2017

State of broadband in Latin America and the Caribbean

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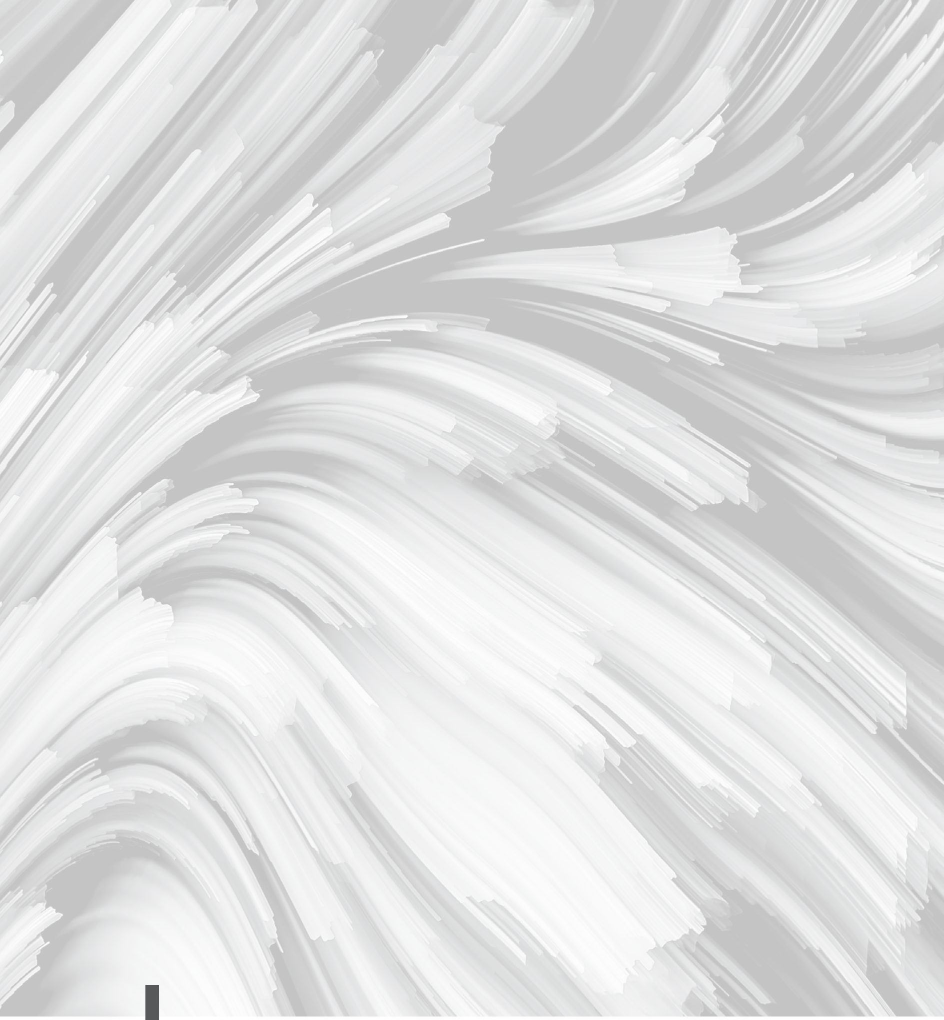

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Contents

Summary

The development of the Internet and its progress continues in Latin America and the Caribbean: 56% of its inhabitants used the network in 2016, this represents an increase of 36 percentage points (p.p.) in a decade. In terms of affordability, in 2010, some 18% of average monthly income was allocated to contract a fixed broadband service of 1Mbps, while as of November 2017, that figure was only 1.2%; all of which were countries below the 5% threshold set as a reference for affordability by the United Nations Broadband Commission.

However, despite these advances, problems related to the quality and equality of Internet access remain pending. In terms of service quality, the two best-ranked countries in our region only have 15% of their connections with speeds above 15 Mbps, as compared to the worst-ranked with 0.2%. As a reference, on a worldwide scale, the 10 most advanced countries in this field have more than 50% of their connections with speeds above 15Mbps.

Likewise, differences persist in Internet access between rural and urban areas, and between quintiles of income distribution. In the country with the greatest gap between urban and rural areas, the difference in penetration is 40 p.p. and the average in the region is 27 p.p. In terms of income, the gaps between the households of the richest quintile in relation to the poorest quintile reach up to 20 p.p. in some countries of the region.

1. Internet access and use

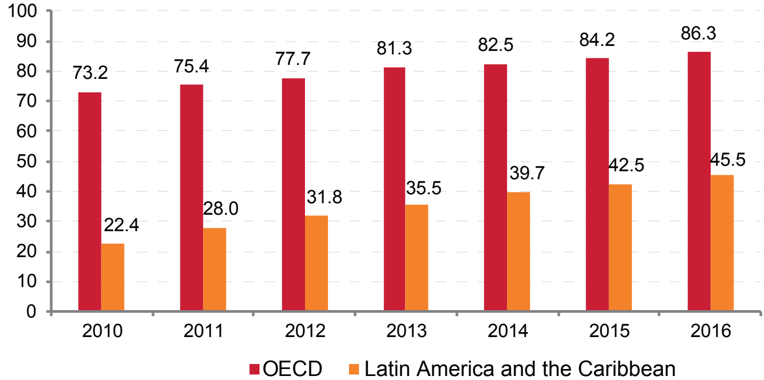
In this section, the access and use of the Internet in Latin America and the Caribbean is analysed. The evolution between 2010 and 2016 is presented along with the gaps compared to developed countries, and their different dynamics according to income, gender, and age.

1.1 Access

The number of households connected to the Internet in the region grew by 103% between 2010 and 2016. Despite this, more than half of households still lack access to the Internet.

Dissemination efforts of the service lead to a significant reduction in the gap with OECD countries. The difference in penetration between the two regions —that was 50.8 p.p. in 2010— decreased to 40.8 p.p. in 2016 (see figure 1).

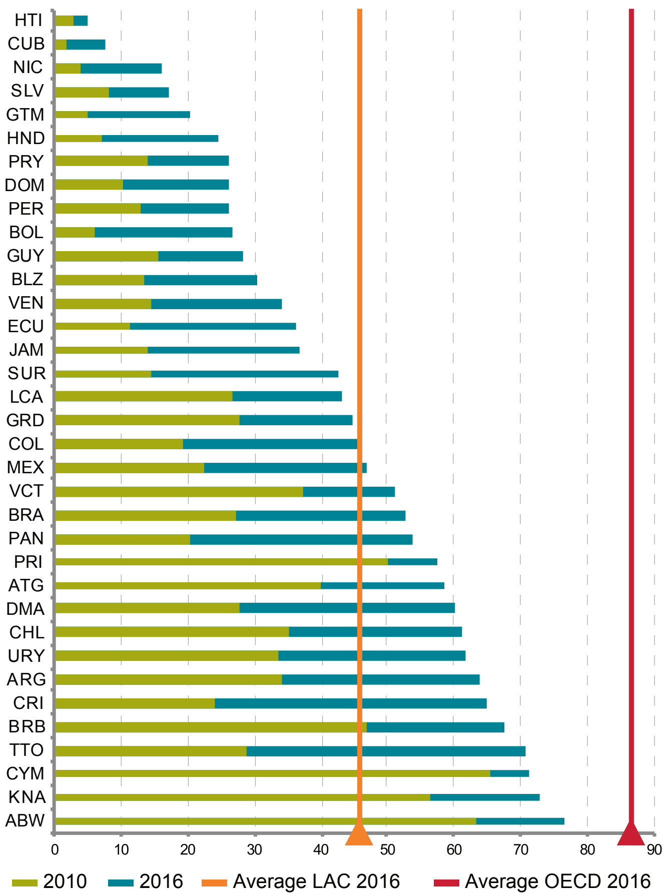
Figure 1
Households with Internet, 2016
(Percentage of total households)



Source: ECLAC Regional Broadband Observatory (ORBA) based on ITU data, World Telecommunications Indicators Database, 2017. The number indicates the regional average of households with Internet. OECD data does not include Chile and Mexico.

The countries with the highest growth were Guatemala, the Plurinational State of Bolivia, Nicaragua, and Honduras, all with more than a 300% increase between 2010 and 2016. On the other hand, the economies with the lowest growth were Puerto Rico and the Cayman Islands (14.4% and 18.3%, respectively). However, these two countries have more than 55% of households connected to the Internet, while the four countries with the highest growth are below 30% (see figure 2).

