SENAI plays an important role in developing education applied to industry, in training, in offering technical services and technological support, and in disseminating technologies. SENAI is, in particular, focused on preparing industries and developing skills for Industry 4.0. Through the "SENAI 4.0" portal

(*senai40.com.br*), it offers consulting services, training courses and a free assessment tool for enterprises to evaluate their degree of maturity in Industry 4.0. Training courses offered to prepare for Industry 4.0 are available at four education levels: technical, professional initiation, professional extension and post-graduate. They cover subjects such as IoT, blockchain, augmented reality, cloud computing, AI, big data and cybersecurity, among others.

Box 3.3. Singapore's SMEs Go Digital programme: Make going digital simple for SMEs

Launched in April 2017, the SMEs Go Digital programme aims to make going digital simple for small and medium-sized enterprises (SMEs). It includes a comprehensive range of initiatives to guide and support SMEs in their digital journeys.

The sector-specific industry digital plans (IDPs) provide SMEs with a step-by-step guide on the digital solutions to adopt and relevant training for their employees at different stages of their growth. The IDPs serve as a common reference for SMEs and are aligned with Singapore's industry transformation maps for each sector. To date, the Infocomm Media Development Authority (IMDA), which is responsible for the programme, has rolled out IDPs for the following sectors: retail, logistics, environmental services, security, food services, wholesale trade, media, sea transport, accountancy and hotel. The IMDA is developing IDPs for more sectors To make it easy for SMEs to adopt the digital solutions recommended in the IDPs, the IMDA provides a list of pre-approved solutions assessed to be market-proven, cost-effective and supported by reliable vendors.

SMEs interested in adopting these solutions can apply for the Productivity Solutions Grant through the Business Grants Portal. The Productivity Solutions Grant can help to offset up to 70% the costs of adopting these solutions. Together with Enterprise Singapore (ESG), the IMDA launched the Start Digital initiative in January 2019. Start Digital helps newly incorporated SMEs, and those that have yet to go digital, get started with foundational digital solutions in accounting, human resource management systems and payroll, digital marketing, digital transactions, and cybersecurity. SMEs can select any two solutions to be included in their Start Digital Pack.

Start Digital Packs are offered by banks and telecom partners. SMEs that sign up for a minimum 18-month contract receive cost waivers for at least 6 months.

The SMEs Go Digital programme not only provides digitalisation guides and digital solutions, it has consultancy and project management services too. The SME Digital Tech Hub provides digital consultancy to SMEs that require expert advice in specialised areas such as data analytics, cybersecurity, artificial intelligence and the Internet of Things. It complements SME centres, which help SMEs identify the pre-approved solutions that meet their business needs.

SMEs can also engage services from a ready pool of skilled digital project managers, at subsidised fees, to help with implementing their digital solutions. This can include the review of business processes and job redesign so that they can realise the full benefits of going digital.

Source: Infocomm Media Development Authority (2020), *SMEs Go Digital*, *www.imda.gov.sg/programme-listing/smes-go-digital* (accessed in March 2020).

Brazil lacks tax incentives to promote digital uptake

Brazil largely employs tax expenditures to support businesses and ICT is one of the sectors the most supported through this instrument. Tax credits are available to companies investing in R&D through the Informatics Law (Lei da Informática), specifically directed at enterprises operating in the ICT sector (producers within the computing, automation, telecom or microelectronics industries) and through the Good Law (Lei do Bem), which is applied across sectors.

The merits of these two instruments in promoting a local ICT industry and in increasing investments in R&D are discussed in Chapter 5. Despite the wide use of tax credits in Brazil (in 2015, tax expenditures

accounted for 61% of total spending on business support policies and 2.9% of GDP; Dutz et al., 2017), there is currently no fiscal incentive for enterprises for technological upgrading, such as the acquisition of ICT machinery and equipment, or in investment in intangible assets, such as software or training related to ICT use. The Good Law foresees accelerated depreciation of machinery, equipment and intangible assets, but under the condition they are used for R&D activities. This therefore restricts the potential beneficiaries to those who carry out R&D. In the same vein, Normative Instruction 986/09 foresees tax breaks for firms in the ICT sector for expenses related to training of personnel developing software. This is also very narrow, as it targets a specific sector and skills development of ICT professionals, rather than employees at large. Furthermore, both of these two tax breaks are based on real profit (*lucro real*), whereas most SMEs operate in the deemed profit (*lucro presumido*) or Simples Nacional regimes, and are therefore excluded from these schemes. Recent changes to the Simples Nacional regime (Resolução CGSN 150/2019) may also affect the investment in intangibles (software and skills development), as informatics instructors will not qualify for a simplified tax regime and may, as a result, increase their tariffs due to an increase in the taxes they will be subject to.

Italy, for instance, has a policy foreseeing the accelerated depreciation of ICT investments in the context of strategies promoting Industry 4.0. Japan also offers tax credit or special depreciation for advanced IT investment to spur growth as part of the Fourth Industrial Revolution. Brazil could rethink its current business support policies, and in particular those related to tax expenditures, towards less sector-specific support and policies to foster broad diffusion of digital technologies across sectors.

A lack of skills in the workforce hinders the digital transformation

In order to increase the adoption of ICTs, firms require workers with the skills needed to make effective use of digital technologies. They need both workers with basic computer skills and ICT specialists to operate new systems. In addition, firms require workers with advanced literacy and numeracy skills and workers with a tertiary education, to take advantage of the new methods of working brought about by digitalisation.

Policies aimed at improving the quality of general education prepare students for the skills needed in the future, as they set the basis to further learn in line with the continuous transformation of technologies. On the other hand, lifelong training opportunities should also be available for workers, for them to upskill and reskill over the course of their careers. As the country progresses in the digital transformation of the economy, not only technical skills, but also cognitive non-routine skills, communication and interpersonal skills, managerial and negotiation skills will increasingly be in demand.

According to the OECD's *Skills for Jobs* database, ICT professionals was the second occupational category the most in shortage in Brazil in 2018 (OECD, 2018c). This category includes software and applications developers and analysts, as well as database and network professionals. ICT technicians (ICT user support technicians, web technicians, broadcasting and audio-visual technicians, among others) also showed a moderate shortage (OECD, 2018c). Industry estimates also suggest shortages of skills, difficulty in retaining talent, as well as dissatisfaction with the skills of the workforce. However, the survey on the use of ICT in enterprises (CGI.br, 2020b) provides little evidence of skills shortages or difficulty in recruiting ICT specialists, as only 6% of enterprises that wanted to recruit IT specialists did not find an adequate supply, whereas the largest majority (68%) declared they did not need to hire IT specialists (CGI.br, 2020b). This finding may also indicate the limited readiness of enterprises to adopt ICT, explaining the low demand for ICT specialists, which can be confirmed by the low growth of ICT capabilities in sectors (other than the ICT sector) in the period 2003-17 (Maciente Nogueira, Rauen Vianna and Kubota, 2019).

The share of 25-34 year-olds with at least an upper secondary education in Brazil is less than the OECD average (67% vs. 85% respectively). The share of 25-34 year-olds with a tertiary education (21%) is about half of the OECD average (44%), although it increased by 10 percentage points in the period 2008-18. Graduates in sciences, engineering and ICTs also represent a lower share of graduates than in developed economies and other Latin American countries (see Chapter 5).

Participation in vocational education – at both upper secondary and post-secondary levels – is still also relatively low. In 2017, only about 8% of students graduating from upper secondary education for the first time obtained a vocational qualification. This is the second lowest share across OECD countries and partner economies and well below the OECD average of 40% (OECD, 2019g). However, a considerable share of students from these vocational courses graduate in ICT (15%), well above the OECD average of 4%. Vocational programmes are also a way for adults to reskill or upskill to meet new demands from the labour market generated by the digital transformation. Brazil offers vocational programmes specifically geared towards adult education at both upper secondary and post-secondary levels. Some 0.5% of the population aged 25 and over are participating in either upper secondary or post-secondary vocational programmes, below the OECD average of 0.8%.

