

Digital technologies for a new future



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Digital Agenda for Latin America and the Caribbean

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Digital technologies for a new future



eLAC·2022
Digital Agenda for Latin America and the Caribbean

Work on this document was coordinated by Sebastián Rovira, Economic Affairs Officer of the Economic Commission for Latin America and the Caribbean (ECLAC), in collaboration with Wilson Peres and Nunzia Saporito. The drafting committee also comprised Valeria Jordán, Georgina Núñez, Alejandro Patiño, Laura Poveda, Fernando Rojas and Joaquín Vargas, of the Division of Production, Productivity and Management, and Rodrigo Martínez, Amalia Palma and Daniela Trucco, of the Social Development Division. The chapters were prepared with input from the consultants Sebastián Cabello and Nicolás Grossman.

The document also included valuable contributions deriving from the seventh Ministerial Conference on the Information Society in Latin America and the Caribbean, and from the comments and contributions of the official delegations that participated in the meeting.

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Foreword

In the two years since the sixth Ministerial Conference on the Information Society in Latin America and the Caribbean, held in Cartagena de Indias (Colombia) in April 2018, issues in the digital sphere that were then considered to be emerging or incipient have come to occupy centre stage. Meanwhile, the coronavirus (COVID-19) pandemic has had an unprecedented economic and social impact on Latin America and the Caribbean. It is estimated that the region's GDP has contracted by about 7.7%, that the value of exports has fallen by 13% and that reduced demand and the slowdown of supply have led to the closure of over 2.7 million businesses, resulting in more than 18 million unemployed. All these dynamics will have major effects on the level of inequality and poverty in the region, and it is estimated that the number of people living in poverty will increase by more than 45 million.

In respect of digitalization, 15 years on from the approval of the first Digital Agenda for Latin America and the Caribbean, the region is facing a new world and a challenging context. Some of the expectations of that time have been fulfilled, but others have not.

Digital technologies have grown exponentially, and their use has globalized. Ubiquitous and continuous connectivity has reached much of humanity thanks to the mass take-up of smartphones and the consequent access to information, social networks and audiovisual entertainment. The acceleration of technical progress in the digital realm has made the use of devices and applications employing cloud computing, big data analysis, blockchains or artificial intelligence routine. The technological revolution has combined with a change in the strategies of the companies at the forefront of digital technology use to greatly increase the role of global platforms, the result being that excessive economic and political power is wielded by no more than twenty or so corporations based in two or three world powers, an all too small group of firms with market capitalizations of close to or more than a trillion dollars.

Technological progress has gone along with socially negative outcomes, such as the exclusion of a large proportion of the world's people from the benefits of digitalization, essentially because their incomes are too low for them to have meaningful connectivity (i.e., high-quality access), access to devices, fixed home connections and the ability to use these day to day. A large demand gap has thus opened up, as coverage is adequate but is not reflected in connections and usage. Other problems have also worsened, such as the proliferation of fake news and cyber attacks, the growing risk to privacy and personal data security, and the large-scale production of electronic waste.

The global backdrop to the unresolved balance between the benefits and costs of digitalization is more adverse than was anticipated 15 years ago. Geopolitical struggles, often centred on digital patents, standards and production, have markedly weakened multilateral decision-making and action. The environmental crisis has escalated into an environmental emergency or, according to some analysts, an environmental catastrophe. The increase in inequality in many countries and the exclusion of vulnerable population groups is making it even more difficult to build social and political systems capable of adequately steering digital development.

The COVID-19 pandemic has accentuated all these problems and driven the world into the worst economic crisis since the Second World War, with all the attendant negative effects on jobs, wages and the struggle against poverty and inequality. Digital technologies have played a key role in addressing the effects of the pandemic. However, the benefits from their use are limited by structural factors, such as limits on connectivity (access, use and speed), social inequalities, productive heterogeneity and low competitiveness, and restricted access to data and information management, among other factors.

Thus, new opportunities and new challenges are opening up for the countries of Latin America and the Caribbean. The region will be the hardest hit by the crisis and will have to confront long-standing problems from a position of greater structural weakness. In particular, it will have to surmount the slow economic growth of the last seven years, with falling investment and stagnant productivity, while at the same time vigorously recommitting itself to the struggle against poverty and inequality. To overcome these problems, it will have to embark on a big push for economic, social and environmental sustainability leading to progressive structural change based on the vigorous creation and incorporation of technology to diversify the production system.

Against this background, the present document seeks to contribute to the debate and to the deployment and use of digital technologies at national and regional level in support of development. Its contents have been organized into four sections. The first section discusses the need to move towards a sustainable digital society within the framework of the systemic impact of digital disruption. The second analyses the effects of digitalization on social welfare and equality, posits the need to universalize access to these technologies and assesses the cost of doing so. The third examines the relationship between digitalization and productivity and the impact on agricultural, manufacturing and services production chains, and looks at some policies for post-pandemic recovery involving economic transformation. Lastly, the fourth section analyses the state of digital agendas in the region, in particular with regard to data management, and presents recommendations to strengthen regional cooperation and the move towards a regional digital market. It also summarizes the main conclusions of the working meetings and panels of the seventh Ministerial Conference on the Information Society in Latin America and the Caribbean, which was held virtually in November 2020 and chaired by Ecuador.

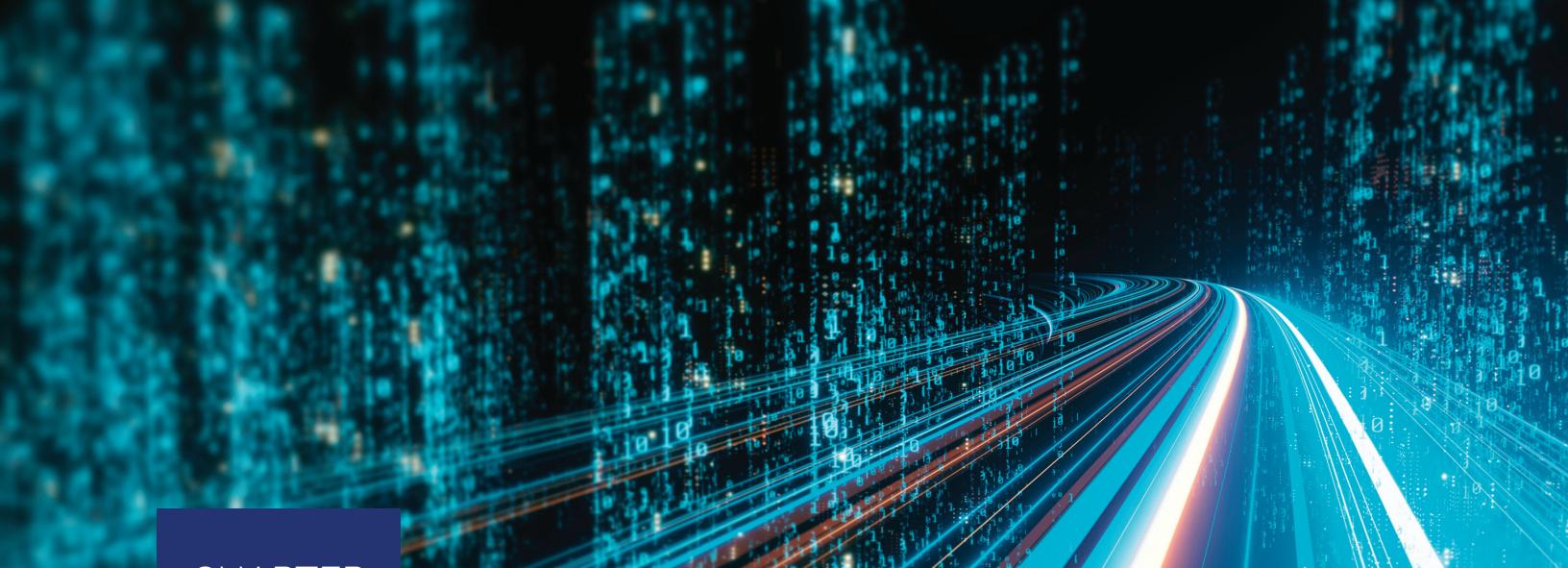
The proposals put forward in the document, once discussed and further developed at the Conference, will open the way for more inclusive and sustainable digitalization, i.e., digitalization that creates the conditions not only for faster recovery from the current crisis but for a more productive and efficient use of these digital technologies and for greater productivity, better jobs and higher wages, helping to reduce the high levels of inequality in Latin America and the Caribbean. In short, the digitalization that is needed for a new future and for progress towards a digital welfare State.

Alicia Bárcena

Executive Secretary

Economic Commission for

Latin America and the Caribbean (ECLAC)



CHAPTER

I

Towards a sustainable digital society

- A. The systemic impact of digital disruption
- B. The difficult balance between digitalization and sustainability
- C. The roll-out of 5G networks: essential to the new models of industrial production and organization
- D. The mass take-up of new technologies requires more infrastructure investment

Bibliography

A. The systemic impact of digital disruption

Since the late 1980s, the digital revolution has transformed the economy and society. First came the development of a connected economy, characterized by mass take-up of the Internet and the roll-out of broadband networks. This was followed by the development of a digital economy via the increasing use of digital platforms as business models for the supply of goods and services. Now the movement is towards a digitalized economy whose production and consumption models are based on the incorporation of digital technologies in all economic, social and environmental dimensions.

The adoption and integration of advanced digital technologies (fifth-generation (5G) mobile networks, the Internet of things (IoT), cloud computing, artificial intelligence, big data analysis, robotics, etc.) means that we are moving from a hyperconnected world to one of digitalized economies and societies. It is a world in which the traditional economy, with its organizational, productive and governance systems, overlaps or merges with the digital economy, with its innovative features in terms of business models, production, business organization and governance. This results in a new, digitally interwoven system in which models from both spheres interact, giving rise to more complex ecosystems that are currently undergoing organizational, institutional and regulatory transformation (ECLAC, 2018).

These dimensions of digital development are constantly evolving, in a synergistic process that affects activities at the level of society, the production apparatus and the State (see diagram I.1). This makes the digital transformation process highly dynamic and complex, and thus challenging for public policies insofar as it requires constant adaptation and a systemic approach to national development. Within this framework, 5G networks will make the convergence of telecommunications and information technologies viable, changing the structure and dynamics of the sector, while the adoption of digital technologies and artificial intelligence (as general purpose technologies) marks a new stage, that of the digitalized economy.

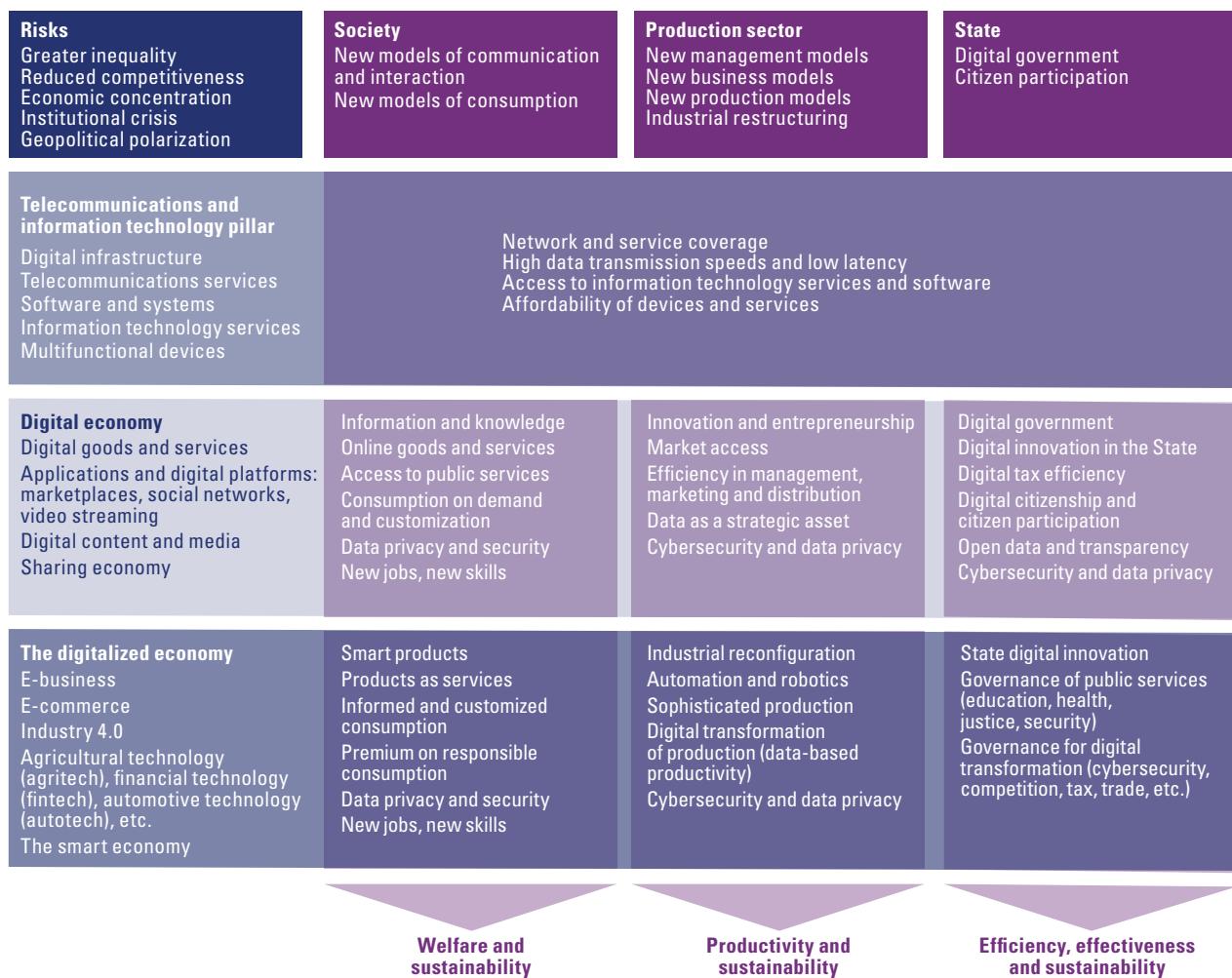
At the societal level, digital disruption leads to changes in communication, interaction and consumption models that are reflected in greater demand for devices, software with more functionalities, cloud computing and data traffic services and the basic digital skills needed to use the associated technologies. In turn, the digital economy represents an opportunity for consumers to access information and knowledge of all kinds in various formats, goods and services, and more streamlined forms of remote consumption. The move towards the digital economy should mean that consumers' needs can be met with smart products, often associated with advanced services that are highly customized. All this means an increase in consumer welfare, accompanied by a reconfiguration of the digital skills needed for more advanced digital consumption and for the new labour requirements resulting from the new production models. At the same time, the new forms of consumption are associated with potential benefits from reduced material use and more sustainable environmental choices, insofar as these are based on more and better information (about the environmental footprint of a product, for example) or reward more environmentally friendly practices.¹

The development of the digital economy has radically changed the value proposition of goods and services via the reduction of transaction and intermediation costs and the exploitation of information from data generated and shared on digital platforms. These digitally enabled models facilitate the generation and capture of data which, when processed and analysed with smart tools, can be used to improve decision-making and optimize supply. This results in more streamlined operating processes, in market segmentation and in product customization and transformation. Data and digitalized knowledge become a strategic production factor (ECLAC, 2016). All this entails a need for regulatory changes in a variety of areas ranging from telecommunications to trade, taking in competition and data protection and cybersecurity policies on the way.

¹ For example, the fintech company Ant Group, an affiliate of Alibaba, implemented an application on its payment platform that has engaged over 500 million Chinese citizens in carbon-saving consumption activities, thus bringing about a change in citizen behaviour. When its users perform some activity that has a positive impact in the form of reduced carbon emissions, such as paying bills online or walking to work, they receive "green energy" points. Once users accumulate enough points virtually, a real tree is planted. Since its launch in August 2016, Ant Forest and its NGO partners have planted around 122 million trees in some of China's driest areas (UNEP, 2019).

Diagram I.1

Dimensions of digital development and the effects on society, the production sector and the State



Source: Economic Commission for Latin America and the Caribbean (ECLAC).

The digital transformation of the production sector is taking the form of new management, business and production models that are facilitating innovation and the introduction of new markets and disrupting traditional industries. The expansion of the industrial Internet, smart systems, virtual value chains and artificial intelligence in production processes is speeding up innovation and generating productivity gains, with positive effects on economic growth. In addition, all this is driving the transformation of traditional industries through automotive technology (autotech), agricultural technology (agritech) and financial technology (fintech), among others. In particular, smart production models can bring increased competitiveness with a smaller environmental footprint, as companies are using digital tools to map and reduce their footprint in order to assess their impact on climate change and modify their production processes.

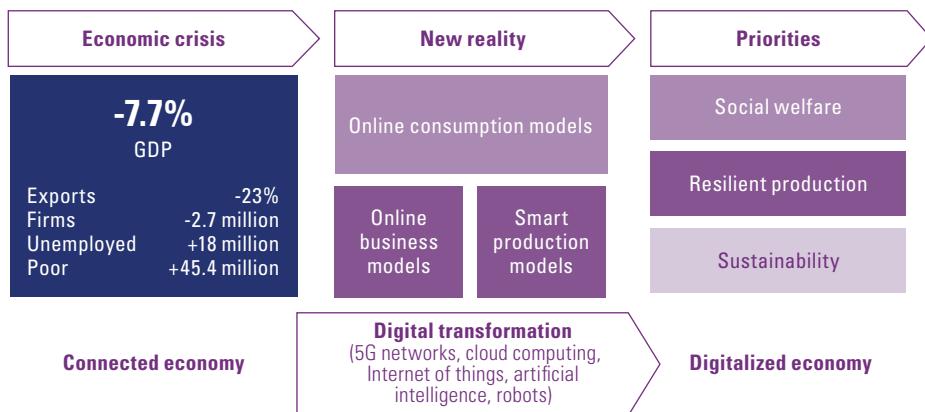
A similar process ought to take place in the public management models of State bodies, in order to meet citizens' demands and improve government action. The adoption of these technologies by such institutions would increase the efficiency and effectiveness of provision for services such as health care, education and transport. It would also improve citizen participation in democratic processes, increase transparency in government operations and facilitate more sustainable practices. In particular, smart city solutions are transformative because of their potential social, economic and environmental impact, especially in a region where 80% of the population is concentrated in cities.

Despite all this potential, however, digital development that is not governed by principles of inclusiveness and sustainability can reinforce patterns of social exclusion, as well as unsustainable exploitation and production practices. Although digitalization can make a major contribution to the three dimensions of sustainable development (growth, equality and sustainability), its net impact will depend on the extent to which it is adopted and on its system of governance.

In the current situation, the economic and social crisis generated by the COVID-19 pandemic and physical distancing measures have precipitated many of the changes discussed, as preference has been given to online channels in an attempt to maintain a certain level of activity (see diagram I.2). This acceleration of digital transformation in production and consumption seems irreversible. The pandemic has created a greater need to reduce digital divides and has shown the importance of these technologies, for example, in contact tracing applications. To carry forward the recovery, digital technologies must be used to build a new future through economic growth, job creation, the reduction of inequality and greater sustainability. This is the way to achieve the 2030 Agenda for Sustainable Development and meet the Sustainable Development Goals (SDGs).

Diagram I.2

Latin America and the Caribbean: towards reactivation, 2020



Source: Economic Commission for Latin America and the Caribbean (ECLAC).

B. The difficult balance between digitalization and sustainability

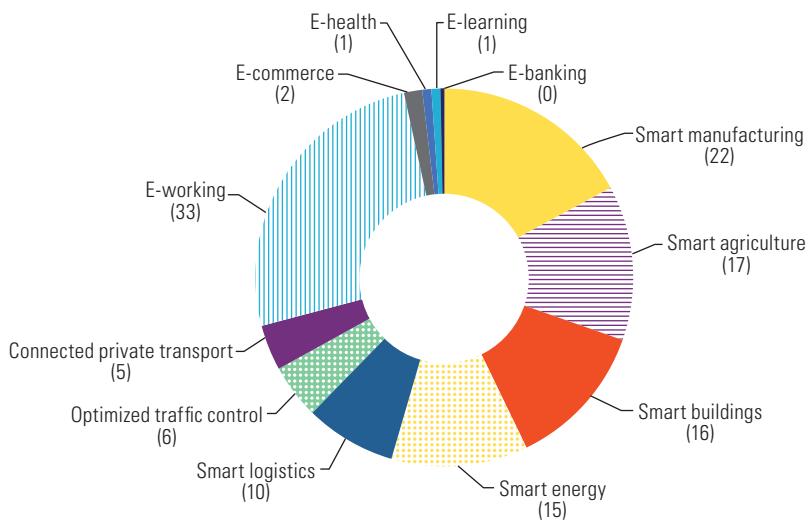
Digital technologies foster ecological innovations that contribute to sustainable development by reducing environmental impacts and optimizing resource use. As these technologies evolve and converge with biotechnology and nanotechnology, they could generate exponential innovations that contribute to a sustainable future. Digitalization has both positive and negative impacts on the environment. On the one hand, it can dematerialize the economy by facilitating the supply of the digital goods and services that represent an increasingly large part of the economy and exports; an increase in the importance of digitally supplied services reduces movements and thence emissions. A more profound change in consumption is expected with the development of the product as a service (PaaS) model, which makes it possible to compare the desired outcome of using a product without purchasing it. Mobility as a service (MaaS) uses this model to combine transport services from public and private providers through a unified gateway that creates and manages journeys. This reduces carbon emissions and optimizes the space occupied by vehicles, helping progress towards more sustainable cities.

At the same time, new business models such as the gig economy are optimizing the use of existing resources by multiplying the opportunities for employing capital goods. Thus, for example, the supply of accommodation services can expand without the need for new hotel construction, or the supply of urban

mobility services can be increased by making use of vehicle downtime: the demand for units does not rise, and there are consequently savings in materials and energy. Urban navigation applications, meanwhile, reduce journey times and emissions. In the production sector, the incorporation of artificial intelligence into decision-making optimizes resource management and reduces the environmental footprint in areas such as the exploitation of natural resources, manufacturing, logistics and transport, and consumption. Digitalization also makes it possible to disintermediate activities, reducing transaction costs and links in value chains, with the consequent savings in energy and inputs.

The Global e-Sustainability Initiative (GeSI) study #SMARTer2030 estimated that by implementing digital solutions in different sectors of the economy, total global carbon dioxide equivalent (CO_2e) emissions could be reduced by 12 gigatons (Gt) by 2030, providing a path to sustainable growth. The most significant contribution to this reduction would be made by mobility solutions, followed by applications in the manufacturing and agricultural sectors (see figure I.1). Real-time traffic information, smart logistics and lighting and other digitally enabled solutions could reduce CO_2e by 3.6 Gt, including savings in emissions from journeys forgone. Smart manufacturing, including virtual manufacturing, customer-centred production, circular supply chains and smart services could save 2.7 Gt of CO_2e . Besides lower carbon emissions, benefits would include a 30% increase in agricultural crop yields, savings of more than 300 trillion litres of water, a reduction of 25 billion barrels per year in oil demand and a decrease of 135 million vehicles in the global vehicle fleet (GeSI, 2015).

Figure I.1
Potential for reducing carbon dioxide (CO_2) by 2030, by type of digital solution

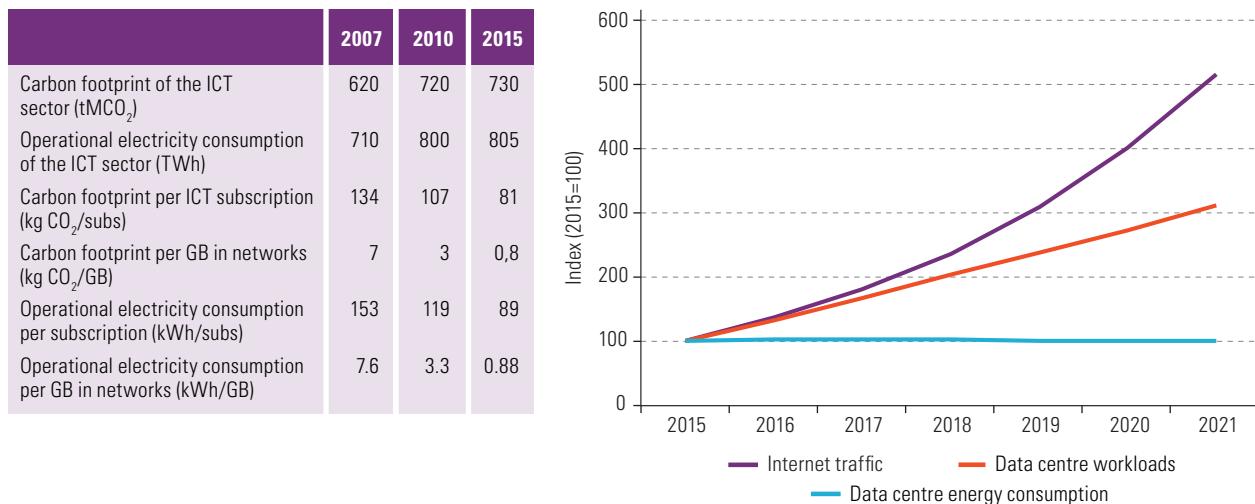


Source: Global e-Sustainability Initiative (GeSI), #SMARTer2030: *ICT Solutions for 21st Century Challenges*, Brussels, 2015 [online] https://smarter2030.gesi.org/downloads/Full_report.pdf.

On the other hand, increased digital development generates negative effects associated with energy consumption (data centres and networks), polluting hardware (screen) production processes, and business models that encourage the rapid replacement of devices. Likewise, the increased use of audio and video solutions and of data in general tends to result in a continuing rise in energy consumption. However, while electricity consumption and the carbon footprint of the information and communications technology (ICT) sector increased between 2007 and 2015, the rate of increase slowed down considerably despite strong growth in subscriptions and data traffic. Intensity indicators show that substantial progress has been made with energy consumption and carbon footprint generation, as each subscription or each GB transmitted has a decreasing impact (81 kg $\text{CO}_2\text{e}/\text{subscription}$ in 2015 compared to 134 kg $\text{CO}_2\text{e}/\text{subscription}$ in 2007, and 0.8 kg $\text{CO}_2\text{e}/\text{GB}$ in 2015 compared to 7 kg $\text{CO}_2\text{e}/\text{GB}$ in 2007) (Malmodin and Lunden, 2018) (see figure I.2).

Figure I.2

The carbon and energy footprint of information and communications technologies (ICTs) and trends in Internet traffic and data centre workloads

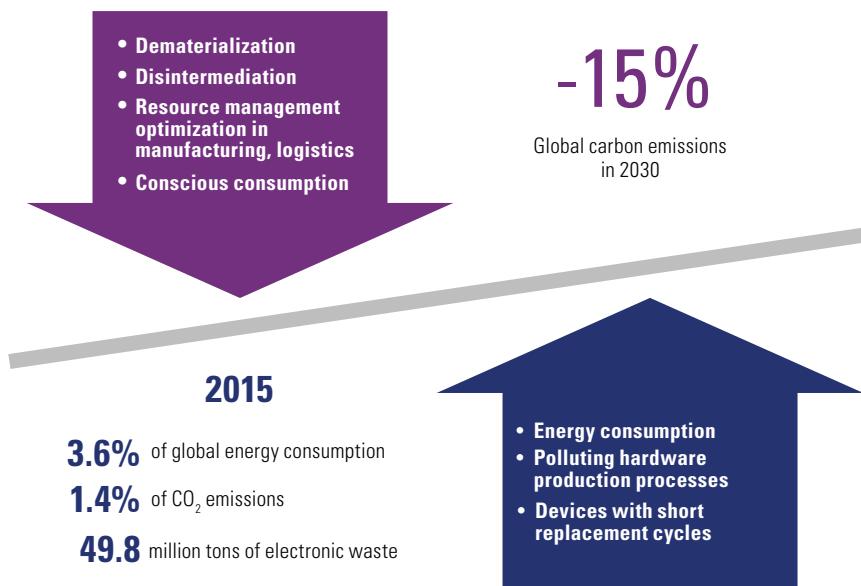


Source: J. Malmodin and D. Lunden, "The energy and carbon footprint of the global ICT and E&M sectors 2010–2015", *Sustainability*, vol. 10, No. 9, Basel, Multidisciplinary Digital Publishing Institute (MDPI), 2018; International Energy Agency (IEA), *Digitalization and Energy*, Paris, 2017.

In addition, the development of advanced technologies such as 5G, the Internet of things and artificial intelligence should help reduce global carbon emissions by up to 15%, or almost a third of the 50% reduction proposed for 2030, via the development of solutions for the energy, manufacturing, agriculture and natural resource extraction, construction, services, transport and traffic management sectors (Ekholm and Rockström, 2019). This can offset some of the negative effects of the production and use of these technologies, which involve high energy consumption (1.4% of the world total), massive generation of e-waste and extraction of natural resources such as copper and lithium (see diagram I.3) (Malmodin and Lunden, 2018).

Diagram I.3

The effects of digitalization on sustainability



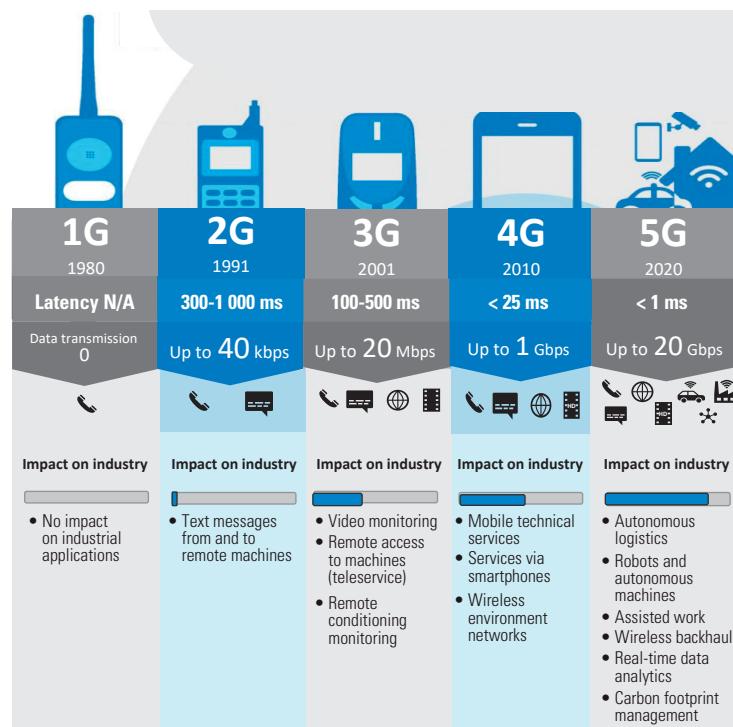
Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of B. Ekholm and J. Rockström, "Digital technology can cut global emissions by 15%. Here's how", Cologny, World Economic Forum (WEF), 2019 [online] <https://www.weforum.org/agenda/2019/01/why-digitalization-is-the-key-to-exponential-climate-action/>; J. Malmodin and D. Lunden, "The energy and carbon footprint of the global ICT and E&M sectors 2010–2015", *Sustainability*, vol. 10, No. 9, Basel, Multidisciplinary Digital Publishing Institute (MDPI), 2018.

C. The roll-out of 5G networks: essential to the new models of industrial production and organization

The fifth generation of mobile networks (5G) will be disruptive to industrial organization and production models because of its technical characteristics (higher transmission speeds, of up to 20 Gbps), ultra-reliable low latency (less than a millisecond), increased network security, massive machine type communications and enhanced device energy efficiency. Thus, the roll-out of these networks will make it possible to extend wireless broadband services beyond the mobile Internet to complex Internet of things systems, with the low latency and high level of reliability needed to support critical applications in all economic sectors (see diagram I.4).

Diagram I.4

The evolution of mobile networks and their technical characteristics



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of Micron Technology, "5G, AI, and the Coming Mobile Revolution", Boise, 2020 [online] <https://www.micron.com/insight/5g-ai-and-the-coming-mobile-revolution>; Siemens, "Industrial 5G: for the industry of tomorrow", Munich, 2020 [online] <https://new.siemens.com/global/en/products/automation/industrial-communication/5g.html>.

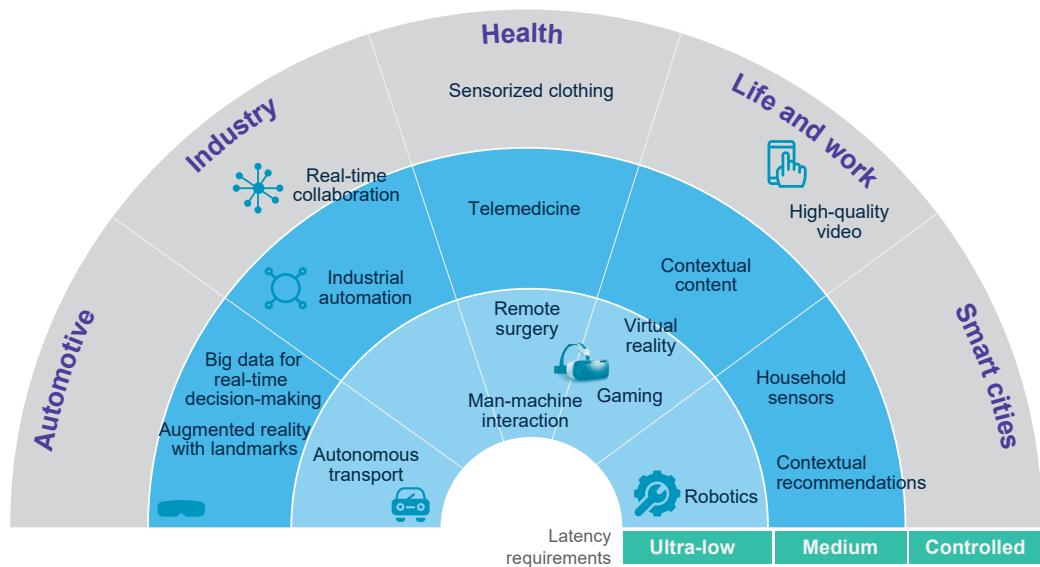
5G mobile networks will support innovative uses in virtually all industries. Enhanced broadband experiences, the large-scale Internet of things and mission-critical services will provide a basis for innovative uses offering segmented levels of latency (see diagram I.5). Although edge computing can be used in a 4G environment, the combination of this with 5G networks and artificial intelligence (AI) is expected to open up new uses in vertical industries and speed up the adoption of Industry 4.0 models, yielding gains in productivity and competitiveness and improvements in sustainability.

