



Is existing digital infrastructure a constraint on recovery?

Background

Since the end of 2019, the COVID-19 pandemic has presented the world with its worst health crisis since the Second World War. As a result, the leaders of the region's nations have had to take a series of decisions and immediate actions



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Although the coronavirus disease (COVID-19) pandemic has had a heavy impact across all of society's activities, it has remained possible to carry on many daily activities thanks to the availability and use of technologies that facilitate communication and coordination between people and organizations. The key role that technological infrastructure has played in reducing the impact of the pandemic points up the need to anticipate the role it will play in the "new normal" situation, which will pose a challenge to recovery in Latin America and the Caribbean.

This *FAL Bulletin* aims to answer the question of whether the technological infrastructure available in the region is a constraint on post-pandemic recovery. It shows why existing technological infrastructure is not a constraint on recovery but rather the opposite, emphasizing the key role infrastructure has played in reducing the pandemic's impact. It concludes with a set of considerations and recommendations, highlighting the importance of continuing to develop technological infrastructure in the region.

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to minimize its impact; at the same time, to keep on offering their goods and services, industries and organizations have had to adapt to new and unforeseen circumstances, adhering strictly to the required safety measures without letting quality suffer. These actions did not go unnoticed at the regional economic level, given that the measures and restrictions imposed generated an economic impact in the region that by 2020 was already projected to drive regional GDP down 8.7%, compared to the 3.9% drop worldwide, according to consensus at Bloomberg (Cont and others, 2021).

During this period, the pandemic affected businesses of all sizes and forced technology and innovation leaders to find ways of turning these challenges and constraints into opportunities for the region's businesses, while also beginning to establish a vision for the future that includes key drivers of recovery and reinvention.

The economic and social dynamic that emerges from that process will be different—and the challenge is that its shape is not yet entirely clear. One thing is for sure, however: digitalization will be one of its core elements. For that reason, the pandemic has been called the great accelerator of industries' digital transformation: unlike in the past, when it could take a decade or more for emerging technologies to begin driving productivity, technology has been key to the mitigation actions lately taken by governments, and indeed the prime mover therein. For example, in a survey conducted by the global consulting firm McKinsey & Company and published in October 2020, it was determined that under the new scenario companies were three times likelier than pre-crisis to conduct at least 80% of their customer interactions digitally (Sneider and Singhal, 2021).

Again, it will be difficult in future to return to the work model that prevailed before the pandemic, which has disrupted—and will continue to disrupt—everything from citizens' work routines to the region's overall economic activity. Therefore, organizations that have not yet done so must immediately incorporate thinking that will enable them to set non-traditional strategies for their sector and so remain in business.

In the light of the future scenario outlined above, in which it is already possible to glimpse the key role that technological and digital infrastructure will play in the region's recovery, the main goal of this ECLAC bulletin is to address the question of whether the technological infrastructure available in the region constitutes a constraint on post-pandemic recovery.

This report comprises four sections. Following this introduction, section II analyses the regional impact of the COVID-19 pandemic, the state of digital technologies in the region, and actions related to the use and adoption of information technologies at the onset of the pandemic and subsequently to address the crisis. The third section projects a post-pandemic scenario in which technological infrastructure will play a pivotal role and the fourth section concludes by setting out strategic considerations and recommendations.

I. The initial state of the region's digital infrastructure at the start of the pandemic

A. Definitions and background

To answer this question, and to facilitate understanding of this document, some of the concepts described below need to be defined.

1. From classic economic infrastructure to digital infrastructure

The dictionary of the *Real Academia Española* defines “infraestructura” as that set of elements, endowments or services necessary for the proper functioning of a country, a city or any organization (RAE, 2020). Likewise, and in general, infrastructure may be defined as that set of engineering structures and facilities —usually having a long useful life— that constitute the basis for the delivery of the services deemed necessary for the conduct of productive, political, social and personal activities (Rozas and Sánchez, 2004).

As now widely used, the concept of digital infrastructure builds on the classic definition of infrastructure and in broad terms encompasses hardware systems, software, facilities and service components that support service delivery, such as data centres and communications networks (links, antennas and the like) (Gartner, 2021), as well as the components necessary to operate and administer public or private environments. Given that vision, the World Economic Forum (WEF) has coined the term *Infrastructure 4.0* to refer to the importance of digital infrastructure in the development of the fourth industrial revolution and as a basis for understanding the digital ecosystem as a new industrial environment with an economic/social impact that flows from the mass adoption of digital information and communication technologies (WEF, 2021).

At this point, it should be noted that, although economic statistics make a clear distinction between infrastructure activities and the provision of infrastructure services, it is common in the economic literature for no further distinction to be made in relation to their impact on growth and development, probably because both types of activity are part of the same production chain (Rozas and Sánchez, 2004).