Figure 3.25. Upper secondary and tertiary attainment for 25-34 year-olds in Brazil and the OECD, 2018
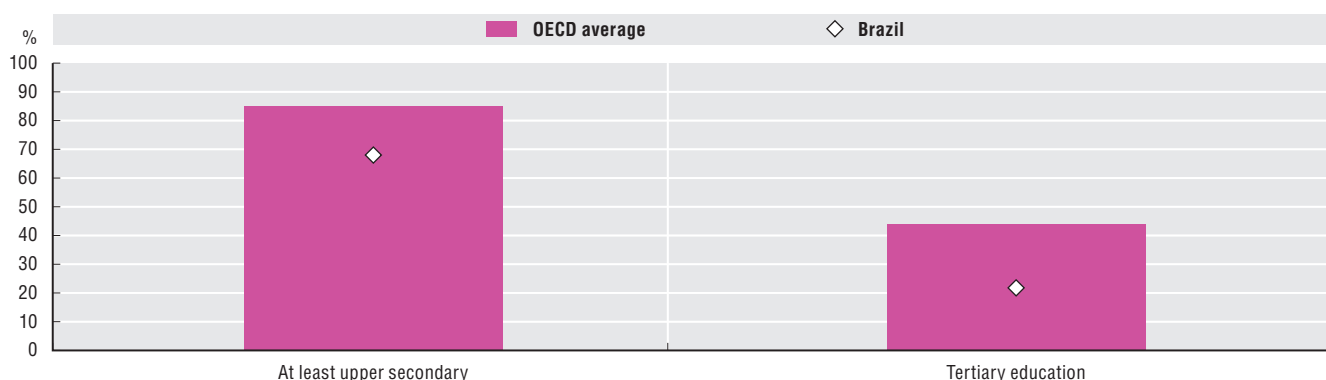
Source: OECD (2019g), *Education at a Glance 2019: OECD Indicators*, *https://doi.org/10.1787/f8d7880d-en*.

Steps are being taken to improve digital skills and reinforce training

Brazil is introducing reforms aimed at introducing digital skills both at the level of general education and of vocational and technical education. At the general education level, the NBCC has been approved since December 2018 also for upper secondary education (*ensino medio*, ISCED 3). The NBCC introduces digital competencies across study areas and computational thinking as part of maths and technology. The "New High School" (Novo Ensino Médio), which will be introduced in 2022, will include the national curriculum base and a "formative itinerary" of the student's choice, among five options. The formative itinerary will be the largest component of the overall training (1 800 hours out of a total of 3 000). These itineraries are: language and technologies, mathematics and technologies, life sciences and technologies, applied human and social sciences, and technical and professional training. The objective of this introduction is to provide more specialisation in general education, while exposing a higher proportion of students to technical and professional training. However, since general education does not provide a technical diploma to directly enter the labour market, and given the low share of students who enrol in tertiary education (15%, compared to 22% in OECD countries), more efforts are also being made to increase the number of students undertaking vocational training. The design of such itineraries is a state-level responsibility; therefore, there may be great variation across the country. Furthermore, the changes in curriculum, and in particular the introduction of the training itineraries, will require adequate training of teachers and additional hires to meet the new knowledge areas covered.

Professional and technological education is offered in upper secondary and in tertiary education. Upper secondary vocational training is of two types: one to three years of technical courses (*cursos técnicos profissionalizantes*) or short (three to six months) professional qualification courses meant to redirect workers to a new occupation or to deepen their occupation-specific expertise (*cursos de formação inicial e continuada*). While the former targets young individuals, potentially still in education, and leads to a qualification equivalent to a lower or upper secondary education, the latter is particularly aimed at individuals who have already left education and integrated the labour market or who are actively looking for a job. Tertiary vocational education and training requires completion of an upper secondary certificate and offers professional degrees (equivalent to university degree) in three years.

The Professional and Technological Education Secretariat (Secretaria de Educação Profissional e Tecnológica, SETEC) of the Ministry of Education is responsible for policies related to professional and technological education (*educação profissional e tecnológica*), implemented by public and private institutions. A key role among the private institutions is played by those of "Sistema S", a group of ten institutions partially financed by private sector companies, such as SENAI and SENAC, the two most important in terms of training provision. According to an agreement between these institutions and the federal government, SENAI and SENAC should allocate two-thirds of their annual revenues from compulsory taxation to the provision of free professional and technical education programmes.

The "New Paths" programme, launched in October 2019, aims to increase professional and technological training to 3.4 million by 2023 (from the current 1.9 million students). The programme is structured around three pillars: 1) management and results; 2) articulation and strengthening; and 3) innovation and entrepreneurship. Under the first pillar, in consultation with the private sector, the programme is updating the 2014 National Catalogue of Technical Courses (Catálogo Nacional de Cursos Técnicos, CNCT), so as to align the training offer with the evolving labour market needs. The new version is expected in 2020. It also foresees the regularisation of private providers of vocational and technical training, and recognition of 11 000 certificates issued by these schools since 2016. Under the second pillar, the programme foresees training and upskilling of more than 20 000 teachers in the subjects under vocational and professional training, through more courses in mathematics and natural sciences offered by the federal institutes of education, science and technology, whose role is to train teachers in basic education.

The programme also foresees changes in the funding model, establishing the obligation for states to link disbursement of training scholarships to the demands of the industrial, service and agricultural sectors, which have to be locally mapped following a methodology developed by the MEC (Ordinance 1.720/2019). Last, under the third pillar, the programme will encourage projects that stimulate applied research, innovation and technological activities, through competitive calls for groups of students, teachers and researchers, with an investment of USD 15.3 million (BRL 60 million) by 2022. A dedicated office at the MEC will promote private-public partnerships. This pillar also foresees the establishment of five innovation hubs in co-operation with the Brazilian Company of Research and Industrial Innovation (Empresa Brasileira de Pesquisa e Inovação Industrial, EMBRAPII), in addition to the nine currently existing, to disseminate the culture of entrepreneurship and leverage the development of applied research that meet the real demand of the private sector, bringing education closer to the labour market.

It is too early to judge the capacity of the "New Paths" programme to foster a higher level of digital skills among the workforce. Much will depend on the course catalogue, which will have to include both courses for specific ICT professions as well as digital literacy as a horizontal competence. The private sector's involvement in contributing to the catalogue's design, as well as the mapping undertaken to understand where needs lie, are certainly positive developments. Training scholarships should be directed as well to low-skilled, informal and unemployed workers, who do not seem to be the target of this policy, nor of the vouchers which will be distributed through SENAI (see below). Looking forward, Brazil should consider the use of digital technologies and big data to help increase the effectiveness of training programmes. The analysis of online vacancies provides more timely information on skills demand across small geographic areas. Big data allows tracking and evaluating the job placement of participants in vocational education and training, thus providing indications on how to improve them. The online collection and dissemination of timely information on the performance of higher education institutions, e.g. universities, helps prospective students' take informed decisions. In order to design skills policies and training programmes that effectively anticipate and tackle skills imbalances, as well as to respond to labour market needs, Brazil should establish rigorous and systematic initiatives to carry out skills assessment and anticipation exercises, which are currently missing (OECD, 2018c).