5G networks make it possible to build smart factories and take advantage of technologies such as automation and robotics, artificial intelligence, augmented reality and the Internet of things at different stages of the value chain (see diagram I.6). Having real-time access to information for decision-making along an entire value chain is a key competitive advantage when it comes to making efficient use of resources and better meeting demand. Cloud-based solutions make it possible to better integrate the different stages of the chain. The same software can be used for the design, simulation and implementation of configurations and instructions for running physical production lines, thus improving the quality and flexibility of operations. This type of solution replaces traditional assembly processes and provides greater flexibility to reconfigure production plants in the event of changes

in the product or in demand. They serve to streamline processes and cut costs, as well as reducing delivery times, improving logistics management and capturing the attention of consumers. Other particularly important uses include industrial automation and control systems, planning and design systems, and field devices that provide information for complete process optimization. In addition, the incorporation of artificial intelligence into decision-making allows resource management to be optimized with a view to reducing the environmental footprint in areas such as natural resource exploitation, manufacturing, logistics and transport, and consumption.

Diagram I.5

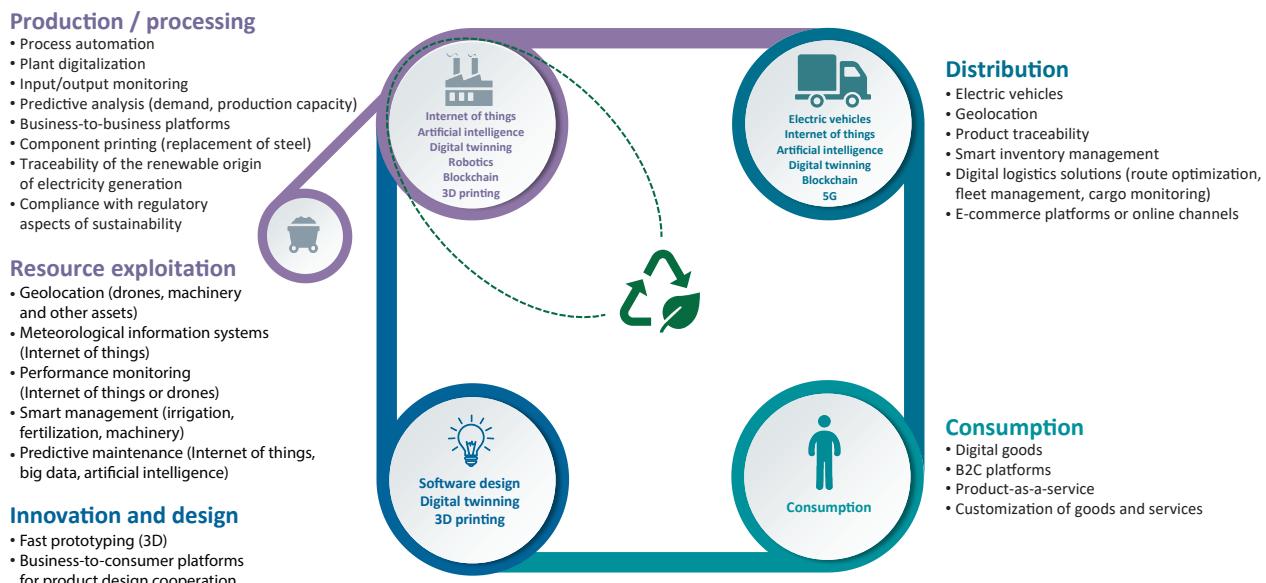
Applications of sectoral 5G networks depending on the levels of latency required



Source: Detecon International, "5G campus networks: an industry survey", Cologne, 2019 [online] https://www.detecon.com/drupal/sites/default/files/2019-10/kor%20190613_5G_Market_Survey_final_0.pdf.

Diagram I.6

Digital transformation of the production chain



Source: Economic Commission for Latin America and the Caribbean (ECLAC).

In addition to driving sustainable industrialization, digital transformation can provide social and environmental value through the development of education, health, transport, city and teleworking applications, as discussed in chapter II.

D. The mass take-up of new technologies requires more infrastructure investment

1. Telecommunications are moving to the cloud: the transformation of the sector

Telecommunications service operators (TSOs) need to become more competitive (reduce their capital and operating expenditure) and make their services more responsive. 5G technology creates an opportunity for them because it allows network functions to be virtualized with lower operating costs. It also allows processes to be automated and made more flexible, with all the consequent scalability and greater dynamism in network management. Network operators will become digital service providers, disrupting the sector's business model.

4G technology marked the beginning of a path towards network virtualization that will be consolidated with 5G technology. Network virtualization allows resource managers to integrate fixed and mobile services, separating them into layers so as to provide each business or individual user with the services they require. Thus, innovative uses requiring different levels of latency can be explored in industry, health services, education, transport, work and home life and cities.

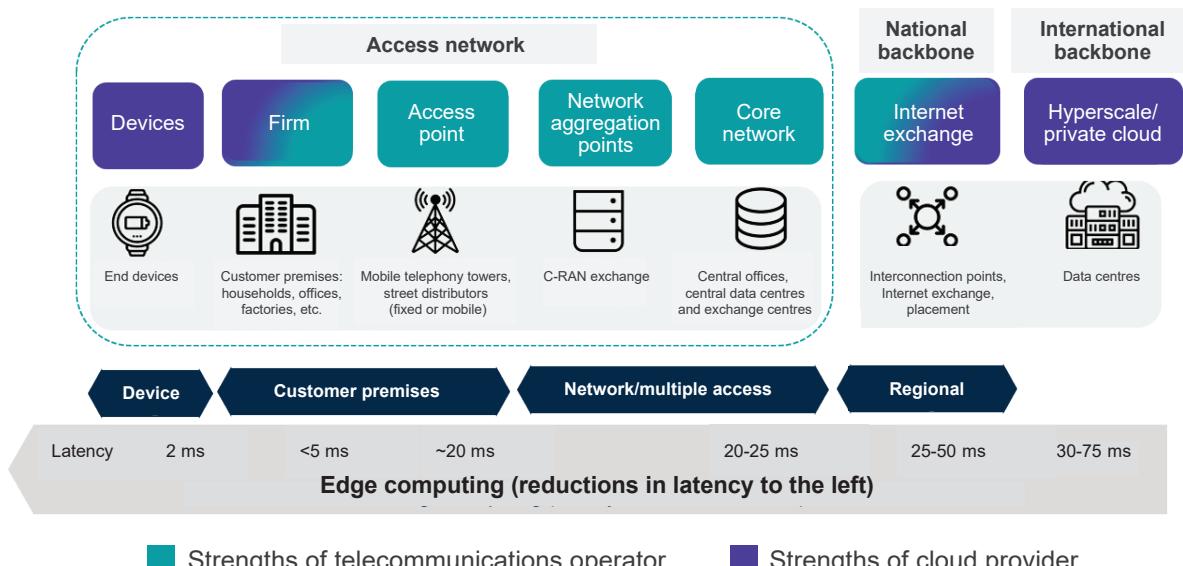
Cloud computing is one of the drivers and enablers for the processing of the large amounts of data generated by the ever-increasing connectivity of things. As this connectivity increases, a crucial factor will be the use of artificial intelligence and the ability of cloud computing to achieve the low latency times required by autonomous vehicles, virtual or augmented reality and certain industrial automation services. Edge computing will supplement cloud computing, which will be provided in a decentralized or distributed manner according to the requirements of the different services (the network gateway, the customer's installations or peripheral devices), as in so-called hyperscale computing (higher latency). These new needs converge with a parallel process in the universe of telecommunications operators, which are resorting to "cloudification" to cut network costs and increase the responsiveness, security and analytical capacity of the data they carry.

These needs and trends are leading to a new convergence between the world of telecommunications and the information technology sector, which provides public cloud services. Telecommunications service operators see that hyperscale public cloud providers could become competitors in the provision of connectivity services. Globally, traditional telecommunications providers such as AT&T and Verizon are working with cloud service providers such as Microsoft and Amazon to add network edge computing to network centres in order to implement 5G technology (see diagram I.7). The two will need each other to achieve an infrastructure capable of providing connectivity and computing capacity to businesses and devices. It is therefore to be expected that more and more partnerships will arise between these actors in order to develop the new supply of integrated services that will make access to the technologies of the fourth industrial revolution viable.

One indication of the transformation in the sector is the tendency to sell off or split up the business, with one part operating the infrastructure network and the other operating the service itself. Just over a decade ago, operators controlled all the passive and active components of the telecommunications infrastructure. Today, telecommunications operators are choosing to split vertically, forming companies that specialize in managing their property assets or selling their towers and sites to new infrastructure network operators. By the end of the first quarter of 2019, over 50% of all towers in Latin America and the Caribbean were in the hands of specialized companies and not these operators (Euromoney Global Limited, 2019). The separation of network management from service provision is motivated by considerations of specialization and the need for sufficient scale to provide services efficiently. This is why some operators have chosen to divest themselves of their data centres. In January 2021, for example, Telefónica signed an agreement with American Tower Corporation to sell its telecommunication towers division in Europe (Germany and Spain) and Latin America (Argentina, Brazil, Chile and Peru) (Telefónica, 2021).

Diagram I.7

Convergence between telecommunications operators and information technology: network virtualization, cloud distribution and network edge computing



Source: Economic Commission for Latin America and the Caribbean (ECLAC).

Changes in business models are transforming the industry (see table I.1). The virtualization of networks and the need to process large amounts of data are leading to convergence with the information technology sector that is encouraging the entry of new players. Maximizing the benefits of technological innovation requires a clear vision of these challenges and a regulatory framework designed to encourage the development of new value chains.

Table I.1

The new dynamics of interaction between new and traditional actors and disruptive developments

	Traditional players	Disruptive developments	New players
Passive infrastructure	AMX, TEF, MIC, TECO	Unbundling, management specialization, asset sweating, sharing	American Tower, SBA, Phoenix, Cellnex, Telxius, Telesites
Active/network infrastructure	Ericsson, Huawei, Nokia, Samsung, ZTE	Virtualization, consolidation, sharing, cybersecurity, trade war	OpenRAN (Parallel Wireless, Altostar) CloudCos (AWS, Azure, Google)
Devices	Samsung, Apple, Xiami, Huawei, Oppo, LG	Scale, operating systems, Internet of things, wearables, sensorization	Internet of things players, 5G
Operators	AMX, TEF, MIC, TECO	Consolidation, heavy regulation, spectrum cost, unlicensed use (Wi-Fi)	Internet service providers (ISPs) offering dynamic IP addresses, private networks, wholesalers, satellite/HAPS
Over-the-top (OTT) services	Service and content platforms	Softwarization, network slicing, business-to-business (B2B) services, vertical industry services, content, cloud/big data, artificial intelligence	Heavy fragmentation by niche Cloud (infrastructure as a service, platform as a service, software as a service)

Source: Economic Commission for Latin America and the Caribbean (ECLAC).

2. The digital transformation driven by 5G networks will have a significant economic impact but require large investments

The transition to 5G technology began in late 2018 in the United States, China and the Republic of Korea, and it is expected to start being deployed more systematically in Latin America and the Caribbean during 2021. At the same time, the development of high-performance satellites, coupled with new models for the use of unlicensed radio spectrum such as Wi-Fi, will be drivers of innovation aimed at increasing connectivity options and improving coverage.

Implementing the procedures for moving from 4G to 5G technology could increase Latin America's GDP by between US\$ 229 billion and US\$ 293 billion by 2030 (Katz and Cabello, 2019). This finding is based on two scenarios. The first is a baseline scenario of urban-suburban deployment centring on first- and second-tier metropolitan centres, with network speeds and capacities remaining consistently lower in rural areas. The second is a national maximum scenario, with a service speed and quality experience that is more uniform in the areas where 95% of the population lives. This measurement is based on consideration of three areas of impact for mobile expansion:

- 1. The impact on digital transformation:** benefits in the form of connectivity, digitalization of households and the production system, growth of digital industries.
- 2. The impact on GDP growth:** the effect of the level of digitalization on GDP partly because of investment in network roll-out, but mainly as a result of spillover effects (positive externalities) on the economy as a whole.
- 3. The impact on the GDP of certain industrial sectors:** the spillover effects from increased operational efficiency and improved productivity in certain industrial sectors.

Figure I.3 shows the impact of improved connectivity on GDP in the six countries analysed, ranging from US\$ 104 billion for Brazil to US\$ 15 billion for Peru, and attributable to direct and indirect effects in a high-impact scenario. The adoption of use cases facilitated by the technological leap could have a combined impact on the efficiency of companies and the public sector, as well as on the scope and coverage of services. At the sectoral level, it is estimated that the greatest benefits from the substantial improvement in quality and efficiency will come in public services (health care, education and security, including smart city services such as traffic management). A considerable increase in value is also expected in professional services, manufacturing and logistics, commerce and services, and agroindustry.

Figure I.3

Latin America (6 countries): the impact of mobile expansion on GDP and by economic sector to 2030

A. GDP impact

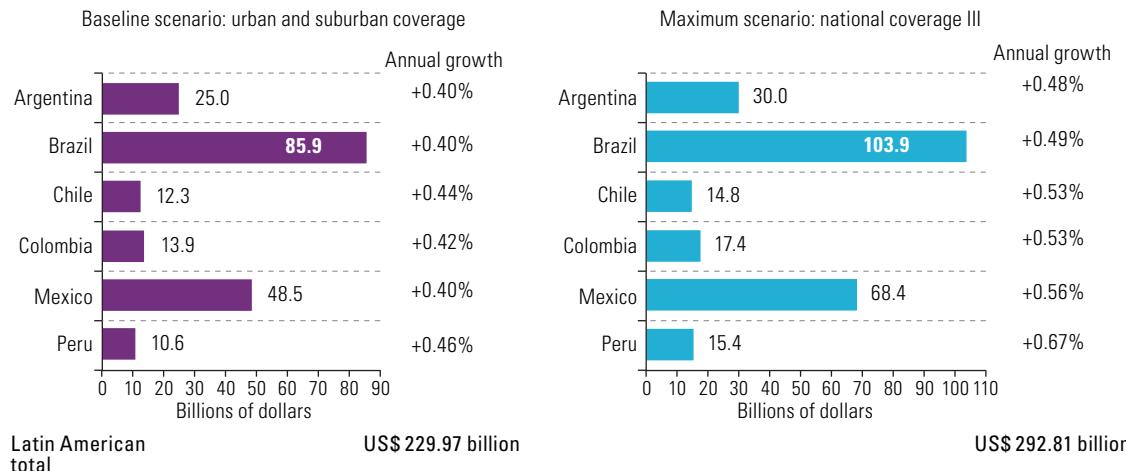
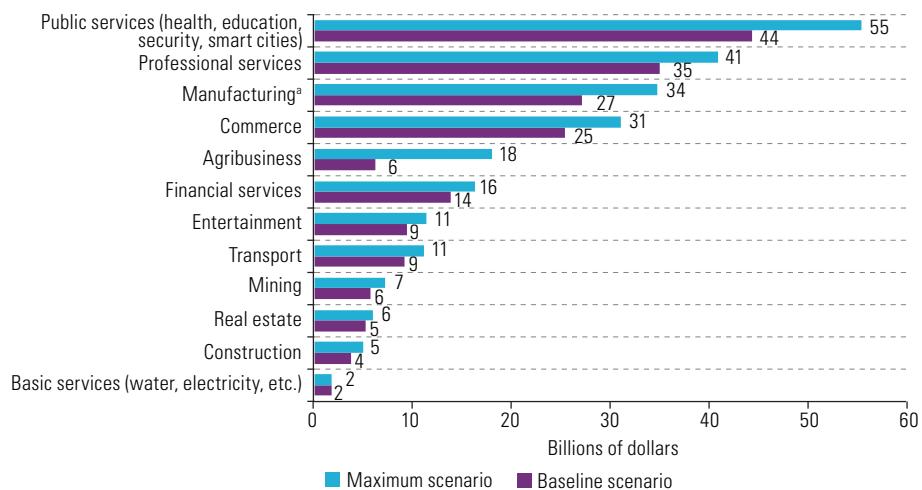


Figure I.3 (concluded)

B. Impact by economic sector



Source: R. Katz and S. Cabello, *The Value of Digital Transformation through Expansive Mobile in Latin America*, New York, Telecom Advisory Services, 2019.

^a Includes all production subsectors except food processing.

The investment in capital goods required to roll out these networks in the six countries considered ranges from US\$ 50.8 billion in the urban-suburban scenario to US\$ 120.07 billion in national scenario III (maximum impact). This implies that telecommunications service operators would have to increase their annual capital expenditures by between 10% (baseline scenario) and 40% (maximum scenario) from their current values. The deployment of 5G technology requires the installation of a denser network with greater capillarity. In addition to telephone antennas and other components, small cells must be installed to extend coverage and fibre optics to connect the installations. The use of small cells and new multiple-input multiple-output (MIMO) antenna techniques is a key factor in this cost, since it will mean acquiring and maintaining two to three times more sites by 2030 than the industry had accumulated in those countries by the end of 2018, assuming that the number of base stations needs to grow three- or fourfold (see figure I.4).

Figure I.4

Latin America (selected countries): estimated total and annual investment required for mobile expansion in the next seven years and projected growth in sites needed by 2030

A. Investment needed over seven years

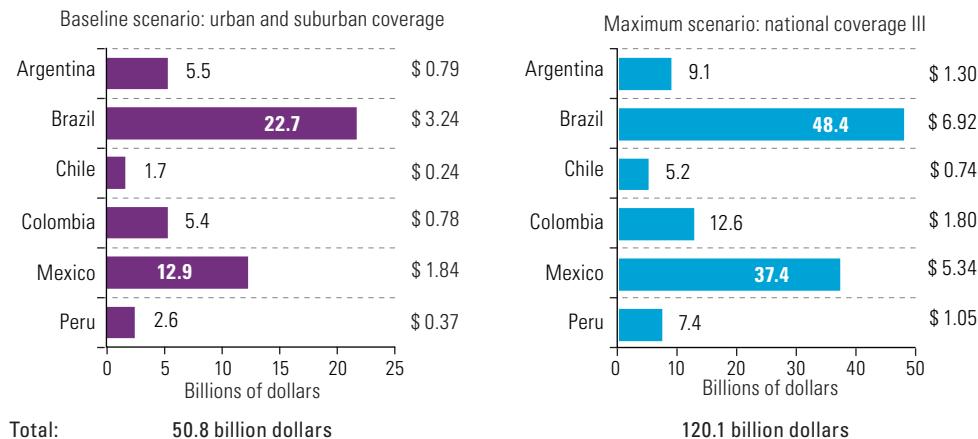
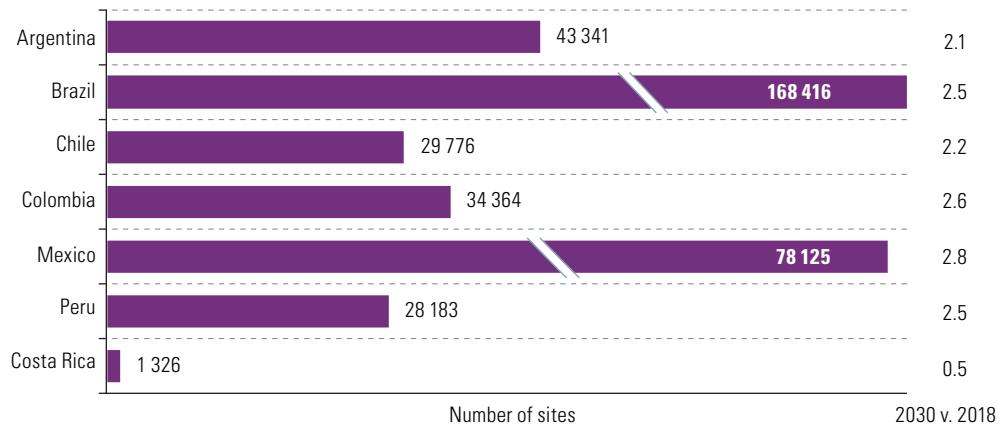


Figure I.4 (concluded)

B. Projected growth in sites needed by 2030



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of R. Katz and S. Cabello, *The Value of Digital Transformation through Expansive Mobile in Latin America*, New York, Telecom Advisory Services, 2019.

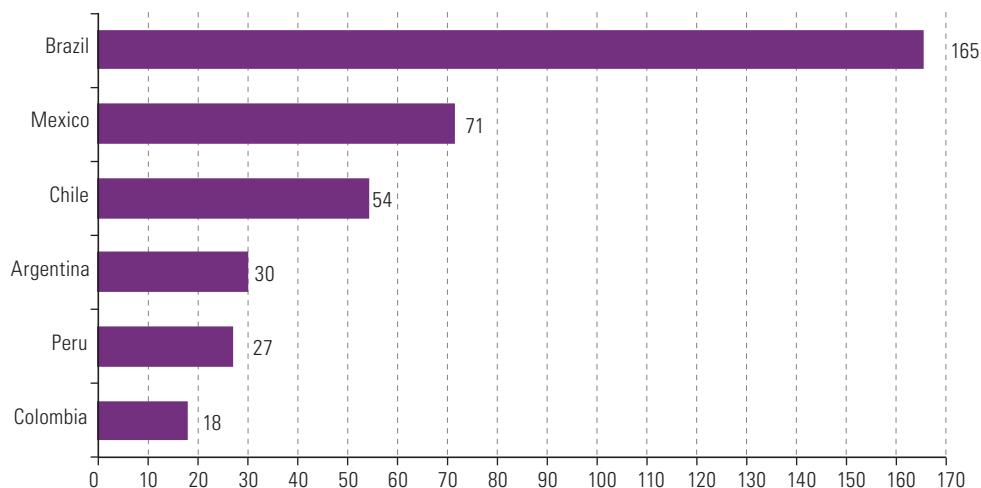
Note: The numbers adjoining the bars are the amount of annual investment (in billions of dollars) required for mobile expansion, assuming an investment horizon of seven years. The capital spending figures do not include spectrum expenditure.

Infrastructure sharing can be a way to cope with this level of investment. However, it poses challenges for regulation, as the more infrastructure is shared, the greater the risk of anti-competitive behaviour. Regulatory attention will need to increase as the number of operators and wholesale networks consolidates and as sharing needs increase.

In addition to transmission networks, the region needs to be equipped with more information technology infrastructure to support the exponential growth of data and the provision of new cloud services. According to the *Datacenter Technologies Cooling Market Map* Thompson and Wentworth (2019), there are 151 data centres in the region, located in 24 countries: 118 in South America and 33 in Central America and the Caribbean. The region has invested very little in data centres in relation to its population (Thompson and Wentworth, 2019) (see figure I.5). For example, Argentina, with a population of 44 million people, has 30,000 square metres in operation, the same space as Austin, Texas, with 1.9 million.

Figure I.5

Latin America (6 countries): operational floor area of data centres, multiple operators, 2019
(Thousands of square metres)



Source: D. Thompson and E. Wentworth, "Buenos Aires: multitenant datacenter market", *Datacenter Technologies Cooling Market Map*, New York, 451 Research, 2019.

Cloud services have become dominant as drivers of the digital transformation. The cloud provides flexible information technology resources that create the conditions for transformed business models and service provision, nimble marketing processes and easy experimentation with new services without the need for new information technology resources, as well as offering greater cybersecurity. Governments and companies have slowly adopted the cloud in their operations, but this trend has been accelerated by physical distancing measures. Teleworking, telemedicine, tele-education, video-conferencing, video on demand, e-commerce, e-banking and online official procedures are now carried out on a large scale and have become part of everyday life.

The most widely used application is software as a service, with solutions such as email, video conferencing, office applications, customer relationship management, resource planning, workflow automation and security. In addition, it enables the use of e-commerce support tools, such as chatbots and messaging, which expand communication channels with customers. In 2019, software as a service uses constituted almost 50% of the cloud market in Latin America and the Caribbean, followed by infrastructure as a service uses, with 46%, and platform as a service uses, with 4.3% (GlobalData, 2020). The region accounts for 8% of global cloud traffic, and this traffic is expected to grow by 22% on average per year up to 2023.

Internet exchange points (IXPs) are crucial to the digital infrastructure. There are 101 IXPs in Latin America and the Caribbean, of which 60% are in Argentina and Brazil. In February 2020, the aggregate traffic of all IXPs in the region averaged 9 terabits per second (Tbps), a figure that increased significantly during lockdowns. In Brazil, it peaked at 8.79Tbps in mid-March, as compared to an average of 4.89Tbps. In Chile, total average traffic increased from 732 gigabits per second (Gbps) to 1.96 Tbps and has settled at around 1 Tbps (Graham-Cumming, 2020).

There are still very few data centres belonging to content distribution networks (CDNs), although the main ones have their own points of presence in many Latin American and Caribbean countries, in addition to hundreds of caches installed at IXPs and in the networks of Internet service providers (ISPs). This is fundamental, since in the last decade content has been located closer to the user. Some 90% of the content searched for by users is located two jumps or less (in topological terms) from the user's ISP. Therefore, although underwater cables are still essential, it is very important to promote the growth of infrastructure that allows content to be stored close to the user in order to make access more efficient (IXPs, data centres and caches) (Echeberría, 2020).

Many data centres in the region were built and designed to meet business demand. But now there is demand for more powerful services, and investment in data centres needs to be increased. Some of the content distribution network operators are coming up against limits in the data centre market when they try to set up more points of presence. In the short term, more data centres will be needed to meet demand from companies as they continue moving their services to the cloud and to respond to higher power requirements.

In sum, the impacts of the digital revolution have become more visible and intensified with the pandemic, reinforcing long-term trends. As will be seen in the following chapter, applications linked to the remote provision of education, health and shopping services, as well as those used for teleworking and social connections, have grown and permeated large areas of society, although digital divides are preventing the universalization of their use and impact. At the same time, despite the positive effects of dematerialization, digital development has sustained or even exacerbated growth patterns that are intensive in energy and raw materials, increasing the generation of greenhouse gases and waste. The positive effects are present and palpable, but so are the negative effects. Taking advantage of the former while reducing the latter means changing the pattern of digital progress and setting it on a path of inclusiveness and sustainability. This process is not automatic and involves all economic and social sectors. The digital revolution must be integrated into a big push for sustainability by means of a progressive structural change that develops the digital sector in the region through large investments, that encourages the take-up of these technologies in the production apparatus and governments, and that universalizes access and develops the capacities required for full use to be made of them. The final outcome will depend on the implementation of strategies, policies and actions that are timely and capable of repurposing digitalization in pursuit of sustainable development.

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Digitalization for social welfare and inclusion

- A. Divides in broadband access
- B. The use and take-up of digital technologies
- C. Universalizing access

Bibliography

A. Divides in broadband access

The digital revolution has changed and will continue to change consumption, production and business models. In addition to increasing the productivity and well-being of users, these changes can fit well with objectives of growth, employment, inclusion and environmental sustainability (ECLAC, 2020c).

However, this does not happen automatically; rather, the development and adoption of digital solutions are strongly influenced by structural factors. In countries where production structures are excessively heterogeneous and undiversified in product terms and where there are highly informal and insecure labour markets and socioeconomic constraints on access and connectivity, a large part of society is unable to appropriate the value generated by digital technologies. In particular, connectivity, understood as adequately fast broadband and ownership of access devices, affects the exercise of the rights to health, education and work, and the lack of it can lead to increased socioeconomic inequalities.

Digital development that does not respect human rights in the digital environment (digital rights) and that is not based on principles of inclusion and sustainability can reinforce patterns of social exclusion and unsustainable methods of resource exploitation and production, as well as exacerbating their negative environmental impacts. In this case, the net effect will depend on the way in which business strategies tie in with policy actions aimed at steering digitalization towards development with equality and sustainability.

Inclusion, as a way of being in or belonging to a society, is affected by the digital revolution and the ability of individuals, society, markets and States to adapt and respond. Moreover, the pandemic and compulsory lockdowns have created a need to find new ways of sustaining social and civil practices through digital platforms. It is thus urgently necessary to strengthen digital citizenship associated with the way people participate in the digital society and economy. It is also necessary to understand the new forms of power and the new public sphere emerging from the digital realm, dominated as this is by a few global companies. Although the digital space could be thought of as a continuation of the analogue space, it also involves new tools and forms of participation (ECLAC, 2016; Claro and others, 2020).

Digital citizenship requires people to have new capabilities and skills if they are to be part of this new way of being a citizen. Digital transformation in Latin America and the Caribbean is taking place in a context of structural inequality which influences the different fields of action and results. This will prevent many people from taking advantage of the opportunities offered by new technologies unless action is taken to make these opportunities visible and equalize access to them. Thus, public policies have an increasing role to play in ensuring that the changes resulting from the digital transformation pave the way for faster progress with inclusive social development and do not widen gaps in a region with high levels of inequality in several dimensions of development.

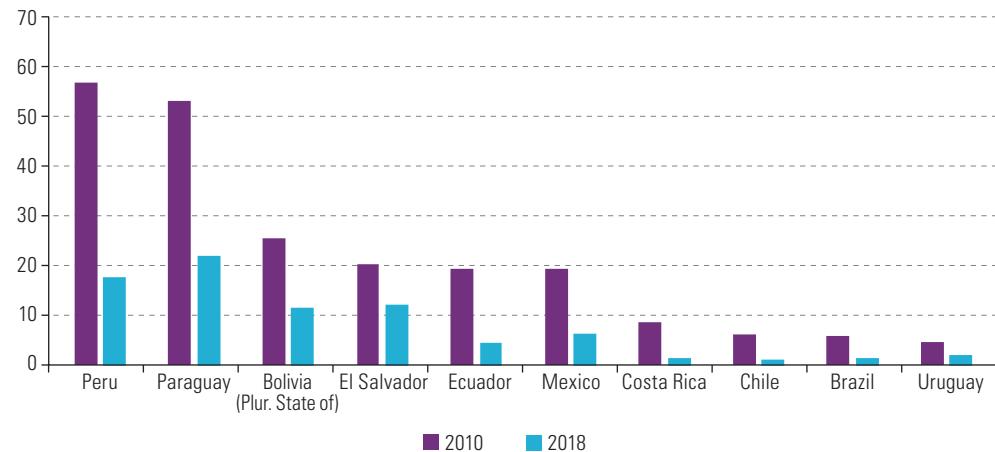
As of 2019, 66.7% of the inhabitants of Latin America and the Caribbean used the Internet. This is remarkable in terms of the speed and extent of the spread of a technology in the region, and was possible because the incorporation of technological progress has been combined with strategies of vigorous competition by private or public companies (depending on the country) and with the implementation of support and regulatory policies for the sector. Despite this great progress, one in three inhabitants of the region has limited or no access to digital technologies because of their economic and social situation, with the main variables being income, age and place of residence.

The context of the pandemic has highlighted the benefits of using digital technologies in different economic and social spheres. However, it has also shown that these benefits are not within the reach of everyone, owing to the different dimensions of the divides in access to and use of these technologies. Divides in access, in uses and skills and in opportunities for inclusion in an increasingly digitalized world are reproduced along the main lines of the region's social inequality matrix, which includes socioeconomic status, stage in the life cycle, geographical location, ethnic or racial origin and gender inequalities, among other dimensions (ECLAC, 2016).

One of the main determinants of access is income. The lowest-income quintiles are those with the most individuals and households excluded from Internet access (see figure II.1). Despite the increase in access between 2010 and 2018, income-related gaps remain. There are also major differences in the situations of the region's countries. For example, Costa Rica has a higher proportion of households with Internet access in the first quintile (the poorest) than the Plurinational State of Bolivia has in the fifth quintile (the richest).

