



Wi-fi as key technology to meet the increase in online activity in Brazil due to restrictions imposed by COVID-19

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Economic imperative of greater connectivity

Wi-Fi as a key technology to meet the increase in online activity in Brazil due to restrictions imposed by COVID-19

Executive Summary

Social distancing has changed the way Brazilians (and the rest of the world) access the Internet. The COVID-19 pandemic has created a world in which video conference applications have become more critical than ever. Remote work has become the new norm, children interact with schools through educational applications and many health services are now provided remotely to minimize physical contact between health professionals and patients. People at home connect with friends and family through video calls, watch movies via streaming services and spend more hours playing online games. These daily activities which are essential for the economic activities and mental well-being of the population are performed through Wi-Fi networks.

It is worth highlighting data that prove the change in behavior of the population and show that Wi-Fi has become a precondition for the functioning of society during the pandemic.

- In Brazil, Wi-Fi has carried an additional 2.8 Exabytes of traffic in the last 6 months as a result of COVID-19 restrictive measures, which have boosted broadband use in homes. This increase is equivalent to the transmission of 560 million HD movies in the period.
- Higher Wi-Fi usage due to COVID-19 in Brazil increased the economic value generated by Wi-Fi by USD 2.5 billion. This expansion represents approximately one year of economic value.

Future demand for Wi-Fi use in Brazil will continue to increase, leading to the exhaustion of its spectrum and limiting the ability of Brazilians to adapt to the new social and economic demands of the post-pandemic reality.

Therefore, we understand that:

- the allocation of additional spectrum throughout the 6 GHz band for Wi-Fi use in Brazil is the most effective and rapid way of mitigating risks associated with spectrum depletion, expanding and improving Wi-Fi performance, ensuring the continuous growth of the online economy and innovation; and
- the National Telecommunications Agency (Anatel) can follow the example of other regulators and act quickly to ensure that our new online reality can be rewarding and allow all citizens to benefit from innovative applications and services to work, study, communicate and receive medical care, among other possible applications.

1. The impact of COVID-19 on people and business

The spread of the SARS-Cov-2 virus, which causes COVID-19, has radically altered the day-to-day life of people in Brazil. To varying degrees, the states and municipalities of Brazil imposed restrictions on their citizens, limiting non-essential travel and requiring people to remain in their homes. The impact of the restrictions is measured by the increase in the social isolation index, as shown in the figure below (produced by inloco):

Social Isolation Index

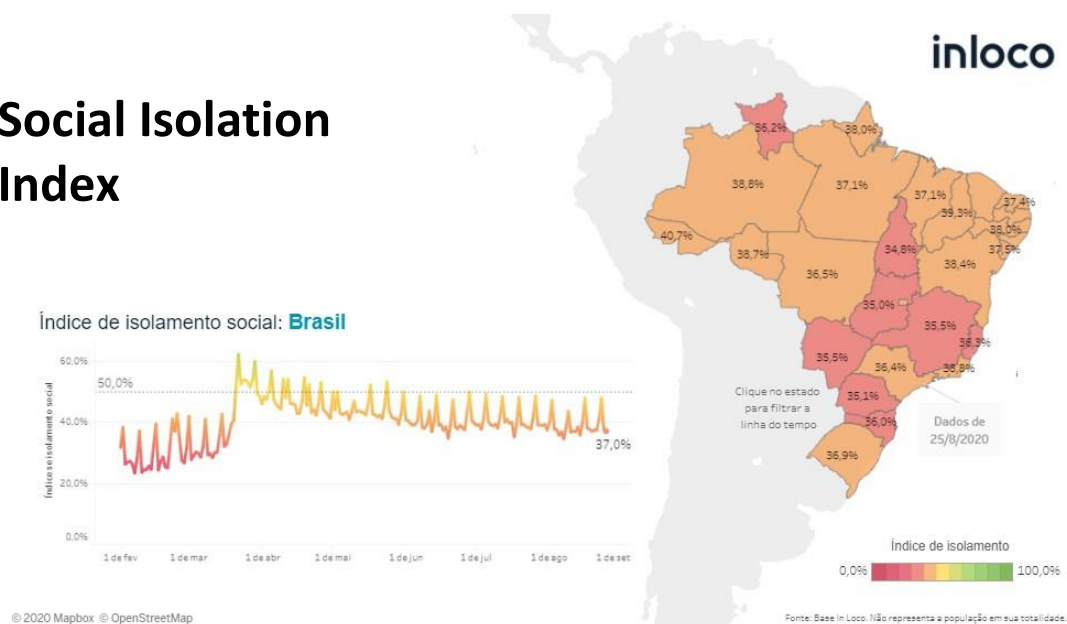


Figure 1: Evolution of the social isolation index in Brazil caused by COVID-19

As the population remained in their homes for longer, there was a significant increase in broadband use. Remote work has become the rule for many, made possible by the increasing use of video conferencing and cloud-based remote offices. With schools closed, children are learning online. Several health services are moving online to minimize physical contact between health professionals and patients, with video consultations and telemedicine services being used. Restrictions on freedom of movement have limited entertainment and social interaction options, which are being replaced by an increasing use of video streaming, online gaming and video conferencing services as a way to interact with family and friends without physical contact.¹ Thus, the six main areas we have identified that have driven online demand in homes are: remote work, remote education, healthcare, video streaming, online gaming and greater remote social interaction. This is proven by the fact that about 56% of Brazilians agree with the statement "The crisis of the coronavirus crisis helped me to adopt technology better in my day-to-day life".²

¹ BBC (2020). [Netflix gets 16 million new sign-ups thanks to lockdown.](#)

² [Report](#) published in August 2020 by Kantar Ibope (Portuguese).