The recognition of acquired skills is also a positive feature of the programme, although it should be further extended, As put forward in the E-Digital Strategy (MCTIC, 2018), Brazil should facilitate the formal recognition of skills acquired in vocational training, through partnerships with vocational

education institutions, companies or other entities. Brazil currently has a decentralised programme for the formal recognition of prior learning, "Rede CERTIFIC", which was never fully developed and implemented (OECD, 2018c). The creation of innovation hubs is also a very interesting component. Given the increasing specialisation of EMBRAPII's units in IoT and advanced manufacturing (see Chapter 5), these should certainly be among the fields for additional innovation hubs.

As part of the Growth Route Plan, the Ministry of the Economy has also recently announced the distribution of 1.3 million vouchers through 2022 for training workers at the S System. With the objective to tie training more to the actual market needs, professional training contracts will be based on performance, so that education institutes hired by the government are only paid if the beneficiary gets a job. This action will be realised without any additional budget, as SENAI will reallocate funding to finance a new National Qualification Strategy formulated by the government. SENAI will distribute the voucher, through an electronic platform, to companies in the sector and following guidelines from the Ministry of Economy. The companies will receive the vouchers, both for retraining their employees and for potential new employees who lack specific skills. The voucher quota will depend on the size of each establishment. All industries will receive at least one coupon upon registration on the platform. Micro and small companies (with up to 99 employees) will be entitled to vouchers corresponding to 20% of their workforce. Medium-sized companies (100-499 employees) may request a volume equivalent to 10% of the staff. In the case of large companies (over 500 people), it will be 5%.

To foster digital skills among young people aged 16-25, Brazil also has an online education programme, Brazil More Digital (Brasil Mais Digital). The programme is financed by the MCTIC and implemented by the industry association Softex. Several ICT companies are partners, contributing content and prospective opportunities for young professionals. It consists of a distance learning platform, which currently offers more than 35 courses (about 1 500 hours), from basic, intermediate and advanced IT courses to topics such as programming, software development and gamified content. By 2018, the platform had about 351 750 registered students, with a total investment of about USD 2.7 million (BRL 9.9 million). The figures suggest, however, that there is a high dropout rate, as only 41 811 courses have been completed. Also, there are no data on the effectiveness of the programme in terms of job placement. The ICT training provided should be equivalent to a technical high school/professional education, but the courses are not recognised by the MEC. The programme should be assessed and the evaluation outcomes taken into account to improve and extend the online programme to other age groups.

There are no policies to increase the number of STEM graduates

Presently, there are no comprehensive, national policies to increase the number of graduates in science, technology, engineering and mathematics (STEM), although a few initiatives have been carried out by a number of relevant players in these fields, particularly on vocational training in high school. Examples include the Brazilian Computer Society's Digital Girls Programme (Programa Meninas Digitais). The programme aims to discover and foster talents for STEM in undergraduate courses. With the same goal, academic entities organise several "Olympiads" in different STEM fields – maths, physics, robotics, astronomy, etc. – for high school students. Finally, the MCTIC is pledging to include incentives for STEM graduate courses in the National Innovation Plan. Nevertheless, Brazil may consider changes in the distribution of scholarships in relationship to the subject in favour of STEM degrees. Some countries, given the shortage of talent in these disciplines, particularly those related to digital technologies, are increasing funding for higher education in these fields (see Chapter 5).

Improving the links between firms and higher education institutions (HEIs) can also help HEIs provide students with the skills demanded in the labour market. In Latvia, for instance, some firms provide scholarships and offer traineeships to academic staff and students. Industry and academia also co-operate in the design and financing of university courses. The Riga Technical University, Riga Business School and the University of Latvia, in association with the Finance Latvia Association (an industry body) established a bachelor degree programme "Computer Science and Organisational Technologies" (OECD, forthcoming b).

Box 3.4. Policy recommendations to foster the use of digital technologies by firms

- Run awareness-raising campaigns on the benefits of the Internet and digital technologies, targeting in particular micro-enterprises.
- Introduce incentives for firms carrying out services on line, such as public procurement (e-procurement).
- Take measures to foster greater competition in the parcel delivery market.
- Remove regulatory barriers to the development of e-commerce business models, such as multi-channels models.
- Harmonise the rate of tax on goods and services (ICMS) across states, as a first step towards a federal VAT system.
- Improve co-ordination among programmes supporting digital uptake by firms; create a single portal where firms can access all information about these programmes.
- Introduce tax incentives for technological upgrade, training and ICT investments for all firms, irrespective of their sector and size.
- Integrate digital skills in professional and vocational courses and better align the training supply with labour market needs.
- Strengthen vocational training for low-skilled, informal and unemployed workers.
- Evaluate the effects of the online education programme "Brazil More Digital" on job placement; enrich the offer of online courses, with the co-operation of the private sector.
- Facilitate the formal recognition of skills acquired through online courses and vocational training, through partnerships with vocational education institutions, companies or other entities.
- Undertake sound skills assessment and anticipation exercises on a regular basis.
- Increase scholarships for STEM students as well as PhD candidates in engineering, natural sciences and ICTs. Increase the offer of Master and PhD courses in these disciplines, in co-operation with the private sector.

Digital government

Digital technologies are radically changing how citizens live, work, consume and interact. The capacity of governments to respond to the digital transformation and produce more inclusive, convenient and collaborative processes and services is crucial for securing citizens' trust.

The uptake of digital services is not improving

A key objective of the Brazilian government's and the public sector's use of digital technologies is to improve public service delivery to citizens and businesses. However, some basic indicators, such as the uptake of digital public services by individuals, show room for improvement. Brazilians still make limited use of the Internet to interact with public authorities and obtain information on line, compared to OECD countries (Figure 3.26).

In 2018, the percentage of Internet users who benefited from digital public services dropped to 55%, from 64% the previous year. The reasons behind this decrease need to be further investigated. Uptake of digital public services is also very unequal, with a 47 percentage point difference between individuals with a high versus those with a low education and a 44 percentage point difference between individuals with a high versus those with a low income. There is also a growing divide in the use of digital public services across urban and rural areas and across generations. These trends follow the general trends in use shown in Section 3.1, and they have been widening over the years (Figure 3.27).

Figure 3.26. Individuals using the Internet to interact and obtain information from public authorities, in Brazil and the OECD, 2018