Figure II.1

Latin America (10 countries): ratios between the number of households with Internet access in the top and bottom income quintiles, 2010 and 2018
(Multiples)

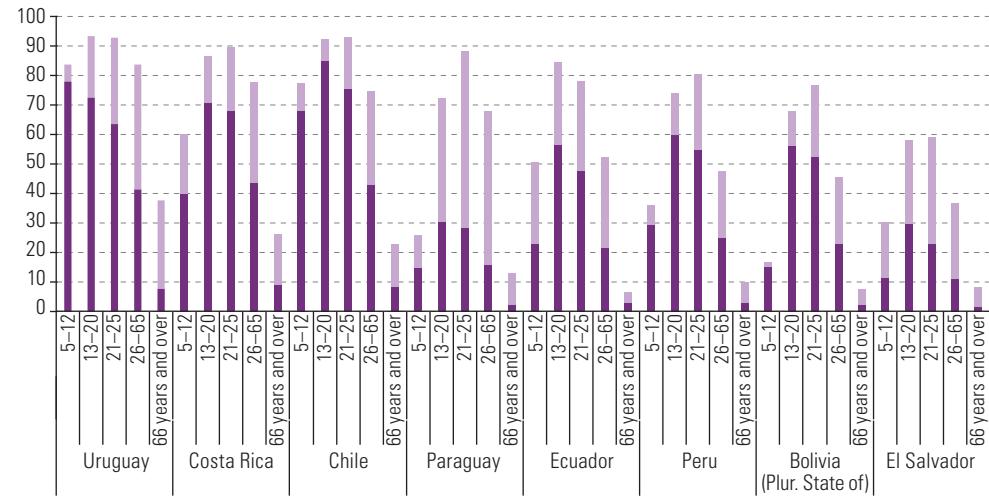


Source: Regional Broadband Observatory, on the basis of Household Survey Data Bank (BADEHOG).

The age groups with the lowest proportions of Internet users are children aged 5 to 12 and adults over 66, except in Uruguay and Chile (see figure II.2). This situation has remained fairly stable over time despite the increase in usage in all countries. As early as 2010, Internet use was already high among children aged 5 to 12 and young people aged 13 to 20 in Uruguay, possibly as a result of the implementation of the Ceibal Plan, created in 2007.

Figure II.2

Latin America (8 countries): Internet users by age group, 2010 and 2018
(Percentages)



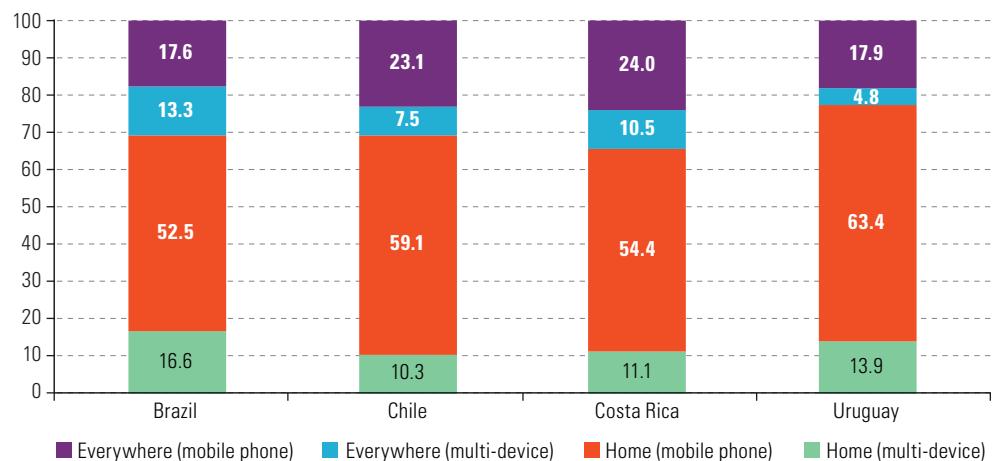
Source: Regional Broadband Observatory, on the basis of Household Survey Data Bank (BADEHOG).

Note: Dark colours show the situation in 2010 and the sum of dark and light colours that in 2018.

The type of device and the ability to stay connected in different places substantially affect the development of children's and adolescents' digital skills. The predominant form of access is from a mobile phone at home, and the least common is ubiquitous multi-device access, i.e., access from several places using different devices, which can be associated with more highly developed digital skills (see figure II.3).

Figure II.3

Latin America (4 countries): methods of physical access employed by child and adolescent Internet users, 2016-2018
(Percentages)



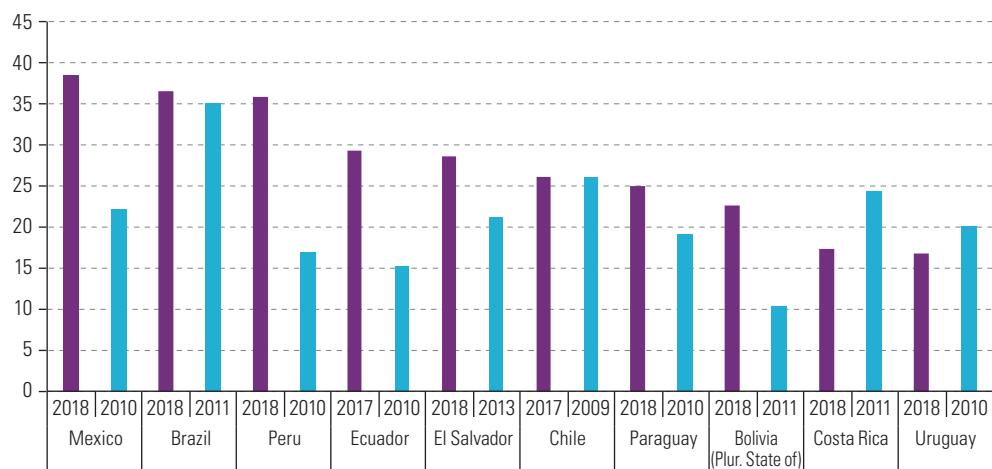
Source: D. Trucco and A. Palma (eds.), "Infancia y adolescencia en la era digital: un informe comparativo de los estudios de Kids Online del Brasil, Chile, Costa Rica y el Uruguay", *Project Documents* (LC.TS.2020/18/Rev.1), Santiago, Economic Commission for Latin America and the Caribbean (ECLAC), 2020.

Note: There are limitations on the comparability of the four countries' data, mainly due to differences in sample designs and the inclusion of different variables for ascertaining key dimensions, such as the socioeconomic level of the population surveyed.

In the countries included in figure II.4, with the exceptions of Uruguay and Costa Rica, the gap between urban and rural households increased during the period from 2010 to 2018, in some cases even doubling. This increase was generally due to faster growth in the number of users in urban areas.

Figure II.4

Latin America (10 countries): access divides between urban and rural households, 2010 and 2018
(Percentage points)

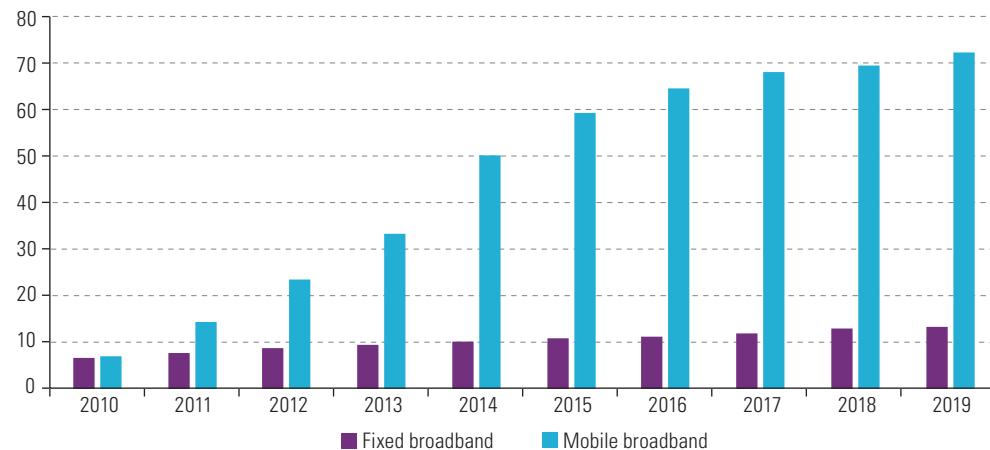


Source: Regional Broadband Observatory, on the basis of Household Survey Data Bank (BADEHOG).

The percentage of the population with a mobile broadband subscription increased tenfold from 2010 to 2018, rising from about 7% to 73%. In contrast, growth in fixed broadband access was much lower, rising from 6.6% to 13.3% over the same period (see figure II.5).

Figure II.5

Latin America and the Caribbean: fixed and mobile broadband subscriptions, 2010-2019
(Percentages of the total population)

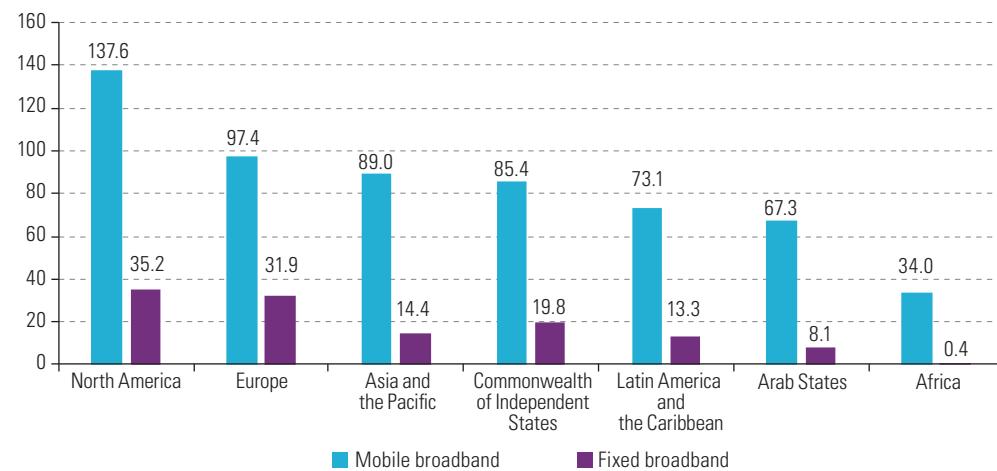


Source: Regional Broadband Observatory.

Latin America and the Caribbean lags behind other regions of the world in the percentage of the population with mobile and fixed broadband subscriptions. In both cases, the region is ahead of only the Arab and African countries (see figure II.6).

Figure II.6

Fixed and mobile broadband subscriptions, 2019
(Percentages of the population)



Source: Regional Broadband Observatory.

One aspect that has become particularly important in the context of the pandemic is connection quality (estimated from download speeds), since social distancing measures have required a variety of tasks to be carried out from home, often simultaneously. In September 2020, only six countries had average download speeds for mobile broadband (the most widely used) of over 25 megabits per second (Mbps), the minimum considered sufficient for intensive use, i.e., for carrying out several data-intensive tasks simultaneously over the same connection (see map II.1). The situation is aggravated by the fact that most mobile technology access devices appear to be smartphones, which are of limited use for remote work or study.

Map II.1

Latin America: broadband download speeds in megabits per second (Mbps), September 2020

A. Mobile broadband



B. Fixed broadband



■ 5.5 <= speed <= 18.5 ■ 18.5 < speed < 25.0 ■ Speed >= 25.0

Source: Regional Broadband Observatory.

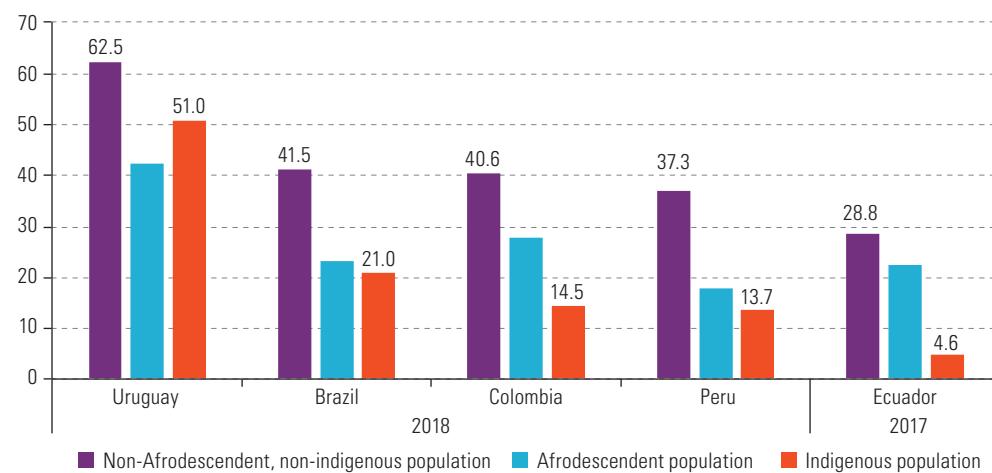
Note: The boundaries and names shown on this map do not imply official endorsement or acceptance by the United Nations.

In the case of fixed broadband, intensive use is possible in 11 countries (see map II.1). However, as fixed broadband penetration is much lower than mobile broadband penetration, the opportunity for intensive use is limited to a small segment of the population.

In ethnic and racial terms, the indigenous and Afrodescendent populations have less access to the Internet than the rest of the population, although gaps vary significantly between countries (see figure II.7).

Figure II.7

Latin America (5 countries): population aged 15 to 64 with an Internet connection in the home, by ethnicity (Percentages)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of Household Survey Data Bank (BADEHOG).

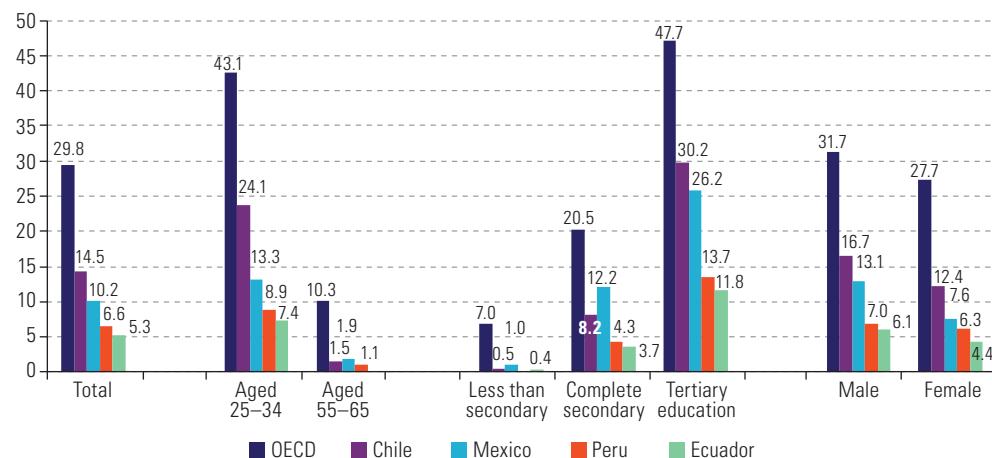
B. The use and take-up of digital technologies

1. Distance learning: essential but inaccessible for many

Experience of and familiarity with the digital world vary according to people's stage in the life cycle, sex and educational level. The young population shows higher achievements in cognitive and work-related skills. A person's general level of education plays an important role in the acquisition of such skills, and there is a clear gap between the attainments of men and women. In these three dimensions (age, educational level and sex), the percentage of the population with high levels of attainment is much lower in the countries of the region than in those of the Organization for Economic Cooperation and Development (OECD) (see figure II.8).

Figure II.8

Latin America (4 countries) and OECD averages: adults with high levels of attainment in problem-solving in digital environments, by age, educational level and sex, 2018
(Percentages)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of Organization for Economic Cooperation and Development (OECD), Programme for the International Assessment of Adult Competencies.

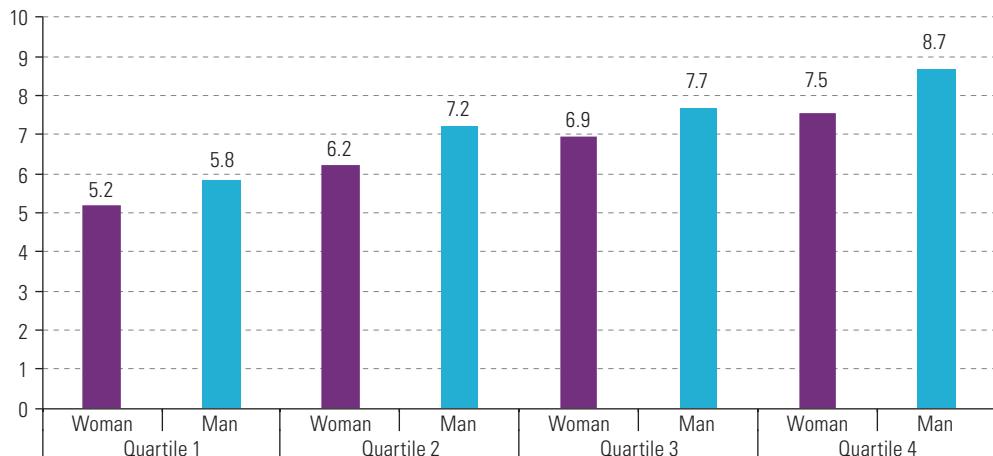
Despite this greater familiarity of the younger population with the digital world, fifteen-year-old students' perception of their self-efficacy in the use of digital media is mediocre at best (8.7 on a scale of 0 to 15) (see figure II.9). Moreover, this self-perception is unequally distributed by socioeconomic level and sex, with women at a disadvantage (ECLAC, 2020c). These gender gaps may then be perpetuated, considering that only 35% of women enrol in science, technology, engineering and mathematics degrees.

In March 2020, as a way of containing the pandemic, most countries in the region partially or entirely suspended face-to-face classes and introduced digitally-based strategies for continuing to provide education. While the interruption of the school cycle opened up opportunities for adaptation and innovation in education systems that may lead to major advances, it has also widened educational divides between the most vulnerable students and those who are better placed in terms of learning outcomes and other educational indicators, such as school progression and retention.

Thus, for students who have high-quality Internet access and live in environments with stronger digital skills, this crisis may be an opportunity to carry on learning and even to learn better, given the great potential of virtual resources (ECLAC/UNESCO, 2020; ECLAC, 2020c). However, a large proportion of students have little access to digital equipment at home and few skills to take advantage of this opportunity. They are thus likely to learn less, and this can lead to higher repetition and dropout rates.

Figure II.9

Latin America and the Caribbean (21 countries): fifteen-year-old students' perception of auto-efficacy with digital media, by sex and socioeconomic and cultural level, 2018



Source: Economic Commission for Latin America and the Caribbean (ECLAC), *Building a New Future: Transformative Recovery with Equality and Sustainability* (LC/SES.38/3-P/Rev.1), Santiago, 2020; Organization for Economic Cooperation and Development (OECD), Programme for International Student Assessment (PISA), Paris, 2018.

Note: Index with values from 0 to 15, where 0 is the minimum and 15 the maximum, based on indicators such as "If I need new software I install it myself", "If I have a problem with a digital device I start to solve it on my own" and "If my friends or family have a problem with digital devices I can help them".

In 2018, 79% of fifteen-year-old students in the 10 countries of the region that participated in the PISA test¹ had access to the Internet at home and 61% had a desktop computer. These levels are significantly lower than the average for the OECD countries (92% and 82%, respectively). Moreover, access to such devices at home is very uneven. In seven of the countries participating in the study,² between 70% and 80% of students in the highest socioeconomic and cultural quartile had a laptop computer at home, compared to only 10% or 20% of students in the first quartile. These differences are replicated for all the digital devices surveyed (ECLAC/UNESCO, 2020).

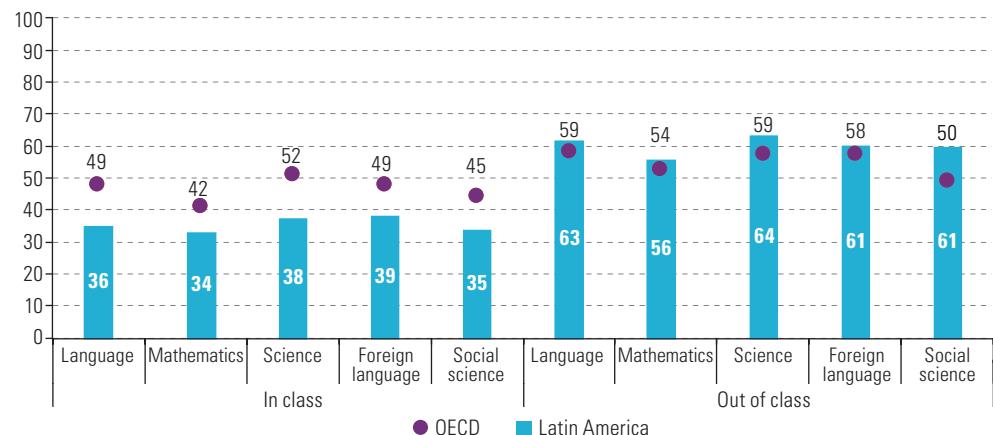
In 2018, only 60% of students in the region were equipped to embrace a distance education model covering essential cognitive skills (language, mathematics, science and social science) using digital media (see figure II.10). The remaining 40% were not equipped to continue their studies virtually (ECLAC/OEI, 2020).

Figure II.10

Latin America (7 countries)^a and OECD average: students aged 15 using digital devices

in or out of class for at least 1 hour a week, by subject, 2018

(Percentages)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), *Building a New Future: Transformative Recovery with Equality and Sustainability* (LC/SES.38/3-P/Rev.1), Santiago, 2020; Organization for Economic Cooperation and Development (OECD), Programme for International Student Assessment (PISA), Paris, 2018.

^a Brazil, Chile, Costa Rica, Dominican Republic, Mexico, Panama and Uruguay.

¹ Argentina, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Mexico, Panama, Peru and Uruguay.

² Brazil, Chile, Costa Rica, Dominican Republic, Mexico, Panama and Uruguay.

The digital skills most often taught at school are safe and critical use of the Internet (e.g., considering the consequences of posting information online or deciding whether to trust the information available). Skills requiring more technical expertise and knowledge are less frequently taught. In all cases, students in the OECD are reported to receive a higher level of training in this area at school than those in Latin America (ECLAC/OEI, 2020). This is compounded by the difference in the ability of teachers and parents to support platform-based learning processes. Teachers and education system officials have had to find ways to respond to the demands that have emerged during the pandemic, and this has often meant their being overloaded with responsibilities, given that they have to cope with their own care and domestic work as well (ECLAC, 2020a).

In this context, the role of adults in the digital education of the new generations is still important. The Kids Online studies identify three types of mediation: active (adult guidance and supervision), restrictive (prohibition of access to certain websites, webcam use or the disclosure of personal information) and monitoring (oversight of sites visited or time spent online) (Livingston and Helsper, 2010). Active mediation is the most important when it comes to developing digital opportunities for children and adolescents; in particular, it is important for risk prevention, skills training and self-care strategies. The Kids Online studies in Brazil (2016), Chile (2016) and Costa Rica (2018) identified gaps in the type of mediation received by children and adolescents. The highest levels of active mediation in the home were found in the population with the highest socioeconomic status, with the exception of Chile, where it was in the middle sectors. This is particularly important during periods when there are no face-to-face classes and studies must be continued at home.

2. Digital health care in the pandemic emergency

Digital transformation is providing new tools for the health sector. Pervasive Internet use has opened up a new perspective on health care by transcending the logic of face-to-face care, as has been seen during the pandemic. Among digital or electronic health interventions (e-health), there is growing interest in and use of telemedicine as an alternative to face-to-face care, with digital technologies being employed to deliver clinical services remotely and use mobile devices for monitoring (mobile health or m-health), teleradiology or telerehabilitation (Oliveira, 2020). However, access to these services requires digital infrastructure, technological capabilities among members of the system and financial resources to cover the costs of digitalization and the consequent expansion of demand (Fernandez and Oviedo, 2010).

From a public health perspective, digitalization is supporting the transition from curative to preventive medicine, helping to put patients at the centre and empowering them, and making service management and delivery more efficient, safe and cost-effective (Odone and others, 2019). Constraints on the provision of quality care arise from the limited supply of general practitioners and specialists to serve those populations that are most vulnerable because of their economic status or because they live far from major urban centres. E-health can help bring care closer to these groups.

During the pandemic, new technologies have made it possible to respond rapidly to the different phases of the crisis. Digitalization strengthens predictive capacity, and the use of artificial intelligence facilitates detection, prevention, response and recovery by enhancing diagnosis, epidemiological surveillance, contact tracing and service automation (see table II.1).

The challenge is to develop the capacity to move forward with digital health care. According to the World Health Organization (WHO) Third Global Survey on eHealth, applied to 15 countries in Latin America and the Caribbean in 2015, only eight had a digital health strategy. Table II.2 shows that seven countries have developed a national telehealth policy or strategy and nine have implemented a telehealth area at the country, regional or provincial level, with three pilot programmes between them. The implementation of electronic health records is one of the most prevalent digital strategies in the region (11 countries).

Table II.1

Applications of artificial intelligence in the different stages of the COVID-19 crisis

Detection	Early warning	Diagnosis	
	Detection of anomalies and digital "smoke signals" (BlueDot)	Patterns of recognition using medical imaging and data on symptoms (CT scan)	
Prevention	Prediction	Surveillance	Information
	Calculation of a person's risk of infection (EpiRisk)	Real-time infection monitoring and tracking (application for tracing the contacts of positive cases)	Personalized news and content moderation to combat disinformation (social networks)
Response	Delivery	Service automation	
	Use of drones to transport materials; use of robots in high-exposure hospital work (Robot Cruzr)	Deployment of virtual triage assistants and chatbots (Canadian COVID-19 chatbot)	
Recovery	Monitoring		
	Monitoring of economic recovery using satellites, the Global Positioning System (GPS) and social network data (WeBank)		

Source: S. Moller, "Intervenciones sociosanitarias y uso de las tecnologías de la industria 4.0 para enfrentar la enfermedad por coronavirus (COVID-19) en América Latina y el Caribe", *Social Policy series*, No. 234 (LC/TS.2020/87), Santiago, Economic Commission for Latin America and the Caribbean (ECLAC), 2020.

Table II.2

Latin America and the Caribbean (15 countries): e-health policies or strategies, 2015

Country	Does your country have a national e-health policy or strategy?	Does your country have a national telehealth policy or strategy?	Does it have some telehealth service implemented at the country, regional or provincial level?	Does your country have a national system of electronic health records?	Does your country have a national policy or strategy regulating the use of big data in the health sector?
Argentina	Yes	Yes	Pilot	No	Yes
Chile	Yes	No	Yes	Yes	No
Colombia	No response	Yes	Yes	No response	Yes
Costa Rica	Yes	Yes	Yes	Yes	Yes
Cuba	Yes	Yes	Pilot	Yes	Yes
El Salvador	No	No	Informal	Yes	No
Guatemala	No	No	Yes	Yes	No
Honduras	No	No	No	Yes	No
Jamaica	Yes	No	No	No	No
Mexico	No	No	Yes	Yes	No
Panama	No	No	No response	Yes	No
Paraguay	Yes	Yes	Yes	Yes	No
Peru	No	Yes	Informal	Yes	No
Trinidad and Tobago	Yes	No	Informal	Yes	No
Uruguay	Yes	Yes	Pilot	No	No

Source: S. Moller, "Intervenciones sociosanitarias y uso de las tecnologías de la industria 4.0 para enfrentar la enfermedad por coronavirus (COVID-19) en América Latina y el Caribe", *Social Policy series*, No. 234 (LC/TS.2020/87), Santiago, Economic Commission for Latin America and the Caribbean (ECLAC), 2020.

As in all other areas of well-being, there are socioeconomic, cultural and geographical determinants that lead to disparities in access to health, with the result that the most vulnerable receive delayed and substandard care. The health sector still lags behind in the use of high-quality data for the digital transformation of health care. The experiences of the leading countries bring out the essential dimensions of a digital transformation of the sector, including the need for a digital strategy that encompasses investments in health data infrastructure, standards, tools and governance.

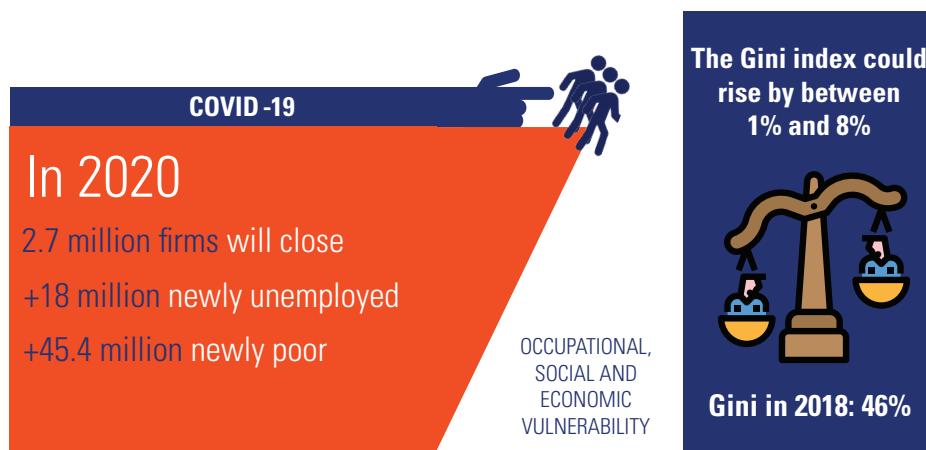
3. Digitalization, the labour market and employment

Before the pandemic, digital technologies and their applications in economic activities were bringing about radical changes in labour markets and skills. Shifts in production and consumption patterns driven by the pandemic have hastened the adoption of digital technologies in many sectors and are magnifying their effects on labour markets. During periods of confinement and restricted face-to-face activities, digital technologies have been critical in sustaining jobs and business activities. The ability to work from home has enabled many companies, organizations and institutions to limit the socioeconomic impact of the crisis.

The potential of telework to mitigate the impact of the crisis in the region is constrained by informality and lack of connectivity. Informal employment, which in 2018 accounted for more than 50% of the total, is concentrated in sectors where physical interactions are needed and work cannot be done remotely. At the same time, the quality of connectivity in the countries affects opportunities for teleworking. As was seen earlier, average connectivity levels in most countries of the region are not good enough for high-consumption activities to be carried out simultaneously. Different surveys in the region's countries have shown that only about one fifth of people in employment have been able to work from home during the pandemic. Specifically, 24.9% of workers in Chile engaged in teleworking activities during the last week of May, as compared to 23.4% in Mexico, 14% in Peru and 17% in Uruguay.³

In this context, it is estimated that an additional 18 million people will become unemployed in Latin America and the Caribbean as a result of COVID-19 (ECLAC, 2020b). The impact of the labour crisis differs substantially by income and education level. The poorest households, informal workers and the most vulnerable will be the hardest hit. As a consequence, poverty and inequality are projected to increase in all countries of the region, as reflected in diagram II.1.

Diagram II.1
Latin America and the Caribbean: COVID-19 and the labour market



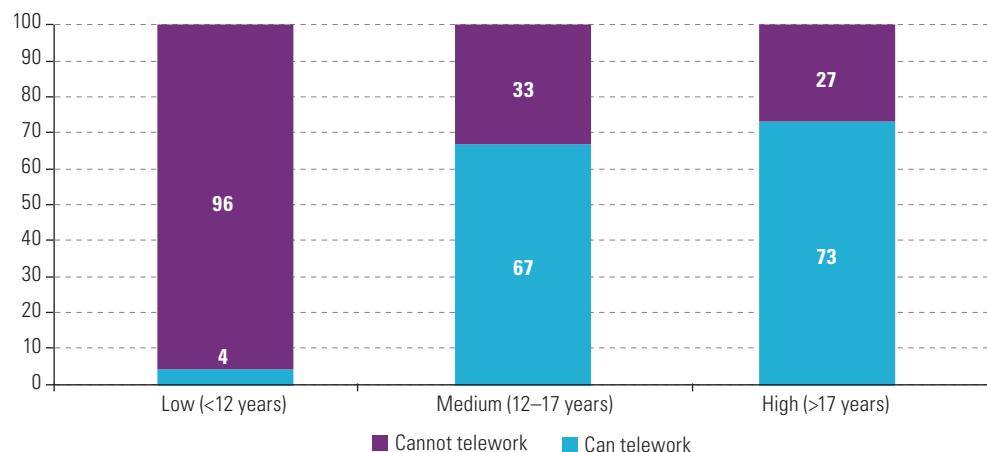
Source: Economic Commission for Latin America and the Caribbean (ECLAC).

One cause of the substantial increase in unemployment is related to labour market segmentation and its consequences in terms of teleworking opportunities. While COVID-19 has accelerated the benefits of telework, the proportion of people in employment who can telework, which varies between countries, is correlated with the production structure and worker skills. A medium-skilled worker has a 67% chance of working from home, while the proportions are 73% for high-skilled workers and 4% for low-skilled workers (see figure II.11). Telework is not an option for low-income workers. In the first three income quintiles, the likelihood of being able to work from home is less than 20% (see figure II.12), which increases people's risk of losing their jobs during lockdowns. These labour market situations have large effects on income distribution, with increases in the Gini index estimated at between 1% and 8%.

³ Chile: survey by the Chilean Safety Association (ACHS), 2020, access figures from InvestChile. Uruguay: Equipos Consultores (2020). Perú: Ipsos (2020). Mexico: INEGI (2020).