2. Recovery and economic growth

These two concepts, although different, are very often confused, hence the need to understand the differences in order to better distinguish between them. They refer to two different phases of the economic cycle: economic recovery refers to a period of growth in which, after a crisis, the economy seeks to return to its pre-crisis level; whereas, during the economic expansion phase, the economy has already recovered and begins to surpass the level of an earlier (recovery) period (Coll, 2021).

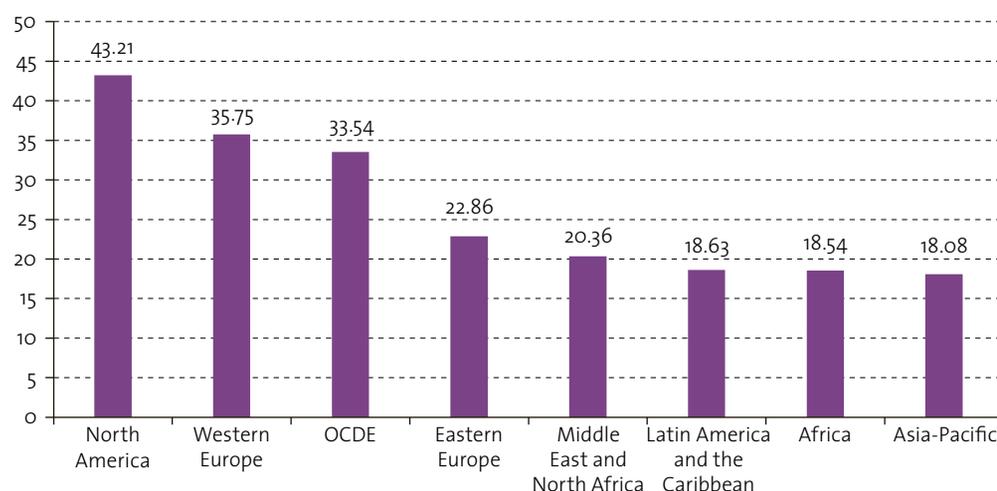
3. Digital gap

The digital gap is defined as the difficulty one segment of the population has in accessing information, knowledge or education through information and communication technologies. The digital gap also strongly influences socioeconomic factors, such as lack of education and skills, that have long-term effects on growth (Cont and others, 2021).

B. Description of the scenario at the outset of the pandemic

At the beginning of the pandemic, Latin America and the Caribbean had a lower annual growth rate than other regions and development of their digital ecosystems was middling compared to other parts of the world (Katz, Jung and Callorda, 2020). In particular, the region's digital development index in 2018 was 18.63, placing it behind the OECD countries (33.54), North America (43.21) and Western Europe (35.75) (ECLAC, 2021b). See figure 1.

Figure 1
Digital development index, 2018



Source: Economic Commission for Latin America and the Caribbean (ECLAC), *Datos y hechos sobre la transformación digital: informe sobre los principales indicadores de adopción de tecnologías digitales en el marco de la Agenda Digital para América Latina y el Caribe* (LC/TS.2021/20), Santiago, 2021.

Based on this information, ECLAC sought to examine whether in practice, despite the aforementioned indicators, the region's level of development in terms of digitization was enough to offset, at least in part, the effects of the pandemic. Above all, the research aims to answer to the question: is the technological infrastructure available in the region a constraint on post-pandemic recovery?

In 2020, various analyses pointed to stagnation or a global recession due to the COVID-19 crisis. In particular, the International Monetary Fund (IMF) predicted that the pandemic would cause a global recession that could surpass that caused by the financial crisis of 2008 and 2009. Complementing this, ECLAC estimated that should such a recession occur, it would drive down the GDP of Latin America and the Caribbean by 1.8% (Agudelo and others, 2020).

With these forecasts in mind, ECLAC and CAF first addressed the looming problems in a joint study carried out in 2020, entitled *Las oportunidades de la digitalización en América Latina frente al COVID-19* (Agudelo and others, 2020), which looked at whether the digital ecosystem in the region was prepared for the challenge of the pandemic and raised the following questions.

- Can digitalization act as a mitigating factor, reducing the pandemic's disruptive impact?
- How effectively are digital platforms being deployed to address the need to disseminate public health measures, facilitate consumer transactions and continue children's education?
- Can Latin America's production system get to a place where supply chains are supported by the efficient flow of digital information?
- How effectively can telecommunications networks respond to the challenge of a massive shift to telework?
- Can the State continue to function by means of digitalized administrative and management processes?