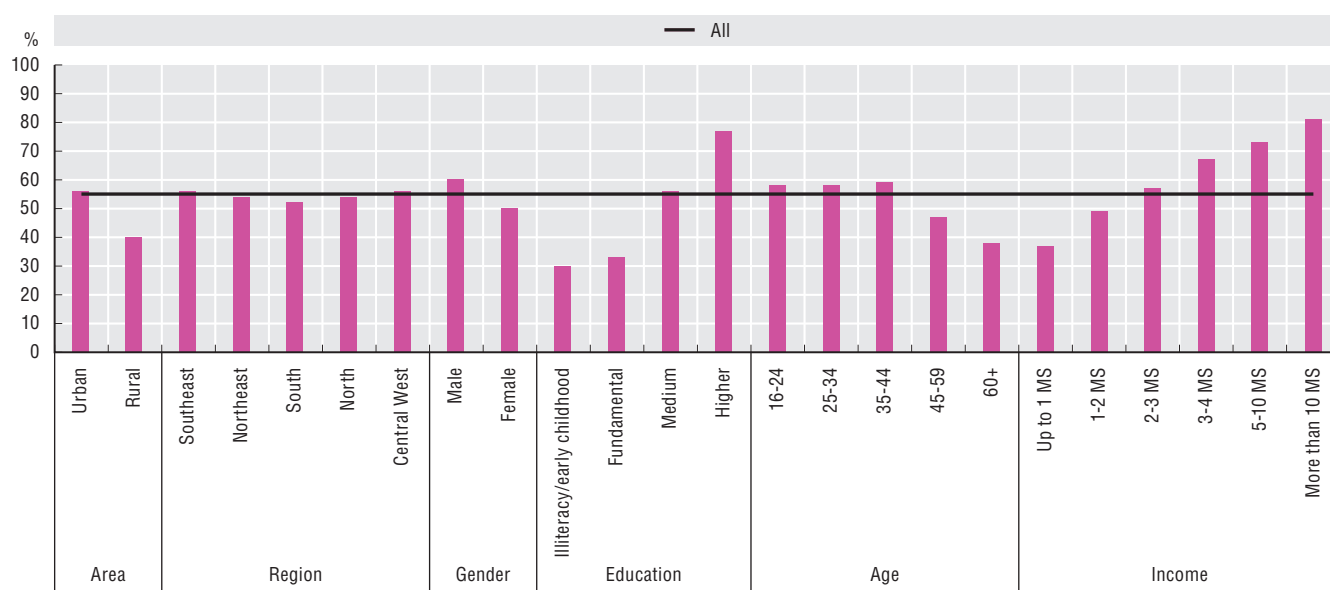*As a percentage of all individuals*
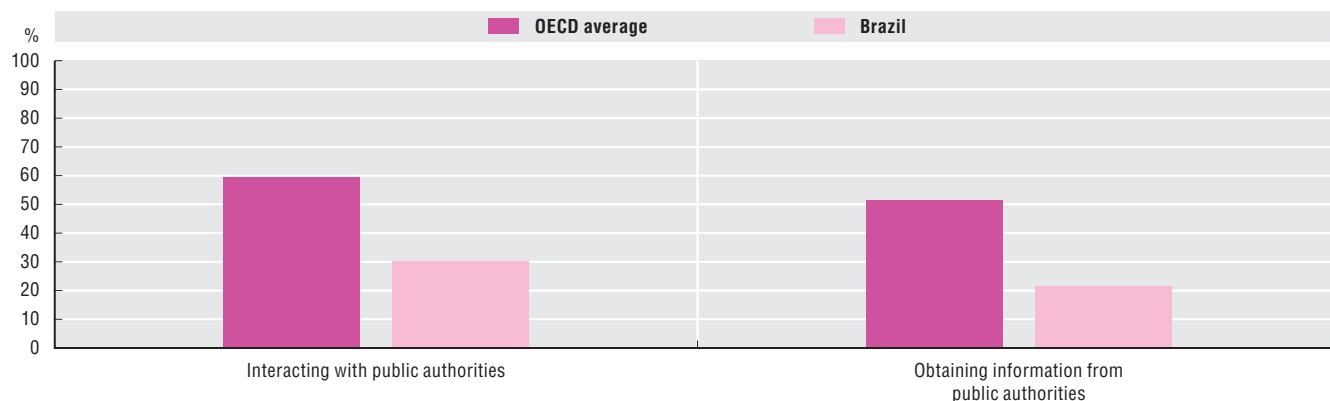
Note: OECD average is an unweighted average of available countries.

Source: OECD (2020a), *ICT Access and Usage by Households and Individuals* (database), *http://oe.cd/hhind* (accessed in February 2020).

Figure 3.27. Individuals using digital government services in Brazil, 2018

As a percentage of Internet users above 16 years old

Note: MS = minimum salary.

Source: CGI.br (2019a), *ICT Households 2018: Survey on the Use of Information and Communication Technologies in Brazilian Households* (database), *https://cetic.br/en/pesquisa/domicilios/indicadores/* (accessed in February 2020).

Those using digital government mostly use services related to labour or social security rights, public education, personal documents, and taxes. However, only health and personal documents were used in 2018 at levels comparable to those in 2016, whereas the others had decreased (Figure 3.28).

Digital government is a priority for Brazil

The digital transformation of government is a priority for Brazil, whose ambition is to make the administration more efficient and citizen-friendly. The government expects annual efficiency gains in the range of USD 16.5-21.6 billion (BRL 65-85 billion), against annual inefficiency costs estimated at USD 333 billion (BRL 1.3 trillion). This priority also responds to the rapid changes foreseen in the public administration's workforce, which is expected to decrease by half in the next five years due to retirement and the government's efforts to rationalise and optimise the size of the public sector workforce.

Figure 3.28. Individuals looking for information or performing digital government services online in Brazil, by service, 2018

As a percentage of Internet users above 16 years old
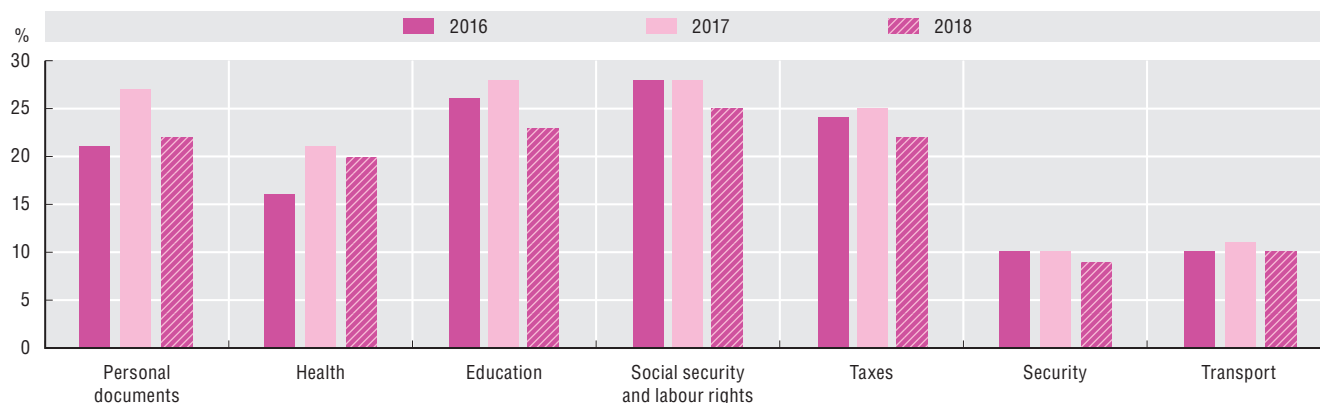
Source: CGI.br (2019a), *ICT Households 2018: Survey on the Use of Information and Communication Technologies in Brazilian Households* (database), *https://cetic.br/en/pesquisa/domicilios/indicadores/* (accessed in February 2020).

In 2016, the former Ministry of Planning (now the Ministry of Economy) drafted the Digital Government Strategy (Estratégia de Governança Digital), which defines the strategic objectives, goals, indicators and initiatives for the digital governance policy in the federal government. The Digital Government Strategy's main objective is to make public policy more efficient by using digital technologies. The Ministry of Economy, through its Secretariat of Digital Government (Secretaria de Governo Digital, SGD), is the main actor responsible for elaborating, co-ordinating and monitoring actions related to the strategy.

The Digital Government Strategy establishes the following objectives and initiatives:

● encourage the provision and use of open data
● promote transparency through the use of ICT
● increase public service delivery through digital transformation and improve its efficiency
● share and integrate digital infrastructure, data, processes, systems and services
● broaden social participation in public policy.

A new national Digital Government Strategy for 2020-22 was adopted in April 2020 (Decree 10.332/2020). The strategy has the vision of a government which will be:

● Citizen-centred: a government offering a more pleasant journey to citizens, responding to their expectations through high-quality services (simple, agile and personalised) and monitoring their experience.
● Integrated: a government that offers a consistent experience of citizen services and integrates data and services of all the levels of government.
● Smart: a government that implements effective policies based on data and evidence and proactively anticipates and addresses the needs of citizens and organisations.
● Trustworthy: a government that respects the freedom and privacy of citizens and ensures appropriate response to the risks, threats and challenges that arise from the use of digital technologies in the public sector.
● Transparent and open: a government that acts proactively in the provision of data and information and enables the monitoring and participation of society in the various stages of services and public policies.
● Efficient: a government that trains its professionals to adopt best practices and makes rational use of the workforce. In addition, it optimises the infrastructure and technology contracts, seeking to reduce the cost and expand the offer of services.