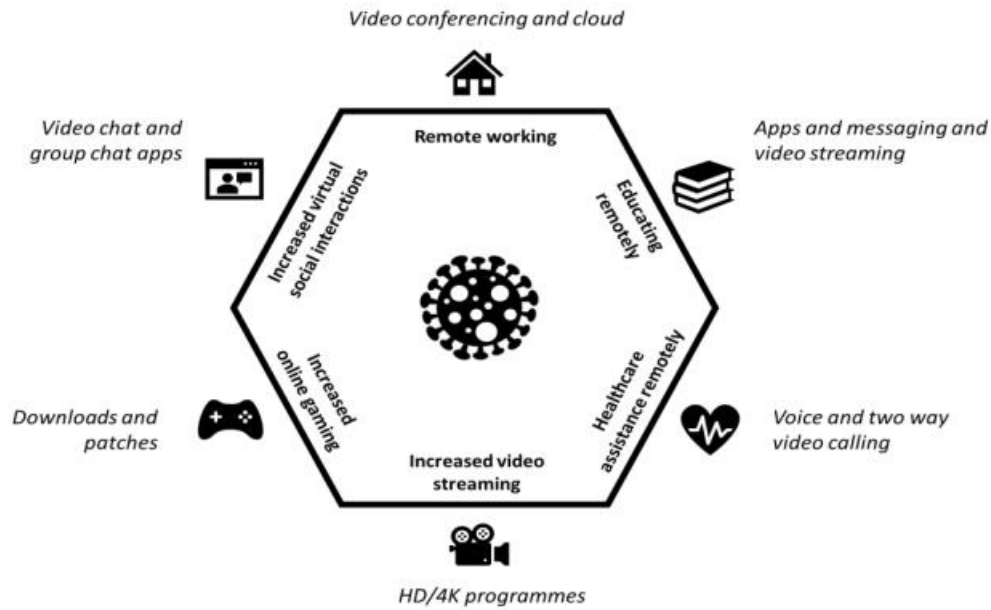


Figure 2: Six sources of online activity that drive online demand at home during the COVID-19 lockdown

2. The importance of Wi-Fi and the increase in its use due to COVID-19

For some time now, Wi-Fi has effectively provided connectivity in homes, connecting devices such as smartphones, tablets, laptops, game consoles and smart TVs to a fixed-line broadband service. It also plays a valuable role in offloading traffic from cellular networks, benefitting mobile operators, reducing the amount of network infrastructure needed to serve consumers, reducing mobile device prices and (in most cases) providing higher speeds than those provided by cellular networks. Having explained how COVID-19 has already changed broadband use in homes in Brazil, the next section will discuss how much Wi-Fi use has increased and the magnitude of this growth as a result of COVID-19.

Internet traffic from wireless connections, especially through Wi-Fi, is increasing.

According to CISCO's VNI Report 2017-2022, by 2022, 79% of total internet traffic will be wireless (including Wi-Fi and mobile data). However, it is worth pointing to the fundamental role played by fixed networks in terms of connectivity and the significant contribution Wi-Fi has made in this area. This is because, although mobile devices such as smartphones are the main devices for accessing the Internet, their connectivity will continue to be facilitated primarily through Wi-Fi (instead of mobile data), as demonstrated by Figure 3.