Figure II.11

Latin America (7 countries): likelihood of teleworking by level of education
(Percentages)

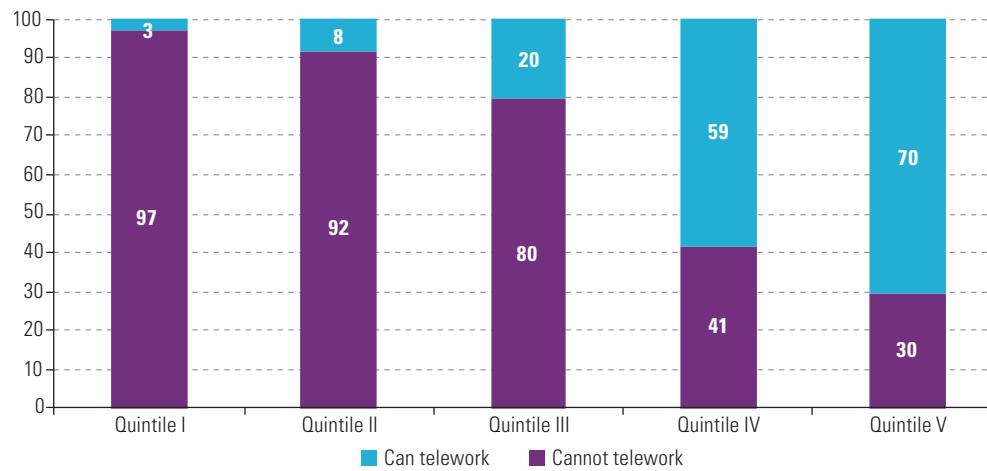


Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of household surveys from the countries.

Note: Simple averages of the figures for Chile, the Dominican Republic, Ecuador, El Salvador, Honduras, Mexico and Uruguay.

Figure II.12

Latin America (7 countries): likelihood of teleworking by income quintile
(Percentages)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), "Universalizing access to digital technologies to address the consequences of COVID-19", *COVID-19 Special Report*, No. 7, Santiago, 2020.

Note: Simple averages of the figures for Chile, the Dominican Republic, Ecuador, El Salvador, Honduras, Mexico and Uruguay.

In the face of inadequate unemployment benefits and changing consumer demand, on-demand work platforms have provided opportunities to supplement the income of the most vulnerable households and individuals. During periods of confinement, logistics and home food delivery applications substantially increased their number of users, with downloads increasing by more than 50% in many countries of the region. At the same time, the absence of specific labour regulations means that those working for on-demand platforms perform their activities without employment protection or rights, which increases their occupational and social vulnerability.

Many of the labour market changes driven by the pandemic will continue beyond the emergency phase. Until a vaccine is found and deployed on a mass scale, teleworking will allow many companies to continue operating and producing, reduce social contacts and mitigate the spread of the virus. At the same time, changing consumption patterns will increase the presence of on-demand platforms.

In this context, harnessing the potential of new digital technologies in labour markets without deepening structural inequalities in the region must involve: (i) universalizing access to the Internet, to devices and applications and to digital literacy programmes; (ii) developing digital skills and rethinking social protection systems; and (iii) designing regulatory frameworks for digitalized labour markets.

4. Financial inclusion: the advance of financial technology (fintech)

By financial inclusion is meant public and private initiatives to provide access to financial services for households and enterprises that are excluded from the traditional financial system for various reasons, and encouragement for productive agents operating within the traditional financial system to make effective use of products that foster inclusion (ECLAC, 2018).

In Latin America and the Caribbean, access to the traditional financial system for households and micro, small and medium-sized enterprises (MSMEs) is limited and unequal, and the supply of products and services that promote inclusion is low. While less than 50% of the population aged over 15 in the region has access to the formal financial system, the proportion in North America and Western Europe is close to 90%, and in developing regions such as Central Asia and North Africa it is between 53% and 72%.

Financial exclusion is explained by supply- and demand-side factors. On the supply side, the greatest restrictions on credit are due to: (i) the risk perceived by financial institutions, which translates into high interest rates and restrictive conditions for borrowers, and (ii) a low expected return on the investments necessary for the inclusion of certain population groups. On the demand side, entry barriers are mainly related to the lack of financial education, lack of identification with the products offered and the costs involved in complying with legal and regulatory requirements (ECLAC, 2018).

The use of digital technologies in the financial sector has helped to remove some of the biggest obstacles to financial inclusion. Their application has changed the way traditional financial sector activities (financing, investing, trading, payments, planning, etc.) are carried out, with major implications for end consumers (OECD, 2018). In relation to financial inclusion in particular, digital technologies have expanded supply (new business models, new products and providers), replaced or changed the role of intermediaries and the costs associated with them, made it possible to take advantage of economies of scale and scope, and facilitated and accelerated the design of niche products for certain segments.

Peer to peer (P2P) platforms allow investment, trading, lending and financing transactions to be carried out at a much lower cost and processed more easily than when the services of an intermediary are used. Examples of business models using these platforms include donations of funds in exchange for a future reward, loans or investment in exchange for a return, equity-based platforms where individuals receive a stake in the companies financed, and those that handle cross-border payments and eliminate payment of the exchange-rate differential. Moreover, these platforms are used to offer services and products such as professional design of investment portfolios whose cost and complexity mean they are usually restricted to certain segments.

Digital technologies have helped lower the fixed costs associated with infrastructure and increase the scale of production to extend service coverage to previously excluded populations. One example is the use of mobile telephony for people in rural areas, which provides the financial sector with a widely used and low-cost platform as long as the infrastructure is in place (De Olloqui, Andrade and Herrera, 2015).

For Internet-based companies, and in particular those using big data tools, these technologies make it easier to design specific products and services for certain market segments. A successful instance of the application of such tools are the collateral-free cash advances offered to small and medium-sized enterprises (SMEs) by the payment processor Worldpay and by Liberis, a London-based non-bank financial institution. The amount and repayment period that each beneficiary SME is able to afford are determined on the basis of sales projection analysis alone, and all loans are granted within these limits.

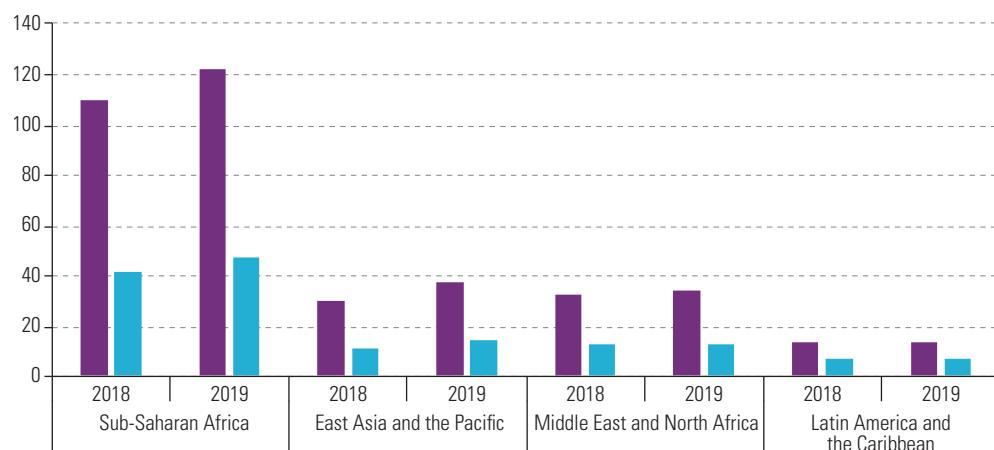
Efficiency savings in internal processes and reductions in overheads achieved by financial institutions through the application of digital technologies are important for financial inclusion (OECD, 2018). This is because the costs of risk studies to determine whether to grant credit often exceed the risk-adjusted return, as is also the case for SMEs and low-income households in the region (ECLAC, 2018).

On the demand side, financial exclusion is also associated with misperceptions of financial services as being of low utility and difficult to use. In terms of financial education and the matching of providers and consumers, digital technologies facilitate consumers' access to information and help them compare products and make informed investment decisions. They also support the monitoring of financial transactions and access to courses. All these factors work together to create a financial culture that encourages demand.

An alternative to traditional financial system tools is the use of mobile money. Mobile money accounts include the ability to transfer money and to make and receive payments through mobile phones. They are available to the unbanked population and have a large network of physical access points to ensure that they can be used by people outside the traditional financial system in particular. In this area, Latin America and the Caribbean lags behind other developing regions, although it has a better ratio of active accounts to registered accounts (see figure II.13).

Figure II.13

Latin America and the Caribbean and other developing regions: number of mobile money accounts registered and accounts active over 90 days, population aged over 15 without an account at a financial institution, 2018 and 2019 (Percentages)



Source: GSMA, *State of the Industry Report on Mobile Money 2019*, London, 2019.

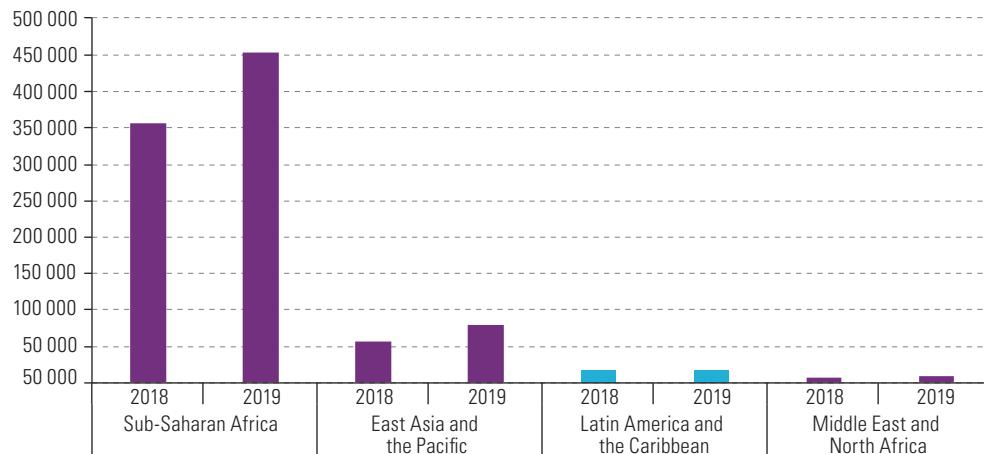
Note: Electronic banking or payment services that use the mobile network only as an additional channel are not included. Information on the population aged over 15 without an account at a financial institution is for 2017.

Moreover, Latin America and the Caribbean lags behind other regions in the use of mobile money as measured by the number of mobile money accounts and the value of transactions (see figure II.14).

Brazil is the leader in the use of applications providing alternatives to the financial services offered by the traditional financial system, with 28.2% of mobile broadband subscribers having applications for using financial services (see figure II.15). In contrast, there are several countries where this figure is below 1%.

Figure II.14

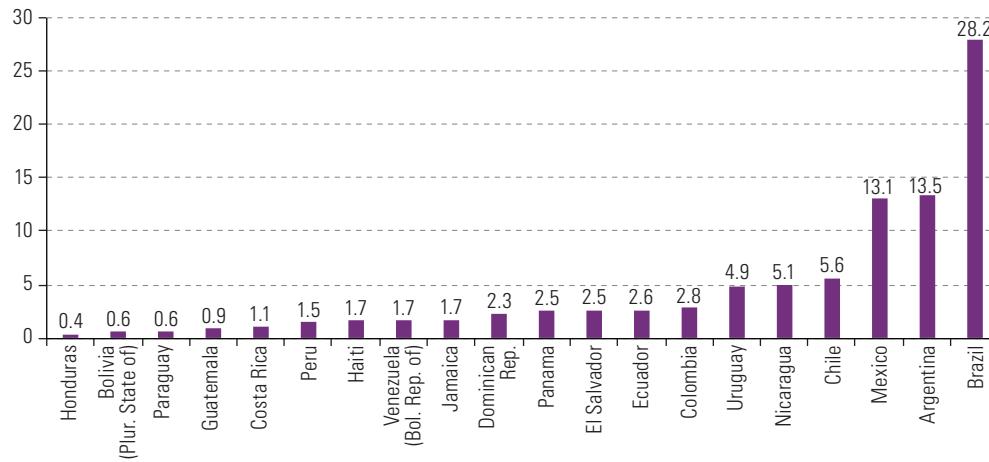
Latin America and the Caribbean and other developing regions: value of mobile money transactions, 2018 and 2019
(Millions of dollars)



Source: GSMA, *State of the Industry Report on Mobile Money 2019*, London, 2019.

Figure II.15

Latin America and the Caribbean (20 countries): downloads of financial services applications, 2020
(Percentages of all active mobile phone subscriptions in each country)



Source: Regional Broadband Observatory, on the basis of Economic Commission for Latin America and the Caribbean (ECLAC), Big Data for Measuring and Fostering the Digital Economy in Latin America and the Caribbean Project; International Telecommunication Union (ITU), World Telecommunication/ICT Indicators Database 2020 [online] <https://www.itu.int/en/ITU-D/Statistics/Pages/publications/wtid.aspx>; Google Play, App Store and 42matters.

Note: The applications included are: Alipay, Google Pay, Mercado Pago, Nubank, PayPal, TransferWise. The information on active mobile broadband subscriptions is for 2019.

In Ecuador and Guatemala, meanwhile, fairly extensive use is made of digital applications for small business management, which suggests a greater awareness of the benefits of digitalization, at least where administration is concerned (see figure II.16).

Figure II.16

Latin America and the Caribbean (21 countries): downloads of applications with services for small businesses, 2020
(Percentages of all active mobile subscriptions in each country)



Source: Regional Broadband Observatory, on the basis of Economic Commission for Latin America and the Caribbean (ECLAC), Big Data for Measuring and Fostering the Digital Economy in Latin America and the Caribbean Project; International Telecommunication Union (ITU), World Telecommunication/ICT Indicators Database 2020 [online] <https://www.itu.int/en/ITU-D/Statistics/Pages/publications/wtid.aspx>; and 42matters.

Note: The applications included are: PayPal for Business, WhatsApp Business, Rappi Partner Growth, Uber Eats Restaurant Manager, Mailchimp, Google My Business, Facebook Business Suite and RappiAliado. The information on active mobile broadband subscriptions is for 2019.

5. Smart cities: a hub of inclusive and sustainable development

A smart city is a model of urban development based on the adoption of digital technologies (the Internet of things (IoT), 5G networks, artificial intelligence (AI), big data, cloud computing, autonomous vehicles and others) to optimize the efficiency of cities' operations and services in order to increase the quality of life of their inhabitants and help improve the environment. This is particularly important for Latin America and the Caribbean, as more than 80% of the population lives in urban areas, where there are serious deficiencies in the provision of public services. Poor public transport, high levels of vehicle congestion, air pollution, insecurity, inadequate waste management and limited access to drinking water, health care and education are problems which urban development policies need to address, and for which smart city models can be a solution.

The design of a smart city must include three elements: the physical infrastructure that supports the delivery of services to citizens (road, sanitation and electricity networks, among others), the digital infrastructure that provides connectivity through devices and sensors connected by high-speed communication networks, and the applications that provide smart data management to optimize processes and improve quality of life and sustainability.

According to the Smart City Index 2020 report of the International Institute for Management Development (IMD), Singapore, Helsinki and Zurich are the world's leading smart cities because of their highly developed infrastructure providing technological solutions for health care and mobility. In Latin America, Medellín (Colombia) is the best ranked (number 72 out of 125 cities), followed by Buenos Aires (88) and Mexico City (90) (see table II.3).

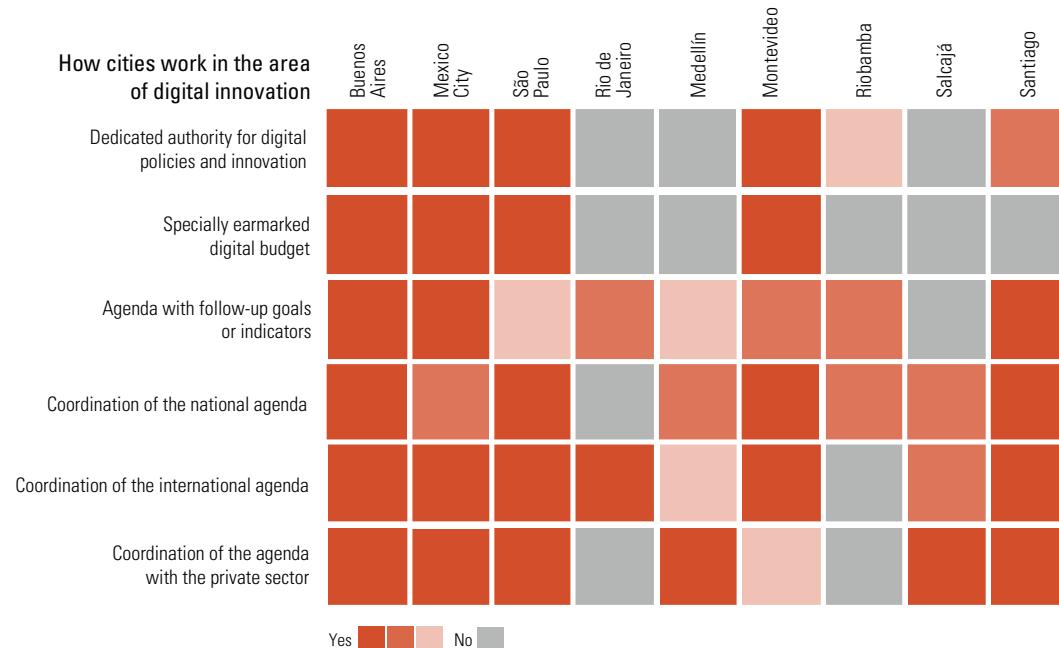
Table II.3
Smart cities in Latin America

 <p>Medellín (Colombia)</p> <p>Initiatives</p> <ul style="list-style-type: none"> • Medellín Smart Mobility System (SIMM) • Security cameras • Climate and air monitoring • Open data and participatory budgeting <p>IMD Smart City Index ranking 2020: 72</p>	 <p>Bogotá (Colombia)</p> <p>Initiatives</p> <ul style="list-style-type: none"> • Traffic Management Centre (CGT) • "123" oversight system • Air Quality Monitoring Network (RMCAB) <p>IMD Smart City Index ranking 2020: 92</p>
 <p>Buenos Aires (Argentina)</p> <p>Initiatives</p> <ul style="list-style-type: none"> • Location of public transport • Security cameras and vehicle monitoring • LED lighting • Open data and online government procedures <p>IMD Smart City Index ranking 2020: 88</p>	 <p>São Paulo (Brazil)</p> <p>Initiatives</p> <ul style="list-style-type: none"> • Smart electricity service (Urban Futurability) • Security video surveillance • Traffic monitoring with IP cameras <p>IMD Smart City Index ranking 2020: 100</p>
 <p>Mexico City (Mexico)</p> <p>Initiatives</p> <ul style="list-style-type: none"> • Air quality monitoring • Wi-Fi connection points (CDMXDigital) • Open data <p>IMD Smart City Index ranking 2020: 90</p>	 <p>Rio de Janeiro (Brazil)</p> <p>Initiatives</p> <ul style="list-style-type: none"> • Information on natural disasters • Smart LED lighting • Security cameras <p>IMD Smart City Index ranking 2020: 102</p>
 <p>Santiago (Chile)</p> <p>Initiatives</p> <ul style="list-style-type: none"> • Weather and air monitoring • Traffic monitoring • Security cameras <p>IMD Smart City Index ranking 2020: 91</p>	 <p>Montevideo (Uruguay)</p> <p>Initiatives</p> <ul style="list-style-type: none"> • Mobility Management Centre • Security Monitoring Centre • "Montevideo Decide" citizen participate platform <p>IMD Smart City Index ranking 2020: -</p>

Source: International Institute for Management Development (IMD), "Smart City Index 2020" [online] <https://www.imd.org/smart-city-observatory/smart-city-index/>.

Turning a traditional city into a smart city is complex, as it involves a wide range of actors and coordination between public sector agencies and departments, as well as requiring appropriately trained human resources. In the countries of the region, smart cities are being developed with varying degrees of planning and coordination. In some cases, cities have a strategic plan; in others, specific initiatives are implemented, often without the involvement of digital modernization authorities or coordination with other bodies. The most digitally developed cities are the largest and those with the highest per capita output (see table II.4).

Table II.4
Latin America (8 countries): development of the smart city model in nine cities



Source: Economic Commission for Latin America and the Caribbean (ECLAC).

Note: A deeper red indicates that the aspect concerned is more highly developed.

Medellín, Buenos Aires, Mexico City, São Paulo and Santiago have plans with clear objectives, protocols and tools to implement technological solutions and digital communication systems in all areas of government. The rest of the cities undergoing digitalization are concentrating on specific issues, managed by the department in charge of each portfolio. In all cases, a leading role is played by private sector and non-governmental organizations with training and production development activities, even if these are not always coordinated among public sector bodies. Only Buenos Aires, Mexico City, São Paulo and Montevideo have agencies in charge of providing comprehensive technological solutions with an earmarked budget, usually reporting directly to the mayor's office or the office of the government chief of staff (see table II.5).

Table II.5
Latin America (7 countries): the institutional structures of some smart cities

City	Authority	Reporting to	Budget (millions of dollars)
Buenos Aires (Argentina)	Secretariat of Innovation and Digital Transformation	Ministerial chief of staff	2.9
Mexico City (Mexico)	Digital Public Innovation Agency	Office of the head of the city government	8.3
São Paulo (Brazil)	Department of Information and Technology	Municipality of São Paulo	26.6
Montevideo (Uruguay)	Department of Sustainable and Smart Development	Mayor's office	14.7
Riobamba (Ecuador)	Riobamba Digital City	Information Technology Management Department, National Council for Telecommunications	
Salcajá (Guatemala)	Ecosystem led by a consortium of private firms	Digital Development Department (SOFEX) of AGEXPORT (a private non-profit association)	
Santiago (Chile)	“Sé Santiago” programme (public-private partnership)	Public-private initiative, Metropolitan Regional Authority and País Digital Foundation	

Source: Economic Commission for Latin America and the Caribbean (ECLAC).

To drive the development of smart cities, there needs to be clear governance that considers local aspects in areas such as the roll-out of traditional (health-care, road, etc.) and digital infrastructure and the development of human capital. This needs to be coupled with a national governance framework that promotes digital development (5G networks, the Internet of things, etc.) and regulates technological risks, such as data privacy and cybersecurity threats. This is vital to give citizens confidence in the use of digital technologies.

C. Universalizing access

The essential requirement for effective participation in the digital age is high-speed broadband access under meaningful conditions of affordability. This means extending fixed broadband coverage and improving the speed of mobile broadband connections. The costs involved in connecting households and the necessary devices, coupled with the difficulties of financing digital infrastructure (e.g., fibre optic cables), are barriers to digital inclusion. For this reason, ensuring that access and devices are affordable is crucial.⁴

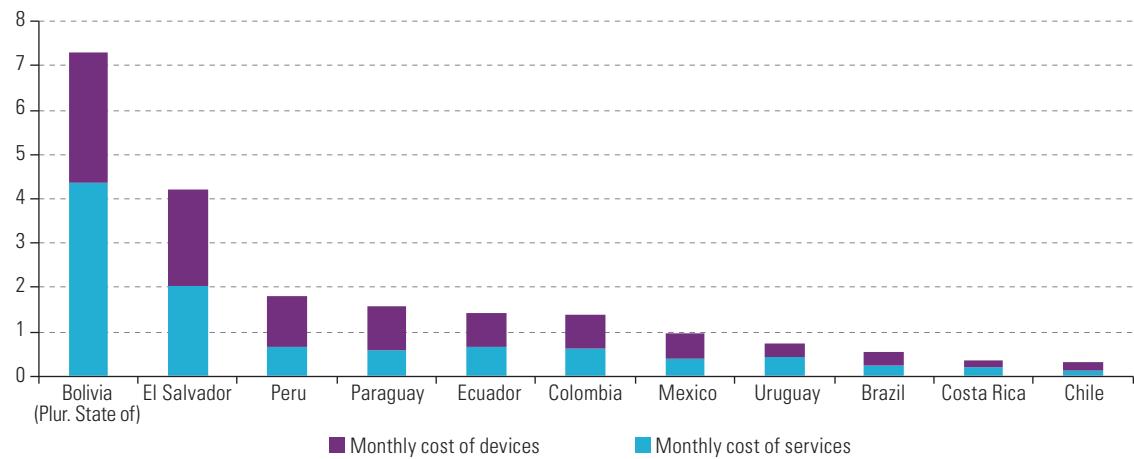
Using the prices of mobile and fixed broadband Internet plans and electronic devices, ECLAC (2020c) has estimated the cost of a basic digital basket that includes monthly connection plans, a laptop, a smartphone and a tablet. The region's countries would have to invest an average of about 1% of GDP per year to ensure access for unconnected households, although with large differences between them (see figure II.17).

Demand subsidies could be used to help lower-income households afford telecommunications services and the basket of access devices. What is essential, though, is to coordinate public-private actions tailored to each country that meet socioeconomic, geographical, age and gender criteria.

⁴ This section is taken from ECLAC (2020c).

Figure II.17

Latin America (11 countries): monthly cost of digital basket of fixed and mobile broadband services and devices
(Percentages of monthly GDP)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), *Building a New Future: Transformative Recovery with Equality and Sustainability* (LC/SES.38/3-P/Rev.1), Santiago, 2020.

A regulatory sandbox can be implemented in this area, with operators being allowed to directly manage some of the resources to be provided by universal access funds or other funds set up to expand telecommunications services on a mass scale, using them to cover the costs of providing services to lower-income households. Authorization could be subject to conditions set by the regulator that incentivized service providers to compete to offer the best conditions in order to obtain this authorization. This could be supplemented by measures to make regulations more flexible in certain areas, such as network neutrality. In this case, the use of education, health and government services could be encouraged by zero-rating access fees.

As regards access to devices, there could be temporary reductions in import duties and sales taxes such as value added tax (VAT) on devices specified by the regulator, as well as encouragement for public-private partnerships with suppliers and manufacturers to produce them at low cost in the region and thus improve conditions of supply.

The monthly values of the basket range from 0.32% to 7.29% of monthly GDP, with an average of 1.8% for the countries in the sample. As regards the financing of the basic digital basket, depending on each particular case and considering the wide variation in costs, part of it could be covered by universal access funds or through similar mechanisms existing in each country.

These universalization efforts need to take place within a framework in which the Internet is conceived as a public good, with secure, universal access so that the entire population can take advantage of its opportunities and benefits. This process must go together with the universalization of social protection.

It is also necessary to highlight access barriers by age, territory, indigenous or African descent, gender and income in order to address them quickly and efficiently in the light of their specificities. Physical accessibility entails special attention for groups excluded from digital technologies, such as people with disabilities, whether because they are affected by a lack of equipment with specific resources to facilitate their access or because most of this population live in poor households (Meresman and Ullman, 2020).

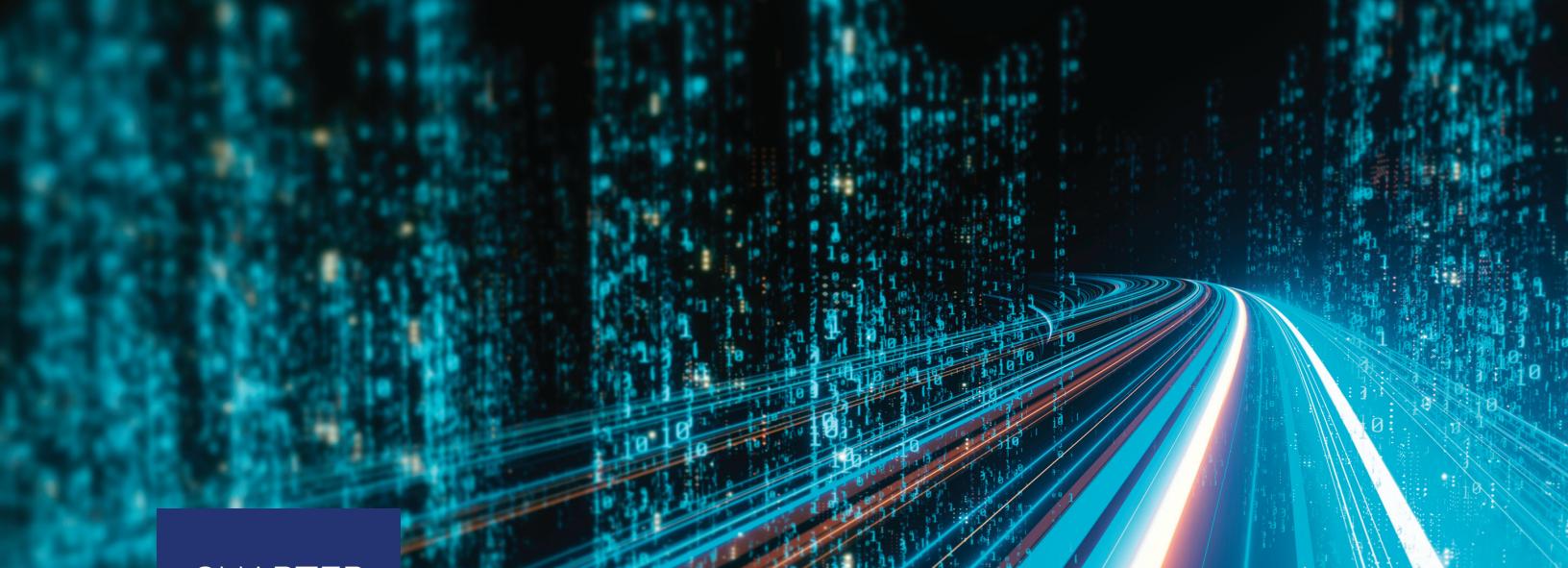
Addressing the challenges of digital inclusion means considering not only physical accessibility, but also skills development and the enforcement of rights in pursuit of a digital citizenship in which no one is left behind. With technological change and digitalization, new forms of citizenship and participation are putting pressure on public institutions with new power dynamics that must be taken into account if citizenship is to be exercised and civic engagement and democracy are to be strengthened. In this area, the countries of the region must develop and agree on standards for the protection of privacy, rights and accessibility and principles of inclusive design in digital spaces (ECLAC, 2020a).

To make progress on these issues, it is essential to implement coordinated digital, social and economic strategies in order to develop cross-sectoral instruments for overcoming barriers and divides. Thus, in addition to digital technologies being incorporated into social policies, inclusion goals must be incorporated into digital and new technology investment policies.

The creation of a regional fund for the universalization of ICTs was proposed at the seventh Ministerial Conference on the Information Society in Latin America and the Caribbean. This initiative, which will be coordinated with other ongoing initiatives being carried out by multilateral organizations, is expected to generate resources to develop infrastructure and universal access projects.

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CHAPTER

III

Digitalization for productive development

- A. Digitalization and productivity
- B. The digitalization of production chains
- C. The digital ecosystem and the main barriers to digitalization of production
- D. Digital policies for recovery and the transformation of production methods

Bibliography

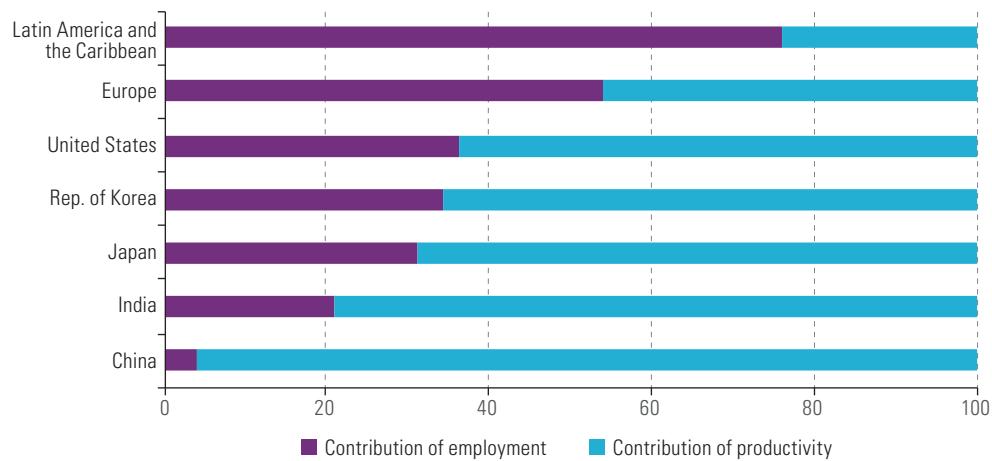
A. Digitalization and productivity

1. Productivity dynamics in Latin America and the Caribbean

Latin America and the Caribbean is faced with the challenge of speeding up productivity growth and generating more and better jobs to drive sustainable and inclusive development. In recent decades, growth in the region's countries has lagged behind that in both emerging and developed economies. This performance has been closely associated with the nature of growth. While growth in emerging and high-growth economies has come mainly from productivity gains associated with structural change and the performance of technologically sophisticated sectors, in Latin America and the Caribbean most growth is explained by the expansion of the labour force (see figure III.1).

Figure III.1

Latin America and the Caribbean and selected regions and countries: contributions of productivity and employment to GDP growth, 2000–2019
(Percentages)



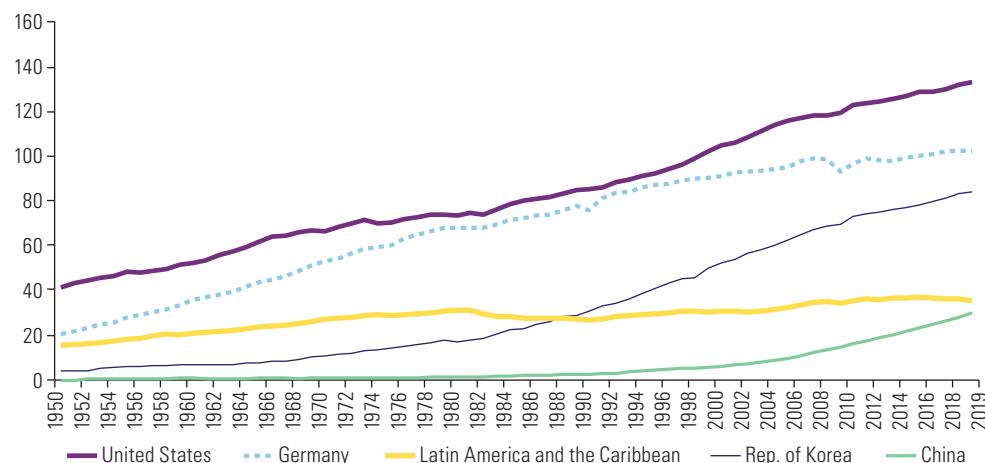
Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of The Conference Board, Total Economy Database [online] <https://www.conference-board.org/data/economydatabase/total-economy-database-productivity>.