The E-Digital Strategy (MCTIC, 2018) also contains digital government priorities and establishes three guiding actions for public policies in the area of citizenship and digital government: 1) increased transparency and social control of government activities; 2) expanded social participation in the creation of public policies; and 3) higher quality digital public services.

Progress towards digital government

The Brazilian government has been iteratively moving towards digital government by prioritising policy issues such as connectivity, interoperability, open government data and citizen-driven service delivery (OECD, 2018d). The country's efforts to digitally transform its public sector have been thoroughly analysed in an *OECD Digital Government Review of Brazil* completed in 2018 (OECD, 2018d), which builds upon the analytic framework provided by the OECD *Recommendation of the Council on Digital Government Strategies* (OECD, 2014). It sets policy recommendations to help the Brazilian government capitalise on its digital government achievements, and to plan and implement a shift from e-government to digital government. This section updates and builds on the main findings and recommendations of the 2018 Review. The main policy recommendations are summarised in Table 3.4, which also indicates the key measures adopted to address them. Some of the key short-term recommendations and measures undertaken are discussed in the following sections.

Increased policy visibility and stronger high-level support for digital government

The *OECD Digital Government Review of Brazil* (OECD, 2018d) found that there is an opportunity to amplify the Brazilian commitment for a digital government through joint communication efforts with other strategic initiatives, such as the E-Digital Strategy and the Efficient Brazil Programme. The Review suggested the identification of a clear institutional function, e.g. a chief digital transformation officer, to lead and steer strategic co-ordination and help deliver on goals and priorities. It also suggested introducing a co-ordination process and mechanisms that allow public institutions to better communicate with each other, share resources and work together.

In terms of governance, since 2019, the Secretariat of Information and Communication Technologies has changed denomination – and enlarged its responsibilities – to become the Secretariat for Digital Government (SGD). This has also been accompanied by an increase in the number of staff: the SGD currently has 400 staff and co-ordinates 400 IT specialists that work in the agencies. The SGD is within the Special Secretariat of Red Tape Reduction (Secretaria Especial de Desburocratização) of the Ministry of the Economy.

The agenda for digital government is being implemented in partnership with the Special Secretariat of State Modernization of the General Secretariat of the Presidency of the Republic. The SGD has among its functions to define guidelines, standardise and co-ordinate projects to simplify services, governance and data sharing, and the use of digital channels. The SGD also has a reinforced role to optimise public IT expenditures. According to Decree 9.745/2019, which defines the structure of the Ministry of Economy, the SGD is responsible for

> supporting the preparation and monitoring of the implementation of the information and communication technology budget within the scope of the Information Technology Resource Management System (Sistema de Administração dos Recursos de Tecnologia da Informação, SISP), in co-ordination with the Federal Budget Secretariat, and proposing actions to increase efficiency and public spending on ICT.

All these elements point to an increased visibility of the digital government agenda and to a stronger governance framework for policy implementation, with high-level political support. Although Brazil has not institutionalised the role of a chief digital transformation officer, the SGD seems to have a comparable, clear and high-level mandate to lead and standardise the development of digital government. In 2019, the SGD also considerably stepped up communication efforts around the measures and the results in this field.

The government has also reduced the number of the public administration's committees (Decree 9.759/2019). In this context, the MCTIC and the Ministry of Economy mapped the committees related to the digital transformation of the state and the economy, and recreated those that are key to advance the digital transformation of the country. These are the CITDigital committee, responsible for the Brazilian Strategy for Digital Transformation (Decree 9.804/2019), the SISP and the Digital Governance and Information Security Committee (Ordinance 1.468/2019). However, despite the rationalisation of the number of committees and their respective roles brought about by the measure, further efforts may be needed in highlighting the relationship and synergies among the different policy instruments.

Table 3.4. Main policy recommendations for digital government in Brazil

Recommendation	Key measures adopted
Strengthening the governance framework for digital government	
Strengthen the communication efforts around the Digital Government Strategy and its relation to the Strategy for the Digital Transformation and Efficient Brazil.	No direct action, but the government has rationalised the number of policy committees through Decree 9.759/2019 and this is expected to increase clarity on respective roles and responsibilities.
Reinforce the role of the Secretariat of Information and Communication Technologies (SETIC), now the Secretariat of Digital Government (SGD) as the federal public sector organisation responsible for leading and standardising the development of digital government.	Increased responsibility, budget and staff. Close oversight and collaboration with the Special Secretariat of State Modernization of the General Secretariat of the Presidency of the Republic.
Consider the institutionalisation of the role of a chief digital transformation officer, supported by a clear and high-level political mandate and assigned clear responsibility to ensure cross-sectoral and cross-level co-ordination for digital government in Brazil.	No action, but the SGD seems to have a comparable, clear and high-level mandate to lead and standardise the development of digital government.
Consider adopting the pre-evaluation of ICT investments, business cases and project management standards, which can help SETIC (now the SGD) co-ordinate public ICT expenditures across the public sector to optimise investments and promote a coherent and sustainable implementation of digital government.	Normative Instruction No. 1 and No. 2 of 4 April 2019 promote transparency, guidelines, simplification in ICT procurement. Ordinance 103/2019 established the Internal Committee of Technical Reference evaluating major ICT expenditures.
Ensure coherency in digital government policies across the public sector by strengthening the communication in the Information Technology Resource Management System.	Normative Instruction No. 1 and No. 2 of 4 April 2019 promote transparency, guidelines, simplification in ICT procurement and mandatory evaluation of investments above USD 7.3 million (BRL 28.6 million)
Establish an inter-federative policy articulation to promote the expansion of a consistent digital offer to states and municipalities.	Five sectoral e-digital plans executed, ten under preparation.
Strengthening institutional capabilities for the sound implementation of digital government policies	
Include specific actions to develop digital skills within the new skills framework to promote the coherent development of user, professional, complementary and leadership digital capabilities among public servants.	Programme for Development of Digital Capabilities in the public sector (Capacita Gov.br) in collaboration with the National School of Public Administration (ENAP). Selection of digital transformation leaders. ICT work expansion strategy.
Consider strengthening the conditions for retaining and remunerating IT analysts.	Plan to elaborate a proposal for the adjustment of the position of ICT analyst within the public sector.
Update the Brazilian ICT procurement policy, promoting a shift towards a digital commissioning approach.	Normative Instruction No. 1 of 4 April 2019 establishes transparency in ICT procurement.
Strengthening the foundation for integrated, citizen-driven, digital service delivery	
Continue investing in the development of important digital enablers, such as digital identity and interoperability, and strengthening the foundations for coherent and integrated service delivery.	New Data Sharing Decree 10.064/2019. Digital Identity: Decree 9.723/2019, establishing the individual taxpayer registration number as sufficient for citizen's access to public services, is considered as a "preparatory act" for the implementation of the National Identity Document. Bill under discussion (PL 7316/2019) on digital certificates and signature. Planned for 2021.
Consider bringing in expertise from outside the public sector to update the existing open source software policy in line with digital government needs.	Work plan for restructuring the Brazilian Public Software Portal.
Continue updating the digital government legal and regulatory framework to incorporate emerging technologies, to ensure that it enables and drives the digital transformation of the public sector while protecting citizens' digital rights.	Bill under discussion (PL 3443/2019) to use technologies, such as blockchain and artificial intelligence, to improve service delivery.
Continue and strengthen an integrated digital service policy, linked to the Digital Government Strategy, to reinforce the coherence, effectiveness and commitment of the Brazilian public sector to delivering high-quality services to citizens.	Unique government portal (gov.br). Establishment of a user experience department within the SGD.
Take a multichannel approach to public services that includes mobile access to prevent the creation of new forms of digital divide to continue to promote the openness, auditability and accessibility of digital services, including transparency via the use, reuse and exchange of open government data.	Various actions.
Consider developing an action plan on the use of emerging technologies to promote inclusive and improved service design and delivery as a complement to the current Digital Government Strategy.	No action.
Consider leading and actively supporting other Latin America and Caribbean countries' efforts on cross-border service delivery, given the political and economic relevance of Brazil in the region as well as its experience in promoting interoperability across different federation levels.	Conference on digital signatures for cross-border services in 2019 in Chile.