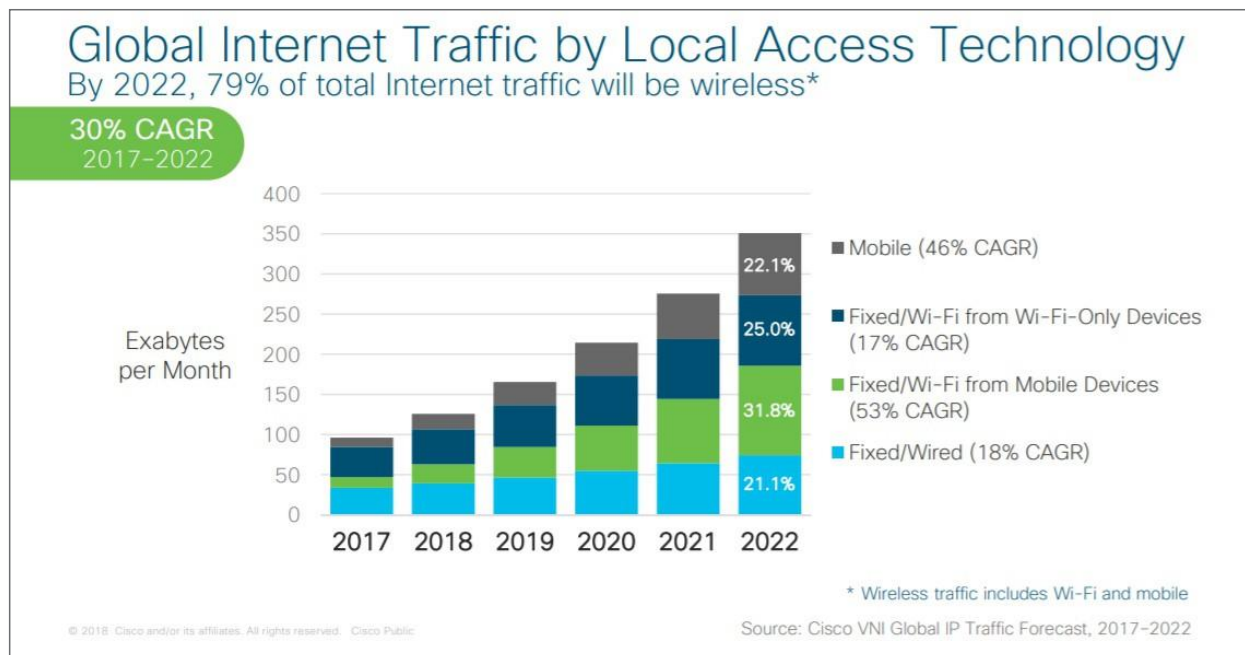


Figure 3: Global internet traffic by type of local access technology

The increase in online activity due to COVID-19 stems from the increased use of broadband at home.

It is known that the gradual implementation of preventive measures to deal with COVID-19, such as the closure of workplaces and quarantine in homes, increased the use of telecommunications networks. According to a study conducted by the ITU, Internet traffic increased by about 30% between the beginning of the implementation of prophylactic COVID-19 measures lockdown and June 2020.³ Due to the transition to remote work, traffic no longer originates substantially in trading centers but in residential areas instead.

As demonstrated above, studies conducted before the pandemic already identified this tendency for connectivity to be increasingly based on the use of Wi-Fi networks. This propensity has been enhanced in recent months: according to the same ITU study, some of the data traffic has shifted from mobile networks to fixed networks and Wi-Fi, with an 80% increase in upload traffic from PCs, laptops and other connected devices to cloud computing platforms and additional spikes in video conferencing calls. Therefore, additional spectrum is required to be allocated for unlicensed use.⁴

³ XITU, [GSR-20 Discussion Paper on the Economic Impact of COVID-19 on Digital Infrastructure](#), 2020 (pdf).

⁴ ASSIA, [The New Normal: Holiday-level Wi-Fi upload](#), 2020.

In Brazil, COVID-19 generated the equivalent of the annual growth in Internet traffic in one year.

Changes in the pattern of Internet use due to COVID-19 can be observed in the main Internet interconnection points and in the main content distribution network (CDN) operators. The information consistently indicates a significant increase in Internet traffic (between 10% and 40%)⁵ above expected levels, although many Over-The-Top (OTT) service providers have reduced their bit rate to avoid network congestion.⁶ We note that Internet traffic continues to grow year-on-year. Nevertheless, recent increases are related to the start of lockdowns in Brazil and are equivalent to the growth of internet traffic expected for a full year.

According to data from the Internet Exchange traffic exchange point IX.br, there was an increase in traffic from mid-March 2020, when the lockdown period began in the country.

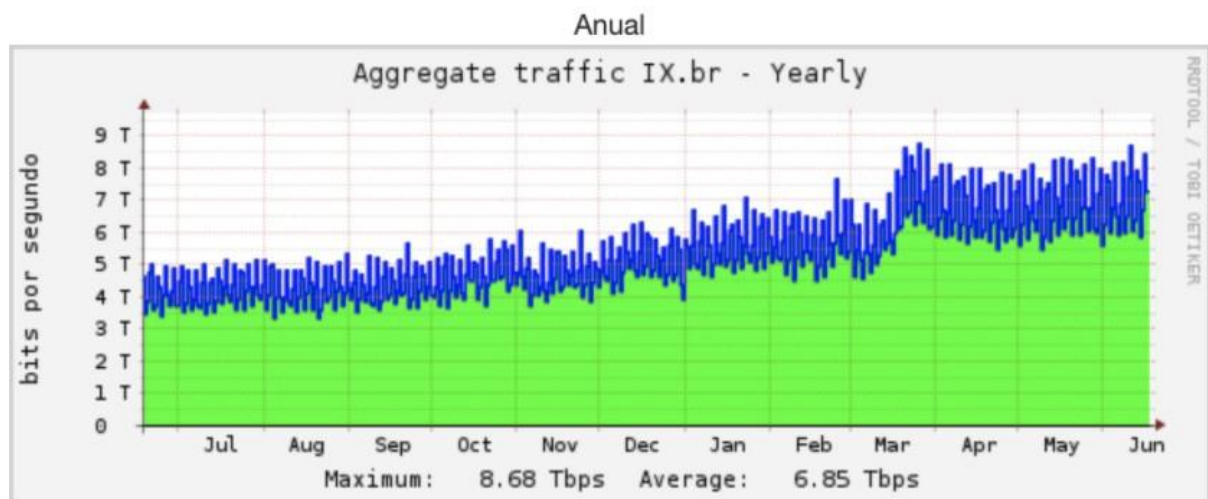


Figure 4: PTT data - IX.br from July 2019 to June 2020

Due to the restrictions associated with COVID-19, this increase in bandwidth consumption is being carried out mainly through domestic Wi-Fi.