From a longer-term perspective, the past 60 years have witnessed a growing divergence between the region's productivity and that of the most developed and emerging economies, which has been particularly pronounced since the 1980s (see figure III.2). In contrast to the developed countries and the emerging economies of Asia, the countries of the region have not reaped the benefits of successive great waves of technological transformation, particularly the digital revolution that began in the 1990s and the more recent and still nascent 4.0 era. In contrast to the region, high-growth economies have seized the opportunity to accelerate productivity through large investments and a commitment to the adoption of new technologies. The Republic of Korea, for example, experienced rapid growth accompanied by the sectoral transformation of its industry and large-scale incorporation of technology into production activities from the second half of the 1960s. Similarly, Taiwan Province of China implemented an ambitious plan to industrialize its economy in the 1980s. Today, its technology sector is one of the most competitive in the world, especially in the production of electronic components and computers.

Thus, the region's productivity gap relative to the technological frontier has widened in recent decades, resulting in a performance that is insufficient to keep up with population growth.

Figure III.2

Latin America and the Caribbean and selected countries: productivity, 1950–2019
(Thousands of 2019 dollars per worker)



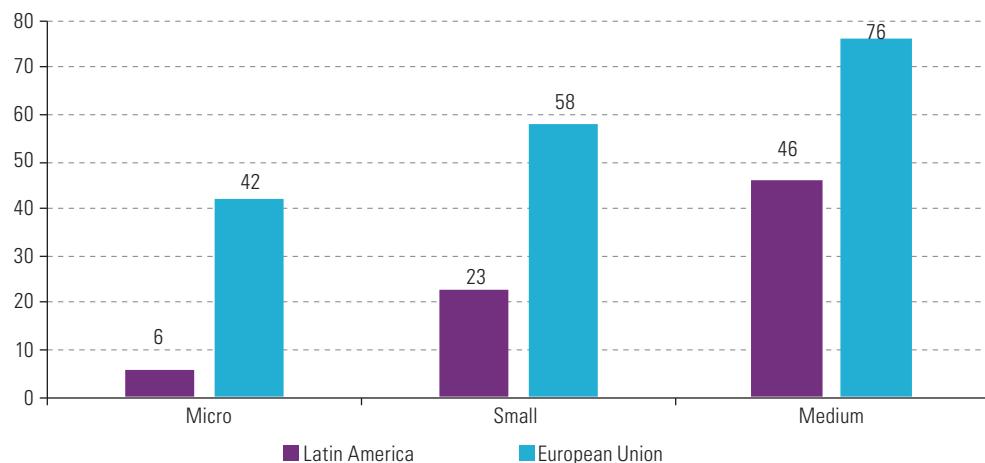
Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of The Conference Board, Total Economy Database [online] <https://www.conference-board.org/data/economydatabase/total-economy-database-productivity>.

The region's weak productivity growth is mainly due to the lack of productive diversification and the concentration of production in natural resource-intensive activities (agriculture, fishing, mining and some industrial sectors) which, although strongly export-oriented, operate with few linkages to the rest of the production structure and do not have significant effects in terms of technological spillovers and capacity-building.

These marked disparities and the region's structural heterogeneity are also reflected in the productivity gaps between small and large firms, which are substantially larger than in other countries and regions (see figure III.3). The labour productivity of a medium-sized firm in Latin America averages less than half that of a large firm, a figure that falls to 23% for small firms and only 6% for microenterprises. On average, the productivity difference between micro and large firms is seven times larger in Latin America than in the European Union (see figure III.3).

Figure III.3

Latin America and the European Union: productivity relative to that of large enterprises, by company size, 2016
(Percentages)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), "Sectors and businesses facing COVID-19: emergency and reactivation", *COVID-19 Special Report*, No. 4, Santiago, 2020.

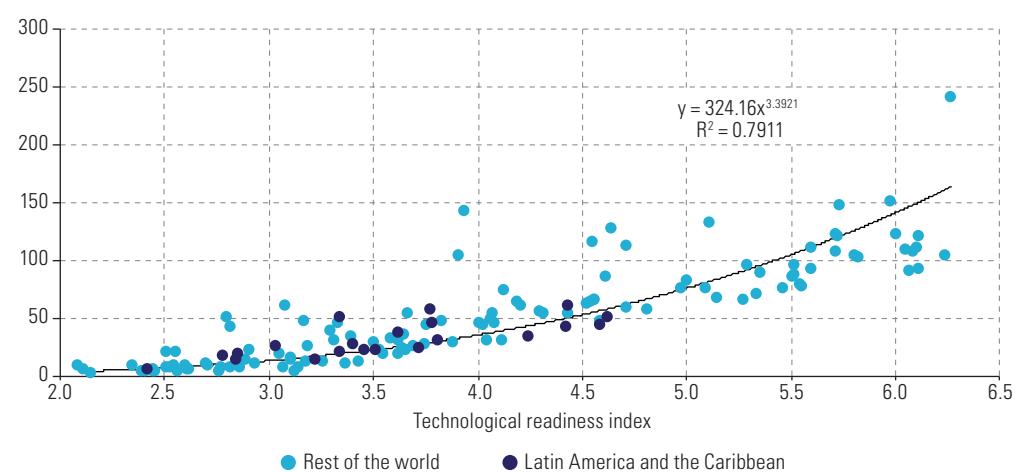
This productivity gap is linked to the region's weak productivity performance. Stagnating productivity is the outcome of a dual dynamic in which strong productivity growth in technology-intensive large firms contrasts with declining or stagnating productivity in the vast majority of small firms, often associated with their slowness to adopt new technologies (Andrews, Criscuolo and Gal, 2016). Firm size is a crucial determinant of information technology investment decisions across all industries. Furthermore, returns to innovation are linked to the presence of complementary inputs, such as skills and financial resources, which are typically found in large firms (Tello, 2017).

2. Digital technologies and productivity

Productivity growth is the main driver of sustained economic growth. Thus, in the long run, increasing productivity is the only way to maintain income growth and access to essential goods and services. Since the first industrial revolution, the introduction of new technologies has contributed to higher productivity in firms and in the economy as a whole. Crudely put, technical progress is the basis for productivity growth. The development and incorporation of new technologies into production processes is therefore essential for growth (see figure III.4).

Figure III.4

Latin America and the Caribbean: productivity per worker and technological readiness, 2010–2018
(Thousands of constant 2017 dollars and technological readiness index values)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of World Bank, World Development Indicators [online database] <https://databank.worldbank.org/source/world-development-indicators>.

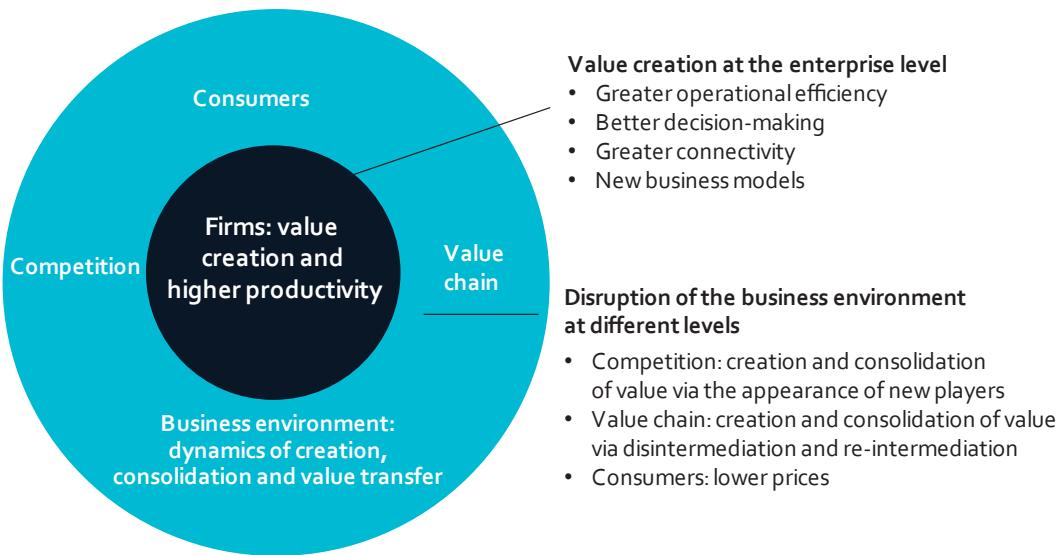
Note: The technological readiness index measures the alacrity with which an economy adopts existing technologies to improve the productivity of its industries, with an emphasis on its ability to harness information and communications technologies (ICTs) in daily activities and production processes for greater efficiency and competitiveness.

The cost-effective adoption of new technologies depends on the capabilities and factor endowments of firms and countries. The production structure, technology intensity in industry and enterprise dynamics are vital in determining whether the full potential of digital technologies is exploited. Given the structure and limited level of technological sophistication of the production sector in the Latin American and Caribbean countries, and considering the business structure there, it is not enough to encourage and facilitate the adoption of technologies. Enhancing the digital ecosystem requires structural policies to support technological sophistication, innovation and productivity.

Although the impact of digital technologies on productivity depends on the production structure and the structural characteristics of firms, digital transformation generates major changes in the organization of firms and market dynamics (see diagram III.1).

Diagram III.1

The impact of digitalization on firms and the business environment



Source: Economic Commission for Latin America and the Caribbean (ECLAC).

Disruptive changes in firms and the business environment resulting from advances in digitalization have accelerated recently with the COVID-19 pandemic and the increased use of digital technologies in response to it. The adoption of digital technologies has become even more of a priority to boost productivity and quality employment.

Technical change has many potential impacts, and there is a strong positive correlation between the technology intensity of the production structure and the productivity of the economy (ECLAC, 2018); at the microeconomic level, digital transformation affects productivity and growth through four mechanisms that improve the efficiency and effectiveness of firms (see table III.1).

Table III.1

Transmission channels through which digital technologies affect the functioning of firms

Transmission channel	Mechanism	Example
Operational efficiency	The digitalization of processes enables business operations to be optimized through cost reductions and efficiency improvements	Digitalization of customer service using chatbots
Better and more effective decision-making	The use of data at scale and advanced analytics algorithms can optimize decision-making and increase profitability	Algorithms for optimized credit scoring
Greater connectivity	Digital channels and the use of digital marketing and procurement tools can expand the customer base and improve customer acquisition, increase access to suppliers and optimize the supply chain	Publicity to capture new customers in social networks
New business models	The virtualization of goods and services and the digitalization of product delivery are fostering new business models that reduce risk and increase profits	Consumption of music via digital applications

Source: Economic Commission for Latin America and the Caribbean (ECLAC).

Besides the direct impacts on business, digitalization is leading to major changes in the competition dynamics of the value chain and in consumers. New business models are giving rise to increasing participation by new players who are “digital natives” and bring with them numerous implications for market dynamics and the economy in general. In some sectors, such as retail, there is direct competition between traditional offerings and digital disruption. When digital channels play a greater role, traditional players and channels may be displaced and have to adapt, develop their own digital channels and integrate with other players’ digital platforms. In some activities, the level of digital disruption may reach the point where digitalization becomes a matter of survival given the demands of the “new consumer”, an example being tourism service intermediation, particularly in the context of the pandemic (see box III.1).

Box III.1

Digital transformation for the survival and development of tourism

Tourism is one of the main drivers of activity and employment in the region, particularly in Central America, the Caribbean and Mexico. Given the nature of its services, it has been one of the activities most severely restricted and impacted by the pandemic.

The implementation of strict sanitary protocols (mainly involving a combination of testing, isolation, disinfection measures and the use of protective equipment), together with restrictions on the use of venue capacity and physical distancing, have allowed some activity to resume in most countries of the region. However, there is still a long way to go before pre-pandemic levels of dynamism are restored. Even once there is a vaccine, many of the current changes are expected to continue affecting the sector. How it makes the transition to a “new reality” is therefore essential.

Digital transformation can accelerate this transition. First, digital platforms make it possible to develop “contact-free” alternatives to mitigate the effects on the core business. For example, many museums in the region have developed fully virtual experiences that allow people to visit spaces and exhibits and interact with them remotely. However, these alternatives have been only limited and inadequate substitutes aimed at offsetting the negative effects on the traditional business model.

In addition to developing digitalized versions of their products, many actors are creating or expanding business models by means of digital technologies that are more closely targeted on the local population. For example, many hotels have taken advantage of the delivery boom to offer a food home delivery service, in some cases creating new exclusive fine dining experiences for the home. Some airlines have developed door-to-door courier services for international shopping. Local tourism organizations have created e-commerce platforms to enable local businesses and restaurants to continue to provide some services.

Digital transformation can also support the recovery of traditional activity. For example, the use of traceability applications can optimize lockdown times and ensure a rapid response to potential contagions. Etihad Airways of the United Arab Emirates worked with Elenium, an automation solutions provider, to change its check-in operation with a view to optimizing check-in times, providing greater convenience and minimizing infection risk. This development combines the registration of passengers’ biometric data via their mobile phones, the use of sensors and artificial intelligence algorithms to recognize baggage and avoid the use of tags, and self-service terminals that facilitate check-in, dispatch luggage and offer personalized shopping.

Digital tools can also help manage some of the impacts of the crisis. The Barceló hotel chain is combining voice recognition with predictive algorithms to detect which customers are most likely to cancel their bookings and what their level of satisfaction is, in order to optimize capacity management and provide a better service.

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of Digital Tourism Think Tank [online] <https://www.thinkdigital.travel/>; Barceló [online] <https://www.barcelo.com>; Etihad Airways, “Etihad Airways and Elenium use ground-breaking technology to revolutionise the travel experience”, Abu Dhabi, 20 March 2019 [online] <https://www.etihad.com/en-np/news/etihad-airways-and-elenium-use-ground-breaking-technology-to-revolutionise-the-travel-experience>; A. Gómez, “El CEO de Barceló Hotel Group explica cómo aplica la cadena hotelera la inteligencia artificial: así predicen qué cliente cancelará o dará una mala valoración”, Madrid, Business Insider, 29 October 2020 [online] <https://www.businessinsider.es/como-aplica-barcelo-hotel-group-inteligencia-artificial-744149>.

Digital transformation can lead to value consolidation and greater concentration of profits through intensification of economies of scope and “superstar” or “winner takes all” dynamics. The combination of these factors, together with changes in consumer habits (preference for digital channels and rapid delivery) is driving the boom in digital platforms.

At the same time, digital transformation is also optimizing the supply chain and bringing it closer to users by reducing transaction, distribution and marketing costs. This process entails an increase in the disintermediation of the chain and in the importance of direct sales channels, as in the case of tourism.

Lastly, in some sectors digitalization is resulting in a transfer of value to consumers in the form of larger consumer surpluses thanks to lower prices, greater transparency and lower search costs. An example is the digitalization of the music industry, where 96% of the gains from technology are estimated to have gone to consumers (Nordhaus, 2005).

The coexistence of value creation mechanisms and transfer dynamics means that a positive and significant relationship between digitalization and productivity growth is not always observed at the macro level, particularly in periods of transition and disruption. In this context, the region has a window of opportunity in which to implement the necessary structural reforms and adapt regulatory frameworks with a view to defining its position on the technological and economic trajectories towards which the world is moving.

B. The digitalization of production chains

1. The potential of disruptive technologies to dynamize the region's sectors

In the era of digital transformation, public and private activities are seeking to take advantage of the efficiency revolution brought about by the use and management of large volumes of data, thus benefiting from new economies of scope and scale. The new Industry 4.0 technologies create the potential for changes in emerging economies' production processes to yield gains in productivity and competitiveness that are sustainable over time.

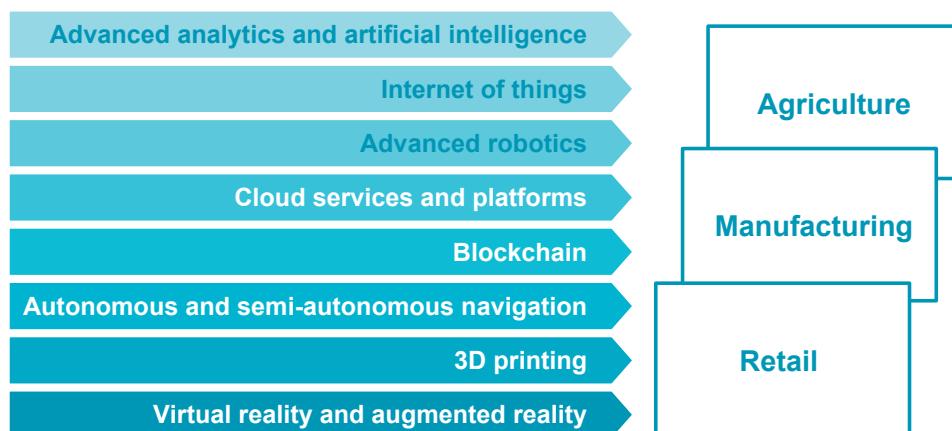
Among the disruptive technologies that can boost productivity, eight stand out for their potential applicability in the strategic value chains of Latin America and the Caribbean (see diagram III.2):

- **Advanced analytics and artificial intelligence:** algorithms and high-performance computers can be used to identify patterns and perform predictive analytics to facilitate automated learning and decision-making. This typically involves combining traditional analytics methodologies (such as regression, search algorithms and linear optimization) with machine learning techniques, which employ methods such as clustering algorithms, dimensionality reduction, deep learning networks and neural networks. By 2023, advanced analytics is expected to represent a market worth more than US\$ 270 billion globally.
- **The Internet of things:** sensors and actuators enable the use of smart interconnected devices or products that can be remotely accessed or tracked. The Internet of things (IoT) allows "smart networks" to be developed to automate or improve the effectiveness of production and distribution processes, particularly when it interacts with technologies such as advanced analytics. The main applications of the Internet of things are in smart cities, smart industry, telemedicine and smart homes. In 2018, Amazon launched Amazon Go, a fully automated supermarket concept where consumers can shop without having to interact with anyone or pay at the store. Technologies such as computer vision, deep learning and sensor networks make it possible to identify consumers and the products they carry and to charge them automatically and fully digitally at the end of their visit.
- **Advanced robotics:** advances in artificial intelligence, computer vision, sensors, motors and hydraulics are enabling robots to perform increasingly complex tasks, with less repetitive and predictable patterns. Industrial robotics, for example, represented a US\$ 12 billion market in 2016 and is expected to grow by 4.4% annually between 2016 and 2023. The market for service robots is particularly buoyant. For example, sales of logistics robots increased by 110% between 2018 and 2019, while sales of medical robots increased by 28% in the same period.
- **Cloud services and digital platforms:** digital or virtual platforms are spaces on the Internet that facilitate the execution of applications or programmes in one place to meet different needs. Most digital interactions take place remotely in the cloud, reducing the need for storage and processing on local computers and devices. Cloud computing enables computing services to be delivered over a network, which reduces usage costs and facilitates the transmission of information. By 2023, these services are expected to represent a market of more than US\$ 350 billion worldwide.
- **Blockchain:** a blockchain is a digital ledger that works with a single decentralized, consensual register to validate information and transactions. The ledger is distributed across multiple nodes in a network and each block stores a number of valid records or transactions, along with information about that block and how it is linked to the previous and next block via a unique digital fingerprint. As new records are created, they are first verified and validated by the nodes in the network and then added to a new block that is linked to the chain. Furthermore, if this information is stored in encrypted form, its confidentiality is assured because only those with the encryption key can access it. This would make it possible, for example, to unify health records, such as individual patients' medical histories, in a secure and convenient way. The pharmaceutical industry could use this technology to check medicines and prevent counterfeiting. Cryptocurrencies, meanwhile, can be thought of as a ledger where every transaction is recorded.

- **Autonomous and semi-autonomous navigation:** this encompasses vehicles operated with reduced or no human intervention. It includes cars, trains and trucks as well as drones piloted by an operator. Drones can be used in different types of projects, such as underwater research, shipwreck searches and salvage operations. They are particularly employed in offshore installations to supplement hull inspections of ships. Unmanned aircraft have been used mainly to deliver objects to remote locations and in disaster areas, as they have the advantage of being able to reach and deliver to out-of-the-way places. Amazon is preparing to deliver orders within 30 minutes of purchase up to 10 miles from the company's warehouse using a fleet of drones.
- **3D printing:** this belongs to the family of techniques known as additive manufacturing. Additive processes allow objects to be constructed by creating and consolidating layers, as opposed to moulding or subtractive techniques. The development of machines with the ability to print objects has attracted increasing attention in recent years. However, there are still doubts about their true potential. While some enthusiasts see it as a new industrial revolution, many others take a more sceptical view and focus on the limitations of the technology and adoption levels, which are still low. Whatever the case may be, 3D printing still has a great potential acceleration role to play both in the direct manufacturing of products and parts and in the creation of tools and moulds, e.g., for customized medical implants. In order to achieve osseointegration, manufacturers use 3D printing to precisely control surface porosity and thus better simulate real bone structure.
- **Virtual reality and augmented reality:** immersive technologies such as virtual reality and augmented reality are being used to reinvent the way content is created and experienced. For example, at Stanford University's Neurosurgical Simulation and Virtual Reality Center, virtual reality is being used for detailed planning of complex brain surgery (e.g., to remove tumours) based on simulations created using information obtained from CT scans. Immersive technologies have multiple impacts for businesses, such as reduced production costs thanks to the use of virtual prototypes and lower barriers to entry for new content creators.

New technologies can be used at all stages in the operation of different sectors and activities. They are specific sources of value for companies and businesses that require a clear connection between business needs and the impact of the solution and a clear vision of how to use the solution that is going to be incorporated. The potential of these technologies is not common to all economic activities; it depends on each sector, its degree of sophistication and linkage with other activities, the technology incorporated and the capabilities and skills of workers, as well as the context in which companies and businesses operate. The adoption of new technologies entails a reconfiguration of the entire production chain, involving new links, services and companies, which opens up opportunities for sectoral diversification and skills development. Three sectoral cases of great transformative potential for the region in the agro-industry, manufacturing and retail sectors and chains are presented below (see diagram III.2).

Diagram III.2
The dynamizing potential of digital technologies



Source: Economic Commission for Latin America and the Caribbean (ECLAC).

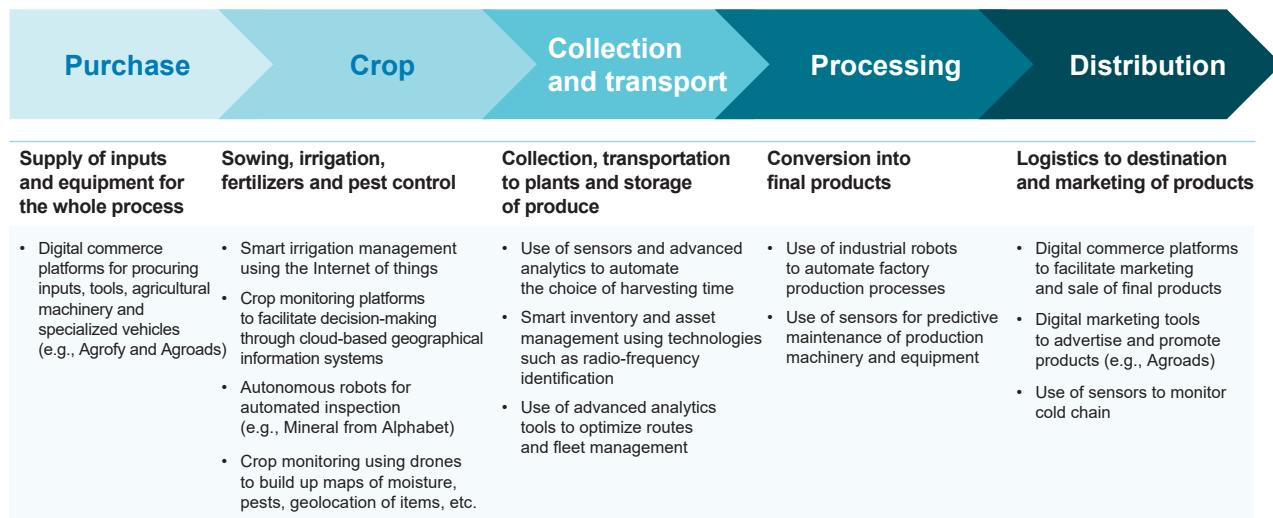
2. Agro-industry

The agro-industrial sector is one of the main drivers of exports in Latin America and the Caribbean and one of the sectors with the largest share of employment in many economies of the region. With some exceptions, however, its productivity is significantly lower than the regional average and than that of the most developed countries.

The digital revolution is an important opportunity to boost productivity and sophistication in the agricultural sector (see diagrams III.3 and III.4). Digital technologies can help farmers produce more efficiently and develop sustainable solutions to climate change. For example, incorporating sensors into conventional agricultural machinery such as tractors, sprayers and harvesters can transform them into networks of smart devices with yield monitors, autopilot or sensors for seed distribution and spraying. The use of advanced analytics would enable information produced by sensors and satellites to be processed in order to optimize production processes and the use of Global Positioning System (GPS)-enabled applications. The incorporation of autonomous or semi-autonomous vehicles would reduce operating costs and energy consumption, as well as increasing safety and accuracy. Digital technologies have great potential throughout the production chain, from the purchase of inputs to the marketing of goods.

Diagram III.3

The use of digital technologies in the agricultural chain



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of data from McKinsey Global Institute.

Numerous digital platforms act as online geographical information systems that allow all information to be held in the cloud and accessed from any device anywhere in the world at any time. For example, satellite imagery can provide normalized difference vegetation index images. Platforms also make it possible to establish monitoring routes that can be followed with the help of the mobile application, produce a report of what is observed in the field and take georeferenced photographs illustrating the situation observed. The report and photographs are kept available in the workspace, which is easily accessed online, so that information can be managed in an accessible way and adjustments can be made as necessary to minimize losses and improve efficiency in input use. Some of the platforms present in Latin America are Campo 360, the Taranis platform, GeoAgro, Climate FieldView and Auravant. This last has a free tool for producers with up to 1,000 hectares that offers basic functions for working with the platform: crop evolution, measurement of areas for monitoring, notification of areas with potential problems and uploading of yield maps.

Another example is an autonomous robot developed by Alphabet (Mineral) which goes around crops and inspects each plant. From these observations, it generates accurate information on the state of agricultural production. This technology provides precise and reliable data from the field that help farmers to adopt more targeted solutions, such as applying fertilizer or insecticide to a specific area. Using the robot can reduce waste

in a 100-hectare soybean field by 10%. To use the potential of robotics in agricultural production, FarmWise is developing an autonomous robot that cuts weeds affecting crops, covers large areas daily, and routinely and efficiently improves the condition of fields.

For the growing phase, smart irrigation management is a digital solution to one of the most important activities in agricultural production. A set of sensors is installed to detect soil moisture levels, and irrigation is carried out automatically on the basis of these readings. The adoption of digital technologies also facilitates smart crop harvesting management. Using analytical tools, data from sensors and external information (weather forecasting or customer needs) are used to determine optimal harvesting times.

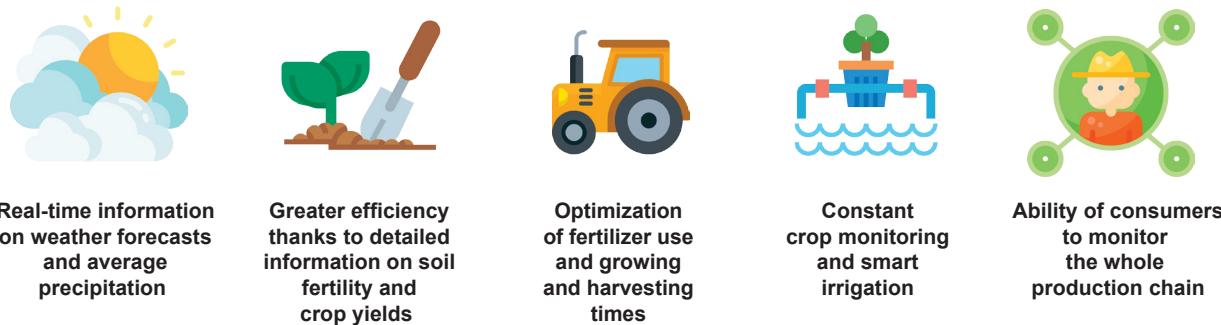
Another application of digital tools such as machine learning and the Internet of things is predictive equipment maintenance. Using drones and sensors, the condition of machinery and equipment is constantly monitored in order to anticipate breakdowns and optimize repair and maintenance times, helping to reduce costs.

On the logistics side, major transnational grain companies (Archer-Daniels-Midland (ADM) Company, Bunge, Cargill, Louis Dreyfus Company (LDC) and COFCO) have formed a partnership to standardize data and digitalize global agricultural shipping transactions using digital technologies such as blockchain and artificial intelligence with the aim of increasing the transparency and efficiency of the chain worldwide.

Digital platforms also facilitate the relationship with customers and suppliers, fostering greater customer trust and generating new services through digital relationships. Platforms function as an online marketplace offering producers inputs, tools, agricultural machinery and specialized vehicles. In addition, these platforms allow users to publish advertisements, publicize their brands and obtain statistics on these publications to ascertain their reach, including not only the number of views received by each, but their geographical origin and impact according to the category they belong to. In Latin America, Agrofy and Agroads offer their services in Argentina and Brazil to those wishing to buy, sell and publish specialized products of interest to farmers.

Diagram III.4

Smart agriculture: the benefits of incorporating digital technologies into agriculture



Source: Economic Commission for Latin America and the Caribbean (ECLAC).

At the same time, digital technologies influence consumers' preferences and decisions, mainly through their interaction with information. Technology allows information to be collected, stored, analysed and shared before, during and after food consumption. This information makes it easier for intermediaries to refine their product offerings, improving the experience of consumers in line with their preferences. This can also have major effects on the mode of production and its impact on the environment, as well-informed consumers can express preferences for products that minimize the ecological damage of their nutrients (e.g., organic, environmentally friendly products with the smallest possible carbon footprint). Seals and labels, supported by the use of blockchain, can also incentivize good use of environmental resources.

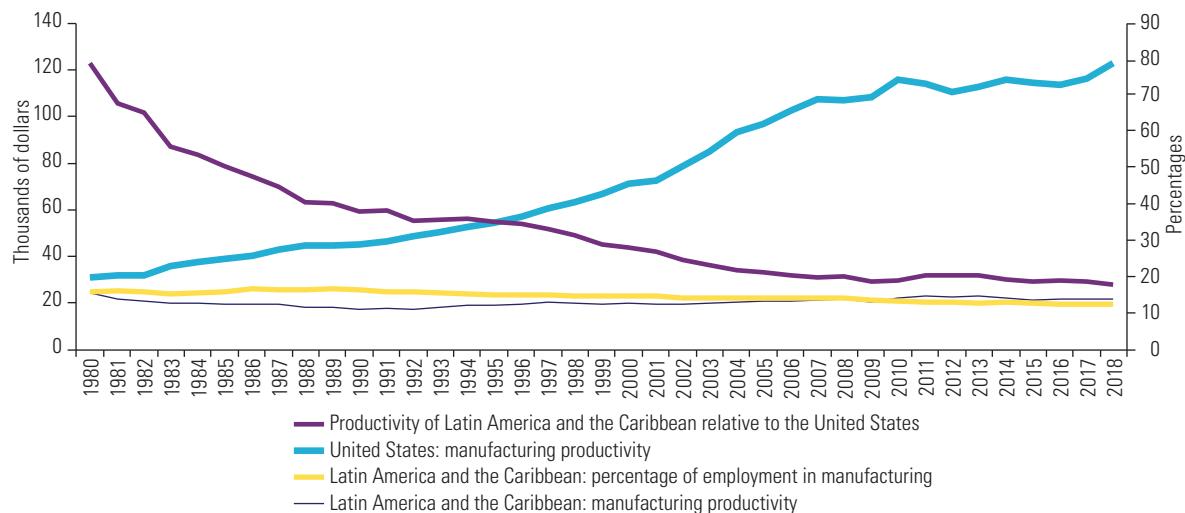
Apart from the use made of these new technologies in individual businesses, their development entails a reconfiguration of the entire chain. First, a growing role is being played by companies linked to the provision of knowledge-based services applied to production processes in agriculture. Second, specific equipment (agro-parts) for precision agriculture (e.g., yield monitors) is increasingly appearing. Lastly, the increased importance of new technologies could result in market power being transferred to companies that provide these types of solutions.

3. Manufacturing

The manufacturing sector plays an important role in many economies of the region, particularly Brazil, Mexico, Argentina, Costa Rica and other Central American countries. As can be seen in figure III.5, in recent decades the sector has been characterized by low dynamism, accompanied by stagnating productivity and a fall in the manufacturing share of employment from 16% in 1980 to 12% in 2018.

Figure III.5

Latin America and the Caribbean and the United States: manufacturing sector productivity, 1980–2018
(Value added per worker in thousands of constant 2010 dollars and percentages)



Source: Economic Commission for Latin America and the Caribbean (ECLAC).