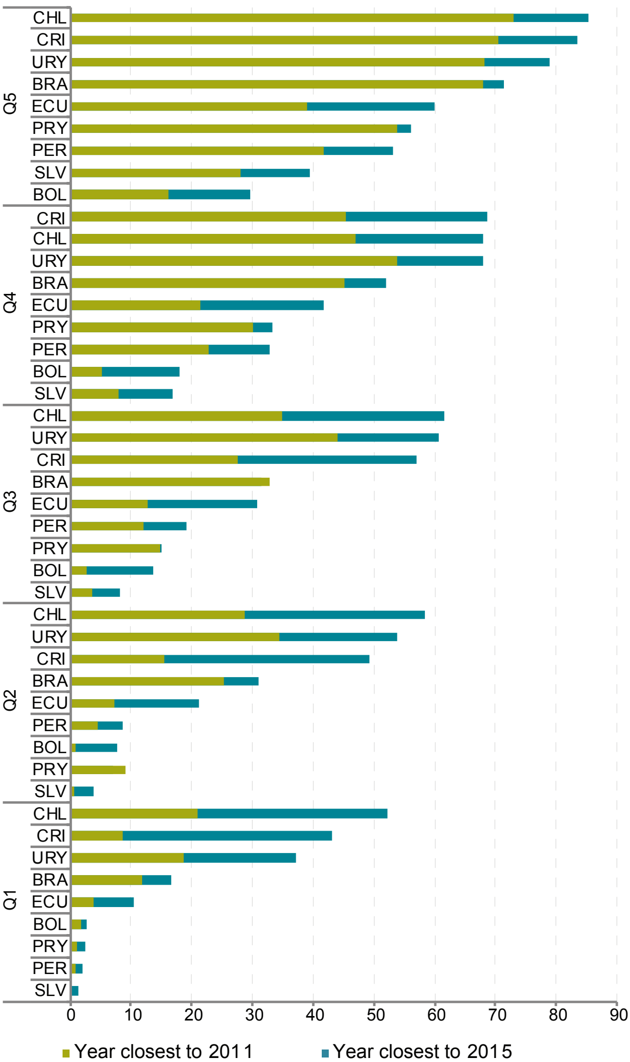
Figure 2
Number of households with access to the Internet per country, 2010 and 2016
(Percentage of total households)



Source: ECLAC Regional Broadband Observatory (ORBA) based on ITU Data, World Telecommunications Indicators Database, 2017.

Figure 3
Households with Internet access according to income quintile

(Percentage of total households per quintile)



Source: ECLAC Regional Broadband Observatory (ORBA) based on household surveys of the Household Survey Data Bank (BADEHOG).

Note: Internet connections in different countries include: in Paraguay, Internet via cable or WiFi, and Internet via USB modem; in Ecuador, dial up, leased line, cable modem and MBB; in Uruguay, FBB, MBB and leased line; in Chile FBB and MBB contracted and prepaid in addition to mobile phone or other mobile device; In Costa Rica, the question targets housing. The dark color is the statistic for year 2011 or the closest year available, the light color is the statistic for 2015 or the closest year available.

Internet penetration varies considerably according to the country's socio-demographic characteristics. Figure 3 shows the percentage of households with Internet access via fixed connection according to income quintile. Internet penetration increased in all countries and quintiles between 2011 and 2015. During this period, the average increase was greater in Q3, except in Chile and Costa Rica where the highest growth was in the lowest income quintile, Q1 (34.5 and 31.3 p.p. respectively).

For the most recent year, the ratio between the number of households with Internet access in Q5 as compared to households in Q1 was close to 2 in Costa Rica, Chile, and Uruguay; between 2 and 10 in Brazil, the Plurinational State of Bolivia, and Ecuador; and greater than 20 in Paraguay and Peru.

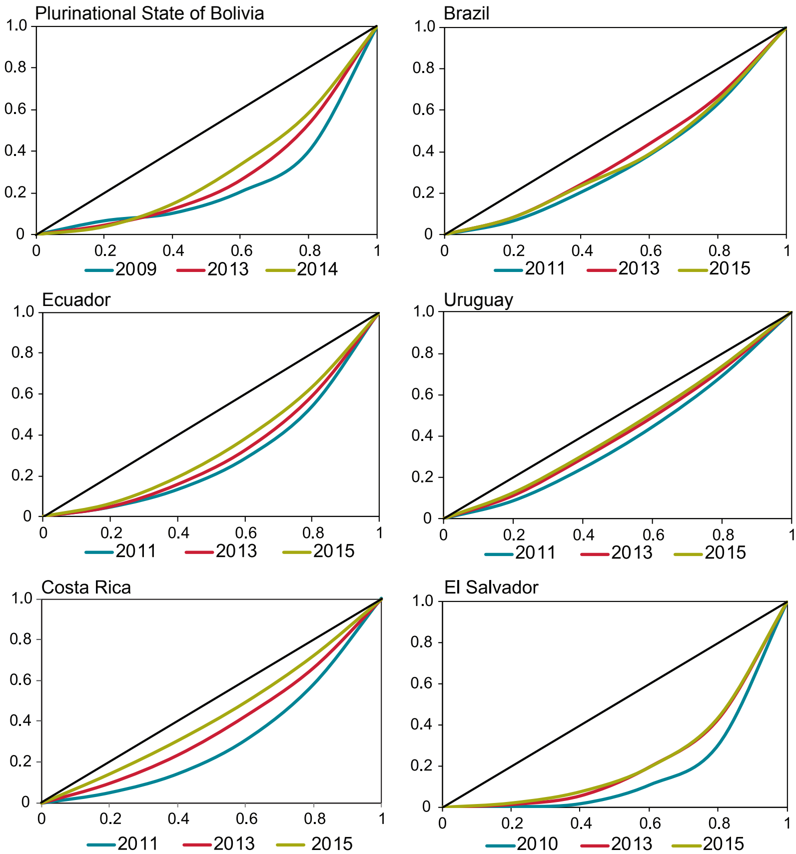
Figure 4 shows the evolution of the distribution of Internet access in relation to an equality parameter that is an approximation to a Lorenz curve. On the abscissa, the cumulative percentage of households ordered by income quintile is indicated; in the ordinates, the accumulated percentage of households with Internet access. In general, equality in Internet access improved.

Additionally, the Gini coefficient was estimated for the most recent year available. The countries where it declined the most were the Plurinational State Bolivia and Costa Rica, reaching 0.36 and 0.13, respectively. Uruguay, although it experienced a lower reduction in its coefficient in relative terms, remains the country with the greatest equality in Internet access among the countries considered.

By contrast, in Brazil, between 2013 and 2015, access to the Internet decreased in the three lowest income quintiles, mainly in the third quintile. This decrease, unlike the rest of the quintiles, implies an increase in the Q5/Q3 ratio for 2015, which indicates deterioration in the distribution of access.

Figure 4
Lorenz curves of the distribution of Internet access

(Years available closest to 2011, 2013, and 2015)



Source: ECLAC Regional Broadband Observatory (ORBA) on the basis of household surveys of the Household Survey Data Bank (BADEHOG).

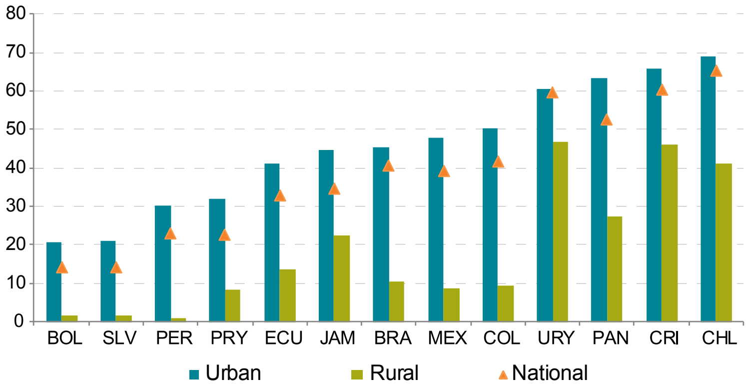
Figure 5 shows the percentage of households with Internet access by geographic, urban or rural area, for 2015[1]. In the sampled countries, there are significant differences between urban and rural means of access. On average, the gap between the two is around 27 p.p.

[1] All the countries in the sample have data for 2015, except for the Plurinational State of Bolivia whose data represents 2014.