Sources: OECD (2018d), *Digital Government Review of Brazil: Towards the Digital Transformation of the Public Sector*, *https://doi.org/10.1787/9789264307636-en* for the recommendations; OECD, based on information provided by the Ministry of Economy for the key measures adopted.

Decree 9.756/2019 established the unique portal "gov.br" and set the rules for the unification of the digital channels of the federal government. Gov.br is the single portal for several services. States and municipalities can also use the platform and some states have adopted the same platform for their state services. By April 2020, 18 portals had been migrated to the single portal "gov.br", including: Brasil.gov.br portal, Planalto, Civil House, General Secretariat, Government Secretariat, Comptroller General of the Union, the Access to Information Law website, the Ministry of Sport and the Ministry of Agriculture. The website offers a single sign-on platform, accessible through the individual taxpayer registration number (Cadastro de Pessoas Físicas, CPF), the unique identifier, which can be used for 400 services. According to the SGD, 45 million people are already using the platform, with the objective of reaching 70 million by the end of 2020. In terms of the digitalisation of federal government services, Brazil moved from 41% to 54%, with the objective to reach 100% by 2022.

The recently approved Digital Government Strategy 2020-22 includes a number of activities under the responsibility of the SDG aimed at increasing co-ordination. Among others, the SGD is responsible for approving the e-digital plans of entities of the public administration (see below), for offering shared technologies and services, as well as for defining technical norms and standards.

The "e-digital plan" was introduced in 2019 for designing digital transformation initiatives among entities in the Brazilian public administration. Responding also to the need to increase oversight of activities among sectors, the e-digital plan aims at matching the main needs and challenges of the sector/public entity with the various tools offered by the SGD. It comprises actions, goals and indicators for the sector in terms of digitalisation of public services for the upcoming one to two years. Fifteen plans are presently under implementation or in the process of being agreed (Table 3.5). In the first half of 2019, the National Institute of Social Security (Instituto Nacional do Seguro Social, INSS) completed the digitalisation of all its services, thus allowing those who want to apply for retirement to complete the procedure entirely on line.

Institutional capabilities are improving

Competencies and skills are fundamental pillars of a digitally enabled state. The 2018 Review found that Brazil faces challenges

> *not only related to attracting and retaining the best ICT professionals in the public sector, but also to developing digital skills and growing awareness among leaders, decision makers and policy implementers about the challenges and opportunities of digital transformation.*

It recommended that Brazil prioritise the development of digital skills in four key areas: user, professional, complementary (new skillsets necessary for public service professions that are profoundly transformed through digitalisation) and leadership. According to the recently adopted Digital Government Strategy, it is the SDG's responsibility to select and allocate the additional workforce required to execute the strategy and develop the digital talents and skills required for digital transformation teams, in conjunction with the National School of Public Administration (Escola Nacional de Administração Pública, ENAP).

In 2019, the Ministry of Economy, in co-operation with ENAP, launched the "Development of Capabilities for the Digital Transformation" Programme (Programa de Desenvolvimento de Capacidades para Transformação Digital). The courses are organised in seven knowledge areas: 1) leadership and innovation; 2) high technology; 3) data science; 4) agile transformation; 5) governance and management of ICT; 6) services for citizens; and 7) security and privacy. Training is provided in the form of short courses, seminars and other training events, in-person and on line, which consider the development of technical, communication and leadership skills. One of the innovations in the training concerns certification, with the aim to build talent banks for improving selection processes in the public administration. The SGD reported that in 2019, 18 000 people were trained through this programme.

Table 3.5. E-digital plans in Brazil

Digital government initiatives across sectors, 2019

Sector	Ministry	Plan status	Brief description	Public services to be transformed
Pension	Economy	Execution	Transformation of public services offered by the National Institute of Social Security in areas such as social benefits, retirement and fight against fraud. The objective is to achieve a 100% digitalisation rate in the sector (except for those services requiring in-person assistance) and consequently decreasing the counter assistance needed.	74
Economy and labour	Economy	Execution	The main objective of the initiative is to raise the level of digitalisation in the sector. Thus, actions relate to the provision of a digital channel for accessing public services mainly for companies that need to comply with labour legislation. The plan also seeks to implement the single sign-on (SSO) and evaluation solutions to existing systems. The SSO solution will enable citizens to access public services across agencies with the same username and password. In addition, the plan aims to simplify the process of starting a business through systems integration and process digitalisation.	58
Infrastructure	Infrastructure	Execution	The plan includes actions for transforming public services in the transport and traffic sector. Proposed actions aim at facilitating access, monitoring and assessment of public services, and reducing transaction costs. Further, the initiative fosters the promotion of competitiveness in the sector by removing barriers in the process of granting, authorisation, licensing and certification.	177
Industrial property	Economy	Execution	Transformation of public services in areas such as topographies of integrated circuits. The plan also includes actions which focus on revision, simplification, digitalisation and reduction of the timeframe for analysing brands and patents. Further, it aims to improve the experience citizens and enterprises have through the available service channels.	3
Energy	Mines and Energy	Execution	Transformation of public services offered by national regulatory agencies in areas such as energy, mining, oil and gas, with a focus on authorisations and inspection for exploitation, transmission and commercialisation activities.	182
Agriculture	Agriculture, Livestock and Supply	Preparation	To reduce fraud rates through digitalisation and data interoperability (pension, customs, Central Bank). Further, the plan aims at making processes such as registration and certification of agricultural and fishery products and facilities more agile. Ultimately, the planned actions will strengthen the transparency and competitiveness of the Brazilian agricultural industry in both domestic and foreign markets.	84
Public health	Health	Preparation	To increase the number of digital services provided by the Brazilian public health system to citizens. In addition, it seeks to reduce users' efforts in accessing the Ministry of Health's digital services and provide online access to healthcare data for citizens, health professionals and service providers.	27
Health regulation	Health	Preparation	To increase the number of digital services provided by the Brazilian Health Regulatory Agency with a focus on authorisations for the import and export of drugs, cosmetics and food. The plan also seeks to modernise the medicine traceability processes, which will improve authorities' capacity to co-ordinate public policies more effectively.	23
Citizenship	Citizenship	Preparation	The plan includes initiatives which focus on providing a digital channel to the public services offered by the sector. It also seeks to implement the SSO and evaluation solutions to existing systems. The main areas of the plan include culture, sport and social assistance.	70
Environment	Environment	Preparation	The plan aims at actions to help streamline the environmental licenses process, as well as to improve the monitoring and controlling processes of conservation areas and the execution of environmental conditionality.	68
Education	Education	Preparation	The proposed plan establishes guidelines and strategies for digital transformation and simplification of public services offered by the Ministry of Education and its related bodies. Initiatives relate to the adoption of the SSO and evaluation solutions to existing systems. The SSO will enable citizens to access public services across agencies with the same username and password.	115
Science and technology	Science, Technology, Innovations and Communication	Preparation	The Digital Science and Technology Plan is currently being developed and involves public institutions in the areas of scientific and technological development, telecommunications, nuclear energy, and space research.	80
Defence	Defence	Preparation	Transformation of public services offered by the Army, Navy and Air Force in areas such as sensitive material, aircraft and vessel registration.	30
Justice and security	Justice and Public Security	Preparation	The proposed e-digital plan focuses on providing a digital channel to the public services offered by the sector. In addition, it seeks the implementation of the SSO and evaluation solutions to existing systems. The mains areas of the plan include the prison system, trade unions, crime, refugees, consumers and human rights, among others.	35

Source: OECD, based on information provided by the Ministry of Economy.