Manufacturing is not only at the heart of the digital revolution, but has the greatest potential to catalyse the use of new technologies, generating better jobs and synergies with other sectors of the economy.

Digital technologies can optimize the supply chain and production and accelerate time to market. In addition, the increasing automation and digitalization of the sector may result in major reconfigurations of the chain, e.g., the reversal of offshoring dynamics, leading to nearshoring and reshoring, and an increasing transfer of value from production to design, research, development and innovation, and services.

Some of the main applications of new technologies in the manufacturing sector are in real-time order tracking and supplier logistics, virtual development systems, machine-to-machine (M2M) communication, customer lifecycle monitoring¹ and management, and business process automation supported by artificial intelligence (see diagram III.5).

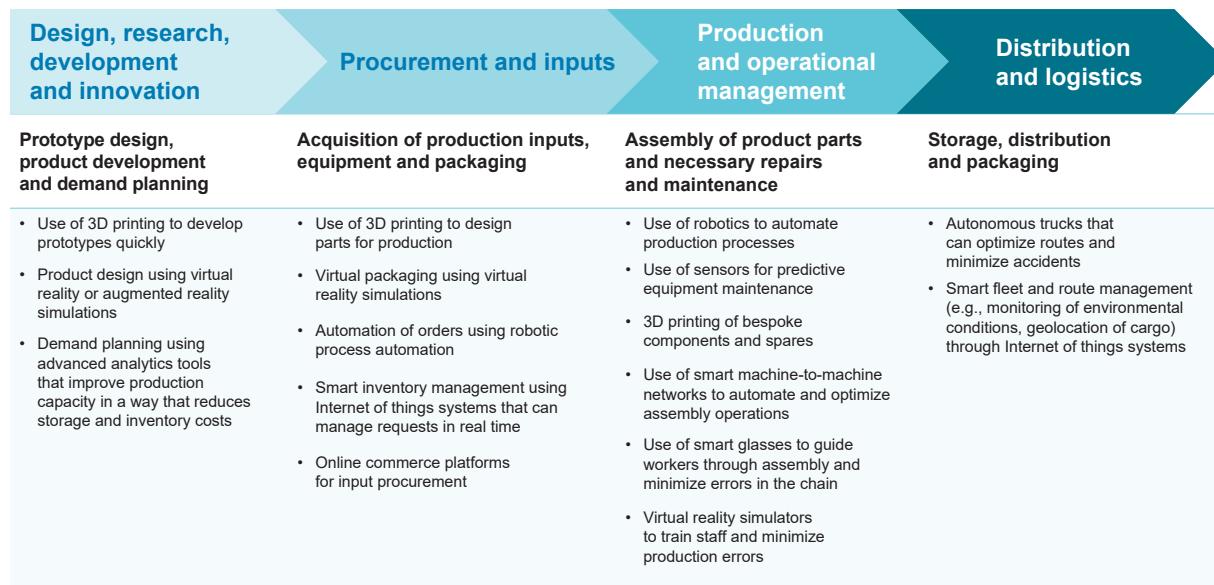
There are many examples of the use and application of digital technologies in the manufacturing sector. In the extractive industries, for example, and the oil industry in particular, sensors and machine learning equipment can be applied to regulate and correct the pumping system in a well in order to increase production and prevent malfunctions. The Argentine oil company YPF uses technology of this type provided by Schneider Electric (through its EcoStruxure platform) in its extraction processes to optimize well operation in real time, particularly in the Vaca Muerta oil field.

Augmented reality makes it possible to control factories from a tablet, with accurate and detailed data from all areas of the plant. For example, a crane simulator with a virtual reality helmet can be used to train staff to operate the controls accurately. The system generates statistics on the process and determines the failure rate and energy consumption in each sector. One of the suppliers of this technology in the region is Schneider Electric with its EcoStruxure platform, designed especially for production plants.

¹ That is, the cycle of familiarization, consideration, exploration, purchasing and loyalty that customers may go through before the possible purchase of a product.

Diagram III.5

The use of digital technologies in the manufacturing chain



Source: Economic Commission for Latin America and the Caribbean (ECLAC).

Moreover, artificial intelligence and machine learning can contribute to cost reductions in sales and input purchases by predicting the demand for and supply of goods and services. Other applications are sales-oriented; for example, the introduction of virtual agents improves customer service at low cost; the increase in earnings before interest and tax can be as high as 13%.

Autonomous navigation devices, which are used for both short- and long-distance transport and logistics tasks, can reduce labour costs and capital expenditure by automating production vehicles, e.g., autonomous heavy machinery in mines and quarries, or autonomous trucks for long-distance transport. Data from Argentina indicate that the use of autonomous trucks would lead to a 45% reduction in logistics costs.

Virtual and augmented reality devices used in product design can reduce production and maintenance costs through improvements in the design and composition of goods (e.g., with virtual testing of objects). One application of this technology is the use of smart glasses to guide assembly, a detailed, virtual way of taking workers through the assembly process, reducing human error on the assembly line. The use of smart glasses is also a digital solution for equipment repair technicians, as remote assistance speeds up the repair process.

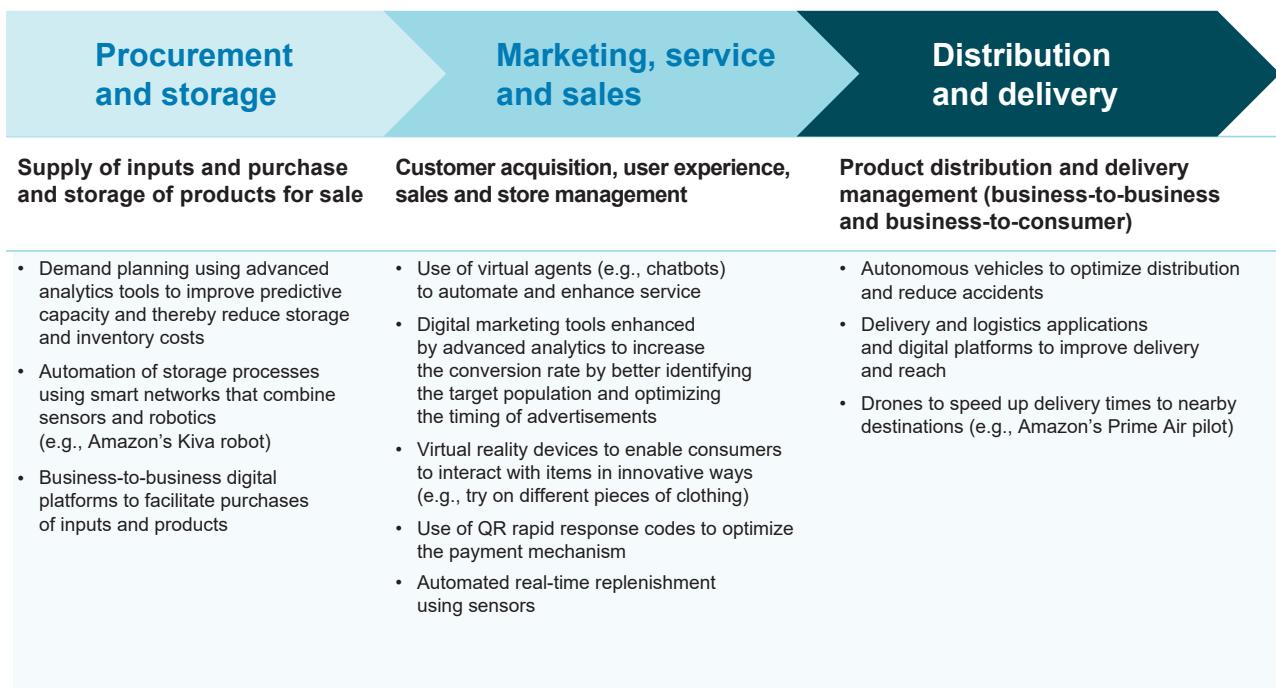
The Internet of things provides digital solutions associated with the distribution and logistics phases whereby processes can be optimized and costs reduced. These include, in particular, geolocation of cargo and fleets, route optimization, monitoring of environmental conditions and monitoring of the cold chain.

The complementarity between these technologies in the stages of a chain allows smart factories to be developed. Brazil has the only two factories in Latin America and the Caribbean that are part of the World Economic Forum, a global network of advanced factories serving as showcases for the adoption of new technologies. The Groupe Renault plant in Curitiba has an approach centred on workers, accountability and employee-to-employee connectivity. It has developed an interconnection platform right along the value chain that includes suppliers, customers and workers. The results have enabled it to increase productivity by 18% without major capital investment. The offshore facility of MODEC (a developer and operator of floating oil platforms) in Rio de Janeiro uses a combination of advanced analytics for predictive maintenance, a digital replica of its processing plant and a proprietary data platform to accelerate the development and exponential scaling of algorithms on floating vessels. This has enabled it to reduce downtime by 65%.

4. Retail

Retail is the region's largest employer and one of the sectors that are least advanced in terms of digitalization and the adoption of digital technologies, which is one of the reasons for its low productivity. Digitalization is an opportunity to boost the sector by improving multi-channel supply chain management, automating warehousing and logistics, optimizing in-store operations, acquiring customers digitally and moving towards nimble delivery models with real-time tracking (see diagram III.6). Digital transformation is bringing major changes along the entire chain. Intensifying economies of scope, changing consumer habits and the growth of e-commerce are leading to an increasing role for digital platforms. It is estimated that in 2019, 1.92 billion people bought goods and services online and e-commerce sales exceeded US\$ 3.5 trillion worldwide. Leading digital commerce platforms in the region include Mercado Libre, Amazon, AliExpress, Wish, eBay, Shopify and Tiendanube.

Diagram III.6
Use of digital technologies in the retail chain



Source: Economic Commission for Latin America and the Caribbean (ECLAC).

Growing disruption in the chain is increasingly blurring the boundaries between the different links and making the traditional distinctions between "retail", "manufacturing" and "logistics" less and less relevant. There is rising pressure for disintermediation and re-intermediation in increasingly modular chains. While retailers were traditionally a link between industry and consumers, manufacturing is moving increasingly towards business-to-consumer models.

In addition, new intermediate players operating between retailers and consumers have been emerging and expanding. In the food chain, for example, there has been consolidation among home delivery companies such as Rappi, Glovo, PedidosYa and Uber Eats. These growing players complement those in the sector while also posing a risk to them, mainly in terms of capturing the customer relationship and transferring market power downstream.

Despite increasing pressure for further digitalization, physical shops still play an important role, particularly in terms of interacting with goods and providing a distinctive experience. However, there is likely to be at least a partial transformation of the role of physical spaces (e.g., as places for recommendations or socializing), as well as greater integration between physical and digital experiences (e.g., customers ordering and paying for in-store products by taking a picture on their phone).

There are multiple applications of new technologies that can help transform operations and the customer experience. For example, virtual reality and augmented reality devices provide substantial improvements in customer service and are an innovative way for brands to advertise. This technology is used, for example, to project clothing in stores, which is very attractive to customers. In Latin America and the Caribbean, Muvit has developed and implemented motion sensors to create commercial applications such as 3D changing rooms and avatars and a virtual rehabilitation platform.

Likewise, artificial intelligence algorithms can optimize prices and promotions in accordance with customer characteristics and increase customer satisfaction. In Latin America and the Caribbean, companies such as Jampp provide such solutions, which can increase revenue and sales. The platform helps advertisers to promote their applications globally and to recover users who have installed the application but are inactive. One of the benefits of the service is that it optimizes the purchasing of traffic on the basis of the level of user activity in the application.

Meanwhile, the use of autonomous navigation devices can substantially reduce the labour costs and capital expenditures associated with delivering packages to nearby destinations, as well as long-distance transportation costs, through the use of autonomous trucks. For example, Alphabet, Google's parent company, has a drone delivery service in conjunction with FedEx and Walgreens, which delivers health and wellness products. This service improves the speed of product delivery and reduces costs, as well as being fuel-efficient, as the drones use an all-electric power system (*Business Insider*, 2020).

In Latin America and the Caribbean, the digital transformation of the sector is still in its early stages, with a focus mainly on e-commerce. During the COVID-19 pandemic, companies have seen the opportunity offered by an online presence as a way to reach consumers. This was demonstrated by the substantial increase in the number of business websites in Brazil, Chile, Colombia and Mexico between March and August 2020 compared to the previous year. As early as April, the number of active business websites was up by 800% in Colombia and Mexico and by around 360% in Brazil and Chile over the same month in 2019.

The largest increases in online presence have been recorded for transactional business sites (active presence) and e-commerce platform sites. In Brazil and Mexico, the number of new e-commerce sites was up by more than 450% in April 2020 compared to the same month in 2019. Meanwhile, sites with an active presence in Colombia and Mexico increased by some 500% during the same period (CEPAL, 2020).

During the pandemic, retail and delivery platforms have come to play an unprecedentedly prominent role for both consumers and those offering their products and services, as they have been able to keep their premises running, generate revenue and retain their employees or delivery workers. The exponential increase in the use of these platforms, which appears irreversible, opens up an opportunity for digitalizing the retail chain and presents countries with the need to strengthen their payment systems (which are crucial for secure and efficient remote interaction), their regulatory and policy frameworks and their competition policies to avoid market concentration and overcharging for services.

C. The digital ecosystem and the main barriers to digitalization of production

1. The digitalization of production processes in the region

Latin America and the Caribbean has made great strides with digitalization over the last decade. Progress with connectivity has been remarkable. In June 2019, there were more than 450 million Internet users in the region, as compared to only some 200 million in 2010. There are large differences by subregion. South America has the highest Internet penetration rate (72% of the population). Internet penetration has grown sharply and at a faster rate than income in all countries of the region.

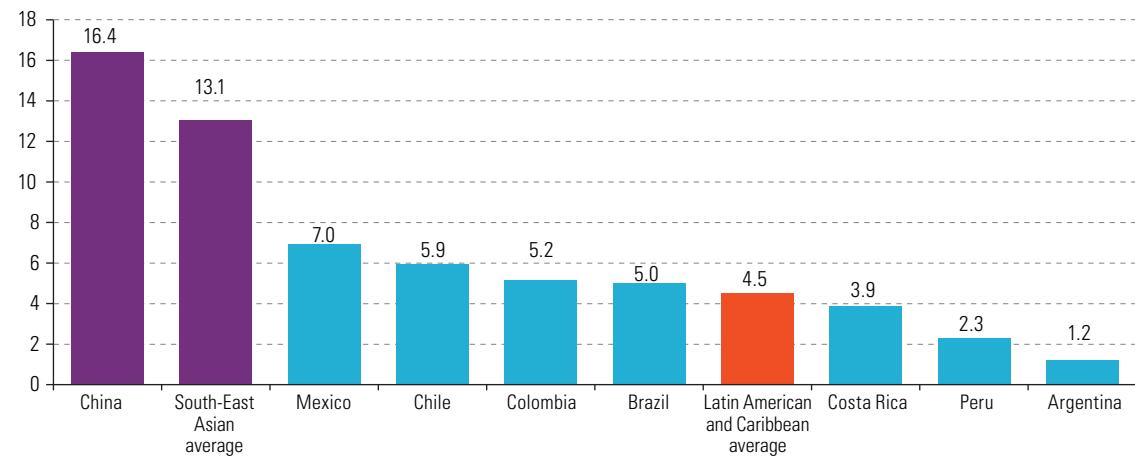
Despite progress with connectivity, performance in terms of digital transformation has been moderate. The region lags badly with the digitalization of production processes. The average growth of digital adoption to change production methods has been lower than in other emerging countries and regions. In the region, digital adoption in business grew by an average of 4.5% between 2014 and 2016, a figure that contrasts with the great dynamism of South-East Asia (13.1%) or China (16.4%) (see figure III.6).

Figure III.6

Latin America and the Caribbean and selected regions and countries: cumulative change

in the Digital Adoption Index, 2014–2016

(Percentages)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of World Bank, Digital Adoption Index [online database] <http://wbgfiles.worldbank.org/documents/dec/digital-adoption-index.html>.

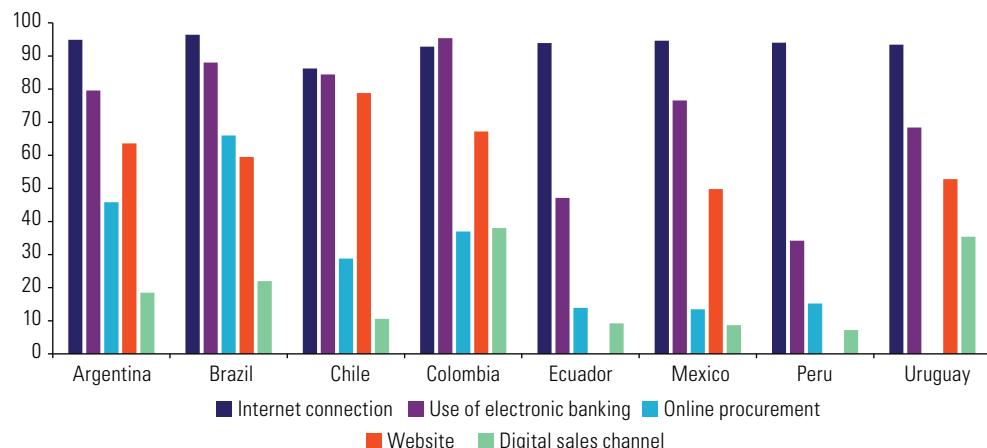
Digital transformation in the region is still in its early stages. Most businesses remain excluded from the benefits of this transformation. There is a large divide in the level of digitalization between the countries of Latin America and the Caribbean and those of the Organization for Economic Cooperation and Development (OECD), mainly when it comes to the digitalization of production processes, digital industries and factors of production, while levels of digitalization in supply chains are also low. According to data from the 2020 Network Readiness Index, countries in the region lag far behind in the adoption of information technologies in business. Chile is the best-scoring country in the region for this subindicator of the index, ranking forty-fourth out of a total of 134 countries surveyed. It is followed by Brazil (fifty-sixth), Peru (fifty-eighth) and Costa Rica (fifty-ninth). Argentina and Mexico, two of the largest economies in the region, appear only in sixty-seventh and eighty-first positions, respectively. The Central American and Caribbean countries are among the lowest ranked, with Trinidad and Tobago in a hundred and first place, followed by Honduras in a hundred and fourth and El Salvador in a hundred and fifth.

Thus, although most firms have access to the Internet in Latin America (more than 90% coverage), a large proportion of them do not use it for their supply chain and distribution channels (see figure III.7). According to Mexico's National Institute of Statistics and Geography (INEGI), only 19% of SMEs purchase inputs online in the country. Much the same is true of the digitalization of distribution channels. The country where the largest proportion of companies have e-commerce platforms is Colombia, but it is no more than 40% (ECLAC/CAF, 2020).

The limited progress made with digital transformation is associated with uneven adoption by businesses and households. While some firms have managed to capture many of the benefits of digital technologies, there is a long tail of digital laggards, consisting mainly of micro-, small and medium-sized enterprises (MSMEs) and businesses in traditional and vulnerable activities, all of which are generally associated with lower productivity and greater informality.

Figure III.7

Latin America (8 countries): firms with digitalized supply and distribution chains, 2018
(Percentages)

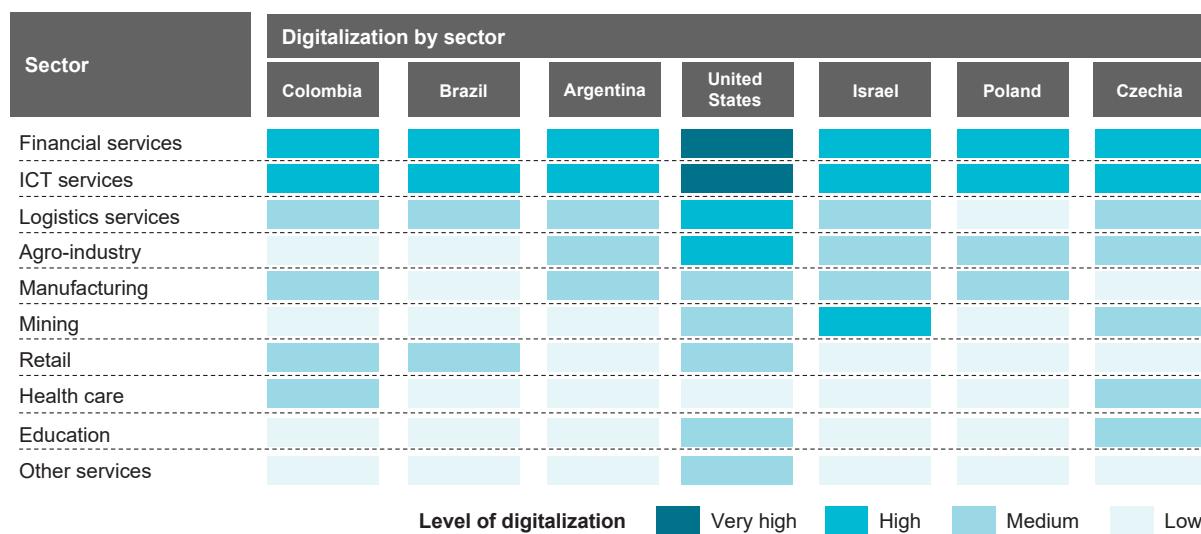


Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of Economic Commission for Latin America and the Caribbean/Development Bank of Latin America (ECLAC/CAF), *Las oportunidades de la digitalización en América Latina frente al COVID-19*, Santiago, 2020.

In the first place, there are large differences in digitalization between sectors. Financial services and the information and communications technology (ICT) sector are the ones with the highest levels of digitalization in the region, as they are globally. At the other extreme, there are digital laggards such as agriculture, real estate services and education. Within manufacturing, there is great heterogeneity (see table III.2). In Argentina, for example, there are high levels of digitalization in the biopharmaceutical and automotive sectors, while lower levels of digitalization prevail in the agricultural machinery, food and textile sectors (Basco and others, 2019).

Table III.2

Latin America (3 countries) and other selected countries: level of digitalization by sector, 2015 or latest year available



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of McKinsey Global Institute.

Note: The colours depict digitalization quartiles relative to the global frontier, namely the United States ICT sector.

Besides variability between sectors, large differences persist at the firm level. ECLAC estimates that only 59% of firms in the region's largest economies have a website, compared to 77% in the OECD countries. But there are even greater differences within countries. In Colombia, for example, large firms are eight times as likely to have a website as microenterprises. Similarly, large firms are six times as likely as microenterprises to place orders over the Internet.

The digital divide extends beyond the issue of connectivity, especially when the more sophisticated tools and uses are considered. For example, the gap between firms in Argentina, Brazil and Chile relative to OECD economies in the use of enterprise resource planning software is three times as large for medium-sized firms as for large firms (OECD, 2019).

Digital technologies bring with them the risk of a widening digital divide. While the vast majority are of general utility, many of the more advanced ones are cumulative in character and need well-developed digital ecosystems to be used most efficiently. For example, there is a strong correlation between a sector's degree of digitalization and the level of adoption of artificial intelligence (Bughin and others, 2017).

In some areas of the region, there are signs of convergence at certain levels. In Colombia, the Digital Economy Observatory of the Ministry of Information and Communications Technologies indicates that the digitalization gap between large firms and microenterprises narrowed from 340% (a 70.7% digitalization rate for large companies versus 21.0% for microenterprises) in 2015 to only 46% in 2017, mainly owing to the great progress made by small companies (76.0% digitalization in large companies versus 52.0% for microenterprises). The downside of this dynamic is growing divergence in the most advanced technologies. It would seem to be a matter not so much of bridging the digital divide as of trying to solve a problem that is constantly shifting.

2. Factors that enable and constrain the digitalization of production

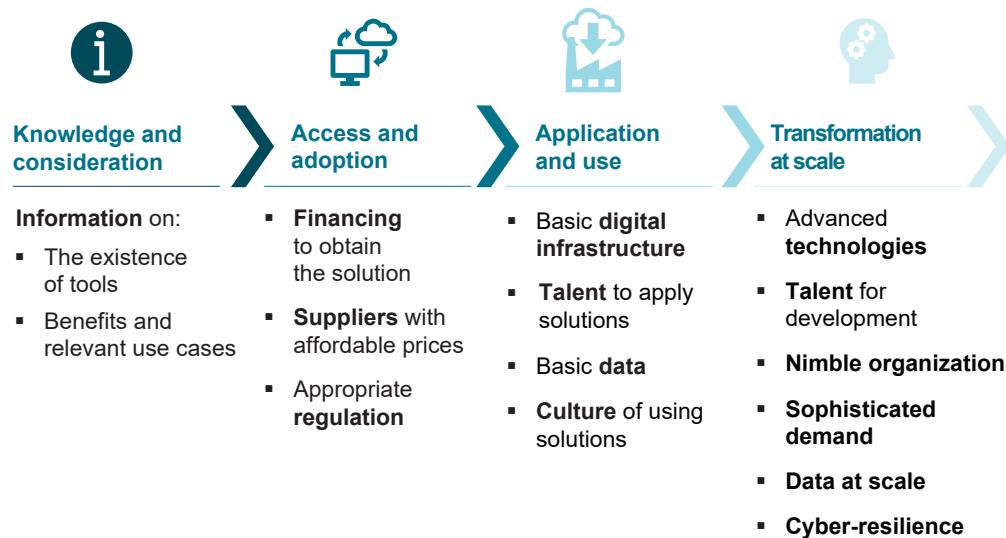
In the Latin American context of sectors operating at different speeds and with little linkage between them, the factors enabling digital transformation are particularly important. While the need to incorporate innovative digital-based production tools is increasingly recognized, there is still a long way to go.

Small businesses and traditional activities face barriers to adopting digital technologies productively and at scale, including a lack of financial resources, adequate infrastructure and equipment, and digital skills. However, there are other constraints on digital transformation that vary significantly in importance depending on the stage of digitalization a firm has reached. To drive productive transformation, it is necessary to identify both the obstacles faced by firms and the enabling factors needed to move forward at each stage of digitalization. Diagram III.7 presents the four main enablers of productive transformation:

- **Knowledge and consideration:** the first priority is to recognize the importance of digital transformation. In a large percentage of companies, this recognition is lacking, particularly when it comes to the need to adopt digital technologies at a sufficiently granular and precise level. The least advanced companies do not have access to information and knowledge about digital tools and their benefits, or about their relevance to their business. In Argentina, unfamiliarity with technologies is one of the major obstacles to greater adoption among less digitalized firms. In Colombia, by contrast, 12% of firms consider the lack of information about available technologies to be a major obstacle to innovation, while 41% believe it is of medium importance, according to data from the National Administrative Department of Statistics (DANE, 2018).
- **Access and adoption:** once the potential of digitalization is recognised, companies must have adequate resources and access to these solutions. This includes financing to be able to acquire the solutions and access to suppliers with affordable solutions, as well as a policy and regulatory framework that facilitates these types of transactions. Lack of resources is the main obstacle to innovation in Colombia, with 42.6% of companies attaching high importance to this factor, according to data from DANE (2018). Difficulty in accessing finance is the second-largest obstacle, with 32.1% of firms considering this to be of high importance. Lack of access to finance is also one of the main obstacles to the adoption of digital technologies by industries in Argentina.

- **Application and use:** access to a solution is not sufficient for value creation. In addition, it is necessary to have the capabilities to apply the technologies appropriately. This means having basic equipment, skills to implement the solution, a minimum set of digitalized data and an organizational culture conducive to their adoption and use.
- **Transformation at scale:** Although many companies have embarked on the path to digitalization, very few “digital disruptors” manage to capture its full potential. A digital transformation at scale requires a set of internal and external conditions, typically seen in firms that are digital natives or in incumbents that manage to quickly design and integrate an appropriate digital strategy. The key differentiators allowing firms to reach this point include having state-of-the-art infrastructure and equipment; talent that can not only implement basic tools, but also design and adapt solutions to local needs; an agile digital culture that permeates the organization; access to big data; the development of cyber-resilience to safeguard information and prevent and mitigate cyber-attacks; and the existence and identification of demand that values and promotes this type of innovation.

Diagram III.7
Factors enabling digital transformation



Source: Economic Commission for Latin America and the Caribbean (ECLAC).

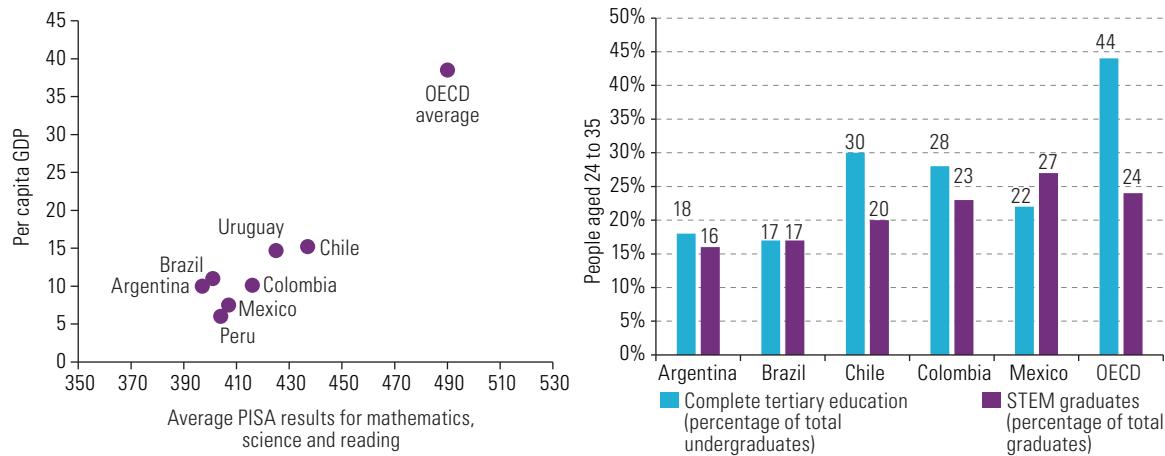
Another problem for Latin America as it seeks to join the fourth industrial revolution is the education of its people. The low quality of education is a brake on the adoption of new technologies. In particular, systems for managing the transition in the face of technological change are poorly developed. Although coverage and access to basic, secondary and technical or vocational education has increased in most countries, positive results in terms of quality are not being seen (see figure III.8).

Having educational systems with the connectivity, devices and teaching skills to develop logical thinking and problem-solving skills alongside socio-emotional and collaborative working skills is vital if new technologies are to be assimilated and exploited.

The region's PISA test scores in mathematics, reading and science are lower than the average for OECD member countries. This should be a cause for concern and action. Only a small percentage of young people complete their studies on time. Less than 20% of students aged between 24 and 35 have completed tertiary or university studies in Argentina and Brazil, in contrast to almost 50% in the OECD countries. At the same time, most students continue to choose traditional courses (law, social sciences or humanities) and few opt for technical or science, technology, engineering and mathematics (STEM) courses, even though these are the subjects most in demand by companies whose growth potential is based on innovation and new technologies.

Figure III.8

Latin America (7 countries) and OECD countries: results of the 2018 PISA test in mathematics, science and reading, and categorization of people aged 24 to 35
(*Per capita GDP in thousands of dollars at 2010 prices and percentages*)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of Organization for Economic Cooperation and Development (OECD), Programme for International Student Assessment (PISA), Paris, 2018; A. Basco and others, *América Latina en movimiento: competencias y habilidades en la Cuarta Revolución Industrial*, Washington, D.C., Inter-American Development Bank, 2020; and national account data from World Bank and Organization for Economic Cooperation and Development (OECD).

The labour market amplifies these gaps, as demand is greater and wages are higher for workers with better digital skills, who are mainly attracted to more productive sectors and larger, digitalized firms. Going by estimates for developed economies, demand for activities involving digital skills and technologies is expected to increase by 55% by 2030, while demand for activities that are more intensive in physical and manual skills or basic cognitive skills is likely to drop by some 15%.

While the Latin American and Caribbean economies are making major strides in their digital transformation, great efforts are still needed to generate value inclusively and at scale. The dynamics of digitalization in the region reflect patterns of marked inequality in productivity and income. This digital divide has become even more marked and negative in the context of the COVID-19 pandemic.