The countries with the greatest differences are Brazil, Mexico, and Colombia, all above 35 p.p. On the other hand, the countries with the lowest differences between the two are Uruguay, Costa Rica, and the Plurinational State of Bolivia with less than 20 p.p.

Figure 5
Households with Internet according to geographical area, year available closest to 2015

(Percentage of total households in each zone)



Source: ECLAC Regional Broadband Observatory (ORBA) based on household surveys of the Household Survey Data Bank (BADEHOG) and ITU, World Telecommunications Indicators Database, 2017 in the case of Jamaica, Mexico, and Panama.

1.1.1 Penetration of fixed and mobile broadband

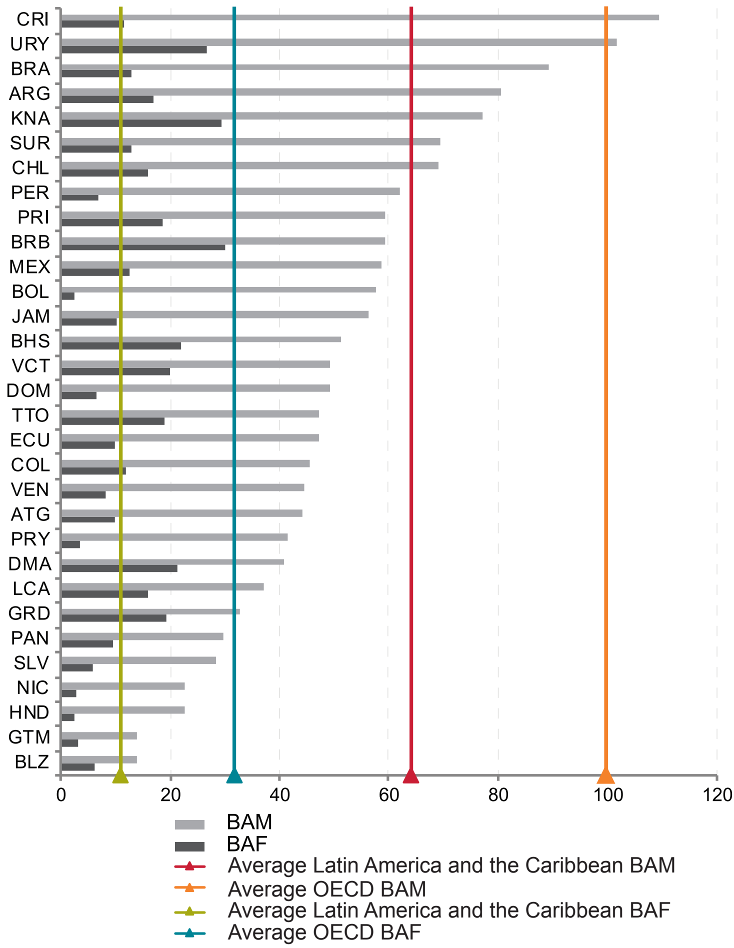
Figure 6 shows the penetration levels of fixed broadband (FBB)[2] and mobile broadband (MBB) for some Latin American countries and the regional average in 2016.

In 2010, the penetration of FBB and MBB was practically the same (close to 6.5%). Since then, the deployment of the MBB far surpassed that of the FBB. In 2016, the MBB reached 64% and the FBB reached 11%. The gap between the countries of the region and OECD countries was 21 p.p. in FBB and 35.5 p.p. in MBB for that year.

[2] For this analysis, broadband are all the connections with speeds higher than 256Kbit/s, in the case of fixed broadband, and technology of at least 3G in the case of mobile broadband. For graphics whose source is the International Telecommunications Union (ITU), the mobile connection refers to connections to the Internet through technologies such as USB modem, SIM card integrated into a computer, and mobile devices such as tablets or smartphones (smartphones).

Within the region, the largest gaps are also recorded in MBB, reaching 90 p.p. between the best and worst located countries. In the case of the FBB, the biggest difference between the countries in the sample is around 26 p.p.

Figure 6
Penetration of fixed and mobile broadband in 2016
(Active subscriptions per 100 inhabitants)

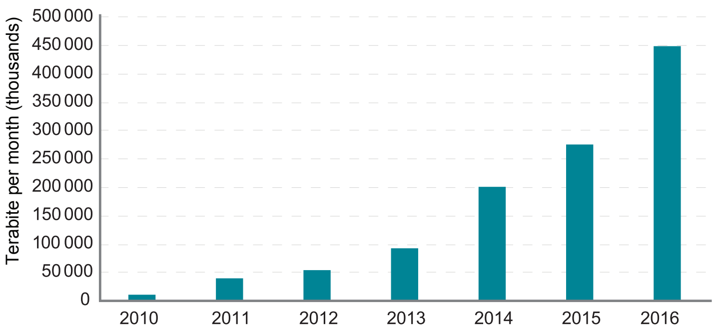


Source: ECLAC Regional Broadband Observatory (ORBA) based on ITU Data, World Telecommunications Indicators Database, 2017.

A complementary element to consider when looking at the growth in MBB is the evolution of mobile data traffic in the region and in the world. While the number of mobile broadband subscriptions grew by 917% between 2010 and 2016, mobile data traffic increased by 3750% in the same period. This means that the data traffic grew 4 times more than the number of subscribers (see graphs 7 and 8).

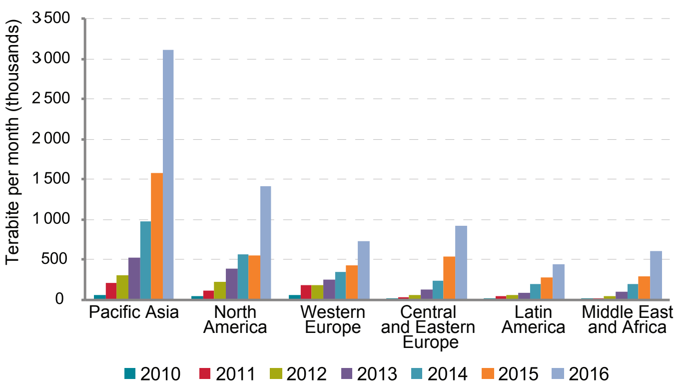
However, despite this significant growth in traffic, Latin America and the Caribbean continues to be the region with the lowest mobile data traffic in the world, with an average of 449 terabytes per month, which is seven times less than the traffic in the Asia Pacific region. (See figure 8).

Figure 7
Evolution of mobile data traffic in Latin America 2010-2016



Source: ECLAC Regional Broadband Observatory (ORBA) based on data from Cisco Systems.

Figure 8
Monthly mobile data traffic by world region 2010-2016

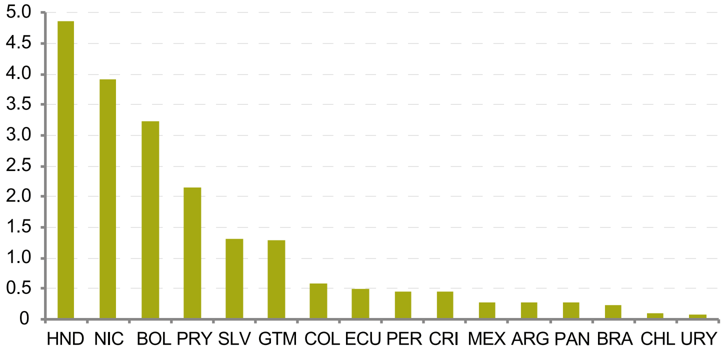


Source: ECLAC Regional Broadband Observatory (ORBA) based on data from Cisco Systems.

1.1.2 Affordability

The affordability of fixed broadband services is measured by the average price offered for a 1Mbps as a percentage of GDP per capita. This indicator is an approximation of the proportion of income that is destined to access the service; the lower the proportion, the more affordable the service.

Figure 9
Fixed broadband rates as a percentage of GDP per capita



Source: ECLAC Regional Broadband Observatory (ORBA) based on information from the websites of the service providers.
Note: The GDP per capita is monthly data for 2016, the rates correspond to 2017.

For FBB[3], the 10Mbps plans were taken as reference. As shown in Graph 10, all the countries of the region considered are below 5%, that is, below the minimum affordability threshold determined by the United Nations International Broadband Commission[4]. Ten countries are below 1%, two are around 1%, two between 2% and 3%, and two between 4% and 5%. The lowest level of affordability is in Honduras, where access still implies an expenditure of almost 5% of income and, secondly, Nicaragua with close to 4%.