Other actions undertaken or planned to strengthen capabilities are: selecting executives with a profile focused on digital transformation ("digital transformation leaders"); elaborating a strategy for expanding, strengthening and developing the ICT workforce; and preparing a proposal for adjusting the position of ICT analyst within the public sector (still at an early stage of development). Through the first, in 2019, ENAP and the SGD selected 17 professionals (out of about 290 applicants) through a transparent process to execute strategic functions in the area of ICT in public administration bodies. They will be responsible for enabling the digital transformation of their respective institutions; act strategically, by prospecting new solutions aligned to the needs of their respective bodies; manage ICT resources, in compliance with the provisions of the SISP's regulations; and mobilise teams that work with ICT. The second action foresees the mobility of public servants within the public administration, to take up roles related to the digital transformation. A call was published to this effect in February 2020, which defines the profiles sought and the application process, as well as the temporary additional remuneration the selected public servants will receive.

These actions are important steps in improving capabilities in the public sector. However, as challenges still persist, in particular in attracting and retaining a talented and competent workforce, the recruitment process in the public sector, as well as career paths, should be revised. Another action should be mapping the existing skills and a needs assessment across the public sector, so to measure the skills needs and the corresponding efforts in the short, medium and long terms.

In terms of institutional capabilities, a key element raised by the Review was the need for strategic planning and policy mechanisms to improve the coherence and sustainability of Brazil's public sector ICT investments, given the increasing share of ICT expenditures in the public sector budget. The Review recommended introducing mechanisms such as the pre-evaluation of ICT expenditures, business cases and project management standards.

The SGD has established an ICT Contracting Governance Model (Modelo de Governança das Contratações de TIC), which strengthens the governance of centralised or joint procurement of ICT solutions within the federal government. The model establishes the review of purchases by a committee and the definition of guidelines for action, of contracting amounts and of operational procedures. To formalise this model, in 2019 the Ministry of Economy published a new model for the purchase of ICT good and services by entities that are part of the SISP – Normative Instruction No. 1 and No. 2 of 4 April 2019.

Normative Instruction No. 1 extends the responsibility of public managers in the contracting process and prioritises the planning process, with an emphasis on comparative analysis of the solutions and justification of the choices made. Covering approximately 3 400 annual purchases, the new act makes mandatory the publication of preliminary technical studies on the Internet, even when dealing with public companies as suppliers. The new model also simplifies the process by eliminating documents (insertion plan, the inspection plan and the capacity plan) and incorporating them in the annual procurement plan. The ordinance also establishes that the government adopts cloud services to expand the capacity of its information systems.

The Review also recommended

> institutionalising the pre-evaluation phase of digital technology investments through two distinct levels of budget thresholds: a first level directed at projects of medium ICT budget where the pre-evaluation would be considered best practice; a second level focused on strategic ICT projects with higher budgets where the pre-evaluation phase would be mandatory.

Normative Instruction No. 2 establishes a threshold above which spending on ICT by the federal government agencies has to be submitted for approval to the Ministry of Economy. The threshold is USD 7.3 million (BRL 28.6 million). As this amount is rather high and would not be applicable to the majority of ICT spending in the public sector, the threshold corresponds to the "second level" suggested in the recommendation. For purchases below this threshold, there is no prior approval by the Ministry of Economy, but contracting agencies have to follow the procedure set by Normative Instruction No. 1.

The analysis and prior approval model involves the work of two boards, one advisory, the other deliberative, instituted by the Minister of Economy through Ordinance 103/2019. The Internal Board of Technical Reference (Colegiado Interno de Referencial Técnico, CIRT) analyses the planning of all major contracts submitted to the SGD for approval. Based on the opinion issued by the CIRT and depending

on the size of the contract, the Internal Board of Procurement of Goods and Services of Information and Communication Technology (Colegiado Interno de Contratações de Bens e Serviços de TIC, CITIC) approves the spending. CITIC decides on the approval of large contracts up to USD 14.8 million (BRL 58 million); above that value, the expenditure has to be approved by the Centralized Procurement and Contracts Committee (Comitê de Compras e Contratos Centralizados, C4ME).

The SGD is also optimising the contracts the public administration has with big IT providers, negotiating 12-month framework agreements with them. Negotiating all the contracts at once allows obtaining lower prices, which are then made public and can also be used by states and municipalities. In terms of IT infrastructures, it is assessing the security of the 130 federal data centres, with the objective of reducing their number and increasing security levels.

Efforts are still *needed for the development of important digital enablers*

Brazil has made efforts in recent years to promote the development, use and reuse of digital key enablers across the public sector. However, the Review found several weaknesses in the current system, which results in inefficiencies and prevents the development of more integrated service delivery approaches. The review recommended that Brazil continue prioritising interoperability frameworks and digital identity systems, in order to build on existing efforts in integrated, multichannel and inclusive digital service delivery.

Brazil has interoperability frameworks for the public administration in place and recognises data as a strategic asset for the digitalisation of the public sector (Box 3.5). Nevertheless, the Review noted that due to the inexistence of the proper policy levers that can make data exchange among public sector entities mandatory, the connection and integration of central databases was still a problem in Brazil. It also noted that despite the development of legal instruments (such as Decree 8.789 of 26 June 2016), there was still room for improvement with regard to public sector data governance and a clearer link with several priorities, initiatives and projects listed in the Digital Government Strategy.

A new Data Sharing Decree (10.064/2019) adopted in October 2019 aims at clarifying issues related to the sharing of information between the bodies and entities of the federal public administration and the legislative and judiciary powers, at all level (states, municipalities and the Federal District). The decree establishes the creation of a Citizen Base Register, which will include in one platform all citizens' personal data, including biometric data. Data will be shared across government bodies with the objective of providing digital public services, according to criteria for interoperability defined by a Central Data Governance Committee. The decree also establishes the interoperability conditions. The SGD is also currently exploring the possibility to use blockchain for interoperability of public databases.

The Central Data Governance Committee will also oversee the sharing of public data with the private sector with a view to stimulating data-driven innovation. In continuity with the Open Data Policy, the Ministry of Economy is working on the "Government as a Platform" (GaaP) project, which will provide a legal mechanism for the private sector to use public data in a controlled environment. Through a consultative process, the SGD has been working with start-ups and companies to identify the data that will be most useful to share in this regard. GaaP refers to an entire ecosystem of application programming interfaces (APIs) and other shared components, open standards and established datasets, as well as the services built on these elements and the governance processes that can keep the system secure and ensure accountability. GaaP is based on the provision of new services from data sharing and on the promotion of civil society participation in co-creating services to meet public policy objectives and foster economic activity.

The Review also recommended considering reinvesting in open source software as a strategic key enabler. Despite Brazil's solid experience in the use of open source software, the topic's significance in the country's digital government policy has decreased in recent years. Brazil is currently developing a plan for restructuring the Brazilian Public Software Portal (PSPB); however, this seems to remain a lower priority for the government.

Diverse public identification documents have been digitalised in Brazil, including an electronic version of the driver's licence, the electronic payment card of the Bolsa Família programme, and several other labour and health documents. A decree adopted in March 2020 (Decree 10.278/2020) sets the technical conditions and "requirements for the digitalisation of public or private documents, so that the digitalised

documents produce the same legal effects as the original documents". This is evidence of the federal government's efforts to increasingly use digital technologies to promote efficiency across the public sector and make citizens' interactions with government institutions more convenient. However, the development of a digital identification system, considered to be one of the central key enablers for digital government development, is delayed due to the complex digital and institutional environments and requirements to implement such a system, and the preponderance of other identity numbers used across the public sector to identify citizens.