1. Reactions and immediate effects of the pandemic: connection needs as one of the key factors

In the vast majority of countries in the region, one of the first measures taken was to impose lockdowns to contain infections. This measure involved (to varying degrees in each country) the closure of offices, places of instruction and factories. Intended to halt the spread of the pandemic, it had an immediate impact on telecommunications infrastructure

and digital connectivity, among the clearest indicators being an exponential increase in Internet traffic, which presented operators with the challenge of maintaining adequate quality levels (Agudelo and others, 2020).

2. Change in assets considered essential

The lockdowns had, and are still having, a major impact on the way societies function and operate, driving much greater demand for digital assets such as high-speed broadband. As family groups entered lockdown, the number of connected devices in the home concurrently using video conferencing and cloud work platforms increased, creating a bottleneck in the Wi-Fi routers operating on the unlicensed spectrum (Katz, Jung and Callorda, 2020). These assets have become essential to today's economies, and certainly tomorrow's too (Deloitte, 2021). In addition, the digital gap widened, given that Internet use in most Latin American households is limited to communication tools and social networks. In other words, Internet penetration *per se* does not map to a high degree of digital resilience in Latin American households (Katz, Jung and Callorda, 2020).

All these factors combined to make teleworking first paradigm shift to which organizations had to adapt: not only were workers no longer co-located in the same workplace, but there was also an urgent need to develop capabilities to coordinate and control work that could be done remotely. The impact of this was not wholly negative: telework has had the effect of standardizing work practices, removing cultural barriers to entry into companies.

3. Accelerating the fourth industrial revolution

It is now a documented fact that the COVID-19 pandemic has accelerated digital transformation (and thus the fourth industrial revolution) by three to seven years (Sneader and Singhal, 2021) thanks to the application of artificial intelligence (AI) analytics, digitalization and other technologies to all phases of economic activity, from design to production. Digitalization can now be said to be everywhere and is critical both to the region's productivity and to the success of individual companies and sectors at the local level. Thus, the study by Sneader and Singhal (2021) notes that "Many executives reported that they moved 20 to 25 times faster than they thought possible on things like building supply-chain redundancies, improving data security, and increasing the use of advanced technologies in operations."

C. Progress in the adoption of recommendations to address the crisis

1. Recommendations on the use of digital infrastructure

In 2020, reflecting concerns about how to focus actions to mitigate the pandemic's impact, ECLAC and CAF published a series of recommendations aimed at promoting the efficient use of digital infrastructure in the region. These recommendations assumed that lockdowns would continue for some time and that telecommunications and digital infrastructure would be essential for countries to save lives and guarantee fundamental rights such as education, health, security, work and access to culture (Agudelo and others, 2020). These recommendations, grouped by theme, are listed below.

(a) Telecommunications

- Temporarily remove any restrictions on the deployment, upgrading or improvement of broadband infrastructure, especially mobile base stations.
- Maximize the efficiency and use of the radio spectrum, assigning resources temporarily both to network operators and to open high-band uses that can resolve bottlenecks in Wi-Fi routers.
- Promote responsible use policies for users and encourage content providers to implement measures to reduce network capacity saturation.
- Promote public-private partnership agreements to ensure the continuity of critical telecommunication services and free access to official COVID-19 information sites and applications.

- At the same time, maintain the integrity of the telecommunications infrastructure and deliver services efficiently, to continue to protect citizens' fundamental rights.
- Universalize access to telecommunications networks and their coverage through public policies and updated regulation that encourage investment in the sector. Put special emphasis on high-capacity networks such as 4G Advanced and 5G networks through development of Internet Exchange Point (IXP) infrastructure that can provide better latency and lower Internet connection costs. To that end, design and implement digital policies at different levels—federal, local and municipal—that can update legal and regulatory frameworks in different areas such as the release and efficient allocation of spectrum, less stringent requirements for the deployment of radio base and fibre optic infrastructure, attraction of content to the region and optimization of Internet interconnection chains.



(b) Basic infrastructure

- Promote digitalization measures that enhance the sustainability of the production ecosystem, physical infrastructure (energy, transport, logistics, and water and sanitation) and supply chains through appropriate coordination between stakeholders.

(c) Industry and production

- Encourage the production sector to innovate, restructuring processes to increase the percentage of the population that can work remotely.

(d) Digital support and platforms

- Promote the development of applications at the district/local level to facilitate people's access to official information. Likewise, promote the development of digital solutions to control the pandemic by acting at different levels: (i) information and transparency; (ii) traceability and diagnosis; and (iii) prevention, control and mitigation—all the while affording users data integrity and protection.

(e) Public policies

- Move decisively to structural policies that allow the implementation of advanced digital solutions with the aim of protecting health and education; and promote productive development.

2. Reactions to recommendations and mitigation actions

After the outbreak of COVID-19 and the health emergency in the countries of Latin America and the Caribbean, the region's governments reacted by implementing a series of measures to stop the spread of infections, the most important of which was mandatory physical distancing.