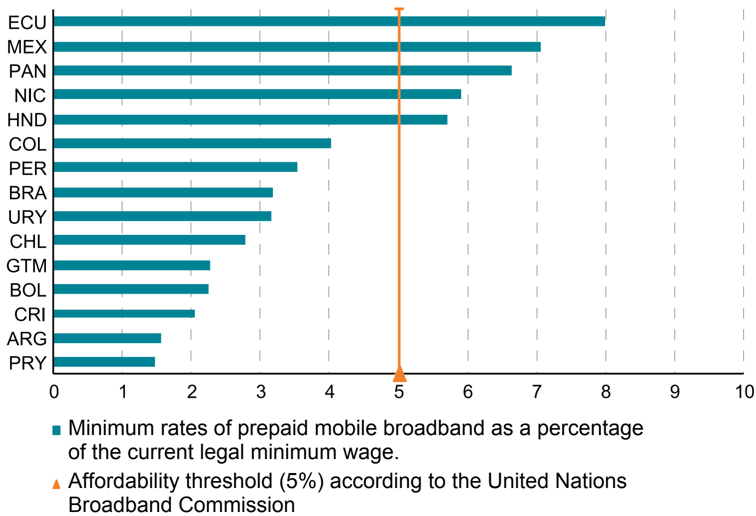
In relation to MBB, many plans, packages, and data plans with different validity and capabilities have been developed for commercial use in the

[3] Rates calculated at 1Mbps from the 10Mbps plans.

[4] The United Nations International Broadband Commission establishes 5% of income as the affordability threshold.

region, in order to reach segments that cannot access post-paid plans. Due to the importance of the prepaid modality, for the analysis of the MBB rates, the lowest prepaid rate offered of data plans in mobile phones was taken as reference for two periods, one day and 30 days; in the latter case, the data plans included are those with a capacity close to 1GB.

Figure 10
Minimum rates of prepaid mobile broadband data plans
(Percentage of the legal minimum wage)



Source: ECLAC Regional Broadband Observatory (ORBA).
The salary information is for October of 2017.

For the duration of 1 day, affordability is measured as the minimum amount of dollars necessary to contract the service as a percentage of the current minimum legal wage (SMLV) in each country. For the duration of 30 days, as in the case of the FBB, the tariff is divided by the per capita monthly GDP as an estimate of income. The result obtained in both cases will be the minimum percentage of the income that must be allocated to access the service.

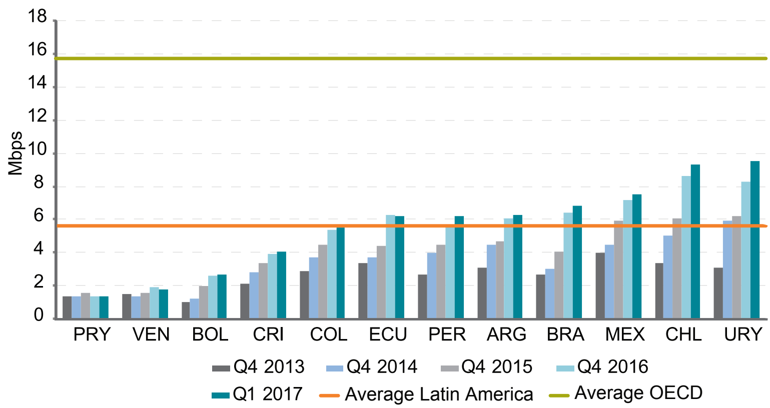
In the lowest-paid prepaid rates, the countries with the greatest affordability are Argentina and Paraguay. Ecuador has the lowest affordability, allocating 8% of the SMLV daily. For the period of 30 days, Argentina, Brazil, Chile, Costa Rica, Mexico, Panama, and Peru have greater affordability with percentages lower than 2%.

1.1.3 Quality

The variable that is commonly referred to in order to measure service quality is the connection speed. However, latency or delay, understood as the time it takes for a package of information to reach its destination and return, plays a fundamental role in the quality of the service.

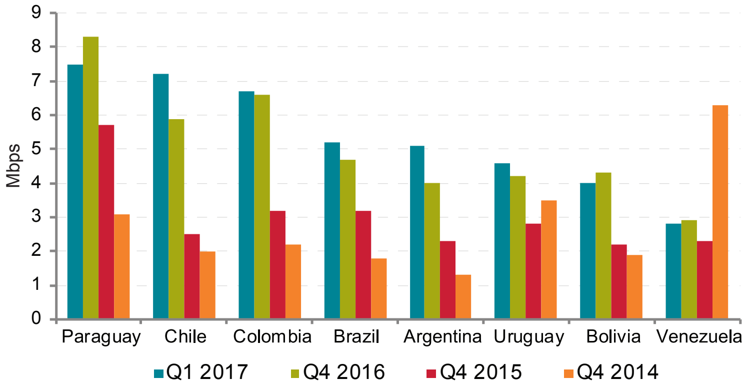
Graphs 11 and 12 show the evolution of average fixed and mobile broadband connection speeds. The average connection speed of FBB increased by 115% between the end of 2013 and the first quarter of 2017. During the same period, the gap between the best country and the worst ranked increased by 170%.

Figure 11
Evolution of the effective average speeds connection through fixed broadband



Source: ECLAC Regional Broadband Observatory (ORBA), based on Akamai's [State of Internet], Q12017 Report.

Figure 12
Evolution of the effective connection speeds through mobile broadband



Source: ECLAC Regional Broadband Observatory (ORBA) based on data from Akamai. Akamai's [state of Internet] Q1 2017 Report.

The speed measurement in mobile connections includes smartphones, tablets, computers, and other devices that connect to the Internet through mobile network providers. The countries of the region sampled have a speed that ranges between 4 to 7.5 Mbps. For the period considered, the average speed increased by 155%. For the same period, the difference between the best and worst ranked countries doubled.

Figure 13
Broadband connections according to the indicated connection speed in 2017

(Percentages)

A. 4 Mbps

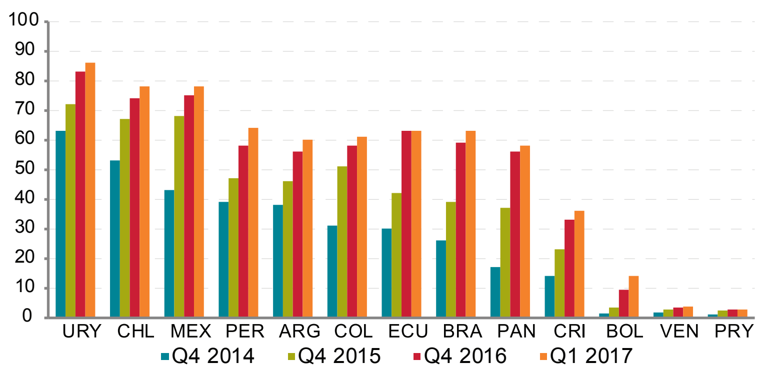
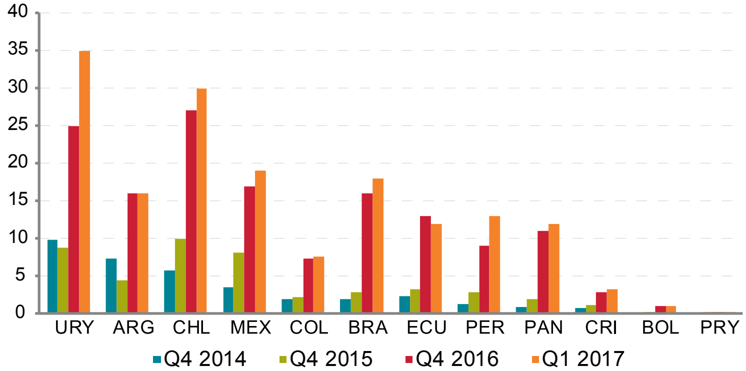
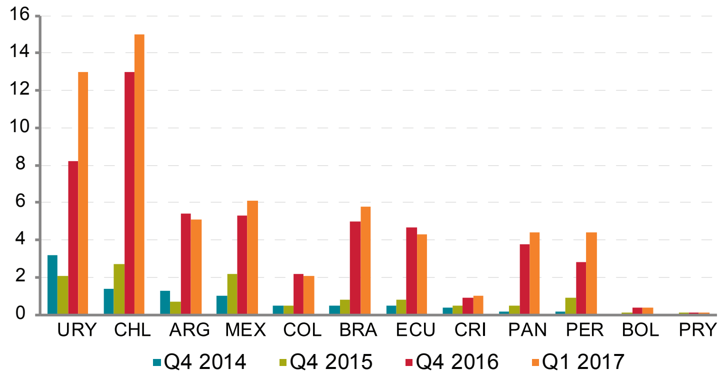


Figure 13 (concluded)

B. 10 Mbps



C. 15 Mbps



Source: ECLAC Regional Broadband Observatory (ORBA) based on data from Akamai's [state of Internet] Q1 2017 Report.