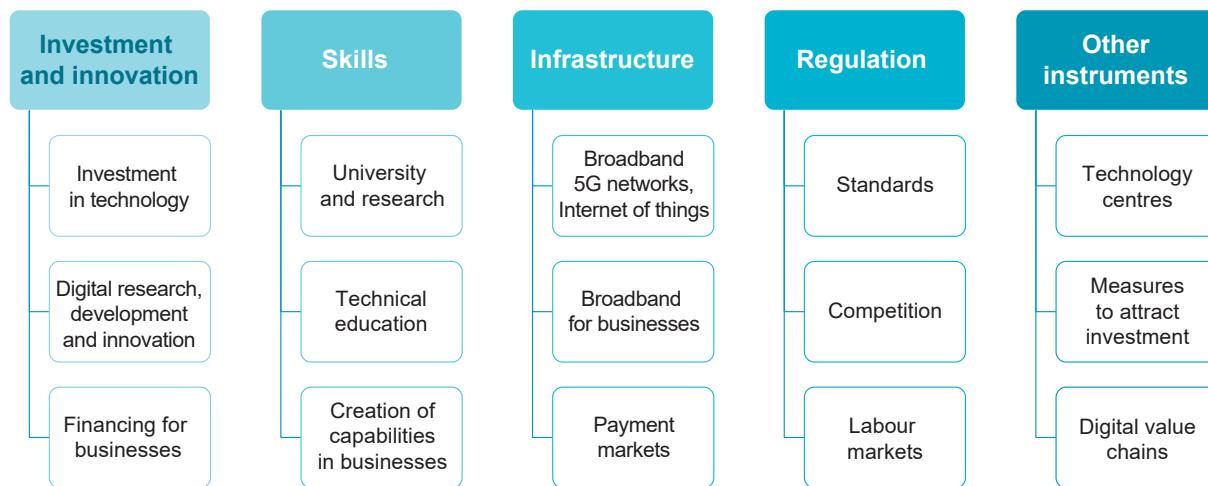
D. Digital policies for recovery and the transformation of production methods

The COVID-19 crisis has posed unprecedented challenges for the preservation of health, economic growth, social welfare and political stability in the region. In this context, bridging digital divides and advancing with digital transformation is critical for rapid recovery and progressive structural change. To achieve these objectives, the countries of the region have pursued a variety of approaches. Some have focused on specific technologies (e.g., the national plan for the Internet of things in Brazil), others have followed a sectoral (vertical) approach associated with local competitive advantages (cross-border trade in Panama), and others again have opted for general plans with a focus on institutions and cooperation between actors (Colombia). In this framework, some countries are implementing actions to boost the adoption of new technologies such as sensors, robotics or advanced analytics. Despite this progress, there are still problems, particularly in the digitalization of MSMEs and traditional sectors, which must be solved in order to generate large-scale change that accelerates sectoral dynamics and transforms the production structure.

To facilitate economic transformation, it is necessary to meet the needs of the productive sector, implement policies and incentives for the incorporation of technology, update regulatory frameworks and generate digital capabilities and skills (see diagram III.8).

Diagram III.8

Main areas of action for productive digital transformation policies



Source: Economic Commission for Latin America and the Caribbean (ECLAC).

To support investment and financing for innovation:

- Immediate action is needed to increase the incorporation of digital technologies in production processes and to overcome the low levels of investment in innovation.
- Governments should implement depreciation mechanisms for fixed capital investments to promote investment in equipment and machinery and in new technologies and plants.
- Apart from immediate needs, supporting access to finance is critical for the adoption of productive technologies, particularly in MSMEs. Governments should implement programmes to increase the creditworthiness of businesses, e.g., through collateral support, and promote new financial solutions.
- In situations where correcting market failures requires a greater public role, direct interventions such as the introduction of financing facilities at affordable rates and support schemes focused on the adoption of new technologies should be considered.
- Markets for venture capital (beyond seed capital) need to be deepened to reduce the gap between traditional venture capital investors such as SoftBank or Kaszek Ventures and accelerators such as NXTP Labs or Start-Up Chile. Public development banks should provide venture capital through investments with the private sector, especially pension funds.

To support the digital start-up ecosystem:

- The development of software, digital platforms and financial and agricultural technologies (fintech and agritech) needs to be encouraged to strengthen the ecosystem for technology start-ups of all sizes.
- Governments can create a suitable environment for attracting and developing investment through promotion and attraction schemes (involving tax exemptions, for example) and through capacity-building at promotion agencies.
- It is desirable to promote the use of digital platforms and strengthen meeting spaces in the digital ecosystem (such as the Centre for the Fourth Industrial Revolution in Medellín) and to foster coordination and cooperation within the ecosystem and between this and the rest of the economy.

- Cluster and zone development needs to be encouraged with appropriate regulatory and tax environments and access to infrastructure and skills.

To support connectivity and access to digital payments:

- The public and private sectors must work together to facilitate the deployment of the connectivity network and encourage sustainable adoption of it. Facilitating the deployment of and access to 5G networks and services should be a priority.
- Logistics needs to be strengthened by increasing efficiency in customs processes, solving problems in last mile delivery and reducing transport costs.
- Access to digital payments should be universalized and records of them used to reduce uncertainty about creditworthiness, which would mitigate risk for financial institutions, reduce costs and facilitate access to credit. Governments should continue to fund digital tools for transfer mechanisms and encourage the growth of transactions and user bases.
- Apart from infrastructure, it is important to develop a regulatory framework that balances the interests of investors and businesses and protects consumers against fraud and cyber risks.

To help MSMEs:

- A comprehensive approach is required in the design of productive digitalization policies targeted at MSMEs. This is related to the consideration of enabling environment and technology factors and those specific to the sector and business.
- Business chambers need to be actively worked with. The impact and scope of these programmes will depend on the ability to relate to the production fabric and on collaboration with business associations.
- There is also a need to strengthen the results monitoring aspects of digitalization and SME programmes. It is critical to have evaluation systems in place to measure results, but also to correct programmes and projects.
- In addition to connectivity, an approach should be implemented that provides clear and effective information about the benefits of digitalization and that enables MSMEs to learn about the important uses of digital technologies and develop the skills necessary to implement them.
- Creating regional and national spaces that act as meeting points (one-stop shops) would help to identify important use cases and connect businesses with specialized suppliers and advisors, as is done in the Productivity Factories programme in Colombia or in the Technology Clinic programme of the government of the Province of Buenos Aires.

To create the activities and skills of the future:

- Coping with disruption in labour markets requires a continuous, granular and long-term approach to help workers adapt. Governments should facilitate these transitions through unemployment insurance programmes, hiring incentives and support in matching labour supply and demand.
- The public sector must work with the private sector (including digital platforms) to close the skills gap in activities where there is demand for labour.
- Vocational training programmes need to pay attention to the specific skills and aptitudes sought by firms. Hybrid models of learning, which combine traditional education with on-the-job training, are effective in balancing the need for increased learning time with the need to maintain earnings streams.
- Digital education services that help identify skills gaps and design customized programmes based on market needs should be strengthened.
- Online talent platforms that help connect individuals more effectively to employment opportunities and create new, more flexible ways of working need to be promoted. In addition to these functions, they can use search and screening algorithms to speed up recruitment and reduce search times.

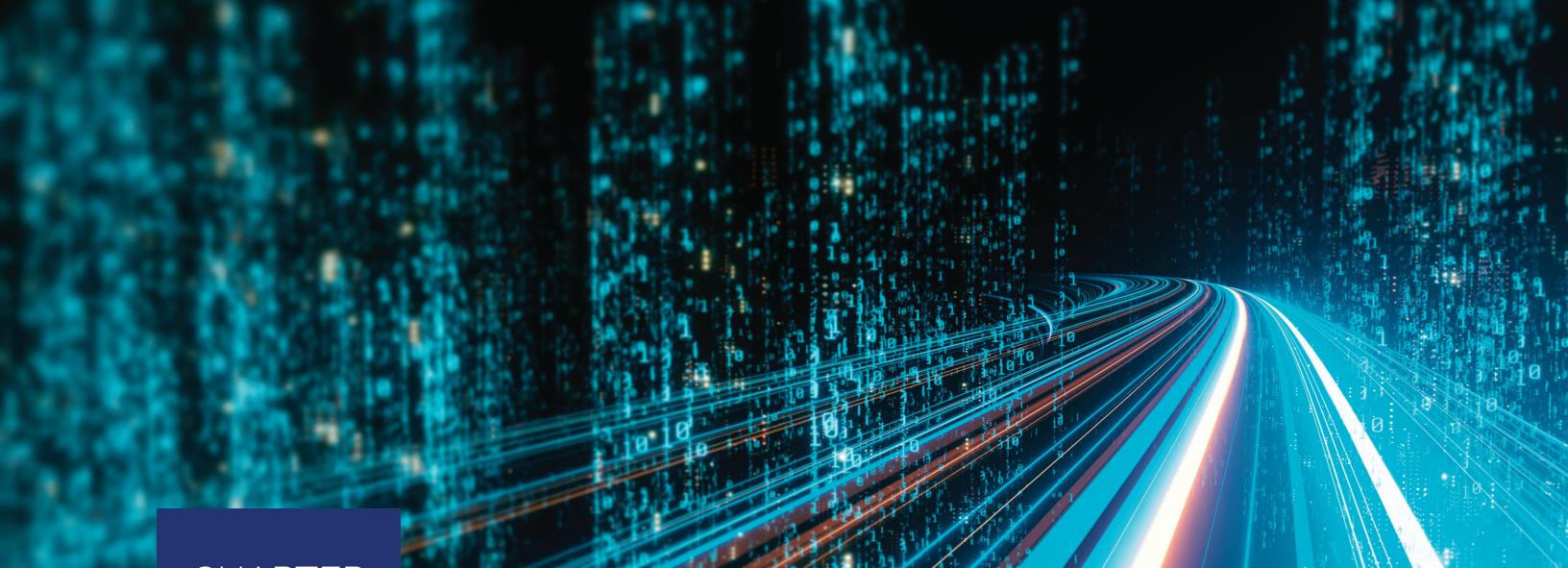
To adapt regulation with a view to creating and embracing digital opportunities:

- Competition policies need to adapt to changing environments with increasing concentration and blurring sectoral boundaries.
- Rules should be put in place to make digital platforms more transparent and accountable for their decisions and information handling. Attention needs to be paid to business-to-business services, whose increasing role (e.g., in home food delivery) may raise prices in a way that makes it difficult for MSMEs to participate.
- Regulation must adapt to changing employment dynamics. Regulators have to balance the creation of employment opportunities with the protection of workers' interests.
- The institutional fabric needs to be strengthened to foster coordination and cooperation across sectors. This must involve creating spaces that promote the generation of shared value between businesses, individuals and government. These efforts must be complemented by continuous improvement in institutional quality focused on boosting productivity and strengthening institutional cooperation.

In summary, a wide range of actions can and should be taken. National and local governments have to decide which to prioritize depending on their situation and focus on a limited set to ensure an adequate level of implementation, which is still the great weakness of production policies in the region, including digital ones. For this reason, the next chapter will analyse in detail the governmental framework within which actions have to be prioritized and implemented, including not only the governance of the digital universe at the national level, but also the need to strengthen the actions of the regional cooperation agenda.

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CHAPTER
IV

Digital governance, institutions and agendas

- A. Digital agendas: empowerment and cross-sectoral policies
- B. Competition, privacy and data security at the heart of digital agendas
- C. Fifteen years on from the first regional digital agenda: strengthening competition
- D. The regional digital market at the heart of subregional integration mechanisms

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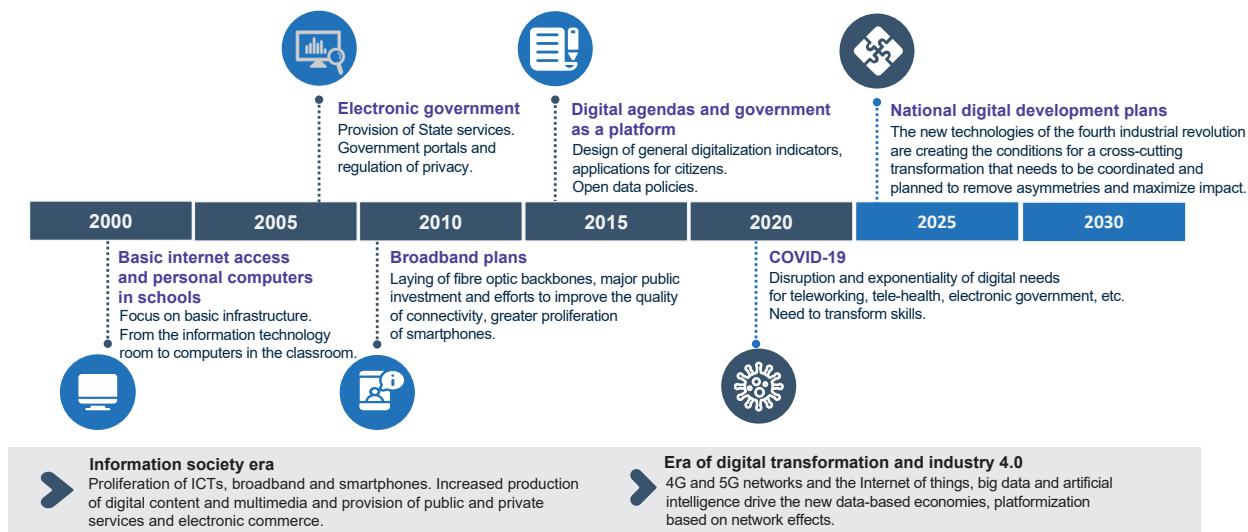
Annex IV.A1

A. Digital agendas: empowerment and cross-sectoral policies

The pandemic has once again highlighted the importance of the State and its institutions in protecting citizens' rights and ensuring that basic educational, health-care and employment needs are met. The Internet and associated technologies have also become essential tools for the continuation of economic and social activities during the crisis. In this situation, digital policies have taken on renewed urgency and importance, given their potential both to maximize the opportunities that arise and to reduce the adverse effects of the crisis. Thus, digital agendas must be at the heart of plans and strategies for economic reactivation and recovery.

The time is now ripe for a digital policy shift, with a move away from policies for the information society towards development agendas based on digital transformation. In other words, it is time to move towards a new era of digital agendas (see diagram IV.1). In 2003 and 2005, the World Summit on the Information Society called for the adoption of information and communications technologies (ICTs) as development tools. This prompted countries to begin developing information society agendas, focused mainly on narrowing the digital divide and boosting e-government and on raising awareness of the possibilities offered by ICTs, particularly in the areas of health and education. The enthusiasm of the early years resulted in institutional adjustments aimed at implementation; over time, however, these agendas lost priority in policy debates and actions.

Diagram IV.1
Towards a new era of digital agendas

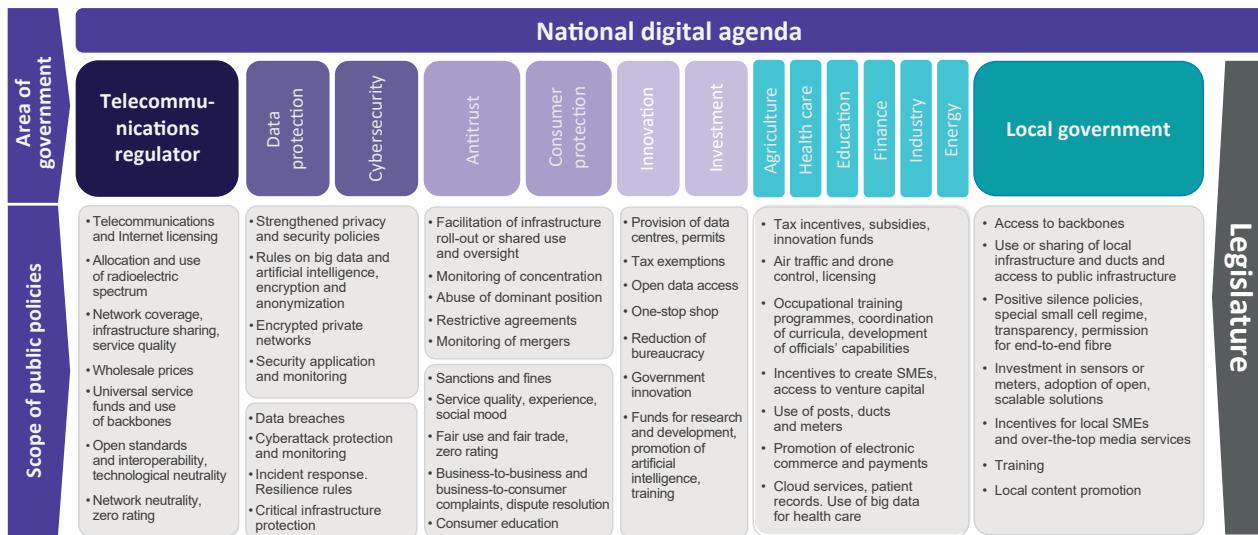


Source: Economic Commission for Latin America and the Caribbean (ECLAC).

The multipurpose nature of digital technologies means that their effects cut across activities and sectors. Moreover, several levels of government have responsibilities related to these technologies and their economic and social effects and to the protection of rights. It is no longer just up to the sectoral body specializing in telecommunications to determine the regulatory approach. Regulatory bodies dealing with data protection, consumer protection and competition also have responsibilities. Digital innovation and investment policies are essential for productivity and economic growth. Meanwhile, local governments are also developing digital technology projects, and their actions need to be coordinated with national policy. Managing this complex web of relationships requires a holistic view of digital policy at the national level and coordination between different actors and levels of government (see diagram IV.2).

Diagram IV.2

Scope of digital policies by area of government

**Source:** Economic Commission for Latin America and the Caribbean (ECLAC).

Out of 27 countries in Latin America and the Caribbean, 16 have current digital agendas that are being implemented, while 11 require reform or renewal in this area. In particular, the great majority of the English-speaking Caribbean countries have digital agendas whose original deadlines have passed and which need revising (see table IV.1). In some countries, the agendas are integrated into national development plans. Although these plans have paid attention to digital policies, the relationship between the two instruments is not always clear and varies between countries. The agendas relate mainly to productivity policies and less to social, institutional and environmental issues (OECD and others, 2020).

Table IV.1

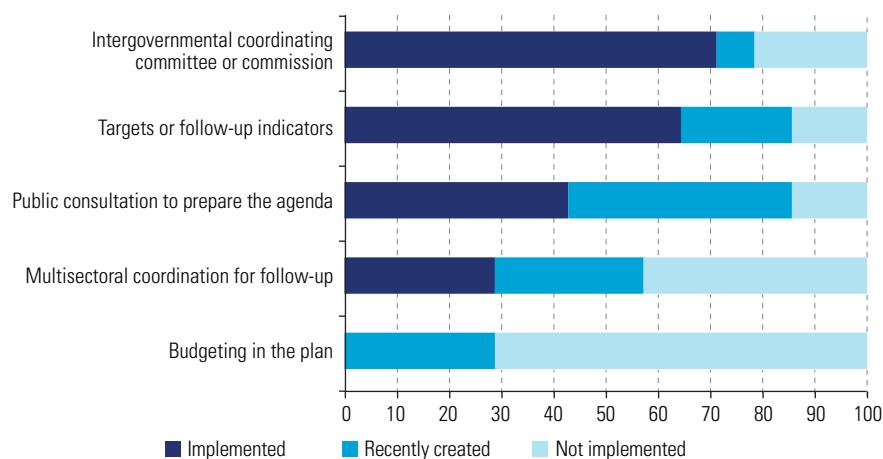
Latin America and the Caribbean (27 countries): state of national digital agendas, 2020

Country	National digital agenda
Argentina	I
Barbados	N
Bolivia (Plurinational State of)	I
Brazil	I
Chile	I
Colombia	I
Costa Rica	I
Cuba	I
Dominican Republic	I
Ecuador	N
El Salvador	N
Grenada	N
Guatemala	I
Haiti	N
Honduras	N
Jamaica	N
Mexico	I
Nicaragua	N
Panama	I
Paraguay	I
Peru	I
Saint Kitts y Nevis	N
Saint Lucia	N
Saint Vincent and the Grenadines	I
Trinidad and Tobago	I
Uruguay	I
Venezuela (Bolivarian Republic of)	N

Source: Economic Commission for Latin America and the Caribbean (ECLAC).**Note:** I: currently being implemented; N: in need of reform or updating.

The success of digital agendas depends on institutional and organizational factors, especially those associated with the formulation of cross-sectoral policies, the establishment of strategic priorities, multisectoral coordination, financing, the application of incentives, the adaptation of regulatory and legislative frameworks and the application of measuring and monitoring instruments. Figure IV.1 details the presence of some of these factors in the digital agendas of 14 countries in the region. The most widespread features are the creation of intergovernmental coordination committees or commissions and the establishment of targets and indicators. In contrast, public consultations on strategy design and the creation of multisectoral coordination mechanisms and explicit budgeting documents in agendas are less common. Although many of the features referred to are mentioned in digital agendas, these elements are not clearly consolidated or, in many cases, have been consolidated only recently. For example, while there are countries with inter-agency coordination mechanisms for following up on their digital agendas, in very few cases have they been consolidated. Likewise, there are few instances of public consultation mechanisms for the design of digital agendas.

Figure IV.1
Latin America and the Caribbean (14 countries):^a institutional characteristics of national digital agendas, 2020
(Percentages of countries)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of Organization for Economic Cooperation and Development (OECD) and others, *Latin American Economic Outlook 2020: Digital Transformation for Building Back Better*, Paris, 2020.

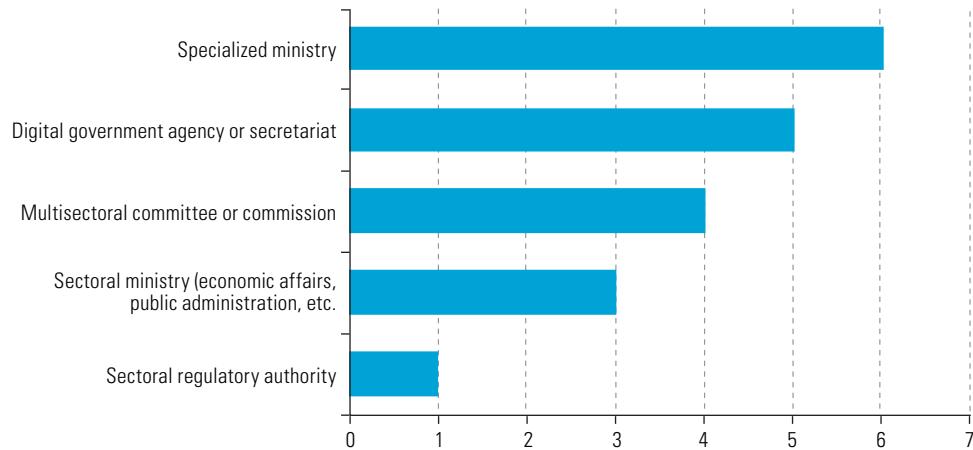
^a Argentina, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Honduras, Mexico, Panama, Paraguay, Peru, Plurinational State of Bolivia and Uruguay.

While the hierarchical level and capacity for institutional coordination of the agency in charge of advancing the digital agenda are crucial to its success, it is also necessary to consider the characteristics of regulations dealing with telecommunications, antitrust issues and consumer and data protection. The scope of regulation, the legal framework, independence, resources and linkages with other State bodies are critical elements of digital policy.

The characteristics of the institution with responsibility for implementing the digital agenda is another determinant of success. Several countries in the region have sectoral ministries specializing in information and communications technologies, telecommunications or science, allowing an appropriate hierarchical level to be assigned to the design and implementation of digital policies (see figure IV.2). In other countries, second-tier entities or bodies have been created to lead these strategies, generally linked to the office of the president, which also ensures that they are highly placed in the hierarchy and have the capacity for coordination. There are also countries with collegiate bodies bringing together the institutions involved in this policy or with sectoral ministries in the areas of economic affairs, trade, industry or public administration heading the agenda (as in the Caribbean countries). In one case, lastly, a regulatory body has been put in charge.

Figure IV.2

Latin America and the Caribbean (19 countries):^a institution heading the country's digital agenda
(Numbers of countries)



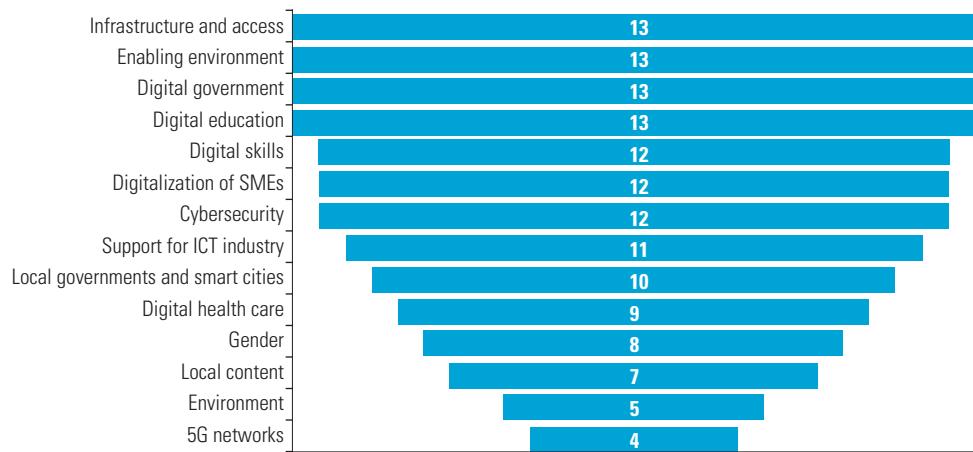
Source: Economic Commission for Latin America and the Caribbean (ECLAC).

^a Argentina, Barbados, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, Grenada, Jamaica, Panama, Paraguay, Peru, Plurinational State of Bolivia, Saint Lucia, Saint Vincent and the Grenadines, Trinidad and Tobago and Uruguay.

As regards the thematic content of digital agendas, the largest number of policy measures are in the areas of infrastructure, access and broadband, enabling environment (regulatory reforms), digital government and digital education (see figure IV.3). Actions linked to digital skills development, digitalization of small and medium-sized enterprises (SMEs) and cybersecurity are included in almost all the countries. Less frequent are policies for the ICT industry, coordination with local governments and health care. Even less consideration is given to issues related to gender, local content, the environment and the development of 5G networks.

Figure IV.3

Latin America and the Caribbean (13 countries):^a policy measures by theme on digital agendas
(Numbers of countries)



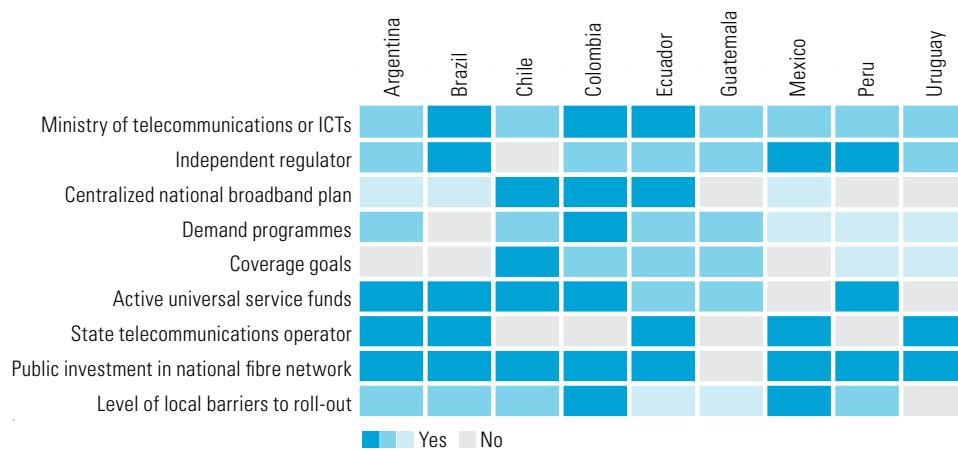
Source: Economic Commission for Latin America and the Caribbean (ECLAC).

^a Argentina, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Honduras, Mexico, Panama, Paraguay, Peru, Plurinational State of Bolivia and Uruguay.

Institutional arrangements for connectivity policies also vary from country to country (see table IV.2). For example, Brazil, Colombia and Ecuador have specialized ministries for ICTs. In other countries, digital and sectoral issues are included in broader ministerial agendas, which means a loss of focus and priority. Where

sectoral regulation is concerned, while most of the countries separate the regulator from the executive branch, there are limits to this independence, such as budgetary dependence or the ability of the government to appoint the agency's authorities. National broadband plans tend to be very general. In some countries they include coverage targets, and most countries set demand targets for providing the service in schools, libraries or public offices (e.g., in Argentina, Chile, Colombia, Ecuador and Peru). Although most of the countries have universal access and service funds financed by private contributions (fixed, mobile and broadband services), not all use them for connectivity. Expenditure is usually less than revenue (56% in Argentina and 75% in Colombia and Peru, for example). In Brazil and Ecuador, these funds tend to be captured by the treasury to reduce the fiscal deficit. In other cases, as in Guatemala, their use is limited to telephony projects.

Table IV.2
Latin America (9 countries): national connectivity policies



Source: Economic Commission for Latin America and the Caribbean (ECLAC).

Note: The darker the colour, the more highly developed the aspect concerned is.

Local regulations can create bottlenecks for infrastructure roll-out. The problem is caused by overlapping regulations at the subnational level and the restrictions that municipalities often place on infrastructure roll-out. In general, municipal autonomy makes it difficult to establish uniform regulations of national scope. Some countries have made efforts to reverse this situation. Costa Rica, for example, encourages municipalities to repeal their regulations and adopt a core set of regulations promoted by the National Institute of Housing and Urban Affairs (INVU). Colombia has introduced national regulations that respect municipal autonomy. The Communications Regulation Commission (CRC) accredits municipalities that are “barrier-free” for infrastructure roll-outs. Those with such accreditation are put on the list of municipalities prioritized to receive funding for connectivity projects.

Similarly, sectoral bodies play a central role in the development of digital policies in areas such as education, health care and security. The design and coordination of these sectoral agendas and programmes varies between sectors and countries. For example, Brazil has a specific agenda in agriculture that is in line with the national plan and is constituted as a national secretariat. In industry, Colombia has iNNpulsa, which implements entrepreneurship, innovation and business productivity programmes. In education, there is greater institutionalization and coordination with national plans. Most of the countries have programmes to provide computers and increase digital access. In health care, Brazil, Chile, Ecuador and Uruguay have special agencies dedicated to the coordination of information and communications technologies, in line with their national digital agendas.

Table IV.3
Latin America (8 countries): sectoral characteristics of digital policy

	Argentina	Brazil	Chile	Colombia	Ecuador	Mexico	Peru	Uruguay
Specific agenda in agriculture	Yes	Yes	Yes	Yes	No	No	No	Yes
In line with the national plan	Yes	Yes	No	No	No	No	No	Yes
Specific agenda in industry	No	No	Yes	Yes	No	No	No	No
In line with the national plan	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Specific agenda in education	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
In line with the national plan	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Specific agenda in health care	Yes	Yes	Yes	Yes	Yes	No	No	Yes
In line with the national plan	Yes	Yes	Yes	Yes	Yes	No	No	Yes

■ Yes ■ No

Source: Economic Commission for Latin America and the Caribbean (ECLAC).

Note: The darker the colour, the more highly developed the aspect concerned is.

Many digital technology development initiatives are carried out by local governments in mobility, security and innovation projects as part of smart city strategies. There are also initiatives led by sectoral ministries in education, health care and government. The regulatory framework is likewise fragmented and falls under the responsibility of different authorities. Consequently, greater coordination of agendas and plans in accordance with the eight key considerations outlined in diagram IV.3 is required to take advantage of the digital transformation.

Diagram IV.3

Key considerations for a national digital agenda



Source: Economic Commission for Latin America and the Caribbean (ECLAC).

B. Competition, privacy and data security at the heart of digital agendas

The role of digital technologies in the economy began to expand significantly more quickly in the first quarter of 2020, when the effects of the pandemic started to be felt. The pandemic has added a new aspect to the discussion on Internet governance, as dealing with it has required full and coordinated deployment of information technologies. This deployment has been generating large amounts of data as a result of the actions of the authorities, medical and research centres, and the population. Substantial incursions have been made into privacy owing to the vast amounts of personal information collected from digital platforms. During the emergency, social networks have been very active in collecting personal information from their users, and the number of active accounts in the world has multiplied as a result of lockdowns.

The security threat from the massive use of sensitive data during the pandemic has prompted various public and private efforts to formulate national strategies that can help address this threat in a coordinated manner.¹ Data protection regulations have evolved significantly in Latin America and the Caribbean in recent months, partly under the influence of the European Union's General Data Protection Regulation (GDPR), and regulatory and institutional frameworks for data protection are being updated. Thus, Brazil and Colombia have amended their regulations to create the post of data protection officer and a data protection performance evaluation system, as provided for in the GDPR framework (OECD and others, 2020).

Cybersecurity regulations in the region focus on data protection, mainly to prevent theft and tampering, interference with the operation of computer systems and attempts to erase, delete or block access to data.² However, cybersecurity standards do not provide for the protection of critical infrastructure, where there may be threats to the supply of public services (water, electricity, telecommunications, transport, logistics chains and port systems, among others).³

The digital economy could treat data protection as a dimension of the welfare State (Costa-Cabral and Lynskey, 2017),⁴ which implies that the quality of data protection should be regarded as a competitive asset for companies that needs to be part of competition analyses. Data are a highly coveted asset, as innovation, dominant positions and even market capitalizations are data-driven (Da Silva, De Furquim and Núñez, 2020). The accumulation of data and the advantages that firms derive from their use also give rise to incentives for misuse (e.g., excessive mining) and concerns about data privacy and protection. Data-opolies therefore give cause for concern about data protection, privacy and competition.

Since data are the main factor of production in the digital economy and are therefore competitive assets, regulation must ensure that they are not used or held in an anti-competitive way, so that actors are given fair access to them. Traditional antitrust policies have not been linked to privacy regulation. The dominance of digital platforms blurs the boundary between antitrust and privacy regulations (Economides and Lianos, 2020). In a context of digitalization, determining data ownership is a critical issue for regulation. Generally, a competition law analyses market failures and their impact on consumer welfare. In contrast, data protection and privacy regulations adopt a fundamental rights perspective, which means that dominance on digital platforms is examined from other angles.

The development of production structures based on smart connected systems is driving the ongoing merger between the digital economy and the real or traditional economy, as discussed in chapter I. Companies are pursuing two strategies to cope with this transformation. First, they are developing digital capabilities of their

¹ The larger a digital platform is, the more prone it will be to cyberattacks. The Internet of things brings additional challenges for the security of personal information collected through machine-to-machine interactions (Bustillo, 2021).