(a) Lockdowns and physical distancing

In the lockdown scenario, having a reliable Internet connection and access to mobile devices or desktop computers made the difference for the vast majority of people, keeping them informed and in contact with family members, medical services, authorities and businesses. In the same way, this connectivity allowed authorities to manage the public space effectively, control the spread of infections and use apps and information systems for management and control purposes. There are very few cases of countries whose relative success in controlling and mitigating COVID-19 is not largely explained by the use of mobile applications and information systems supported by digital technologies. In the business sphere, these containment measures compelled companies to reconfigure their operations, but also afforded them an opportunity for transformation. Hence, companies struggled to implement or adapt new technologies under intense pressure (Sneider and Singhal, 2021).



Physical distancing drove an increase in online activities. As in-person activities became impossible, there was a surge in remote activities, especially telecommuting, distance learning and telemedicine. These decisions on how to maintain activity had a profound effect on people's lives, mainly because the paradigm shift limited access to traditional centres that foster development, culture and a sense of belonging (such as schools and workplaces), turning homes into the hub of activities for all household members.

(i) Telework

Before the COVID-19 crisis, the progress of the remote working concept was neither rapid nor extensive. The pandemic changed that, as tens of millions of people began working from home, using virtual platforms to hold meetings, report, coordinate and track progress with colleagues and bosses. Accordingly, the workforce needed access to those platforms that enable remote work, so Internet access and digital devices and skills became essential. Additionally, the shift to remote working called for a legal and regulatory framework for organizations instituting it (Agudelo and others, 2020).

(ii) Distance learning

Owing to the pandemic, face-to-face classes had to be suspended and, where possible, held online. Content delivery was adapted to take advantage of some commercial virtual platforms, many of which —like Google, Zoom and Microsoft— made a great contribution by facilitating access.

However, despite the progress made, there are still difficulties in distance education. Connectivity problems, owed both to limited access to equipment and Internet connections and the lack of technological skills among the most vulnerable groups of teachers and students, became the great education challenge during the pandemic (Agudelo and others, 2020). While some countries in the region had pre-existing solutions developed for their education systems, upon the outbreak of COVID-19 the vast majority had to scramble to come up with solutions —whose success is, regrettably, contingent on connectivity and connection quality, and on human resources trained to deliver content in an innovative format.

(iii) Telemedicine

In the area of medicine, one of the decisive strategies for dealing with the COVID-19 pandemic was mitigation, to slow its spread, protect vulnerable groups and minimize demand on the health system for non-critical care. Fostering trust in technology played an important role. Telemedicine was developed and promoted mainly through the use of videoconferencing and to a lesser extent by the capability of smart devices to assist health professionals in making diagnoses on the basis of data received from patients. Modern

wearable fitness trackers, for example, make it possible to measure a number of health parameters with sufficient accuracy to support medical diagnosis.

Moreover, digital infrastructure allowed doctors or retired doctors to bolster health teams through remote work, or by sharing experiences with specialists in other countries on severe cases or when second opinions were required. It also facilitated the online training of health workers who, in the pandemic scenario, had to learn special protocols and how to apply them effectively.

(b) First regional-level actions

For the purposes of their joint publication entitled *Las oportunidades de la digitalización en América Latina frente al COVID-19* (Agudelo and others, 2020), ECLAC and CAF undertook a broad survey, mentioning the actions taken by the governments of the region in response to the need for people to remain in their homes and for productive activities to continue. The document concluded that telecommunications and digital infrastructure have been essential for saving lives and guaranteeing fundamental rights such as education, health, security, work and access to culture. Several public policy measures were maintained during the various phases of the pandemic and are even expected to carry over into the post-pandemic scenario.

3. Use of information in initial pandemic control

The ability to collect and manage large volumes of information afforded by the available technology made it possible to position information as a relevant asset for controlling the pandemic. A series of public and private initiatives were undertaken during the first phase of the pandemic to facilitate decision-making in different areas based on the information available. In the field of health, in particular, applications and information systems were developed to pinpoint virus spread and the number of people affected and monitor citizens' health status. In addition, in the public transportation sector, initiatives were taken to help adapt service frequency, maximizing ridership with existing fleets and complying with the restrictions imposed by biosafety regulations (Agudelo and others, 2020). Because information on the pandemic was freely available, the information provided by the authorities was perceived as more transparent and reliable.

4. Telecommunications reinforcement as an immediate enabling action

One of the major enabling factors for pandemic control measures was undoubtedly the availability of connectivity. In general terms, therefore, the region focused, relatively successfully, on providing basic connectivity to citizens while at the same time limiting the bandwidth consumption of certain high demand services (such as streaming services).