Box 3.5. Interoperability and data-sharing architecture in Brazil

The ePing architecture, Standards of Interoperability of Electronic Government, reflects a Brazilian interoperability policy for the public sector. ePing defines a set of minimum requirements, policies and technical specifications governing the use of ICT in the public sector, establishing the basis for interoperability across public sector institutions.

In 2018, the Secretariat of Information and Communication Technologies also launched a new interoperability platform called Conecta GOV, which makes available a catalogue of application programming interfaces to be used by public sector organisations.

Brazil currently operates two open platforms that reflect the recognition of data as a strategic asset for the digitalisation of the public sector in Brazil:

- Portal brasileiro de dados abertos (*dados.gov.br*): A single national portal for open government data at the federal level.
- GovData (*govdata.gov.br*): A platform to cross-check information and produce strategic information, relaunched in 2018.

The mandate to develop a national digital identity framework has been given to the Supreme Electoral Court, which is also responsible for managing Brazil's electronic voting system. The National Identification Document (Documento Nacional de Identificação, DNI) is created from the national voter registration biometrics database, which currently only covers about 100 million Brazilians. The DNI will bring different registers together into one single document: the individual taxpayer registration number, the birth certificate and the voter's registration. In 2019, the individual taxpayer registration number replaced a number of other documents (Decree 9.723/2019) for citizens to access public services. This was considered to be a "preparatory act" for the implementation of the DNI.

The Brazilian Ministry of Economy is working with the Federal Electoral Court on a joint work plan for issuing the DNI to the population. USD 28 million (BRL 110 million) have been earmarked in the 2020 budget for the implementation of the voter identification automation system. The schedule is for the DNI to be made available to citizens at the end of 2021. However, the limited progress in the development of the digital identity system makes it unlikely that this objective will be met.

A related aspect for adoption of digital identity is the legal validity of electronic and digital signatures for proving authorship and confidentiality, as well as to regulate the provision of information services. Currently digital certificates are still the only technology to have the essential attribute of legal validity in the country. Digital certification was introduced in Brazil with the creation of the public keys infrastructure (Infraestrutura de Chaves Públicas, ICP-Brasil), through Provisional Measure 2.200-2/2001. The Digital Certificate is an electronic document that uses a cryptographic key and a specific standard containing the owners' data and guaranteeing their identity, thus ensuring confidentiality, authenticity and endorsement of any signed electronic transactions, as well as the exchange of information with integrity, confidentiality and security. Today, there are approximately 8.8 million active digital certificates in Brazil, corresponding to 3% of the total population.

New technologies such as blockchain, advanced biometric identification and quantum digital keys promise a large range of applications in this field, but they cannot be integrated, due to outdated laws, which has not kept up with the development of new technologies. A new bill (PL 7316/2019) aims to create the National Digital Signature and Identification System (Sistema Nacional de Assinatura e Identificação Digital, SINAID), which will amend the provisional measure, to take into account new

digital identification technologies and the Civil Rights Framework for the Internet and the General Data Protection Law. The new regulation is a necessary step to include more secure technologies, such as cryptography, and to step up the use of digital certificates and signatures, both for the provision of public services and for use by the private sector.

The need to move to a data-driven public sector

In order to improve digital service delivery, the SGD established a user experience department, which is conducting research and evaluations with users of public services in various channels and agencies that offer public services. Although these efforts are very important, Brazil should move beyond simply digitalising what was previously analogue to open, user-driven service delivery, shifting from an e-government to a digital government approach (OECD, 2014). The government will also need to take a multichannel approach to service delivery in order to secure equitable and inclusive access to all segments of the population.

Efforts for the development of a data-driven public sector are already underway. These efforts should be continued so that data can become integral to policy making and service design and delivery. Achieving a true digitalisation of services implies better exploring integrated approaches such as life events, but also the application of the "once only principle". It also requires building a proactive service delivery capable of anticipating citizens' needs. Exploring the use of emerging technologies such as AI would be critical.

As part of the new strategy, the government foresees the use of blockchain to make the different base registers interoperable, to establish data analytics capability within the federal government and to use IoT to anticipate citizens' and services' needs. Brazil is currently in the discussion phase of a law (PL 3443/2019) which makes use of emerging technologies, such as blockchain and AI, for improving the efficiency and effectiveness and enhancing public sector intelligence. Brazil already has some advanced examples of the use of emerging technologies in the public sector (Box 3.6). It is also in the final phase of elaborating a national strategy for AI and is a signatory to the OECD AI principles (OECD, 2019h).

Box 3.6. Examples of the use of artificial intelligence in the Brazilian public sector

The Court of Accounts of the Union uses artificial intelligence (AI) to better analyse the procurement processes of the federal administration ("Alice" – Analysis of Bids and Tenders). Based on the information published on the public procurement portal, the system analyses the costs of tenders and compares the information with other databases. Based on this information, the system is able to identify risks and send alerts to auditors. AI also assists the auditor when writing a text ("Sofia" – System of Guidance on Facts and Evidence for the Auditor), pointing to possible errors and even suggesting information related to the parties involved or the topic addressed.

The Superior Labour Court (Tribunal Superior do Trabalho, TST) manages court cases with AI (Bem-Te-Vi). Since May 2019, the tool allows automatic analysis of compliance with the deadlines of the proceedings.

The Comptroller General of the Union (Controladoria-Geral da União, CGU) also uses an AI-based system for overseeing contracts and suppliers. The tool carries out a risk analysis, including not only that of corruption, but also of other problems, such as the possibility of a supplier not fulfilling the contract.

Source: MCTIC (2019), *Estratégia Brasileira de Inteligência Artificial, Consulta Pública,* *http://participa.br/profile/estrategia-brasileira-de-inteligencia-artificial.*

The Review also recommended that, given the political and economic relevance in the region, the government of Brazil consider leading and actively supporting efforts on cross-border service delivery in Latin America and the Caribbean. In this regard, a conference to discuss digital signatures in cross-border services took place in 2019 in Chile. The conference led to the signature of an agreement for mutual recognition of public key infrastructures within Mercosur, with a view of also reaching an agreement on the mutual recognition of signatures, on the basis of the European Union's (Electronic Identification, Authentication and Trust Services) eIdas (EU Regulation 910/2014).

Box 3.7. Policy recommendations for digital government

Brazil should push forward with those recommendations of the *OECD Digital Government Review of Brazil: Towards the Digital Transformation of the Public Sector* (OECD, 2018d) that are still valid. In particular:

- Continue reinforcing the responsibilities and resources of the Secretariat of Digital Government.
- Increase co-ordination and build synergies between the Digital Government Strategy and e-Digital.
- Continue prioritising digital skills development in any policy or framework for the public sector.
- Continue enhancing interoperability among the public administration's systems.
- Advance the new legislation on sharing of personal data among government bodies, initiated by the Data Sharing Decree (10.064/2019).
- Reinforce public efforts for the development of a digital identity framework.
- Speed up the establishment of the National Digital Signature and Identification System.
- Reinforce efforts to develop a data-driven digital government.
- Update the digital government legal and regulatory framework to seize the opportunities of emerging technologies.

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Notes

Israel

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

1. Basic education in Brazil includes kindergarten (*educação infantil*, 0-5 years), primary/secondary school (*ensino fundamental*, 6-14 years) and high school (*ensino médio*, 15-17 years).
2. CA 87/15 establishes that up to 2018, the DIFAL is divided between the states of origin and destination. From 2019 onwards, the DIFAL is due in full to the state of destination.