² Between June 2019 and June 2020, ransomware attacks grew by 108% year on year and attacks on networks in the Internet of things grew by 833% year on year (Check Point Software Technologies, 2020).

³ For example, attacks on companies in logistics and transport chains grew by 78% year on year during 2019, placing the sector third behind financial services and retail with 10% of all attacks worldwide. The region's countries rank in the top quarter of the world's most targeted countries (Díaz, 2020).

⁴ However, this has been countered with the argument that the standard of consumer welfare is governed by economic principles and that competition authorities lack the legal powers and technical expertise to incorporate non-economic concerns into their sphere of competence (Costa-Cabral and Lynskey, 2017).

own and may even transform themselves into digital service providers. Second, they are using mergers and acquisitions and strategic partnerships with global platforms or digital natives to acquire capabilities that are enabling them to adapt their offerings to the new kinds of demand. Thus, the boundaries between traditional industries are blurring, giving rise to new industrial and sectoral structures (e.g., a fintech can be classified within the technology services or financial services category). This convergence is shifting the boundaries of markets and industries, altering the ground rules, affecting competition and challenging regulatory models.

In the post-pandemic world, where the role of digital technologies and platforms will have been strengthened, it will be essential to create regulatory and institutional frameworks to prevent the abuse of market power arising from concentration and incentivize competition. The regulatory model will depend on the type of platforms involved: (i) those using general search engines to provide access to information or content, (ii) those providing access to personal data and other “private” content, (iii) those providing access to goods or services offered by third parties or by “collaborative economy” platforms, (iv) those providing access to labour or particular skills based on expertise and (v) those providing access to capital, such as crowdfunding, payment systems or cryptocurrency sites (ECLAC, 2020a).

While accessing databases is difficult, building them is even more challenging because of network effects. Data are a driver of takeovers and the reason for many monopoly positions. They are thus a strategic asset that poses risks to competition. Data-driven and predatory acquisitions are an important part of technology firms’ strategies (see figure IV.4).

Figure IV.4
Firms leading acquisitions globally, 2020
(Numbers of acquisitions)



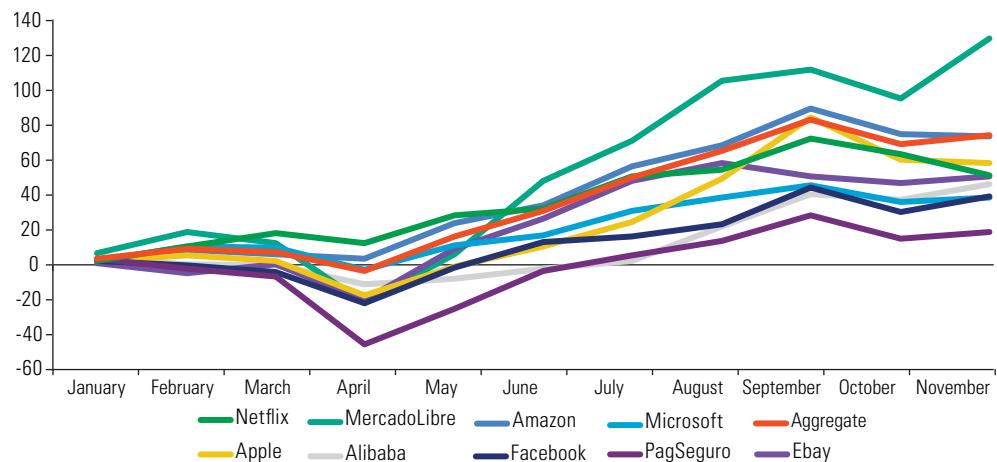
Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of Crunchbase [online database] <https://www.crunchbase.com/>; E. Da Silva, J. De Furquim and G. Núñez, “La libre concurrencia en la economía digital: las mipymes en América Latina y el impacto del COVID-19”, Santiago, Economic Commission for Latin America and the Caribbean (ECLAC), 2020, unpublished.

Restrictions on data access can prevent companies from offering goods and services at competitive levels. This affects their survival in data-driven markets and can weaken competition (Annual Conference of Executives (CADE), 2019). In strategic terms, data can become barriers to entry for new competition, as they can facilitate collusive agreements (algorithms that automate pricing agreements) and affect third markets (data collected by a company in one sector can be used to learn about and cater to consumers in another sector) (Da Silva, De Furquim and Núñez, 2020).

Figure IV.5 shows the trend in the market capitalization of the world’s and the region’s leading platforms. During the pandemic, the centrality of digital services increased the market value of firms in the digital sector, particularly platforms. This contrasts with the situation of many firms in the analogue economy that were adversely affected by the suspension of economic activities and the disruption of value chains.

Figure IV.5

Latin America and the Caribbean and the rest of the world: market capitalization of leading platforms, December 2019 to October 2020
(Percentages)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of Macrotrends [online] <https://www.macrotrends.net/>.

The conclusions of the above analysis highlight the need to develop strategies and policies tending towards the integration of antitrust and data protection measures to ensure market access without jeopardizing the security of the parties involved. There is a need to reduce distortions to competition and innovation (predatory practices) that favour technology giants, but without hindering national or regional innovation and entrepreneurship (start-ups). While the protection of intellectual property rights can incentivize innovation, it can also restrict access to data derived from research.¹ Restrictions on the flow of research data increase costs. One alternative that has been put forward is the centralization of data by government entities to secure inputs for innovation. Policymakers need to strike a balance between data-supported innovations, cross-border data transfer and the safeguarding of consumer privacy.

To improve the competitive position of micro, small and medium-sized enterprises (MSMEs) in the digital economy, governments must guarantee the free flow of data (e.g., through a fee-based data marketplace) and an adequate level of data protection. They must ensure that data are not used or held in an anti-competitive way and that actors have fair access to them. In the recovery from the pandemic, alternatives that could be explored include the creation of data cooperatives allowing small and medium-sized enterprises to aggregate their databases in order to attain a significant volume with which they can use big data techniques (Da Silva, De Furquim and Núñez, 2020).

The intensive use of data requires effective monitoring by market regulators. Thus, data risk, as an intangible asset, should be at the centre of investment analysis. In general, the level of risk associated with intangibles is higher than that associated with physical or financial assets. This translates into higher risks for companies that accumulate data and for investors in these companies' shares. The State can play a role as a market maker: its actions could reduce uncertainties and information asymmetries and thus facilitate price allocation (De Carvalho, 1992).

In the absence of markets for data or intangibles, it is difficult to assign a monetary value to platform-based business models. The lack of such markets can also increase risks, which poses a twofold problem: the valuation of such assets and the implementation of regulations. First, lack of liquidity and restricted risk-sharing opportunities increase the risk associated with investments in intangible assets. Second, regulators can improve the allocation of resources and make information about such assets more transparent to reduce

¹ According to OECD and others (2020), data access and sharing generate social and economic benefits worth between 0.1% and 1.5% of GDP for public sector data and between 1% and 2.5% of GDP (up to 4% in some studies) when private sector data are included.

market failures (information asymmetry and uncertainty constraining the calculation of the risk associated with the asset) and thus foster competition. The formalization of intangibles markets can be an incentive for firms, mainly smaller ones, to enter these markets. This points to the need to coordinate data protection, security, market access and competition.

C. Fifteen years on from the first regional digital agenda: strengthening competition

The High-level Panel on Digital Cooperation, convened by the Secretary-General of the United Nations, concluded its work in June 2019 with the presentation of the report *The Age of Digital Interdependence* (see table IV.4).¹ This showcases a set of recommendations on how the international community could strengthen the use of digital technologies and mitigate their risks, turning on five areas: (i) building an inclusive digital economy and society; (ii) building human and institutional capacity; (iii) protecting human rights and human agency; (iv) promoting digital trust, security and stability; and (v) fostering global digital cooperation. On this last point, the report notes that the current digital cooperation architecture has become highly complex and fragmented, and that it is particularly difficult for the voices of developing countries, small and medium-sized enterprises, marginalized groups and other stakeholders with limited budgets and expertise to gain a hearing in it (United Nations, 2020b).

Table IV.4

Actions recommended to improve digital cooperation in the report *The Age of Digital Interdependence* by the Secretary-General of the United Nations

Recommendations	Connectivity	Digital public goods	Digital inclusion
1. Build an inclusive digital economy and society	Achieve universal connectivity by 2030: everyone should have secure and affordable Internet access.	Promote digital public goods for a more equitable world: public and open-source software should be adopted and supported.	Ensure digital inclusion for all, including the most vulnerable: underserved groups need equal access to digital tools.
2. Create human and institutional capacity	Creation of digital capacity		
	Strengthen the creation of digital capacity: the development and formation of skills are necessary everywhere.		
3. Protect human rights and human agency	Digital human rights	Artificial intelligence	
	Ensure the protection of human rights in the digital age: human rights apply both online and offline.	Support global cooperation on artificial intelligence that is reliable, human rights-based, secure and sustainable and that promotes peace.	
4. Promote digital trust, security and stability	Digital trust and security		
	Foster digital trust and security: call for a global dialogue to promote the Sustainable Development Goals.		
5. Foster global digital cooperation	Global digital cooperation		
	Build a more effective digital cooperation architecture: make digital governance a priority using the United Nations approach.		

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of United Nations, *The Age of Digital Interdependence*, New York, 2020.

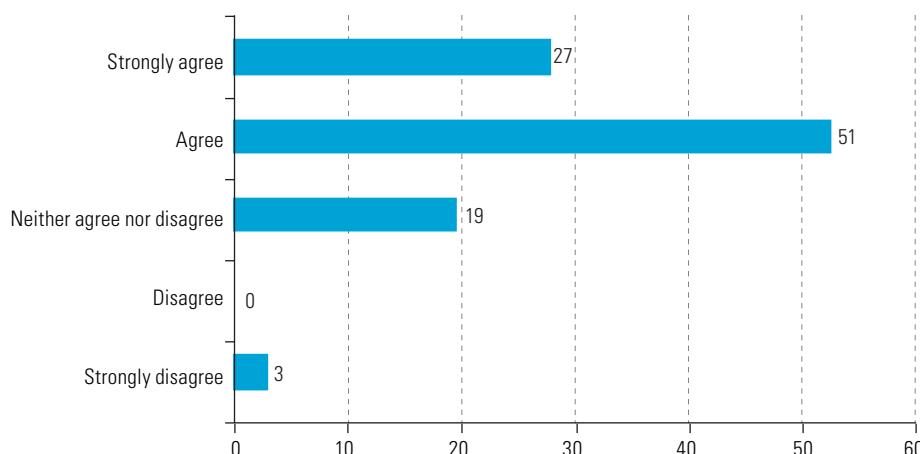
¹ The purpose of the report was to advance proposals for strengthening cooperation in the digital space among governments, the private sector, civil society, international organizations, the technical and academic communities and all other relevant stakeholders.

The United Nations would become a platform for multi-stakeholder policy dialogue on emerging technologies (United Nations, 2020a). In this context, three components are suggested to strengthen a new model of international cooperation: (i) nationally driven development processes by strengthening institutional capacities, (ii) inclusive multilateral governance platforms to facilitate exchange on an equal footing and (iii) inclusion of new tools and actors within instruments to coordinate policies at the international level (OECD and others, 2020). These recommendations should be applied in the digital sector and in the institutional and cooperation arrangements of the regional digital agenda, taking advantage of its multisectoral and multilevel character.

At the same time, recent surveys of experts and opinion leaders in the region have found that 78% agree that Internet-related cross-border legal challenges will become more acute in the next three years (see figure IV.6). At the same time, 73% agree or strongly agree that there is a demand for coordination to address cross-border legal challenges, and 61% believe that the region has the right institutions to address these challenges.

Figure IV.6

Will Internet-related cross-border legal challenges become increasingly acute in the next three years?
(Percentages of all respondents)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), *Key findings of the Internet & Jurisdiction and ECLAC: Regional Status Report 2020* (LC/TS.2020/68), Santiago, 2020.

The digital agenda follow-up mechanism can be strengthened in different dimensions so that it can play a more active role in capacity-building and in the design of agendas and policies in the countries, as well as in facilitating coordination with the digital actions being carried out in the region's various trade blocs (see table IV.5). The digital agenda could facilitate the identification of common projects and challenges in which it is advisable to act jointly as a region, e.g., digital identity, cybersecurity, education and migration issues. It could also generate joint actions by the actors participating in the mechanism, strengthening their coordination with other spaces for debate such as the regional Internet Governance Forum (IGF). There is likewise scope to design new instruments to strengthen cooperation between countries and technology transfer.

Table IV.5

Role of the Digital Agenda for Latin America and the Caribbean (eLAC2020) in strengthening digital cooperation in the region

Dimension	Description	Application to digital cooperation	Possible areas of cooperation in the framework of the region's digital agenda
Building domestic capacities	Strengthening countries' capacities to design, implement and evaluate development policy priorities and plans, encouraging alignment between domestic and international priorities and ensuring integrated approaches to more complex and interlinked challenges.	Encouraging initiatives that build Latin American and Caribbean countries' capacities to overcome several of the development traps. Building a regional digital market to tap into Latin America and the Caribbean's digital potential. Fostering cooperation at the multilateral level on issues such as digital taxation.	Generating support mechanisms for the design of the digital agenda and digital policies. Providing technical support for the design of regional digital market strategies and their coordination between the different integration blocs (Pacific Alliance, Southern Common Market (MERCOSUR), Mesoamerica Project).
Working inclusively	Engaging countries at all levels of development on an equal footing in building and participating in multilateral and multi-stakeholder partnerships to tackle shared multidimensional development challenges with multidimensional responses.	Engaging in partnerships that promote a human-centred and multidimensional approach to Latin America and the Caribbean's digital development. Articulating all levels of digital development and involving multiple stakeholders such as the private sector and civil society within the regional digital market. Strengthening the involvement of Latin American and Caribbean countries on an equal footing in multilateral and multi-stakeholder initiatives on issues such as digital taxation.	Generating joint work agendas with different private actors, civil society and the technical community on priority issues. Engaging other public sector bodies besides those directly involved in ICT fields in a joint work agenda. Strengthening cooperation with other spaces (e.g., the Regional Preparatory Meeting for the Internet Governance Forum).
Operating with more tools and actors	Expanding instruments for greater international cooperation (e.g., knowledge sharing, policy dialogues, capacity-building, technology transfers) and including more actors (e.g., public actors) in a whole-of-government approach.	Promoting technical assistance and technology transfers through bilateral, multilateral, interregional, triangular and South-South cooperation for the development of Latin America and the Caribbean's digital capacities. Establishing policy dialogues and encouraging knowledge sharing and capacity-building between Latin American and Caribbean countries within a regional digital market. Fostering new multilateral cooperation initiatives on key global digital issues.	Designing instruments (appropriate technology programmes, technology transfer, etc.) to strengthen cooperation between countries. Maintaining a continuous dialogue on digital policies and identifying important issues.

Source: Organization for Economic Cooperation and Development (OECD) and others, *Latin American Economic Outlook 2020: Digital Transformation for Building Back Better*, Paris, 2020.

At the seventh Ministerial Conference on the Information Society in Latin America and the Caribbean, the countries of the region agreed on a regional digital agenda running up to 2022. It includes eight areas of action: (i) digital infrastructure, (ii) digital transformation and the digital economy, (iii) digital government, (iv) inclusion and digital skills and other competencies, (v) emerging technologies for sustainable development, (vi) trust and digital security, (vii) the regional digital market and (viii) digital regional cooperation. In addition, it includes a specific section on combating the COVID-19 pandemic and on the role of digital technologies for economic recovery and reactivation, identifying 39 specific goals for implementation (see annex).

D. The regional digital market at the heart of subregional integration mechanisms

On the basis of the agreements adopted at the Ministerial Conferences on the Information Society in Latin America and the Caribbean held in 2015 and 2018, and with the support of ECLAC, the countries of Latin America and the Caribbean initiated a debate on the opportunity presented by the creation of a regional digital market. They also discussed the measures needed to achieve this goal, which requires the establishment of a regional strategy to increase trade, expand the digital economy and strengthen competitiveness through regulatory consistency, infrastructure integration, the development of digital platforms, ease of cross-border data flows and trade facilitation measures. Among these points, the advisability of working on regulatory harmonization stands out as an important aspect where much remains to be done in some trade blocs, such as the Pacific Alliance and the countries of the Mesoamerica Project.

Fragmentation into different markets for the development of telecommunications infrastructure can be a barrier to exploiting economies of scale and to developing operators in integrated digital markets (Cullen International, 2016). This can be seen when large economic blocs with few operators and economies of scale (the United States and China have single markets of 330 million and 1.4 billion customers, respectively, served by four or five large operators) are compared with the European Union, where there are hundreds of operators serving a market of 510 million customers.

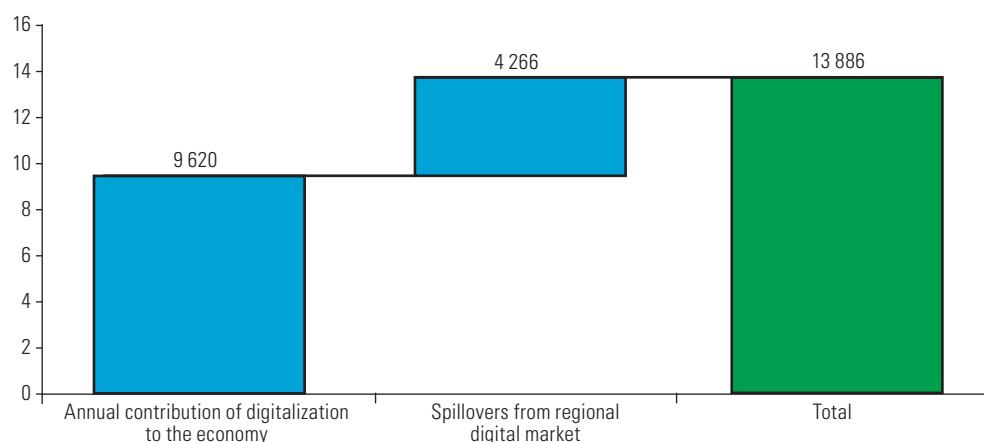
While fragmentation may not be a drawback in the countries of the region, insofar as the same telecommunications operators are present, there is consensus on the need to work on the harmonization of regulatory environments to promote the digital economy. This is particularly necessary in areas such as consumer protection, personal data protection, identity, digital payments and securities, transport and logistics standards, and tax regimes (ECLAC, 2020c). Progress thus needs to be made with regulatory harmonization to take advantage of economies of scale.

On this premise, several blocs in the region have initiated efforts to design or revise their digital integration strategies. In particular, the Pacific Alliance has proposed the design of a regional digital market strategy that would create the conditions for greater market scale, better coordination of resources and lower transaction costs. A larger scale would allow for further-reaching development of digital services and products, with a view to creating a platform and content industry that would allow Pacific Alliance countries to compete in this segment on a global scale. The regional digital market could also be an instrument for the coordination of technological research and development and innovation resources. Lastly, regulatory harmonization could reduce transaction costs, as companies would be operating in a more homogeneous and unfragmented regulatory environment.

The economic impact of such initiatives can be observed in other regions and blocs. For example, since the formation of the digital single market strategy in the European Union, its degree of digitalization has grown by more than that of other OECD countries that are not part of this zone.¹ The implementation of a regional digital market among the Pacific Alliance countries could increase the annual impact of digitalization on GDP from US\$ 9.62 billion to US\$ 13.886 billion, taking into account only the spillovers from the creation of this market (see figure IV.7).

Figure IV.7

Increase in GDP produced by the spillovers from a regional digital market among the Pacific Alliance countries
(Billions of dollars)



Source: Economic Commission for Latin America and the Caribbean (ECLAC).

¹ The index of digitalization in the European Union has grown at a compound annual rate that is on average 1.12 times as high as in OECD countries outside the Union.

Another integration initiative is the Mesoamerican Digital Agenda, which coordinates the efforts of the member countries of the Mesoamerica Project.¹ One of its initiatives is to develop telecommunications and digital economy infrastructure in the subregion, the two being closely linked. The implementation of the Agenda could generate additional value of US\$ 3.305 billion over five years. For its part, the Caribbean Community (CARICOM) has a strategy which is the digital component of the CARICOM single market, aimed at creating a borderless ICT space that fosters economic, social and cultural integration. The initiative encompasses ICT policies, legislation, regulations, technical standards, best practices, networks and services to harmonize them regionally (OECD and others, 2020). Another initiative is that of the Southern Common Market (MERCOSUR), which established the Digital Agenda Group (GAD) in 2017 with the objective of “promoting the development of a digital MERCOSUR” (MERCOSUR, 2020). The GAD negotiated its first Action Plan (2018-2020) in 2018, with commitments on digital infrastructure and connectivity; security and trust in the digital environment; the digital economy; digital skills; digital government, open government and public innovation; technical and regulatory aspects; and coordination in international forums (MERCOSUR, 2020).

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¹ Comprising Belize, Colombia, Costa Rica, the Dominican Republic, El Salvador, Honduras, Guatemala, Mexico, Nicaragua and Panama.

Annex IV.A1

Digital Agenda for Latin America and the Caribbean (eLAC2020)

A. Background

1. The 2030 Agenda for Sustainable Development marks the entry of a new era and a time of opportunity when the dissemination and adoption of new technologies and global interconnection, and in which information and communications technology (ICT), offer enormous potential for accelerating human progress, facilitating access to information and developing knowledge societies. The 2030 Agenda also acknowledges the critical nature of scientific and technological innovation in areas that are vital to development such as health and energy. Both the Sustainable Development Goals (SDGs) of the 2030 Agenda and the Agenda itself expressly include ICT as an essential tool for improving the quality of education, promoting women's empowerment, driving inclusive and sustainable industry and promoting innovation, as well as part of the means of implementation of the Agenda.¹

2. In 2020, it will be 15 years since the Plan of Action for the Information Society in Latin America and the Caribbean (eLAC2007) was adopted in Rio de Janeiro (Brazil) in June 2005. This cooperation mechanism has been renewed over the years, and was last updated during the sixth Ministerial Conference on the Information Society in Latin America and the Caribbean, held in Cartagena de Indias (Colombia) in April 2018, where the Digital Agenda for Latin America and the Caribbean (eLAC2020) was adopted and it was agreed to hold the seventh Ministerial Conference in 2020.

3. The present situation caused by the coronavirus disease (COVID-19) pandemic forms a new and complex global panorama, characterized by an economic and social collapse of unforeseen magnitude. In this new reality, digital technologies have proven to be essential tools to facilitate physical distancing and mitigate the economic and social effects of the crisis. Adoption of these technologies has also accelerated considerably during this period, providing solutions for trade, labour, education and health. However, the coverage and use of digital technologies are still determined by structural and socioeconomic factors. In the medium and long terms, social welfare will clearly not be possible without access to and use of digital technologies in all areas of economic and social life.

4. The Digital Agenda for Latin America and the Caribbean is intended as a catalyst for regional cooperation on digital matters and a mechanism to promote policy design, capacity-building and political dialogue on the challenges and opportunities that the digital transformation creates for society and the economy. Technological progress, coupled with the challenges of the crisis, calls for renewed cooperation that facilitates the expansion of the digital economy to all segments of the population but also promotes trust and security in the use of digital technologies.

5. A cooperation agenda is needed to address the short-, medium- and long-term challenges associated with digital inclusion. To respond to the challenges the region faces in this area, the Digital Agenda for Latin America and the Caribbean (eLAC2022), presented below, includes 8 areas of action —in addition to a section on the fight against the pandemic and economic recovery and reactivation— and identifies 39 specific goals for implementation. This Agenda was formulated based on a survey of eLAC2020 focal points and observers, consultation with working groups and a review of documents. The Agenda aims to follow on from previous agreements and provide inputs for political dialogue at the seventh Ministerial Conference on the Information Society in Latin America and the Caribbean.

¹ General Assembly resolution 70/1 of 25 September 2015.

B. Areas of action and goals

1. Digital infrastructure

- Goal 1: Adopt policies, digital agendas and plans with specific targets relating to affordable universal access, which encourage deployment of broadband connections and resilient high-capacity networks, through an appropriate balance of public investment and the promotion of competition within an investment-friendly environment.
- Goal 2: Promote broadband access and connectivity that is meaningfully affordable and of sufficient quality in remote, rural and semi-urban areas, fostering the development of alternative connectivity providers such as community networks, rural operators and cost-efficient technologies, through alternative and sustainable investment models.
- Goal 3: Foster policies and incentives for the deployment, sharing and operation of the enabling infrastructure and technologies needed for the development of the Internet, especially by promoting the establishment and strengthening of Internet exchange points (IXPs) and adoption of Internet Protocol version 6 (IPv6) protocols, through multi-stakeholder approaches.
- Goal 4: Formulate plans and strategies that facilitate the efficient and effective provision, management and use of radioelectric spectrum in accordance with international standards and recommendations, to promote the harmonized deployment of fifth-generation mobile technology (5G) in all countries of the region, taking into account the need for appropriate metrics to measure the efficient use of the spectrum.
- Goal 5: Promote the strengthening or creation of specialized digital and connectivity infrastructure to boost education, science and technology in the region as fundamental pillars of economic and social development and to accelerate processes of digital transformation.

2. Digital transformation and the digital economy

- Goal 6: Promote digital presence and effective adoption, dissemination and use of advanced digital tools related to Industry 4.0 to foster business productivity and competitiveness, as well as entrepreneurship and structural change, with a focus on small and medium-sized enterprises (SMEs) and women-led initiatives.
- Goal 7: Incentivize entrepreneurial ecosystems and public and private collaboration to promote production linkages and innovation, and to accelerate technology-based enterprises, through incubators, accelerators, business networks and digital ecosystem observatories.
- Goal 8: Stimulate the diversification of financing options for technology-based enterprises, including alternative sources of financing supported by systems such as targeted trusts, person-to-person loans and financial services through digital and other platforms and use digital technologies to reduce information asymmetries and barriers to access to capital markets, in accordance with domestic legislation and based on an appropriate regulatory framework that balances innovation, stability and security.
- Goal 9: Address the emerging challenges of the digital economy by updating rules and regulations on taxation, labour, competition and international trade, within a framework that safeguards rights and promotes sustainable development, taking into account the differences between countries that could hinder progress.
- Goal 10: Strengthen the political and regulatory frameworks to facilitate digital transformation processes and their linkages with national education, research and innovation systems.

3. Digital government

- Goal 11: Promote open standards, based on the principle of technological neutrality, that facilitate and expedite government services and promote multichannel and multidevice services, fostering an interoperable regional environment through data exchange and the development of infrastructure, platforms, architectures, standards, integrated systems and computer interfaces that ensure digital transformation.
- Goal 12: Foster the adoption of a regional strategy of standards and agreements for digital identity interoperability, digital signature, e-apostille and electronic medical records that support innovations in the public and private sectors, safeguarding data privacy, enabling public consultation, ensuring transparency and non-discrimination and strengthening security and trust in online services.
- Goal 13: Promote the use of digital tools for government procurement and contracts for public services and works, to ensure transparency, services for citizens, civic oversight and effective accountability.

4. Inclusion and digital skills and other competencies

- Goal 14: Promote the development and incorporation of digital skills and competencies in science, technology, engineering and mathematics into teaching and learning by updating curricular content, digital educational resources and teaching standards according to the skills that will be demanded by the activities of the future.
- Goal 15: Strengthen advanced digital, technical and professional skills and competencies and establish incentives for companies and governments to provide opportunities for continuous learning to workers, based on individual and local needs and labour market requirements.
- Goal 16: Promote a digital culture that incentivizes appropriation of technology and development of digital skills and competencies, for the innovative, ethical, safe and responsible use of ICT to promote digital inclusion.
- Goal 17: Promote accessibility of digital technologies as a necessary resource for the inclusion of persons with visual, auditory, mobility, motor and cognitive disabilities, among others, in work, education, health, culture, access to justice, public services and smart cities.
- Goal 18: Establish a comprehensive and non-discriminatory perspective in public policies for digital inclusion, guaranteeing full access and use of ICT and emerging digital technologies for women, girls and older persons and promoting their online participation and safety, as well as women's leadership in public and private decision-making spaces.
- Goal 19: Promote telework in the region, updating labour policies to ensure adequate social protection, social dialogue, decent work and participation of workers in the digital economy, above all in the case of vulnerable groups and women.

5. Emerging technologies for sustainable development

- Goal 20: Promote technological development and digital and data innovation through incentives for development of new products and services, provision of public and private financing, a flexible regulatory environment and consolidation of a digital ecosystem.
- Goal 21: Encourage open access to data and its reuse in the public and private sectors, to drive innovation, co-creation of value, new products and services, and evidence-based policymaking.
- Goal 22: Consider the use of emerging technologies, especially artificial intelligence and 5G technology, in a convergent and interoperable manner, taking into account factors relating to ethics, impartiality, transparency, accountability, security, privacy and non-discrimination.

Goal 23: Promote the use of digital technologies to prevent, mitigate and adapt to the effects of climate change and natural disasters, reduce greenhouse gas emissions and promote sustainable development.

6. Trust and digital security

- Goal 24: Combat digital crime by formulating public policies and cybersecurity strategies for critical infrastructure protection, by developing or establishing regulatory frameworks aligned with international human rights instruments, building capacities, strengthening secure systems based on best practices, and by coordinating at the local, regional and international levels among cyber incident response teams and among stakeholders.
- Goal 25: Coordinate multi-stakeholder actions aimed at ensuring privacy and personal data protection, the protection of consumers and their rights on online platforms, access to public information and freedom of expression in the digital environment, restricting improper and unauthorized use of data and strengthening mechanisms of collaboration between the competent authorities in the region.
- Goal 26: Promote civil society participation in assessment, mediation, transparency, capacity-building and consumer protection.

7. Regional digital market

- Goal 27: Promote a regional digital market strategy, including in the framework of regional and subregional integration mechanisms, that facilitates cross-border e-commerce and digital trade through integration of digital infrastructure, regulatory harmonization, free flow of data with trust, in accordance with domestic legislation; trade facilitation; improved postal and logistics services; and regulatory frameworks that encourage innovation in digital payment services.
- Goal 28: Facilitate greater regional coordination through a digital integration plan that establishes a common vision and goals, with mechanisms for dialogue and coordination with existing regional and subregional organizations.

8. Digital regional cooperation

- Goal 29: Promote strengthened regional digital cooperation in Internet governance processes by reinforcing national, regional and subregional multi-stakeholder dialogue mechanisms.
- Goal 30: Strengthen the institutional structure of the entities responsible for designing, implementing and following up on digital agendas. Formalize and coordinate multi-stakeholder participation in the development of such policies.
- Goal 31: Promote digital regulatory coherence at the regional level, especially on data protection, cross-border data flows, cybersecurity, e-commerce and digital trade, consumer protection and rights on online platforms, and interoperability between digital signatures and digital identity systems in the region, in line with domestic policy and regulatory frameworks.
- Goal 32: Improve the measurement of digital transformation and the digital economy by strengthening data collection, analysis and review for official statistics, use of new methods and advanced technologies such as big data analytics, strengthening and harmonization of common frameworks of indicators and their monitoring and evaluation through regional observatories.

9. Combatting the pandemic and facilitating economic recovery and reactivation

- Goal 33: Design strategies for economic recovery and reactivation based on productive digital transformation and the use of ICTs and which encourage inclusive innovation and changes in management, production and business models, with a special focus on SMEs.
- Goal 34: Promote comprehensive policies on information management in the different key government areas to address the pandemic and enable coordination of testing, dissemination channels, communication, services, epidemiological forecasting and limitation of physical contact between people.
- Goal 35: Implement specific measures to promote and expand access and continuity of access to quality Internet services and digital platforms, preserving in particular the open architecture and interoperability of the Internet, and addressing the affordability of connectivity and devices.
- Goal 36: Strengthen the institutional and regulatory frameworks for data protection and privacy, providing a guarantee to citizens that the exceptional access to personal data required to deal with a crisis, such as the COVID-19 pandemic, entails adequate custody of the data, and that their privacy will be safeguarded.
- Goal 37: Strengthen distance education programmes in national education systems, considering the use of digital tools specifically designed for low-connectivity settings, in addition to supporting the training and digital literacy of teachers and the development of digital educational content.
- Goal 38: Promote strategies and programmes in the field of digital health, considering aspects such as training of health professionals, promotion of telemedicine services, interoperability of health information and records systems, regulations to protect patient privacy and validation of the use of emerging technologies, and new means of delivering health services.
- Goal 39: Accelerate the creation of affordable services and online government solutions that allow citizens to be served remotely, to facilitate physical distancing, through the use of digital identification systems.

Fifteen years after the adoption of the first Digital Agenda for Latin America and the Caribbean, the region is facing a new world. Some of the expectations of that time have been fulfilled, but others have not. Growth in digital technologies has been exponential and they are now used worldwide, but this has been accompanied by negative social repercussions. The region has yet to strike the right balance between the benefits and costs of digitization in a more adverse global situation, exacerbated by the coronavirus disease (COVID-19) pandemic.

This document contributes to discussion on the use and deployment of digital technologies for more inclusive and sustainable development and to related actions. It is divided into four chapters that analyse the potential effects of digital disruption, the impact on well-being and equality, the costs of universalizing Internet access, the relationship between digitization and productivity, the impact of digitization on various production chains, and the need for specific policies to recover from the effects of the pandemic with a transformation of production. The report also examines the state of digital agendas in the region, particularly in terms of data management, and concludes with some recommendations for strengthening regional cooperation and a process leading to the formation of a regional digital market.