While at first there was an impact on the availability of connectivity infrastructure, this increase in consumption coincided with the ongoing development of a connectivity expansion scenario in the region in which reinforcement of existing infrastructure was strongly emphasized, with the implementation of redundant intercontinental connections through undersea cables, and constant technological renewal of last-mile connectivity equipment and end points.

In addition to this consolidation and improvement of existing digital connectivity infrastructure, 5G networks began to be rolled out in the region (these being at different stages of progress ranging from proofs of concept to spectrum bids). Service providers at first focus on rolling out 5G connections for enterprise use, as they afford significantly greater speed and density of connected devices, creating an environment highly conducive to the growth of the Internet of things (IoT), big data and artificial intelligence.

With respect to connectivity in hard-to-reach places, there are also advances in development that can have a positive impact on the region, in particular due to the approval and start of testing of the “*Starlink*” project in Chile; broadly, this consists of a constellation of satellites designed to provide high-speed, low-latency broadband Internet connections in parts of the world previously unreachable by this technology. Although this technology is at an

early stage of implementation and has a number of restrictions —like the line-of-sight requirement, and uncertainty as to the real performance of its broadband— it is still an encouraging option for places in hard-to-serve regions.

5. First actions: considerations and lessons

During the first phase of the pandemic, marked mainly by disease propagation, there was a significant reaction on the part of the region’s authorities and key stakeholders, who generally took very similar actions and measures.

The temporary and permanent measures taken have clearly made access to telecommunications even more important, as strategies such as telework, distance learning and telemedicine have made it possible to keep social and commercial services operational, producing and consuming.

II. Projected new post-pandemic scenario and recovery

A. Recovery to the “next normal”

When trying to visualize the post-pandemic scenario, there is a strong consensus that the “next normal” will be different and will definitely not constitute a return to the growth conditions that existed up until 2019, nor will it perpetuate the global economic downturn of 2020 (-3.2%) (ECLAC, 2021a).

Looking ahead to 2021, ECLAC projects growth for the region to be close to 6% (ECLAC, 2021a). Consequently, it can be posited that 2021 will be the year that ushers in the recovery phase, wherein individuals, businesses and society can begin to look ahead to shape their future rather than simply riding out a present constrained by pandemic restrictions.

During that recovery phase, many of the restrictions imposed during the pandemic, and considered temporary, will continue to apply to some degree as a precautionary measure, particularly those associated with the prevention of new infections and with the efficiencies gained from the use of the available digital infrastructure, in particular for tasks that can be performed remotely; this will become the baseline from which economic and social recovery will begin.

One particular trend will be remote working with a digital connection (telecommuting), which is likelier to happen in professional and technical services and education sectors, and very unlikely in agriculture, construction or manufacturing industries. The McKinsey Global Institute estimates that upwards of 20% of the global workforce could work most of their time out of the office and be just as effective. The success of this mode of work will depend on countries’ structural conditions (labour markets, level of formality, productive structures and digital infrastructure quality) (Agudelo and others, 2020).

1. Mobility: reduction and efficiency

The COVID-19 pandemic greatly affected people’s mobility and led to a consideration of whether physical presence was really needed for many tasks: office work, business trips and certain types of medical consultation, to name just a few. Leisure trips are and will continue to be discretionary, since people who travel for their own satisfaction will want to do so again. For business trips, on the other hand, a valid question arises: when exactly are they needed? Some studies estimate that while business travel will return in a big way and global economic growth will generate new demand, it may never recover to the level of 2019 (Sneider and Singhal, 2021).

On the other hand, trust in digital platforms affords an opportunity to take advantage of and optimize the use of transportation-related services, both passenger and commercial. Technology use can bring improvements to the region’s transport systems in terms

of planning, management, consumption and governance. When more information is available on such things as location, routes and arrival times, there is an impact not only on service users, but also on those who plan and provide transportation services.

2. Green growth and recovery

The pandemic also had an impact on the value set on health and the environment. The cost of pollution and the benefits of environmental sustainability will be increasingly recognized worldwide, while plans for implementing environment-friendly recovery measures are also taking shape around the world. The stated commitment by Japan and China to achieve carbon neutrality by 2050 and 2060 respectively is noteworthy in that regard.

Green growth opportunities abound in massive sectors such as energy, mobility and agriculture. Just as digital economy companies have driven stock market returns over the past two decades, green technology companies could play that role in the coming decades (Sneader and Singhal, 2021).

It is possible to ensure that infrastructure serves as a platform to connect the built environment, the natural world and human lives in a way that allows all three to thrive (WEF, 2021).

3. Energy efficiency

In this new reality, where technology and connectivity pivot towards recovery, energy (generation, distribution and availability) becomes a critical factor. Adopting an energy efficiency policy focused on better spending, loss reduction and regional integration —along with the development of renewable generation sources— is among the immediate challenges for Latin America’s energy agenda (Cont and others, 2021).