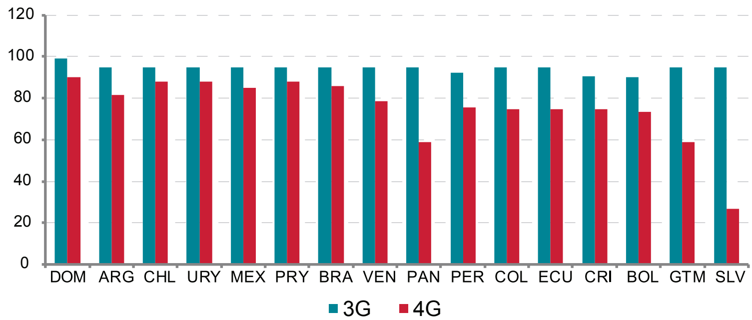
Graphs 13a, 13b, and 13c present the percentage and the quarterly growth rate of households according to speed connections offered that are above 4 Mbps, 10 Mbps, and 15 Mbps, respectively. The growth of connections at speeds greater than 10 Mbps and 15 Mbps was significantly superior than the growth of connections above 4 Mbps. The first two grew about fivefold while those at 4 Mbps only doubled.

Despite this growth, there are still few high-speed connections (higher than 10 and 15 Mbps). Chile and Uruguay, which are the best-ranked in the region, only have 30% of their connections above 10 Mbps and close to 15% above 15 Mbps. The countries with the lowest percentage of high-speed connections are Paraguay and The Bolivarian Republic of Venezuela with about 0.2% connections over 10 Mbps, and about

0.1% connections greater than 15 Mbps. As a reference, worldwide, the 10 most advanced countries in this field exceed 50% of their connections above 15 Mbps.

Regarding the technological evolution of MBB connections, the region shows significant advances. In the third quarter of 2017, it presents an average coverage in relation to the population of 94.5% with 3G networks and 75.2% with 4G networks, for a sample of 16 countries (see Figure 14). In the case of 3G networks, the differences between the countries in the sample are low, with the country having the lowest coverage only 9 p.p. below the country with the most coverage, while in 4G networks that difference reaches 74 p.p.

Figure 14
3G and 4G connections in Latin America, 3rd quarter 2017
(In percentages)



Source: ECLAC Regional Broadband Observatory (ORBA) based on data from GSMA Intelligence 2017.

The region is still strongly dependent on international Internet traffic, mainly from the United States, not only because that country is the main provider of content, but also because many of the content generated in the region is hosted in that country. In that sense, the quality of access highly depends on the international telecommunications infrastructure.

Two of the important elements are submarine cables and Internet traffic exchange points (IXP). The availability of both has a direct impact on service quality parameters derived from variables such as latency or traffic delay.

In this regard, Tables 1 and 2 detail the information on submarine cables that were or will be installed in the period 2015 to 2020, and the main IXPs that came into operation in the period 2015 to 2017.

Table 1
Submarine cables according to the start date of operations

Name	Points on land
2015	
Pacific Caribbean Cable System (PCCS)	Balboa, Panama; Cartagena, Colombia; Hudishibana, Aruba; Jacksonville, Florida, USA; Manta, Ecuador; María Chiquita, Panama; San Juan, Puerto Rico, USA; TeraCora, Curacao; Vírgin Islands, United Kingdom.
FOS Quellon-Chacabuco	Chacabuco Port, Chile; Quellón, Chile.
2016	
GTMO-1	Dania Beach, FL, USA; Guantánamo Bay, Cuba.
2017	
Seabras-1	Playa Grande, Brazil; Wall Township, New Jersey, USA.
Monet	Boca Raton, Florida , USA; Fortaleza, Brazil; Santos, Brazil.
2018	
ARBR	Las Toninas, Argentina; Playa Grande, Brazil.
BRUSA	Fortaleza, Brazil; Rio de Janeiro, Brazil; San Juan, Puerto Rico, USA; Virginia Beach, Virgina, USA.
Kanawa	Kourou, French Guiana; Schoelcher, Martinique.
South Atlantic Cable System (SACS)	Fortaleza, Brazil; Luanda, Angola.
South Atlantic Inter Link (SAIL)	Fortaleza, Brazil; Kiribi, Cameroon.
GTMO-PR	Guantánamo Bay, Cuba; Punta Salina, PR, USA.
2019	
South America Pacific Link (SAPL)	Balboa, Panama; Colón, Panamá; Jacksonville, FL, USA; Makaha, Hawaii, USA; Valparaiso, Chile.
EllaLink	Fortaleza, Brazil; Funchal, Portugal; Beach, Cape Verde; Santos, Brazil; Sines, Portugal.
SABR	Cape Town, South Africa; Recife, Brazil.
2020	
AURORA	Balboa, Panama; Belize City, Belize; Bluefields, Nicaragua; Cancun , Mexico; Cartagena, Colombia; Manta, Ecuador; Maria Chiquita, Panama; Puerto Barrios, Guatemala; Puerto Limón, Costa Rica; Sarasota, FL, USA; Trujillo, Honduras; Valparaiso, Chile.
Deep Blue Cable	Archaie, Haití; Barranquilla, Colombia; Boca Raton, FL, USA; Bodden Town, Cayman Islands; Cap Haitien, Haití; Cartagena, Colombia; Chaguaramas, Trinidad and Tobago; Hudishibana, Aruba; Jacmel, Haití; Kingston, Jamaica; Kralendijk, Bonaire, Sint Eustatius and Saba; Manzanilla, Trinidad and Tobago; Maria Chiquita, Panama; Montego Bay , Jamaica; Naples, FL, USA; North West Point, Cayman Islands; Ocho Rios, Jamaica; Providenciales, Turks and Caicos Islands; Puerto Plata, Dominican Republic; Rockly Bay, Trinidad and Tobago; San Juan, PR, USA; Santo Domingo, Dominican Republic; St. Louis, Saint Martin; The Valley, Anguila; Tortola, Vírgin Islands (United Kingdom); Willemstad, Curacao.
Fibra óptica Austral	Puerto Montt, Chile; Puerto Williams, Chile; Punta Arenas, Chile; Tortel, Chile.

Source: ECLAC Regional Broadband Observatory (ORBA) based on TeleGeography data.

Table 2
Traffic exchange points (IXP) installed between 2015 and 2017, selected countries

Name	Location	Online since	Link
CABASE IXP GBA Zona Oeste	Buenos Aires, Argentina	2016	http://www.cabase.org.ar/ixp-gba-zona-oeste/
CABASE IXP Jujuy	Jujuy, Argentina	2016	http://www.cabase.org.ar/ixp-jujuy/
CABASE IXP Junin	Junin, Argentina	2016	http://www.cabase.org.ar/8430-2/
CABASE IXP Norte de Gran Buenos Aires	Pilar, Argentina	2016	http://www.cabase.org.ar/ixp-gba-zona-norte/
CABASE IXP Pergamino	Pergamino, Argentina	2015	http://www.cabase.org.ar/ixp-pergamino/
CABASE IXP Resistencia	Resistencia, Argentina	2017	http://www.cabase.org.ar/ixp-resistencia/
CABASE IXP Sáenz Peña, Chaco	La Plata, Argentina	2016	http://www.cabase.org.ar/ixp-saenz-pena/
CABASE IXP Salta	Salta, Argentina	2016	http://www.cabase.org.ar/ixp-salta/
CABASE IXP Tandil	Tandil, Argentina	2016	http://www.cabase.org.ar/ixp-tandil/
CABASE IXP Tucuman	San Miguel de Tucuman, Argentina	2015	http://www.cabase.org.ar/ixp-tucuman/
CABASE IXP Viedma	Rio Negro, Argentina	2016	http://www.cabase.org.ar/ixp-viedma/
PIT Chile	Santiago, Chile	2016	http://www.pitchile.cl/
Intercambio de tráfico de Internet de Honduras	Tegucigalpa, Honduras	2016	---
Jamaica IXP	Kingston, Jamaica	2015	---
Aracaju	Brazil	2017	http://ix.br/adesao/se
Foz do Iguaçu	Brazil	2016	http://ix.br/adesao/igu
João Pessoa	Brazil	2017	http://ix.br/adesao/jpa
Santa Maria	Brazil	2017	http://ix.br/adesao/ria/

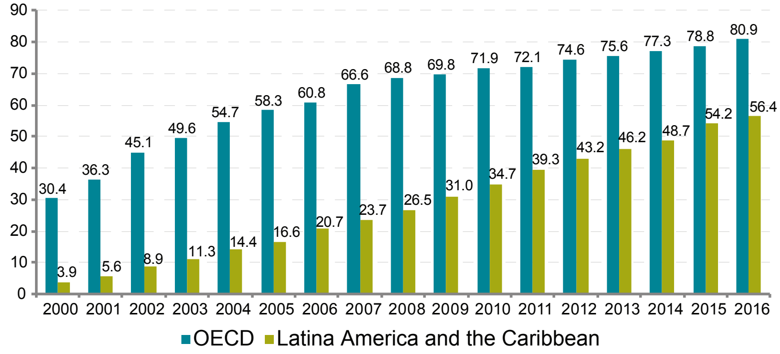
Source: ECLAC Regional Broadband Observatory (ORBA) based on data from TeleGeography and the Internet Management Committee of Brazil CGI.br (IX.br).

1.2 Use

Figure 15 shows the evolution of the percentage of users with respect to the total population in Latin America and the OECD in the period 2000-2016. In 2000, the difference between the two regions was 26.5 p.p.; this difference increased to a maximum of 42.9 p.p. in 2007 and, as of that year, it gradually decreased, reaching 24.5 p.p. in 2016.

Figure 15
Internet users: comparison between Latin America-OECD countries, 2000-2016

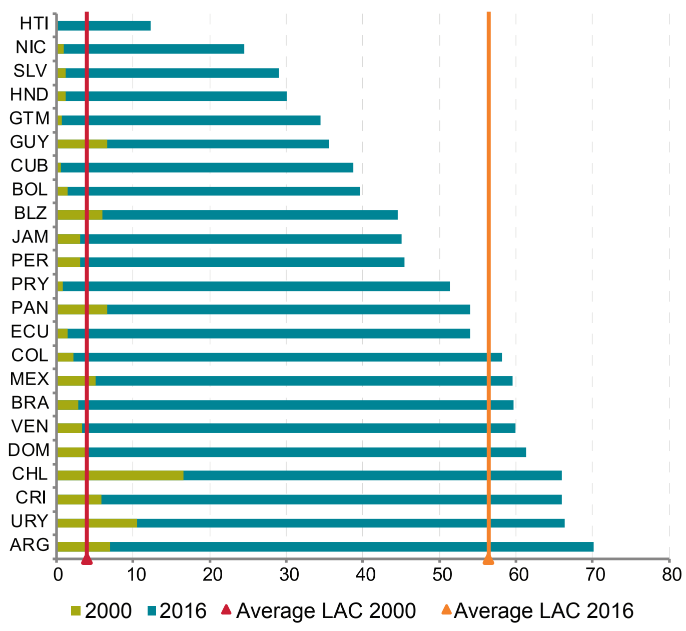
(Percentage of total population)



Source: ECLAC Regional Broadband Observatory (ORBA) based on ITU Data, World Telecommunications Indicators Database, 2017. OECD data does not include Chile and Mexico.

Figure 16
Internet users in Latin America, 2000-2016

(Percentage of total population)

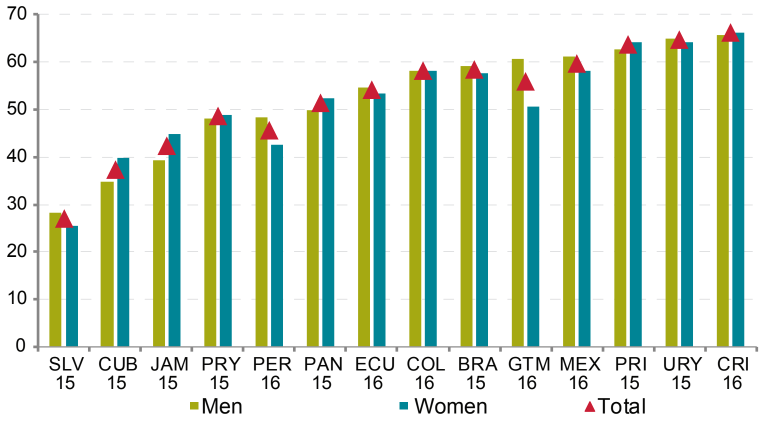


Source: ECLAC Regional Broadband Observatory (ORBA) based on ITU Data, World Telecommunications Indicators Database, 2017.

In the period 2000-2016, the number of Internet users in the sampled countries increased by more than 50 p.p. going from 3.9% to 56.4%. This evolution was increasingly heterogeneous within the region, with growths from 12 p.p. up to more than 60 p.p. In this regard, the gap between the best and worst ranked country in 2000 was just over 16 p.p., while in 2016 it exceeded 50 p.p.

In the sampled countries, the difference in terms of Internet users by gender is on average only 0.6 p.p. However, the situation varies from country to country; while in Guatemala it reaches 10 p.p., in Uruguay it is 0.7 p.p. At the same time, some countries register differences in favor of women, which is the case in Jamaica with the greatest difference registered reaching 5.5 p.p., while in Colombia it reaches 0.1 p.p.

Figure 17
Internet users by gender, year closest to 2016
(In percentages)

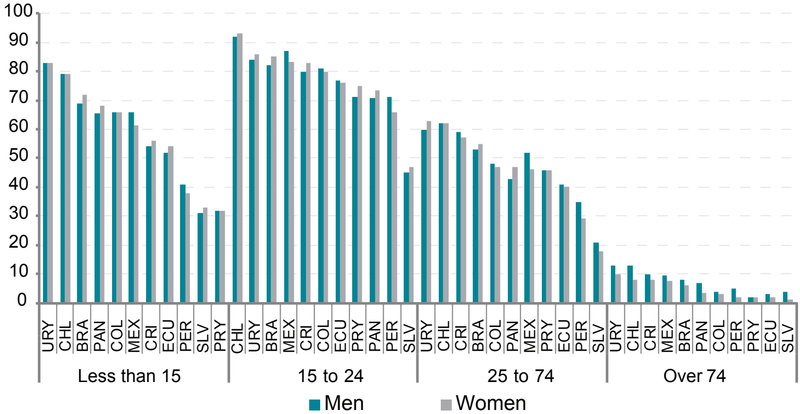


Source: ECLAC Regional Broadband Observatory (ORBA) based on ITU Data, World Telecommunications Indicators Database, 2017.

Regarding the use of Internet according to age, the 15 to 24-year-old group is the one with the highest number of users, both men and women. The largest gaps are recorded in the group of 25 to 74 years; in Peru, the number of male users exceeds women by 6 p.p.; in Panama a difference of 4.1 p.p. is registered, although in this case the women outnumber the men in the use of the Internet.

On average, in the groups under 15, and 15 to 24-year old, the number of women who use the Internet exceeds the number of men by 0.4 and 0.6 p.p. respectively. On the other hand, in the groups of 25 to 74-year old and above 74-year old, the reverse is presented: male users outnumber women by 0.9 and 2.3 p.p.

Figure 18
Internet users by gender and age, 2015
(In percentages)



Source: ECLAC Regional Broadband Observatory (ORBA) based on ITU Data, World Telecommunications Indicators Database, 2017.

2. Digitization of production

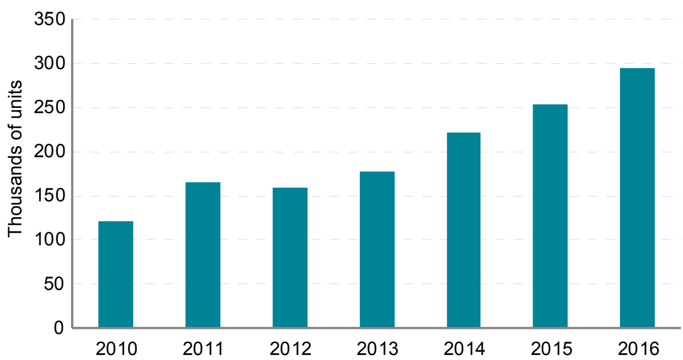
2.1 Robotics and automation

At a global level, the digitization of the economy is impacting the way of producing and marketing goods and services, and business models, requiring the development of new skills in order to function successfully in the new digital environment.

The productive processes are incorporating advanced and digital technologies in practically all activities. Part of this transformation is done through the incorporation of automatic processes to perform various tasks.

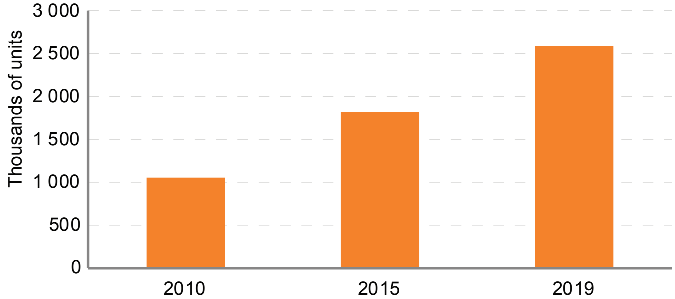
In this regard, Figures 19, 20, and 21 show, from different perspectives, the important increase that has occurred in recent years in the incorporation of robots in industrial processes and present forecasts for the coming years.

Figure 19
Worldwide sales of industrial robots



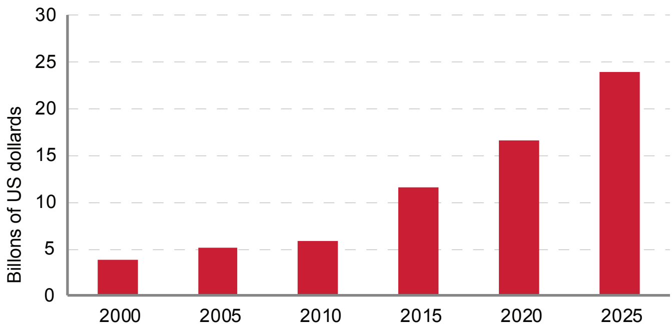
Source: ECLAC Regional Broadband Observatory (ORBA) based on data from Statista (https://www.statista.com/statistics/264084/worldwide-sales-of-industrial-robots/).

Figure 20
Worldwide pool of industrial robots in operation



Source: ECLAC Regional Broadband Observatory (ORBA) based on data from Statista 2017 (https://www.statista.com/statistics/281380/estimated-operational-stock-of-industrial-robotsworldwide/).

Figure 21
Expenditure projections of the purchase of industrial robots in the world market



Source: ECLAC Regional Broadband Observatory (ORBA) based on data from Statista 2017 (https://www.statista.com/statistics/441963/forecast-for-industrial-roboticsspending-worldwide/).

The data presented show that automation is an expanding process with significant growth projections worldwide. The region lags in the adoption of advanced digital technologies in productive processes, which generates productivity and competitiveness gaps with more developed countries in these matters.

Table 3 shows this lag with regards to robotization, taking as a parameter the annual shipments of robots worldwide. Mexico and Brazil stand out, individually surpassing all the rest of South America. However, they are well below countries such as the United States, China, Japan, the Republic of Korea, and Germany.

Table 3
Annual shipments of multipurpose industrial robots

Country	2015	2016	2017[a]	2018[a]	2019[a]	2020[a]	Δ % 2017/ 2016	Compound annual growth rate (%)
America	**38 134**	**41 295**	**48 000**	**50 900**	**58 200**	**73 300**	**16**	**2018-2020**
North America	36 444	39 671	46 000	48 500	55 000	69 000	16	14
USA	27 504	31 404	36 000	38 000	45 000	55 000	15	15
Canada	3 474	2 334	3 500	4 500	3 000	5 000	50	13
Mexico	5 466	5 933	6 500	6 000	7 000	9 000	10	11
Brazil	1 407	1 207	1 500	1 800	2 500	3 500	24	33
Rest of South America	283	417	500	600	700	800	20	17
Asia/Australia	**160 558**	**190 542**	**230 300**	**256 550**	**296 000**	**354 400**	**21**	**15**
China	68 556	87 000	115 000	140 000	170 000	210 000	32	22
India	2 065	2 627	3 000	3 500	5 000	6 000	14	26
Japan	35 023	38 586	42 000	44 000	45 000	48 000	9	5
Republic of Korea	38 285	41 373	43 500	42 000	44 000	50 000	5	5
Taiwan	7 200	7 569	9 000	9 500	12 000	14 000	19	16
Thailand	2 556	2 646	3 000	3 500	4 000	5 000	13	19
Others Asia/Australia	6 873	10 741	14 800	14 050	16 000	21 400	38	13
Europe	**50 073**	**56 043**	**61 200**	**63 950**	**70 750**	**82 600**	**9**	**11**
Central and Eastern Europe	6 136	7 758	9 900	11 750	13 900	17 500	28	21
France	3 045	4 232	4 700	4 500	5 000	6 000	11	8
Germany	19 945	20 039	21 000	21 500	23 500	25 000	5	6
Italy	6 657	6 465	7 100	7 000	7 500	8 500	10	6
Spain	3 766	3 919	4 300	4 600	5 100	6 500	10	15
United Kingdom	1 645	1 787	1 900	2 000	2 300	2 500	6	10
Others Europe	8 879	11 843	12 300	12 600	13 450	16 600	4	11
Africa	**348**	**879**	**800**	**850**	**950**	**1 200**	**(9)**	**14**
Not specified by country[b]	4 635	5 553	6 500	7 000	8 000	9 400	17	13
Total	253 748	294 312	346 800	379 250	433 900	520 900	18	15

Source: ECLAC Regional Broadband Observatory (ORBA) based on data from the International Federation of Robotics (IFR) and national associations.
Note: a: Projection; b: Reported and estimated sales that cannot be disaggregated by country.

Table 4 presents, for five countries in the region, estimates of the number of automatable jobs,[5] for the top 10 occupations in each country in terms of number of employees.[6]

Table 4
Automation potential of the main occupations

El Salvador				
Occupation	**Number of employees**	**Probability**	**Occupational structure**	**Number of employees that can be automated**
Shop merchant and market stands	136 339	0.94	4.93	128 159
Farmers and skilled workers of extensive crops	116 672	0.57	4.22	66 503
Shop and warehouse sales assistants	115 999	0.95	4.19	110 199
Store merchants	113 736	0.16	4.11	18 198
Cleaners and domestic assistants	109 393	0.69	3.95	75 481
Chefs	94 641	0.84	3.42	79 498
Bakers, pastry-cooks and confectionery makers	88 180	0.89	3.19	78 480
Construction workers	70 918	0.82	2.56	58 011
Security guards	65 234	0.89	2.36	58 384
Sewing machine operators	58 747	0.89	2.12	52 285
Mexico[a]				
Occupation	**Number of employees**	**Probability**	**Occupational structure**	**Number of employees that can be automated**
Shop and warehouse sales assistants	3 083 093	0.95	5.85	2 928 938
Workers in the cultivation of corn and/or beans	2 089 971	0.57	3.97	1 191 284
Merchants in establishments	2 083 072	0.55	3.95	1 145 690
Cleaners and domestic assistants	1 955 108	0.69	3.71	1 349 025
Construction workers	1 582 527	0.82	3.00	1 294 507
Drivers of buses, trucks, vans, taxis and passenger cars	1 181 000	0.75	2.24	891 163
Bricklayers, masons and related fields	1 068 912	0.65	2.03	696 396
Sweepers and cleaning workers (except in hotels and restaurants)	983 077	0.75	1.87	732 392
Drivers of heavy duty trucks	889 340	0.41	1.69	364 185
Street vendors of edible products	831 584	0.90	1.58	748 426

5 The probability was estimated in the study "The Future of Employment: How Susceptible are Jobs to Computerization?", by Carl Benedikt and Michael A. Osborne. It refers to the probability that an occupation is fully automatable given the characteristics and different activities that they imply respectively. In particular, three bottlenecks are identified for automation: perception and manipulation tasks, social intelligence, and creative intelligence. The more activities of this type that are involved the less is the chance for automation. For more detail are available at: https: //www.oxfordmartin.ox.ac.uk/downloads/academic/The_Future_of_Employment.pdf.

6 In all the countries sampled, the 10 chosen occupations are those that concentrate the largest number of employees. On average, these 10 occupations represent around 30% of total employment in each country.

Table 4 (concluded)

Uruguay				
Occupation	**Number of employees**	**Probability**	**Occupational structure**	**Number of employees that can be automated**
General clerks	91 152	0.97	5.53	88 417
Cleaners and domestic assistants	78 055	0.69	4.73	53 857
Shop and warehouse sales assistants	70 930	0.95	4.30	67 383
Cleaners and assistants of offices, hotels and other establishments	52 412	0.68	3.18	35 378
Accountability empoyees	51 567	0.97	3.13	50 019
Bricklayers	51 240	0.82	3.11	42 016
Livestock farmers	42 521	0.76	2.58	32 315
Store merchants	35 679	0.16	2.16	5 708
Chefs	29 163	0.84	1.77	24 496
Drivers of heavy duty trucks	28 162	0.41	1.71	11 532
Chile[b]				
Occupation	**Number of employees**	**Probability**	**Occupational structure**	**Number of employees that can be automated**
Store and retail merchants	506 266	0.68	6.72	342 109
Cleaners and domestic assistants	335 918	0.69	4.46	231 783
Garden and horticulture employees	267 812	0.95	3.55	254 421
Cleaners of offices, hotels and other establishments	242 208	0.78	3.21	189 528
Wholesale and retail managers	218 284	0.16	2.90	34 925
Chefs	186 315	0.69	2.47	129 178
Secretaries	171 015	0.56	2.27	96 384
Doormen and guardian, and the like	168 660	0.89	2.24	149 545
Driver of passenger cars, taxis and vans	167 193	0.70	2.22	117 453
Shop merchant and market stands	150 262	0.93	1.99	139 368
Ecuador				
Occupation	**Number of employees**	**Probability**	**Occupational structure**	**Number of employees that can be automated**
Sales clerks not elsewhere classified	360 201	0.97	4.96	349 395
Farmers and skilled workers of extensive crops	297 180	0.57	4.10	169 393
Store merchants	291 087	0.16	4.01	46 574
Driver of passenger cars, taxis and vans	237 229	0.70	3.27	166 653
Farmers and skilled workers in tree and shrub plantations	207 954	0.57	2.87	118 534
Bricklayers	203 166	0.82	2.80	166 596
Shop vendors and market stands	169 834	0.94	2.34	159 644
Cleaners and domestic assistants	160 019	0.69	2.21	110 413
Construction workers	156 862	0.82	2.16	128 313
Producers and skilled workers of a mix of agriculture and livetock goods whose production is destined for the market	144 383	0.76	1.99	109 731

Source: ECLAC Regional Broadband Observatory (ORBA) based on household surveys, selected countries.

[a] The name of the occupation corresponds to the least disaggregated classification of occupations, CIUO08 or SINCO11.

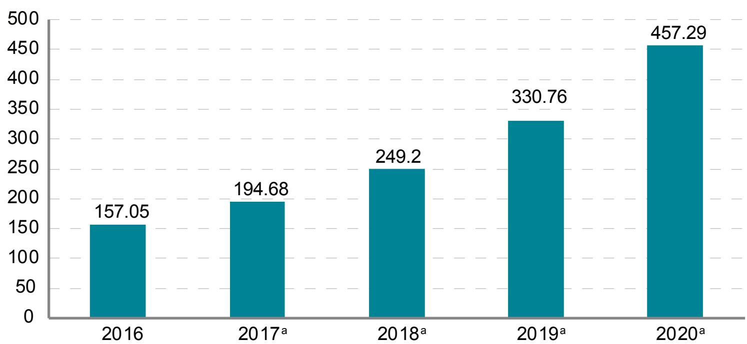
[b] The name of the occupation corresponds to the least disaggregated classification of occupations, CIUO08 or CIUO88.

In general, the literature emphasizes that the automation potential depends on factors such as regulatory frameworks, the availability and costs of advanced technologies, the costs of labour, and the organizational culture. However, the data presented indicate that automation is a process that will impact and change production models in an important way, which is why public policies are required to manage the impacts of this change, particularly as regards to the labour market, and the necessary skills to participate actively in it.

2.2 Internet of Things (IoT)

One of the enabling technologies for automation and digitalization of production processes is the Internet of things. Its evolution in recent years and future projections reinforce what has been mentioned about the profound transformation of production models.

Figure 22
Size of the global IoT market 2016-2020
(In billions of dollars)

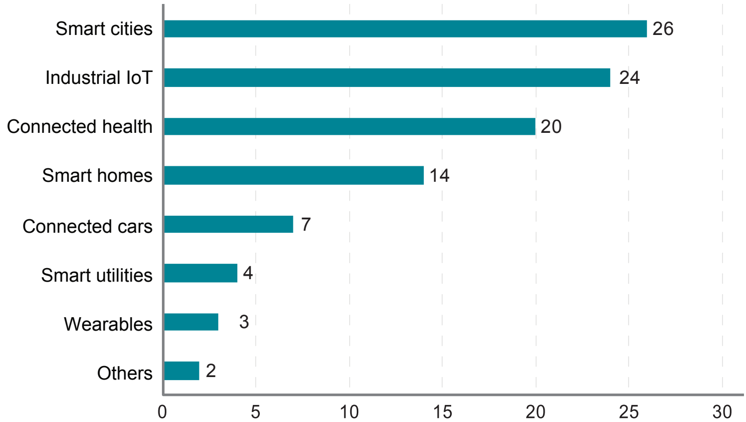


Source: ECLAC Regional Observatory of Broadband (ORBA) based on data from Statista 2017 (https://www.statista.com/statistics/764051/iot-market-size-worldwide/).
[a] Projections.

Figure 22 shows that the IoT market will practically triple between 2016 and 2020, going from 157 to 457 billion dollars.

Likewise, the composition by subsector of the IoT market shows that industrial applications correspond to 24% of the total, constituting the second most important category, after smart cities. In the region, for at least a three-year period there has been growing interest in the subject as reflected in the Roadmap for the Internet of Things, prepared in Mexico in 2014, and the recent Action Plan on the Internet of Things in Brazil, where it is stated that this technology is a first step in the direction of a more competitive future, with more robust productive chains and better quality of life,[7] or Colombia that established a Center of Excellence and Appropriation in the Internet of Things (CEA-IoT), in which companies from the private sector and universities participate. The lines of work prioritized by the CEA-IoT are aligned with the goals of the "Plan Vive Digital" 2014-2018.

Figure 23
Global IoT market shares by subsector 2017
(In percentages)

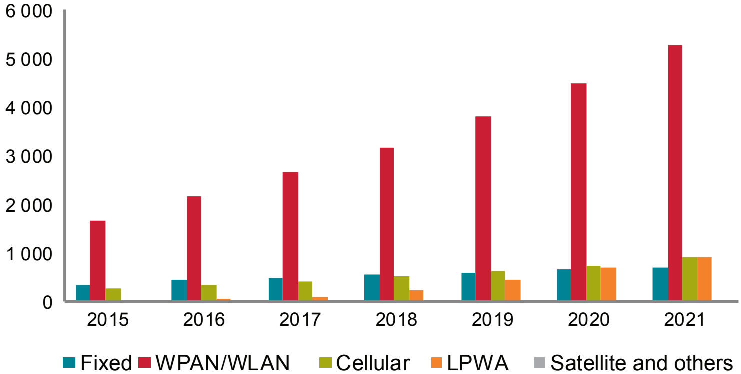


Source: ECLAC Regional Observatory of Broadband (ORBA) based on data from Statista 2017 (https://www.statista.com/statistics/764061/iot-market-share-by-sub-sector-worldwide/).

On the other hand, the relevance for IoT of wireless connections is also highlighted, particularly Wireless Local Area Network (WLAN) and Wireless Personal Area Network (WPAN).

[7] For Mexico, see PROMÉXICO, Roadmap for The Internet of Things, 2014. For Brazil, see BNDES, Ministry of Planning, Development and Management and Ministry of Science, Technology, Innovations and Communications, Report on the Plan of Action, Initiatives, and Mobilizing Projects, 2017.

Figure 24
Devices connected worldwide by technology 2015-2021
(In millions)



Source: ECLAC Regional Broadband Observatory (ORBA) based on data from Statista 2017 (https://www.statista.com/statistics/626323/connected-iot-devices-things-worldwide-by-technology/).

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