⁵ [Em três dias de quarentena, consumo de internet fixa sobe 40%, Folha de S. Paulo](#) (Portuguese).

⁶ [Anatel](#) (Portuguese).

To better understand the role played by Wi-Fi networks in connecting people, it is pertinent to assess whether consumers are spending more time using Wi-Fi than before restrictions due to COVID-19. Recently, the mobile connectivity analytics firm OpenSignal published data⁷ on how the use of Wi-Fi by smartphone users has changed since the start of the COVID-19 pandemic. The analysis covers several countries in the world, including Brazil, and in all of them, there was an increase of 10-25% in the time smartphone users spent on Wi-Fi. These changes are closely aligned with national measures that require citizens to stay at home. Even though this study focused only on smartphone users, it presents additional evidence of how Wi-Fi is carrying much more traffic now than it did before COVID-19.

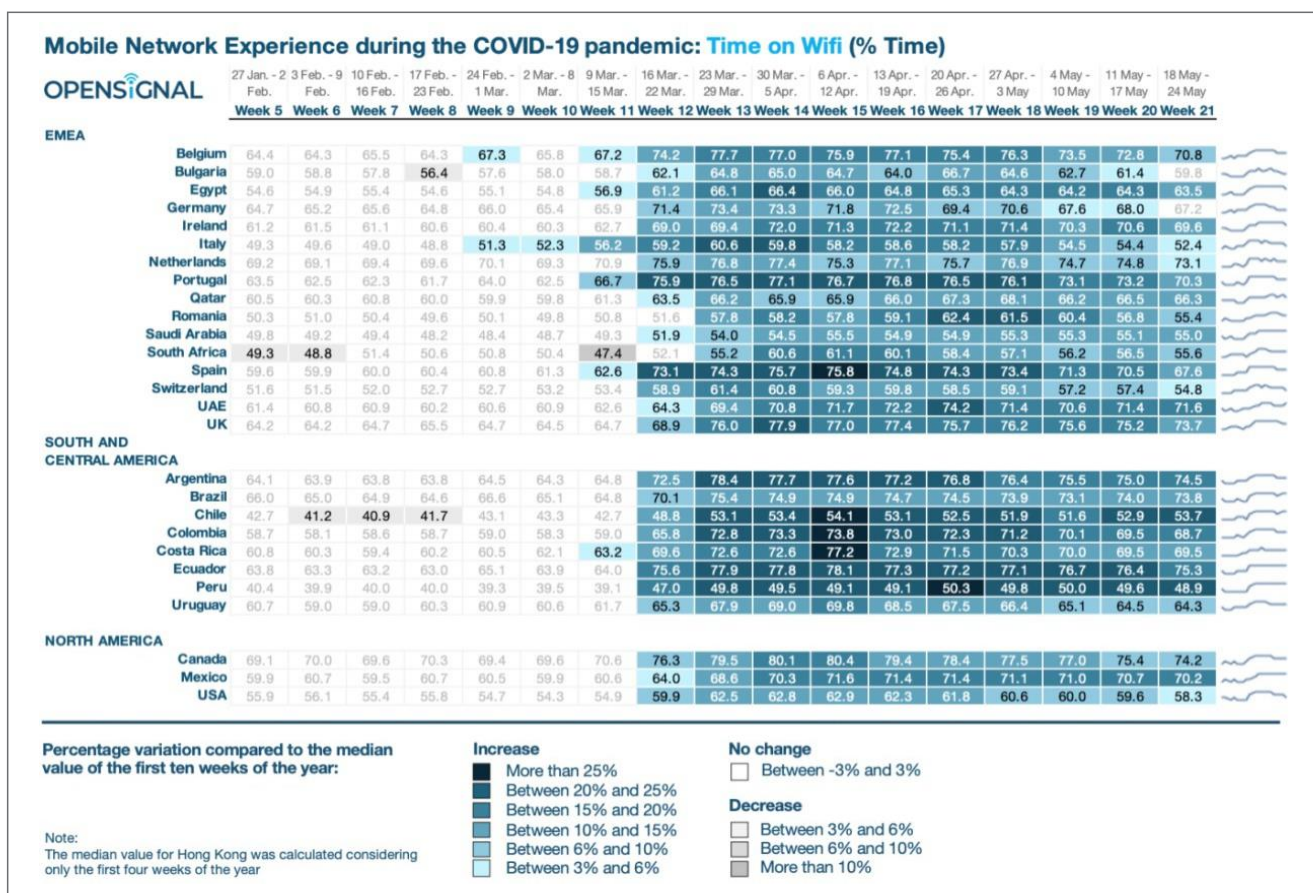


Figure 5: % of the time smartphones remain connected to Wi-Fi (before and during the COVID-19 pandemic)

Using estimates of average traffic per person per month in Brazil, we calculate that COVID-19 is generating an extra 5 Exabytes of traffic to be transported over Wi-Fi networks every month.

Published data shows that Internet traffic increased in Brazil due to COVID-19. Based on the findings, we conclude that this has generated a growth in Internet traffic that would usually be expected over years. Considering the per capita⁸ monthly traffic estimates, combined with our analysis that 48% of all traffic is carried over Wi-Fi, we estimate that the total

⁷ Opensignal (2020). Mobile Network Experience during the COVID-19 pandemic: June update.

⁸ VNI Mobile Forecast Highlights Tool (Brazil).

increase in traffic carried by Wi-Fi throughout Brazil due to COVID-19 was about 2.8 Exabytes in the last 6 months. This equates to 560 million HD movies every month.⁹

This type of estimation requires assumptions and extrapolations of data and behaviors, but it is important to focus on the magnitude of the increase, not the specific value – that is to say: Wi-Fi is carrying significantly more traffic.

3. The need to rethink spectrum use in Brazil and the economic value of increased Wi-Fi use

The fact that current Wi-Fi networks need to deal with this growing need for Internet connection creates risks for Brazil's connectivity. This is because all the activity takes place in just two frequency ranges (at 2.4 GHz and 5.8 GHz), which are shared with everything from baby monitors to Bluetooth devices. The additional spectrum for Wi-Fi will be needed globally and in Brazil to meet the growing demand for data, which was already gradually increasing before the pandemic.

The launch of 5G networks, the proliferation of Internet of Things (IoT) devices and the growing need for consumers and businesses to have access to broadband connectivity continue to drive demand for licensed and unlicensed spectrum, as well as the exponential increase in the number of Internet-connected devices, which is expected to reach 28.5 billion by 2022.¹⁰

In this scenario, IoT solutions have different connectivity requirements in terms of reach, data throughput, power efficiency and device cost, and Wi-Fi is often the best connectivity alternative in this situation, as its indoor coverage is almost ubiquitous. Globally, Wi-Fi speeds for mobile devices are estimated to double by 2022.¹¹ Cisco VNI projects that Wi-Fi usage will continue to increase every day, especially in hospitals, where Wi-Fi is improving healthcare delivery and team productivity, as well as industries where machines and people are interconnected; data travels vertically and horizontally throughout the automated system, enabling the development of Industry 4.0.

There is considerable research evidence that Wi-Fi technologies have a significant social and economic value. A 2018 study by Dr Raul Katz of Columbia University, with support from Telecom Advisory Services (TAS), estimates that the overall economic value of Wi-Fi in 2018 was USD 1.96 trillion. By 2023, the overall value of Wi-Fi is expected to increase to USD 3.47 trillion. In addition, estimates indicate that global jobs directly associated with the Wi-Fi industry will increase by more than 50%, reaching nearly one million in 2023.¹²

For the purposes of the study, the economic impact of Wi-Fi was evaluated by deriving its intrinsic value. Wi-Fi creates economic value by being used in economic and social activities

⁹ Assuming that an HD movie lasts 2 hours and consumes 6GB of data. [Netflix data](#)-driven estimation.

¹⁰ [Cisco Annual Internet Report \(2018–2023\) White Paper](#).

¹¹ [Cisco Annual Internet Report \(2018–2023\) White Paper](#).

¹² [The Economic Value of Wi-Fi: A Global View \(2018 and 2023\)](#).

such as online media, telework, telemedicine and online businesses.

1. Wi-Fi allows free or low-cost broadband access by complementing cellular networks. Smartphones, for example, easily operate on Wi-Fi hotspots that allow for free or cheaper broadband. This creates value for consumers in the form of savings that can be spent on other items. Even the newest cellular (5G) technology will require significant Wi-Fi capability to voice and video services, which will be delivered best with Wi-Fi 6 technology.
2. Wi-Fi enables industry growth and innovation, making it easier to adopt emerging technologies such as IoT and improve the use of operational technologies such as system monitoring and control. The use of unlicensed spectrum is cheaper and faster to implement, allowing the industry to innovate and grow rapidly.
3. Wi-Fi is also a catalyst for eliminating the digital divide. According to a *TIC Domicílios* survey, promoted by the Regional Center for The Development of the Information Society (Cetic.br),¹³ a quarter of individuals in Brazil (47 million) are still disconnected. The data indicate that more than 20 million households do not have Internet connection in the country, a reality that especially affects households in the northeast region (35%) and families with incomes of up to one minimum wage (45%). Also, according to the research, a total of 79% of households with Internet access were found to have Wi-Fi connection in urban areas and 66% in rural areas.
4. The Wi-Fi equipment industry also contributes directly to the economy through the direct production and manufacture of these devices, along with providing jobs.

Calculating the value of Wi-Fi from these points is complicated, as it makes use of unlicensed spectrum and has many different uses and applications. The economic value is estimated considering the contribution of Wi-Fi to GDP and the economic surplus (consumer and producer) produced by Wi-Fi. The 2018 TAS document measures eight Wi-Fi value creation effects (with consumer use in their homes being the most significant) and applies this analysis to six countries (United States, United Kingdom, France, Germany, Japan and South Korea). Then, as mentioned above, the analysis is used to extrapolate an overall Wi-Fi value in 2018 of USD 1.96 trillion, increasing year-on-year to reach USD 3.47 trillion by 2023.

Our analysis of Wi-Fi usage due to COVID-19, combined with analysis of the economic Wi-Fi value in the TAS document, allows us to conclude:

- Increases in internet traffic due to COVID-19 occurred predominantly more on home Wi-Fi networks.
- The increase in Internet traffic due to COVID-19 is probably equivalent to a year of normal increase in total Internet traffic.

¹³ CGI.br/NIC.br, Regional Center for Studies for the Development of the Information Society (Cetic.br), [Research on the use of information and communication technologies in Brazilian households](#) - ICT Households 2019.

- Therefore, we consider it reasonable to assume that the economic value equivalent to one year, as calculated in the TAS document, was generated by the COVID-19 crisis. In other words, COVID-19 accelerated economic value by one year.
- To determine the economic value for Brazil, we used calculations of the economic value of global Wi-Fi in the TAS document, considering the representativeness of Brazil's GDP in global GDP.¹⁴

The result of this analysis indicates that the increase in Wi-Fi use in Brazil, due to COVID-19, has an estimated economic value of USD 2.5 billion.

Wi-Fi usage in Brazil has increased and is delivering more economic value per MHz than ever before. Consequently, restrictions on Wi-Fi spectrum constitute a significant loss of economic value, particularly during the COVID-19 crisis, when the additional spectrum for Wi-Fi could have allowed more people to remain economically active and maintain/increase the productivity of others.

4. Enhanced Wi-Fi can help more people stay economically active

The measures of total or partial restriction due to the crisis of COVID-19 are affecting 2.7 billion workers, representing about 81% of the global workforce, according to the International Labor Organization (ILO).¹⁵ Similarly, the United Nations Educational, Science and Culture Organization (UNESCO) estimates that 1.3 billion students and young people worldwide are being affected by the closure of schools and universities.¹⁶

Workforce

As more people access the Internet to work from home (IBGE registered 8.3 million people in Brazil as working remotely between 19 July and 25 July)^{17,18} and an increasing number of devices are connected simultaneously to the same networks, there is a significant demand for additional unlicensed spectrum to support Wi-Fi. Increased spectrum availability would allow for higher bandwidths and increase the average capacity of routers to support applications that use more data. Wi-Fi Forward estimates that providing additional spectrum in the 6 GHz range will increase the router's average capacity from 137 Mbps to 468.00 Mbps.¹⁹ This, in turn, will expand productivity, averaging 0.30-1.97% of GDP in the United States alone.²⁰

¹⁴ The TAS Report extrapolates the six-country analysis of the study to generate an estimate of the value of global Wi-Fi. To do this, they observe a correlation between GDP and Wi-Fi value and apply a reducer to calculate the value for less developed countries using the United Nations HDI index. To reach Brazil's value, the country's GDP share is considered in the total global GDP.

¹⁵ ILO (2020). [ILO Monitor: COVID-19 and the world of work. 2nd edition.](#)¹⁶ UNESCO (2020). [Global Education Coalition.](#)

¹⁶ UNESCO (2020). [Global Education Coalition.](#)

¹⁷ [IBGE website](#) (Portuguese).

¹⁸ Office of National Statistics (2020). [Coronavirus and homeworking in the UK labour market: 2019.](#)

¹⁹ Telecom Advisory Services (2020). [Wi-Fi Forward: Assessing the Economic Value of Unlicensed Use in the 5.9 and 6GHz Bands](#) (pdf).

²⁰ Telecom Advisory Services (2020). [Wi-Fi Forward: Assessing the Economic Value of Unlicensed Use in the 5.9 and 6GHz Bands](#) (pdf).

Education

Providing additional spectrum and, consequently, increased bandwidth for Wi-Fi will make it easier to use the video conferencing tools needed to support remote education. In Brazil, 71% of federal universities continued their activities during the pandemic online, accounting for about 844 000 students and 75 000 teachers.²¹ Around the world, elementary and high school teachers are relying on video conferencing tools like Zoom to continue education while children are required to stay at home.

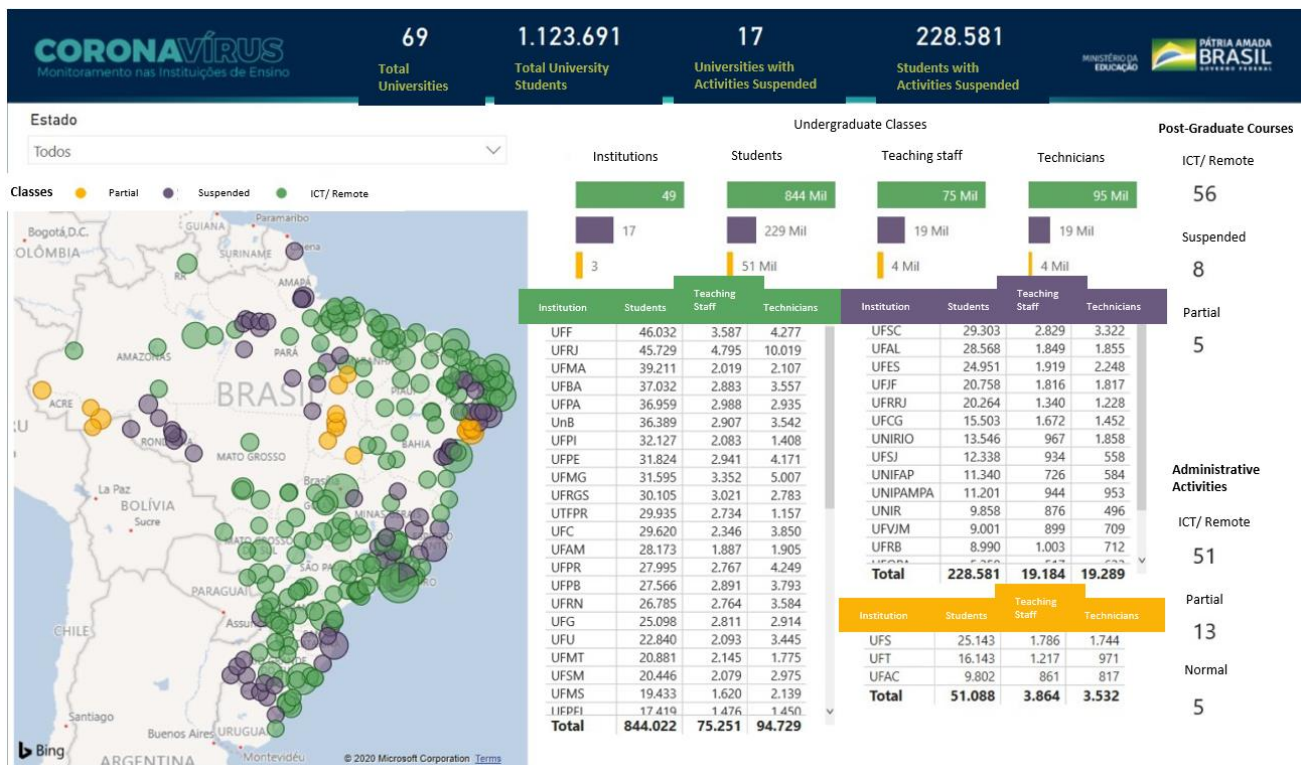


Figure 6: Map of the activities of Brazilian federal universities during the pandemic

Health

Telemedicine applications consume a lot of data and are therefore traditionally accessed over a Wi-Fi network. According to data compiled by *Exame* magazine in August 2020, about 1.7 million remote consultations have been made in Brazil since the beginning of the pandemic.²² The increasing use of telemedicine worldwide^{23,24,25} is contributing directly to relieving the pressure on health institutions and flattening the COVID-19 contagion curve. However, Wi-Fi bandwidth restrictions prevent more data connections from being supported, which impacts services provided in medical centers. The availability of more spectrum, with increased bandwidth, will allow an additional group of health professionals

²¹ [Ministry of Education](#) (Portuguese).

²² [The time of telemedicine – The country has already made 1.7 million distance consultations](#) (Portuguese).

²³ The Specialist (2020): [Coronavirus: Doctolib makes its teleconsultation platform free of charge for all doctors in France](#) (French).

²⁴ Quartz (2020). [Telemedicine struggles to be an option for everyone in the wake of coronavirus.](#)

²⁵ [Meikto](#) (2020).

to use Wi-Fi networks, both from hospitals and the comfort of their homes.

Innovation

It will not be possible to catalyze innovation or streamline the deployment of advanced technologies such as IoT and augmented/virtual reality (AR/VR) applications without more spectrum for Wi-Fi. AR and VR applications, for example, require significant bandwidths. In its most recent report,²⁶ CISCO estimated that the most demanding future UHD VR applications will require 500 Mbps of bandwidth. As we know, the current spectrum available for Wi-Fi cannot support the widespread adoption of AR/VR applications.

Online Business

The restrictions imposed by COVID-19 have forced thousands of small businesses (mostly retailers) to accelerate their migration to the online marketplace, with many operations currently being carried from home. This stems in part from the significant change in consumer behavior in relation to more purchases and online transactions. A survey conducted by Ebit I Nielsen found an increase in the percentage of consumers buying online for the first time, according to the graph of the figure below.



Figure 7: Growth in the percentage of consumers making online purchases for the first time

Another survey by SBVC²⁷ (Brazilian Society of Retail and Consumption) indicates that 61% of customers who performed online purchases during the lockdown increased their volume of purchases due to social isolation. In 46% of cases, this increase in purchases was more than 50%. Additional spectrum and bandwidth will encourage more companies to trade

²⁶ Cisco (updated 2020). [Cisco Annual Internet Report \(2018-2023\)](#) White Paper.

²⁷ [Hábitos de consumo adquiridos na pandemia deverão permanecer](#) (Portuguese).

online as they gain greater confidence in the resilience and capacity of domestic networks. Better connections can also facilitate more transactions per second and improve user experiences, leading to additional transactions.

5. Initial policy conclusions and next steps

It is known that the additional spectrum for license-exempt applications will generate significant benefits for economies and communities around the world. Certain frequency ranges can enable better Wi-Fi links, multi-gigabit speeds, low latency connections and enhanced capacity for low-power indoor devices (LPI), allowing communities around the world to expand the capacity of already-overloaded Wi-Fi networks and eliminating existing bottlenecks and mitigating the impact of overcrowded networks.

The relevant authorities are beginning to act, seeking to leverage technology to promote social and economic growth. The Federal Communications Commission (FCC) in the United States, for example, has decided to increase the spectrum available for Wi-Fi by making the entire 6 GHz (5 925-7 125 MHz) band available for unlicensed operation. This is the most significant decision on unlicensed spectrum in more than 20 years, made at a critical time where the world is becoming increasingly dependent on Wi-Fi.

Through this decision,²⁸ the FCC sought to consolidate U.S. leadership in wireless technology and facilitate Wi-Fi applications in 1200 MHz of contiguous spectrum, which will result in an increase of USD 183.44 billion in total economic value between 2020 and 2025,²⁹ according to studies.

Inspired by the FCC's decision, the Board of Directors of the National Telecommunications Agency (Anatel) recently took an important step in recognizing the potential of the 5 925-7 125 MHz range for the development of low-cost connectivity solutions such as Wi-Fi 6 technology (by amending the Regulation on Restricted Radiation Communication Equipment, approved by Resolution No. 680/2017). This way, Brazil strategically aligned itself with the U.S. market, allowing the country to benefit in the future from products developed for the North American market.

The benefits of improved Wi-Fi use are universal, with studies showing up to USD 70.15 billion of total economic value in the UK and USD 63.93 billion in France by 2023.³⁰ This is why the European Commission has commissioned a study on the regulatory and technical feasibility of introducing WAN/RLANs into the 6 GHz band (5 925-6 435 MHz),³¹ with the aim

²⁸ Under the FCC's decision, three classes of unlicensed devices will be permitted: standard power devices, through which an Automatic Frequency Coordination (AFR) mechanism will avoid interference with other services; LPI devices operating approximately four times lower than standard Wi-Fi and without requirement for frequency coordination; and very-low-power (VLP) devices, which would be indoors or outdoors and also do not require frequency coordination as they operate with 60 times less power than standard Wi-Fi.

²⁹ Telecom Advisory Services (2020). [Wi-Fi Forward: Assessing the Economic Value of Unlicensed Use in the 5.9 and 6GHz Bands](#) (pdf).

³⁰ Wi-Fi.org (2018). [What is the Value of Wi-Fi?](#)

³¹ European Commission (2017) [Mandate for CEPT](#) (pdf).

of increasing the supply of Wi-Fi spectrum by 500 MHz.

The FCC and EC's decision recognizes the maturity of the Wi-Fi industry ecosystem, as devices are expected to begin supporting 6 GHz Wi-Fi this year. For example, Broadcom announced a 6E Wi-Fi mobile chip, Qualcomm has signaled its readiness to support 6GHz Wi-Fi on next-generation wireless products and Intel will have chips ready for January 2021.

The FCC and its European counterparts will also develop rules for existing services to continue to thrive as new wireless innovations such as Wi-Fi 6 coexist harmoniously with them.

In Brazil, it is important that technical specifications which allow the effective, unlicensed use of the 5 925-7 125 MHz range are defined by Anatel soon, so it is possible to implement 6E Wi-Fi equipment and applications in the country in the short term.

6. Agile and aligned decision with the rest of the world will bring immediate results

Wi-Fi has been an extremely important source of connectivity in recent years, as it also allows a huge volume of data to be transferred, supports traffic from homes and businesses and generates wide and varied economic value. In this context, the COVID-19 pandemic highlighted the central role of Wi-Fi connectivity as a prerequisite for a functioning society.

In terms of a possible destination for Wi-Fi 6, we consider the 6 GHz (5 925-7 125 MHz) band to be particularly suitable for unlicensed use due to its proximity to the 5 GHz (5 725-5 850 MHz) band already used widely on an unlicensed basis (without any action from the ITU Radio Communications Sector). Thus, massive investments already made in 5 GHz devices could be directly leveraged at 6 GHz. This spectral proximity will also facilitate the integration of 6 GHz radios with 5 GHz radios, allowing the 5 GHz and 6 GHz networks to be implemented transparently and simultaneously.

Therefore, the new 6 GHz spectrum, in addition to being valuable to Wi-Fi, will also bring direct benefits to 5G networks that will need Wi-Fi to deliver all its functionality indoors. As users purchase 5G phones and get used to even higher speeds while on the go, they will expect this experience to be the same in indoor environments. With the added capacity provided by Wi-Fi 6, the likelihood of uninterrupted data transfer increases. As a result, the satisfaction of all wireless network users will also increase, no matter what networks they are using. Although it is recognized that the 6 GHz band is well-suited for these purposes, interesting traditional operators, there is no doubt that any action to reserve part of these frequencies to meet long-term commercial interests of incumbent services would represent an immediate injunction of the potential identified in this study.

The importance of connectivity to mitigate various issues arising from the pandemic underlines the steps that Anatel needs to consider before the next (or second phase of the current) pandemic. In this sense, it is urgent to adopt measures that enable the use of new technologies, especially making the 5 925-7 125 MHz available for unlicensed devices to expand connectivity in the country.