B. Changes in use of the region’s digital infrastructure owing to recovery needs in pandemic and post-pandemic scenarios

1. The value of infrastructure for economic recovery

There is currently a high level of interest globally in building back after the pandemic period, and to that end organizations must keep up, innovate and use digital solutions to retain and (re)build stronger relationships with customers, as well as to generate new sources of revenue (Hoque, 2017). This is where information and communication technologies can have a fundamental impact, altering sectors’ operating and business models; they can help produce an environment conducive to the region’s recovery.

2. Infrastructure as a necessity for development and growth

The efficient provision of infrastructure services is one of the most important aspects of development policies, especially in countries whose growth is outward focused. Most economists see the absence of adequate infrastructure and the inefficient provision of infrastructure services as major obstacles to the effective implementation of development policies and the achievement of economic growth rates that exceed international averages (Rozas and Sánchez, 2004).

C. Changes in infrastructure use

1. Impact of digitalization on existing infrastructure

Infrastructure networks —energy, transport, telecommunications and drinking water supply and sanitation services— support a host of economic, political and social activities. Because infrastructure services (particularly the first three) are derived demand, changes in the level of activity, both production and consumption, have a positive effect on the quantities required (Rozas and Sánchez, 2004). Likewise, infrastructure networks providing energy, transport, telecommunications and drinking water supply and sanitation services are central to the integration of a country’s economic and territorial system, making

transactions possible within a given geographic and economic space, and with the outside world. Hence, such networks form part of the backbone of the countries' economic structure and markets, as well as of the specific mechanisms linking national economies to the world economy so that trade can occur (Rozas and Sánchez, 2004). Accordingly, the incorporation of digital strategies into their evolution takes on great importance when the region's recovery is in the balance.

In the digital era, the traditional physical infrastructure networks for energy, transport and drinking water supply and sanitation services, which remain central to the integration of a country's economic and territorial system, are evolving rapidly with advances in information and communication technologies, generating data gathering, processing and analysis capabilities that allow for better planning, management and development of new infrastructure services that can be of great utility in emergencies.

(a) Energy

Obviously, electric power is key to the operation of digital infrastructure, so progress in its generation and distribution will in itself be a driving factor in the deployment of digitalization.

With the emergence of the new digital economy, there is an opportunity to define a new electrical grid to provide consumers and generators with services that can be of higher quality and greater complexity (for example, through greater automation, allowing decisions to be made very quickly or even in real time). Progress in the implementation of smart grids will increase supply reliability and quality and make for more efficient energy distribution and more flexible demand management.

(b) Logistics

Goods transport is an important service for many sectors' economic activity, and so any growth of the sector as a result of digitalization will have a positive impact on regional recovery. This advance in the state of the art should be mainly based on the application of technologies such as sensorization via IoT, the use of the Global Positioning System (GPS), big data and blockchain, in particular, which serve to automate processes, facilitate goods traceability and more effectively plan distribution routes, frequencies and schemes (Valdés Figueroa and Pérez, 2020).

(c) Water and services

The projected future scenario in which people stay home a good deal more creates a need to put emphasis on the water and sanitation sector, where, in addition to network and resource flow management, the implementation of various technologies (sensorization via IoT, big data, remote management) can provide early detection of leaks and prevent service outages, as well as maintain adequate control of variables, such as water quality and turbidity, that are of great importance to households, and more so in the event of a health emergency.

2. Key factor: importance of telecommunications infrastructure in recovery

Telecommunications infrastructure is critical in supporting today's economic and social performance. Access to that infrastructure, to the Internet, to telecommunications services and information technologies has become practically a human right, since it enables the exercise of other fundamental rights such as those to health, education, culture, security, freedom of expression and mobility. Likewise, this infrastructure is strategic, because in critical situations such as the one arising from COVID-19 it safeguards the exercise of these rights and is the best ally of governments and society in keeping the economy going (Agudelo and others, 2020).

In the digital age, these networks remain central to the integration of a country's economic and territorial system. They are evolving rapidly with the progress in information and communication technologies and have acquired data collection, processing and analysis capabilities that allow better planning, management and development of new infrastructure services that can be important assets in an emergency. Key in this scenario is

the expansion of broadband, which has a strong multiplier effect that influences quality of life and the productivity of the economy, in addition to promoting integration of regional States' productive and administrative processes (CAF, 2019).

3. Resilience, a necessary attribute of infrastructure

The exponential spread of COVID-19 across the world revealed the urgent need for infrastructure to be resilient so that, in scenarios of crisis and drastic changes in consumption patterns, transport, connectivity and public services can continue to function smoothly (Agudelo and others, 2020). Digitalization of production will therefore be fundamental in keeping the economy operating despite the disruptions caused by COVID-19 (Katz, Jung and Callorda, 2020).

For a production system to function with a certain resilience in the context of the pandemic, all participants in a supply chain must have an advanced degree of digitalization, to enable them not only to absorb shocks but to use them to build competitive advantage (Sneider and Singhal, 2021).

4. Investment in infrastructure

In the new normal, many governments will be encouraged to create an environment that allows and promotes significant public-private investments in infrastructure, to generate both immediate momentum and long-term growth. In the post-COVID-19 era, investment in digital infrastructure will be a powerful and essential means of sustaining employment, ensuring that businesses stay afloat and strengthening the productive capacity of the region's economies. The focus of such investment should be on integration with existing assets, in an endeavour to increase efficiency, strengthen resilience and use technology to transform and contribute to the region's recovery (Deloitte, 2021). Infrastructure investment done right has the potential to help build a more sustainable, equitable and prosperous world (WEF, 2021).

III. General considerations and recommendations

A. Is existing digital infrastructure a constraint on recovery?

Given the discussion herein and the question posed in the title —whether existing digital infrastructure is a constraint on the region's recovery— what we can say is that by itself, the existing digital infrastructure does not act as such a constraint; indeed, we can go so far as to say that with its help the region has been able to cope with the pandemic quite well.

To clarify: looking at the challenge of recovery in the light of the theory of constraints, it is apparent that the existing digital infrastructure will not be the first bottleneck to be addressed, and may even be a significant enabler, as it still has a lot of room to grow. Empirical proof of this has been the digital infrastructure's observed behaviour and resilience during the pandemic period: although some digital services were affected, overall they made it possible to achieve the projected growth for 2021.

Similarly, the immediate limitations are found in other related areas: technology-forward ones and in particular those related to initiatives for regional digital transformation (proposed as a fundamental cultural change), which are the trailblazers for the use of current and future information technologies.

Absent the requisite digital and cultural development, the future scenario promised by changing technologies and those that are coming soon (such as the connectivity improvements expected to flow from the broad rollout of 5G networks) may fall somewhat short of its technological potential. To draw a perhaps outlandish parallel, it would be like having more and better roads, roomier and faster cars, but no drivers trained to drive them.

B. Considerations

The pandemic has changed the way work is done, possibly forever. While much remains uncertain about the post-pandemic scenario, many of the changes it brought are expected to be permanent, even given society's natural propensity to return to its base state.

Technology will play an increasingly important role in the future of business, communications and the way infrastructure is delivered, increasing the need for high-speed broadband and other digital capabilities.

Digital infrastructure in particular is one of the key components in maintaining resilience and economic recovery. As the world recovers from the pandemic, the rise of digital infrastructure and its enhanced potential present a window of opportunity for critical improvements that will affect the region's digitalization and recovery indicators.

Hence, while investments in infrastructure are not critical factors today, they will be a crucial element in the ongoing changes, with great future impact. However, it should be kept in mind that investments are required as part of the natural evolutionary process and are mainly associated with research and development in areas that are seen to be promising. One example of this is the collection and use of data from the expected growth in IoT, leveraged by the ability to increase the density of devices connected to the 5G network. In the short term, the potential of existing technology must continue to be exploited. This can still promote faster recovery and drive accelerated growth.

In connectivity, the rollout of 5G networks does show great promise, but as they are not yet widely available, no all-encompassing use case can be established for them. One factor that may be decisive in shaping the adoption and development curve for devices and applications that efficiently use high-speed network capacity is the customer focus adopted by today's telecommunications companies; as is well known, the boom in mobile communications was strongly leveraged by society's massive use of wireless connectivity for personal purposes.

In creating demand for technological capacity, digital transformation (as a cultural paradigm shift) is key; and the corollary of that is that telecommunications must be considered the cornerstone of digital growth. Access to connectivity, then, will be the main factor in reducing the digital gap in the region.

These considerations are generalizations, based as they are on the region as a whole; actual conditions will vary with each country's relative degree of development.

C. Recommendations and next steps

1. Digital gap

- Consider as integral to the digital transformation process the social impact of the changes companies are making to achieve their digital transformation. At present the benefits of digitalization are unequally shared among the region's citizenry: there are digital gap, both in absolute terms (physical access to or affordability of the technologies, quality, upgradability, value of innovations...) and relatively speaking (lower presence in low-income households and rural areas and among specific users such as children or older people, or workers in economic activities that do not lend themselves to telework).
- Empower the users of digital technology. In most Latin American households today, Internet use is limited to communication tools and social networks. The challenge is to promote and leverage the development of the skills required for the uptake and use of technological capabilities, which in turn is essential to successful digitalization in the region.
- Heighten organizations' social responsibility. Organizations are made up of people, who will be affected by the decisions made on the way they perform their duties. As a result of the pandemic-era measures, the home has become the place where all household members carry out their activities and so have simultaneous connectivity needs. In

many cases, limited access to devices is a constraint to be considered and addressed in order to reduce the digital gap. The persistent digital gap is an obstacle for large swaths of the region's citizenry. The need to work remotely can be an opportunity to modernize the world of work, a structural change that makes for greater flexibility and opens up opportunities for access to the labour market, particularly for women and young people.

- Mitigate the impact on traditional services. Digital infrastructure will often facilitate the way things are done and services delivered, but there will still be a demand for services to be delivered in the traditional way, mainly to the most vulnerable sectors of the population.

2. Digitalization-based ecosystems

- Plan and approach the growth of digital infrastructure through the creation of a digital ecosystem that takes as its design fundamentals enterprise digitization and continuous adaptation to new technologies, with the acute awareness that everything is digital these days, from smart electric grid management applications to road analysis systems, and that infrastructure is no exception.
- Encourage owners and operators of infrastructure assets to establish digital business strategies in order to facilitate the adoption of new technologies, the creation of innovative ecosystems and the development of new digital skills. Create study spaces with technological knowledge focused on infrastructure engineering and information management, to foster a broader technological vision. Innovative initiatives should be selected not just as demonstrations of interesting technology in a particular area, but as factors that enable better outcomes.
- Consider environmental sustainability and climate change in the design and development of digital infrastructure.

3. Promotion of smart investment in digital infrastructure

- Reformulate current cost-benefit analyses to take into account the areas for infrastructure development pointed up by the pandemic as well as new types of financial and non-financial considerations (digital gap, digital transformation, importance of connectivity, among others), so as to envision infrastructure development as a platform for improving economic, environmental and social outcomes.
- Design acquisition and investment models that are collaborative in nature in order to optimize the value of technologies over their life cycle; promote their inclusion in existing infrastructure; and avoid an increase in technological waste due to unplanned obsolescence.
- Promote the creation and use of policy frameworks that facilitate the transition of technological innovations from the idea phase to commercial exploitation by creating a favourable, attractive environment for private sector participation in the enablement and growth of the region's digital infrastructure. At the same time, this participation must be incentivized by reducing unnecessary impediments to growth, cutting red tape and simplifying (or speeding up) approvals and regulations.

4. Smart access to and use of data and information

- Recognize that data and data processing are an integral part of digital infrastructure and that as more devices are integrated into communication networks through an IoT scheme, these will need to be added judiciously, as they offer great potential to increase the social and economic value of available infrastructure assets through predictive maintenance, real-time optimization and demand management, among other techniques.

5. Infrastructure resilience

- In infrastructure plans, take care to respond adequately to the changing dynamics of post-pandemic scenarios and to leave some leeway for any adjustments and modifications needed.

6. Strengthening of telecommunications infrastructure

- Recognize the value of the key role played by telecommunications during the pandemic and its contribution to the region, and create incentives to encourage the rapid implementation of fixed and mobile networks in those sectors lacking connectivity.

7. Digital infrastructure security

- Assign a high degree of importance to the protection of digital assets. As organizations' critical processes become digitalized, their risk exposure changes: they become attractive targets for cyberattacks. In the current situation, where supply chains, means of payment and connectivity are increasingly based on digital media, security needs to be catered for right from the design stage and made an integral part of digital assets' life cycle.

8. Cooperation as a strategy to overcome the crisis

- Promote the emergence in the region of cooperative spaces in which to pool experiences, successful strategies, best practices, and lessons learned regarding processes that are key to the region's recovery, especially in those work areas where the performance of certain digital ecosystem components can be improved.

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V. Publications of interest



FAL Bulletin N° 381

Digital Transformation in Latin American and Caribbean logistics

Luis Valdés Figueroa
Gabriel Pérez

This *FAL Bulletin* continues the Reflections on Disruptive Technologies in Transport that ECLAC has been publishing through this medium. The present edition analyses the importance of the digital transformation of logistics, especially in the current circumstances where the need for fluid, safe and resilient logistics calls for additional actions on traceability and process facilitation.

Available in:



FAL Bulletin N° 382

Cybersecurity in the time of COVID-19 and the transition to cyberimmunity

Rodrigo Mariano Díaz

This *FAL Bulletin* forms part of the Reflections on Disruptive Technologies in Transport that often appear in Economic Commission for Latin America and the Caribbean (ECLAC) publications. On this occasion, it examines the importance of cybersecurity from a logistical standpoint, especially in the current context of a pandemic.

Available in: