CHAPTER 2

SMALL INTERNET PROVIDERS AS AGENTS: INTERNALIZING DIGITAL INFRASTRUCTURE IN BRAZIL

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ABSTRACT

The expansion of connectivity on a national scale in Brazil, whether through mobile Internet or fixed broadband, is described as one of the factors that can lead to social and economic benefits for large parts of the population who do not have a network connection. It can also help to reduce poverty by improving the infrastructure of services and increasing Internet use for education purposes. It also provides people with the ability to communicate with online administrative services – local, regional, and national. In Brazil, the main difficulty facing an effective universalization of telecommunications has been limitations in accessing services. This chapter demonstrates the relevance of small Internet providers for the expansion of fixed broadband in less commercially attractive regions (in terms of subscribers, income, and distance) who have been growing over recent years and are now present in 70% of Brazilian municipalities and whose role is paramount to reducing the digital divide.

THE INTERNET ENVIRONMENT

From November 2010, the number of operating mobile phones exceeded the number of inhabitants (202.9 million mobile phone accesses for 190.7 million Brazilians) until December 2019 (226.7 million mobile phone accesses for 210.1 million Brazilians).[1] Brazil went through a "virtuous cycle" in the digital world. Mobile phones are still the main source for the increasing Internet use in Brazil, a country which still has unequal rates of economic, educational, technological, and income development. Generally, these standards are higher in urban areas in the Southeast and the South.

The infrastructure of fixed broadband has led to digital advances in the last decade. The expansion of fiber optic networks was mostly boosted by the National Broadband Program (PNBL), created in 2010 to "promote widespread access" to the Internet, especially in regions where technology is lacking, mainly in the states of the North and the Northeast. Article 1st of the Act stated that:

> […] The National Broadband Program (PNBL) is hereby established with the objective of promoting and spreading the use and supply of goods and services of information and communication technologies with the purpose of:
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> I – promoting widespread access to broadband internet connection services;
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> II – increasing social and economic development;
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> III – promoting digital inclusion;
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> IV – reducing social and regional inequalities;
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> V – increasing employment and income;
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> VI – expanding online government services and making it easier for citizens to use state services;
>
> VII – teaching the population on how to use information technologies;
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> VIII – increasing technological autonomy and competitiveness in Brazil. (Decreto n° 7175 2010)

The objective of Telebrás, the company who would install the network, was to expand the number of access points from 23.7 million to 90 million by 2014 (Senado Federal, 2011). This objective was not met and, in December of 2016, the terms of the agreements with the operators expired, and the PNBL was shut down (Amaral, 2017). The Program serviced retail businesses in 5,400 municipalities, offering them an Internet speed of 1 Mbps for broadband, or a package combining landline and broadband Internet. Anatel (the National Telecommunications Agency) found some discrepancies with regard to the information that the Oi, Telefonica/Vivo, and CTBC/Algar groups were providing on the PNBL, such as failing to promote the program (which was cheaper than their packages), and company staff either being unaware of the program itself or providing inaccurate

information about it (Anatel, 2016, pp. 29–31). Residents in the interior (those living on the "final mile": the final stretch between the provider and the user's reception point) were dependent on the large telecom groups, which, in turn, were not interested in offering service or reasonable prices – about US\$11.00 as per the 2016 exchange rate.

Regional and local Internet providers began to thrive in this highly concentrated telecommunications sector and brought modern digital communication to areas of Brazil that had never had it before either because they were too remote, too rural, or had lower income levels. By May 2019, after five years of continuous growth (2014–2019), small local/regional providers accounted for 23.2% of Internet users in Brazil – 4% more than Telemar/Oi; 0.1% less than Telefonica/Vivo, and 5.6% less than the group leader, Telecom Americas (Claro, Net, and Embratel). By January 2020, small providers accounted for more than 10 million accesses (Anatel, 2020b) and were mostly part of the Brazilian Association of Internet and Telecommunications Providers (Abrint) and the National Association for Digital Inclusion (Anid). The National Telecommunications Agency states that Small Providers (PPPs) account for less than 5% of national participation in every retail market in which they operate, excluding the large telecommunications groups (Anatel, 2019).

Over the last decade, Brazil has invested heavily in the development of Internet in terms of universality and international regulatory standards, although there continue to be problems in the application of legislation and there is a lack of access and connectivity in some regions.

Two recent international studies on Brazil support the assertions in this chapter: UNESCO (2019) and *The Economist* Intelligence Unit commissioned by Facebook (2020).

The UNESCO document that assesses the Internet ecosystem in Brazil is based on four principles from its Internet Universality Indicators, from the English acronym ROAM+X (Rights, Openness, Accessibility to All, Multistakeholder participation + Cross-cutting indicators). Each principle is detailed as follows:

1. *Rights*: This refers to the legal and regulatory framework, freedom of expression, right of access to information, and freedom of association (including participation, privacy, economic, social, and cultural rights).
2. *Openness (transparency)*: Refers to the legal and regulatory framework, with open standards, open market, open content, and open data.
3. *Accessibility to all*: Refers to the legal and regulatory framework, technological and geographic connectivity, access to networks and services, equal access to content and language, capacities, and competencies.
4. *Multi-stakeholder participation*: Refers to the legal and regulatory framework, national Internet governance, and international and regional Internet governance. The "X" category refers to cross-cutting issues which include: gender equality, children and youth, sustainable development, trust and security, and ethical and legal aspects of the Internet. The contextual indicators aggregate economic, development, ICT development, governance, and demographic data sets.[2]

The study shows that although more Brazilians have access to the Internet today, there are inequalities regarding the conditions of use and appropriation of information and communication technologies (ICTs), pointed out as one of the most critical issues for developing the Internet on a national level (UNESCO, 2019, pp. 17–18). It also highlights that the country still faces several challenges to the universalization of Internet access, some of which are: the lack of effective public telecommunications policies, especially in low-income regions and areas not serviced by high-speed networks; a failure to invest resources, especially sector funds, in universal access policies; reduced support for small local Internet service providers operating in regions of low commercial interest.

Lastly, it highlights the existence of a large portion of the population which does not have any type of access to the Internet, particularly the low-income areas, those over 60 years old and those living in rural areas. Access via fixed broadband, especially among groups with limited connection, has not evolved to the point of contributing to universal access, even in an environment where mobile connections are the main means of spreading the Internet (UNESCO, 2019, p. 19). The study concludes that disparities in network access are still visible:

About 61% of Brazilian households are connected to the Internet, but in rural areas, only 34% of families have access; the Internet is present in only 30% of low-income households (C and D classes), while in high-income households (A and B classes), it reaches 99% (UNESCO, 2019, p. 188).

The Inclusive Internet Index 2020, conducted by *The Economist* Intelligence Unit,[3] measures/evaluates the existing conditions of the Internet in Brazil. The data collected are also distributed into four criteria. The first is *availability* – levels of Internet usage, quality of access and network infrastructure, and electricity for connection. The second is *affordability* – the price or cost of access relative to levels of income and competitive environment, that is, the existing concentration levels in the Internet services market. The third is *relevance* – local content (content available in the local language) and relevant content (access to journalistic, financial, health, business, and entertainment information). The fourth criterion is *readiness* – the capacity to access the Internet, including competencies, cultural acceptance, and supporting policies (digital literacy, reliability, security, and public policies/national strategies for promoting the spread of Internet use (*The Economist* Intelligence Unit, 2020).

The report shows that Brazil is currently ranked 34th in the global ranking of inclusion on the Internet and ranks 5th out of the group of 10 countries classified as *upper-middle income* (ahead of Argentina) (9th place) and Colombia (10th place). Looking at the categories, Brazil has a better ranking in terms of affordability (22nd in the world), but it occupies the worst positions in the other criteria – relevance (35th), readiness (44th), and availability (46th).

The three least favorable classification items in *The Economist's*[4] study corresponds with data from the UNESCO study, which also found the difficulty of access to occur mainly in regions that are farther from urban centers, especially rural areas, and places with lower income per capita, as is the case with the municipalities examined in this chapter.

Using data from these two studies, which show the challenge of universalizing Internet services in low-income areas, this chapter presents and evaluates access conditions and Internet connectivity in 32 Brazilian municipalities with a very low Municipal Human Development Index (MHDI)[5] – less than 0.5 on the indicator that evaluates well-being from the three dimensions of Global Human Development Index (HDI).

THE RELEVANCE OF THE SMALL INTERNET PROVIDERS

This chapter focuses on the performance of small Internet providers in order to evaluate company services such as service capacity, technology, available broadband speed, and user relationship strategies in products and services. We used information from public databases (National Telecommunications Agency (Anatel); Ministry of Science, Technology, Innovations, and Communications; Internet Management Committee; and IBGE) to map access to the Internet and infrastructure conditions for the cities included in this study.

It is relevant to this study to observe current market dynamics for the provision of Internet services and the role played by small providers in the universalization of services. The presence of these small providers helps to overcome the digital exclusion that occurs to users of a particular income and geographic location. Small businesses have become incrementally stronger in local markets and are able to offer quality services using fiber optic networks that are cheaper for consumers. Thus, they act as a counterpoint to the concentrated model of the Brazilian market, which is dominated by five large telecommunications operators (Telefonica, Telecom Americas, Telecom Itália, Oi, and Sky/AT&T) with no interest in serving more distant regions or rural areas. The small providers, then, contribute to the access of low-income Internet users living far from urban centers and to modernizing local telecommunications systems. As of 2018, there were:

> […] thousands of these companies, responsible for 85% of the 2.3 million new connections in Brazil. And we are not talking about a weak Internet. They provide 52% of the country's ultra-broadband through fiber optics – some packages reach speeds of up to 450 Megabits per second. (Gomes, 2019)

Once transmission systems had been adjusted and Internet speeds improved, small companies were then able to expand their businesses to other territories. A report from Anatel (2019, p. 4) indicates that small Internet providers constitute 29% of the national *market share*. In 95% of Brazilian municipalities with up to 20 thousand inhabitants, this share is 63.6% of the total accesses, which reinforces the importance of companies for expanding fixed broadband in less commercially attractive regions. In November 2019, Anatel reported that 9.49 million subscribers were serviced by PPPs via fixed broadband Internet (Brandão, 2019).

This study comes under the field of analysis of the construction of public policies. It deals with the logic of action; understanding the performance of institutions and different actors who contribute to and create solutions for digital access. For the logic of action, Subirats et al. (2008, p. 21) claim that any research

in this area must consider the particular arena in which the actors interact, the influence that institutions have on these actors, and the concrete results of public action. They also highlight resources to assert these actors' respective interests. In other words, actors interact on issues of general interest. The functionality, or non-functionality, of the adopted measures, considering their intended objectives, shows how interactions can influence the construction of public policies. In addition to being orderly, stable, and coherent, the essential features of public policies are constantly being defined and redefined, and the conflicting parts require agreements to be made between different groups and social interests.

This dimension shows the need for further studies on the political, social, and historical contexts in which public policies are implemented. Rua (1998) argues that it is impossible to make decisions without looking at well-defined historical outlooks, as the allocation of resources is an ongoing process. Government decisions are often conditioned and limited by resources which have been previously allocated to other projects either by the current government or the ones preceding it. The decision-making process itself is limited to what resources are available at any one specific point in time. This situation often leads to a slower decision-making process, which hinders the implementation of public policies. So, implementing a policy comes to fruition through a continual process of interaction and negotiation between those who want to put it into practice and those who depend on its effective operation (Rua, 1998, p. 270).

This qualitative analysis deals with a continuous, constant interaction and negotiation process in the digital environment. The data-gathering process aims to identify the logic of small providers in the internalization of Internet access and to understand the dynamics of the various actors involved in solving a social problem: (a) the state's action to shape and implement a regulatory framework; (b) the social debate on mitigating the digital divide in low-income areas; and (c) the performance of small Internet companies that provide services to areas not covered by major operators.

The term municipality is used in this work to identify the geographical area in each region. In Brazil, municipalities comprehend a larger space than a city or town and include both urban and rural areas. A municipality is the administrative center, where the city hall and the city council are located.

SMALL INTERNET PROVIDERS IN 32 LOW-INCOME MUNICIPALITIES

Article 4 of Resolution No. 694/2018 (3, 2018) classifies "Small Internet Providers (PPPs)" as companies that hold less than 5% of the retail market in which they operate, and do not belong to the dominant groups Telefonica, Telecom Americas, Telecom Italia, Oi, or Sky/AT&T. This was the understanding of the Telecommunications National Agency's Board of Directors under Normative Act n° 6,539 of 2019:

> […] Art.2 declares that, by exclusion criterion, the telecommunications service providers not belonging to the Groups listed in Art. 1 of this Act are considered Small Providers, according to

the concept established in item XV of Art. 4 of the General Competition Goals Plan approved by Resolution No. 600, November 8, 2012, and amended through Resolution No. 694, July 17, 2018. (Anatel, 2019a)

Before this official definition, the Agency defined "small providers" as those having up to 50 thousand accesses in services. The current concept defines it as 5% of their market. As a result, the classification of a small Internet provider has risen to 1.5 million customers (this is because the market has about 30 million active accesses). This significantly increased the small provider's group. Act No. 6,539/2019 will be revised within two years in order to ensure legal certainty for small providers. After that period, if any provider reaches more than 5% of the retail market in which it operates, it will have 180 days to readjust to sector regulations.

As of 2017, the small companies are not required to obtain a license or authorization in order to operate as a Multimedia Communication Service (SCM). This applies to providers that use fiber optics or cable and restricted radiation equipment such as Wi-Fi antennas – all they need to do is register with Anatel. Whoever oversees the small provider must, however, provide annual updates about new customers by entering them into Anatel's electronic system and is also required to comply with the rules imposed on this type of service provision (Anatel, 2017). If the provider does not register in advance and is not authorized to operate as a multimedia service, it will be considered illegal and be forced to shut down, receive fines and face criminal prosecution. Additionally, any company that provides broadband access must be registered with the Regional Council for Engineering and Architecture and have technical support available.

Reorganizing the sector meant a reduced regulatory charge and advances in public policies that encouraged the development of the Internet in the country's interior. Small providers are exempt from several regulatory obligations such as maintaining indicators to measure quality, providing a 24-hour *call center*, or even having physical stores for face-to-face service. In order to switch over control of these companies one would need approval from Anatel's Supervision of Competition, which is responsible for a number of matters, including the economic norms of telecommunications service providers, analyzing the competitive and corporate environment, assessing and pricing cost structures, and evaluating services.

In terms of norms, small providers need to adjust to the General Law on Protection of Personal Data – Law No. 13,709 (updated in July 2019 through Law No. 13,853), which is expected to be in force in August 2020.[6] Several changes are expected to take place involving the routine of small regional providers, who will be required to inform users of how and why they collect their data, how long they keep that data for and with whom they share them, and what their current level of protection is for these data and for the processes they are using. A Cetic.br (2017) study showed that 79% of small providers had already filed user connection records. Once the new law comes into force, they will be required to invest in information security in order to prevent any confidential data from leaking out and hire qualified technicians to store, protect, and ultimately process the data.

THE TECHNOLOGICAL INFRASTRUCTURE

Throughout the 1990s and the first half of the 2000s, Internet access in Brazil was realized through fixed telephone lines, the xDSL lines for digitally transmitting data over telephones among subscribers. By 2015, small Internet providers had to overcome many hurdles just to get affordable data infrastructure equipment. The Internet Information and Service Providers Association (InternetSul[7]) accused electricity utilities of unfair service as they were charging small companies up to ten times more for cable posts and data access infrastructure equipment than they did the big operators (Bucco, 2019).

In view of these barriers preventing new competitors from entering the telecommunications market, Anatel (2018) launched a kind of "virtual supermarket" called the Wholesale Offers Negotiation System (SNOA).[8] This is an online system where companies find the resources they need to increase, or start, providing broadband services such as dedicated telecommunications lines, sharing towers and pipelines, different types of interconnections (fixed, mobile, and data), national roaming and unbundled networks, all at wholesale prices.

Thus, a new provider can rent all the elements it needs to make its business viable (network access, metropolitan transport, long-distance transport, and IP connectivity), start as a reseller, and grow enough to eventually build parts of the network and provide higher value services. The SNOA, you can think of it as a virtual supermarket, offers the resources that small providers need for their businesses to grow (Bucco, 2019).

The prices of the products in this virtual trading system are approved by Anatel and providers accredited in the system are protected from any price change not established in the contract or against problems in the quality or speed of the Internet signal. Transparency and price control for high-speed pipelines and transport links are already showing positive results. According to Anatel, the cost of a 1-km fiber optic cable duct in 2019 dropped from R$40,000 to R$400.00. The transport cost for 1 Mbps, which used to fall between R$200 and R$300, is now close to R$24.00. As a result, fiber optic technology has also become cheaper. Anatel has assessed that small providers are slowly expanding and massifying broadband, especially in places which do not have any strong economic or financial attractiveness, thus taking advantage of the competitive advantages SNOA offers in high-speed services (Grossmann, 2019).

The 2017 ICT Providers survey estimated that Brazil had 6,618 small providers operating in the country, and just over 88% of these were either micro or small companies (Cetic.Br, 2017). In 2019, the magazine *Pequenas Empresas & Grandes Negócios* (Small Companies & Big Business), using a study from the Teleco consultancy firm based on data from Anatel, reported that the total number of operating regional providers was 14.1 thousand. Together, they represented 31.5% of the country's broadband customers. That same study also showed that regional providers were market leaders in 3,509 municipalities, a healthy growth when compared to 2017 when they were present in 2,523 municipalities.

Another factor in consolidating the presence of small providers is the increased service supply via fiber optics. Mapping the infrastructure of the high-capacity

Table 2.1. Brazilian Broadband Market 2019 – Main Small Providers Companies (PPPs).

Company	Number	Market Share (%)
Algar (CTB Telecom)	605.965	1.85
Brisanet Serviços de Telecomunicações Ltda	301.77	0.92
Prefeitura de Londrina/Copel	288.743	0.88
Hughes Telecomunicações do Brasil Ltda	181.363	0.56
VM Openlink Comunicação Multimídia Ltda EPP	170.907	0.52
Desktop – Sigmanet Comunicação Multimídia Ltda.	127.078	0.39
Cabo	123.868	0.38
Mhnet Telecomunicações Eireli	90.192	0.28
Unifique Telecomunicações Ltda	89.254	0.27
Companhia Itabirana de Telecomunicações Ltda	72.979	0.22
Total	2,051,626	6.3

Source: Telecommunications sector monitoring report – SCM– Fixed Broadband. Anatel (2019b, 3rd quarter).

telecommunications networks used in service provisions (Anatel, 2019b) shows that small providers are expanding their networks and mostly using fiber optics to increase their share of the market (Table 2.1). Around 875 of the 2,633 municipalities in 2019 were serviced by small Internet providers using fiber optics, representing 15.7% of Brazilian municipalities.

The expansion of services through small providers also results from the relationship between companies and their users. Local providers tend to be closer to customers, as they are inserted in the same reality and know local demands. As a result, they offer an important counterpoint to Internet services provided by large groups to users in larger cities, a relationship characterized by long waiting periods for solving problems, which often go unsolved. Since local providers have a much smaller number of customers, the service is more effective, and technicians can be sent out to solve problems, sometimes on the same day that the request was made.

This closeness to their users is reflected by the favorable results in the official satisfaction and quality survey in 2019.[9] The four companies which received the most positive feedback in terms of fixed broadband were small providers: Copel Telecom (Paraná state), Brisanet (present in four Northeastern states – Paraíba, Pernambuco, Ceará and Rio Grande do Norte), Unify (Santa Catarina state), and Cabo Telecom (Rio Grande do Norte state). The list of 11 companies with good customer satisfaction rates also includes regional operators Sercomtel, in Paraná state, and Multiplay, in Ceará state (Anatel, 2020a).

MAIN FINDINGS OF THE FIELD RESEARCH

Fixed Broadband Access in Municipalities with Very Low MHDI

This chapter mainly references the MHDI, which covers three dimensions of the Global HDI (health, education, and income). It includes municipalities classified

with very low development indexes (less than 0.5 on the assessment scale). The 32 municipalities with the worst average human development are in the North (18) and Northeast (14) regions. They correspond to 0.57% of the 5,570 Brazilian municipalities, which equals 670 thousand inhabitants or 0.32% of the country's population. The average income per capita in the municipalities is around R$158.00 (about US$38.5 as of December 2019). Using the Gini index[10] for measuring income, the lowest income represent an average of 45% of the population of the municipalities assessed.

The media network and ICT services in these areas are quite substandard, a condition that tends to exacerbate exclusion, poverty, and isolation. These municipalities have low access numbers to fixed broadband, while in the Federal District, 72 out of every 100 homes have broadband, and in the highest density municipality with a very low MHDI, Anajás (PA), 7 out of 100 homes have broadband (Table 2.2).

In addition to the density of accesses, the analysis identified Small Providers that offer Internet access in the 32 municipalities with very low MHDI. Anatel's Data Panel lists 26 Internet service provider companies. Two of these (Oi and Claro) are classified as large providers (Art. 4 of Resolution No. 694/2018) and five (Hughes, BT – British Telecom, Yah Telecomunicações, Telefonica International Wholesale Services Brasil, and Centurylink Comunicações do Brasil) are companies associated to large global conglomerates that also serve several regions of the country. Thus, for the purposes of this chapter, of the 26 providers located on the Anatel Data Panel only 19 were considered as small.

The Brazilian group Oi has companies in 23 municipalities while Hughes (USA) has companies in three. Six other municipalities – Afuá (PA), Chaves (PA),

Table 2.2.   Fixed Broadband Access Density Per 100 Households, as of December 2019.

City	Access Density 100/Households	City	Access Density 100/Households
Anajás (PA)	7.0	S. Francisco de Assis do Piauí (PI)	1.1
Afuá (PA)	5.6	Caxingó (PI)	1.0
Chaves (PA)	4.9	Satubinha (MA	0.8
Cacheira do Piriá (PA)	4.6	Itamarati (AM)	0.7
Jenipapo dos Vieiras (MA)	4.0	Uiramutã (RR)	0.6
Olivença (AL)	3.8	Cocal dos Alves (PI)	0.6
Assunção do Piauí (PI)	2.8	Marajá do Sena (AM)	0.4
Cocal (PI)	2.7	Jordão (AC)	0.4
Ipixuna (AM)	1.7	Atalaia do Norte (AM)	0.4
Ipixuna do Pará.(PA)	1.5	Santo Antônio do Içá (AM)	0.4
Betânia do Piauí (PI)	1.4	Fernando Falcão (MA)	0.4
Itapicuru (BA)	1.3	Santa Isabel do Rio Negro (AM)	0.3
Manari (PE)	1.2	Pauini (AM)	0.3
Bagre (PA)	1.1	Portel (PA)	0.3
Amajari (RR)	1.1	Maraã (AM)	0.3
Inhapi (AL)	1.1	Melgaço (PA)	0.2

Source: Information collected per municipality – Anatel (2019) Data Panel.

Jenipapo dos Vieiras (MA), Olivença (AL), Ipixuna (AM), and Amajari (RR) – have a higher number of small company subscribers: Você Telecom (in two municipalities) and Cidade Online, TC Net, Unonet, and InfoRR (in one municipality).

After identifying the companies, a survey was conducted to make sure all providers on the Anatel panel do, in fact, service the municipalities they are located in. What we discovered was that some companies were not operating in the locations. These companies were: Brasilink, Sivnet, Bitcontrol, and Minas Info. The first three are on the market, yet do not offer services to the municipalities of Cocal (PI), Satubinha (MA), and Cachoeira do Piriá (PA), respectively. Minas Info actually offered Internet service to Itapicuru (BA) but stopped working in the municipality due to signal problems, with no timeline for it to return.

There are some cases where we were unable to find any information about the provider companies: Intercom Informática, Thiago & Vitória Informática, R E Comercio and Serviços de Internet, and B S Comércio and Serviços em Informática do not have a website, social media address or contact phone number. The address given for B S Comércio and Serviços in Portel (PA) is the same address as the municipal cemetery.

Another point worth noting is that Anatel discloses information using the companies' corporate names (the names they legally registered). Thus, the fantasy names included in Table 2.3 are those available on the database for the National Register of Legal Entities. There are also companies whose location does not appear on Anatel's Data Panels, yet they offer Internet services in two municipalities in the state of Piauí with very low MHDI: the small Paidegua Network providers in Caxingó, and Online Telecom in Cocal. By aggregating information from both Anatel's database and field research conducted on companies' registries, we found a total of 18 small providers out of the 20 operating in municipalities with very low MHDI (Table 2.3).

As for the technologies used in the municipalities we analyzed, there is a predominance of the following: satellite, metallic cables, radio, and fiber optics. The significant change in the value of fiber optic installation means it is available in 25 of the municipalities we analyzed, but it is still used by a smaller proportion of customers. Only in Olivença, in the state of Alagoas, fiber optics represents 80.6% of the installed broadband technology. The second municipality analyzed with the greatest use of fiber optics was Cachoeira do Piriá, in Pará, with 26.1% of installed capacity.

Satellites are present in all 32 municipalities and, in 16 of them (50%), it is the main technology used for connectivity. Metallic cables are used in 29 municipalities, and it is the main technology used for connectivity in 12 of them. Radio connection is offered in 19 municipalities, yet it is the main technology in only three of them. The information shows us that, even though some companies offer Internet services via fiber optics, it is not the technology most used in municipalities with very low MHDI (Table 2.4).

Characteristics of the Small Internet Providers

Of the 13 small providers in municipalities with very low MHDI, 4 four are based in the municipality itself: Paidegua Network, in Caxingó (PI); EletelNet, in Cocal (PI);

Table 2.3. Small Providers Companies in Municipalities with Very Low MHDI (2019).

City	Providers	City	Providers
Anajás (PA)	Hughes (98.1%) Oi (1%)	São Francisco de Assis do Piauí (PI)	Oi (52.6%) Telefônica International Wholesale Services Brasil (31.6%) BT (5.3%) Claro (5.3%) Hughes (5.3%)
Afuá (PA)	Você Telecom (52%) Hughes (44.8%) Oi (2.2%) Outros (1%)	Caxingó (PI)	Oi (56.3%) Hughes (37.5%) BT (6.3%) Paidegua Network[b]
Chaves (PA)	Você Telecom (75.4%) Hughes (21.9%) Oi (1.8%) Outros (0.9%)	Satubinha (MA)	Oi (80%) Hughes (10%) BT (3.3%) Sivnet (3.3%)[a] Claro (3.3%)
Cachoeira do Piriá (PA)	Oi (39.8%) Hughes (31.1%) Intercom Informática (24.3%) Bitcontrol (24.3%)[a] Claro (1.6%)	Itamarati (AM)	Oi (50%) Hughes (35.7%) BT (7.1%) Claro (7.1%)
Jenipapo dos Vieiras (MA)	Cidade Online (75%) Yah Telecomunicações (17.6%) Oi (5.9%) Hughes (1.1%) Outros (0.5%)	Uiramutã (RR)	Oi (38.9%) Claro (22.2%) InterRR (22.2%) BT (16.7%)
Olivença (AL)	TC Net (43.9%) Telecom Internet (34.5%) Oi (12.2%) Hughes (5%) Yah Telecomunicações (2.2%) Claro (1.4%) Outros (0.7%).	Cocal dos Alves (PI)	Oi (66.7%) Claro (16.7%) BT (8.3%) Hughes (8.3%)
Assunção do Piauí (PI)	Oi (46.3%) Hughes (44.8%) Telefonica International Wholesale Services Brasil (6%) BT (1.5%) Claro (1.5%)	Marajá do Sena (MA)	Oi (88.9%) BT (11.1%)
Cocal (PI)	Oi (68.3%) Telefonica International Wholesale Services Brasil (9.8%) EletelNet (9.4%) Hughes (8%) Brasilink Serviços Eireli (2.2%)[a] Claro (1.8%) Online Telecom[b] Outros (0.4%)	Jordão (AC)	Oi (50%) Hughes (30%) BT (10%) Centurylink Comunicações do Brasil (10%)

Table 2.3. (*Continued*)

City	Providers	City	Providers
Ipixuna (AM)	Unonet (87.7%) Oi (8.5%) Claro (1.5%) Hughes (1.5) Outros (0.8%)	Atalaia do Norte (AM)	Oi (55%) Claro (15%) Hughes (15%) InforTread (10%) BT (5%);
Ipixuna do Pará (PA)	Oi (92.3%) Nevoli Telecom (3.7%) Claro (1.8%) Hughes (1.1%) Outros (1.1%)	Santo Antônio do Içá (AM)	Hughes (45.8%) Oi (37.5%) BT (8.3%) Claro (8.3%)
Betânia do Piauí (PI)	Oi (80.8%) Telefonica International Wholesale Services Brasil (11.5%) BT (3.8%) Hughes (3.8%)	Fernando Falcão (MA)	Oi (91.7%) BT (8.3%)
Itapicuru (BA)	Oi (85.8%) Hughes (7.4%) Minas Info (4.1%)[a] Claro (2%) Outros (0.7%)	Santa Isabel do Rio Negro (AM)	Oi (50%) Claro (22.2%) Hughes (16.7%) BT (5.6%) Ozonio (5.6%)
Manari (PE)	Oi (51.2%) Hughes (20.2%) Thiago & Vitória Informática (19%)[a] Telefôncia International Wholesale Services Brasil (6%) BT (1.2%); Claro (1.2%) Giganet (1.2%)	Pauini (AM)	Oi (56.3%) Claro (18.8%) Hughes (18.8%) BT (6.3%)
Bagre (PA)	Hughes (91.7%) Oi (7.3%) BT (1%)	Portel (PA)	Oi (41.8%) B S Comercio e Serviços em Informática (40%)[a] Hughes (9.1%) Claro (5.5%) BT (3.6%)
Amajari (RR)	InfoRR (63.3%) Oi (23.8%) BT (7.1%) Hughes (4.8%);	Maraã (AM)	Oi (50%) Claro (21.4%) Hughes (21.4%) BT (7.1%)
Inhapi (AL)	Oi (88.9%) Hughes (6.3%) BT (1.6%) Claro (1.6%) R E Comercio e Serviços de Internet (1.6%)[a]	Melgaço (PA)	Oi (50%) Hughes (50%)

Source: Information per Municipality – Anatel (2019) Data Panel, company websites and personal contact.
[a]Providers that appear on Anatel Data Panels but are not actually present in the municipalities.
[b]Providers that do not appear on Anatel Data Panels but are present in the highlighted municipalities.

Table 2.4.   Small Internet Providers Technology in Municipalities with
Very Low MHDI (2019).

City	Technology	City	Technology
Anajás (PA)	Satellite (100%)	São Francisco de Assis do Piauí (PI)	Satellite (57.9%) Metal cable (21.1%) Fiber optic (15.8%) Radio wave (5.3%)
Afuá (PA)	Satellite (46.9%) Metal cable (36%) Radio wave (16.5%)	Caxingó (PI)	Satellite (50%) Metal cable (37.5%) Fiber optic (12.5%)
Chaves (PA)	Metal cable (44.7%) Rádio (31.6%) Satellite (23.7%);	Satubinha (MA)	Metal cable (70%) Satellite (20%) Fiber optic (6.7%) Radio wave (3.3%)
Cachoeira do Piriá (PA)	Metal cable (41.6%) Satélite (32.3%) Fiber optic (26.1%)	Itamarati (AM)	Satellite (100%)
Jenipapo dos Vieiras (MA)	Radio wave (75.5%) Satellite (20.2%) Metal cable (3.2%) Fiber optic (1.1%)	Uiramutã (RR)	Satellite (61.1%) Radio wave (22.2%) Fiber optic (11.1%) Metal cable (5.6%)
Olivença (AL)	Fiber optic (80.6%) Satellite (9.4%) Metal cable (8.6%)	Cocal dos Alves (PI)	Metal cable (58.3%) Satellite (33.3%) Fiber optic (8.3%)
Assunção do Piauí (PI)	Satélite (55.2%) Metal cable (25.4%) Fiber optic (11.9%) Radio wave (7.5%)	Marajá do Sena (MA)	Metal cable (44.4%) Fiber optic (22.2%) Radio wave (22.2%) Satellite (11.1%)
Cocal (PI)	Metal cable (58%) Satellite (21%) Fiber optic (19.2%) Radio wave (1.8%)	Jordão (AC)	Satellite (80%) Metal cable (10%) Fiber optic (10%)
Ipixuna (AM)	Radio wave (87.7%) Metal cable (6.2%) Satellite (5.4%) Fiber optic (0.8%)	Atalaia do Norte (AM)	Satellite (50%) Metal cable (40%) Fiber optic (10%)
Ipixuna do Pará (PA)	Metal cable 76.8% Fiber optic (18.8%) Satellite (3.7%) Radio wave (0.7%)	Santo Antônio do Içá (AM)	Satellite (66.7%) Metal cable (33.3%)
Betânia do Piauí (PI)	Metal cable (50%) Satellite (23.1%) Fiber optic (19.2%) Radio wave (7.7%)	Fernando Falcão (MA)	Metal cable (75%) Fiber optic (8.3%) Radio wave (8.3%) Satellite (8.3%)
Itapicuru (BA)	Metal cable (69.6%) Fiber optic (12.2%) Satellite (11.5%) Radio wave (6.8%)	Santa Isabel do Rio Negro (AM)	Satélite (88.9) Metal cable (5.6%) Fiber optic (5.6%)
Manari (PE)	Metal cable (31%) Satellite (28.6%) Radio wave (26.2%) Fiber optic (14.3%)	Pauini (AM)	Satellite (62.5%) Metal cable (37.5%)

Table 2.4. (*Continued*)

City	Technology	City	Technology
Bagre (PA)	Satellite (96.9%) Metal cable (1%) Fiber optic (1%) Radio wave (1%)	Portel (PA)	Satellite (50.9%) Radio wave (41.8%) Fiber optic (5.5%) Metal cable (1.8%)
Amajari (RR)	Radio wave (64.3%) Satellite (31%) Metal cable (2.4%) Fiber optic (2.4%)	Maraã (AM)	Satellite (85.7%) Metal cable (14.3%)
Inhapi (AL)	Metal cable (65.1%) Fiber optic (17.5%) Satellite (9.5%) Radio wave (7.9%)	Melgaço (PA)	Satellite (91.7%) Fiber optic (8.3%)

Source: Information per municipality – Anatel (2019) Data Panel.

Online Telecom, which also has an address in Cocal (PI); and Nevoli, in Ipixuna do Pará (PA). The others are located in other areas.

In terms of technology (a few municipalities with fiber optic resources), speed is an issue to be considered in local connections. Although companies offer plans between 20 and 500 megabytes (Table 2.5), they are often not available in municipalities with very low MHDI. Ten companies offer plans with more than 34 Mbps but, according to data from Anatel, in 20 of the 32 municipalities, the most prominent speed is between 512 kbps to 2 Mbps. Minimum speeds from 0 kbps to 512 kbps are more frequent in the following six municipalities – Olivença (AL), Itamarati (AM), Jordão (AC), Atalaia do Norte (AM), Santo Antônio do Içá (AM), and Maraã (AM). The following four municipalities – Jenipapo dos Vieiras (MA), Ipixuna (AM), Amajari (RR), and Portel (PA) – have companies that offer a connection speed between 2 Mbps and 12 Mbps. There are only two municipalities – Ipixuna do Pará (PA) and Itapicuru (BA) – which offer a bandwidth speed of 12–34 Mbps.

Out of all these companies, only Online Telecom, Unonet, and Você Telecom offer services other than fixed broadband: the first two provide TV and video *on demand*, and the third, landlines. Two of the companies do not have a website.

The companies listed in Table 2.5 use social media to attract consumers. Even though they are providers operating on a small scale, most of them use social networks effectively to gain new subscribers. Some develop professional communication projects and go beyond just disseminating connection plans, for example, institutional videos, messages to interact with the public, prize draws and information about their service. Companies with this kind of profile have a significant number of followers (around 2,500, mostly on social networks). The others do little to explore social networks and do not release publications regularly (Table 2.6).

Table 2.5.   Local/Regional Small Providers Companies per Location,
Coverage, and Technology.

Providers	Location	Coverage (Municipalities)	Technology	Speed
Giganet	Ibimirim (PE)	Pernambuco (3)	Metal cable	Up to 34 Mbps
Paidegua Network	Caxingó (PI)	Piauí (13)	Radio wave Fiber optic	Up to 70 Mbps
Cidade Online	Barra do Corda (MA)	Maranhão (4)	Radio wave Fiber optic	Up to100 Mbps
EletelNet	Cocal (PI)	Piauí (5)	Radio wave Metal cable Fiber optic	Up to 20 Mbps
Ozonio	Manaus (AM)	Amazonas (11)	Satellite	Up to 34 Mbps
Telecom Internet	Santana do Ipanema (AL)	Alagoas (11)	Radio wave Fiber optic	Up to 75 Mbps
Online Telecom	Local addresses in 27 municipalities	Ceará (20) Piauí (4) Maranhão (1) Pará (2)	Fiber optic	Up to 500 Mbps
Nevoli Telecom	Local addresses in 10 municipalities	Pará (19)	Radio wave Fiber optic	Up to 320 kbps
InfoRR	Boa Vista (RR)	Roraima (15)	Radio wave Satellite Fiber optic	Up to 200 Mbps
TC Net	Ouro Branco (AL)	Alagoas (20) Bahia (2) Pernambuco (3)	Fiber optic	Up to 250 Mbps
InforTread	Manaus (AM)	Amazonas (4)	Radio wave Satellite Fiber optic	Up to 34 Mbps
Você Telecom	Macapá (AP)	Amapá (15) Pará (5)	Radio wave Metal cable Fiber optic	Up to 1,000 Mbps
Unonet	Cruzeiro do Sul (AC)	Acre (4) Amazonas (2)	Radio wave Fiber optic	Up to 40 Mbps

Source: Information per municipality – Anatel (2019) Data Panel, company websites and social media, and direct contact.

CONCLUDING REMARKS

The expansion of connectivity on a national scale, whether through mobile Internet or fixed broadband, is described as one of the factors that can lead to social and economic benefits for large parts of the population who do not have a network connection. It can also help to reduce poverty by improving the infrastructure of services and increasing Internet use for education purposes. It also provides people with the ability to communicate with online administrative services – local, regional, and national. In Brazil, the main difficulty facing an effective universalization of telecommunications has been limitations in accessing services. In the telephone sector, the limitations that came with landlines and long-distance calling were only overcome with the spread of the mobile telephone service in the 2000s.

Table 2.6.   Small Internet Providers – Company Profile.

Providers	Overview
Giganet	Service offered: Broadband. This company does not have a website. It does have a social network – Facebook. It does not disclose information about plans and speeds available to the municipalities it serves. The latest publications are about commemorative dates and notices to customers about network maintenance
Paidegua Network	Service offered: Broadband. This company has a website and social networks pages (Facebook and Instagram). There is information on its website about its plans and pricing. Facebook is used inconsistently for advertising. The company's Instagram page is actually the owner's personal profile
Cidade Online	Service offered: Broadband. This company's slogan is "We value quality and not quantity." It does not have a website, but uses social networks (Facebook and Instagram) as a means of dissemination. It has a professional profile on both networks; its Instagram page has 1,024 followers. It has a standard layout for publications and keeps Facebook and Instagram pages up to date with promotions and, in some cases, opening hours. The company sells electronic products and, on certain dates, holds prize draws on its social networks
EletelNet	Service offered: Broadband. This company has a website and online help; it advertises on Facebook and Instagram – 1,109 followers. It has a visual identity and publishes posts frequently – an average of seven a month, all from talking about the company's services to offering tips and information about the Internet. It offers a 50% discount to existing customers who refer a friend to their company
Ozonio	Service offered: Broadband. This company has a website. It does not have any social network accounts. There is information on its website about its services, but does not list pricing options
Telecom Internet	Service offered: Broadband. This company has a website and a Facebook page. Its website allows you to select from one of the 11 municipalities it services to find out the speed available in each location. Its social network is not used very often. The last publication was in October 2019
Online Telecom	Services offered: Broadband; TV (Maxi TV) and *on demand* ("Online Play"). Despite servicing municipalities in the states of Ceará, Piauí, Maranhão and Pará, TV services are only available in five municipalities in Ceará. It has *on demand* service for all municipalities it services in the state of Ceará. It offers packages with broadband and TV services (up to 99 channels); and "Online Play" is free for broadband subscribers. The company has a website on which you can select the municipalities that the company covers, and see the services available in each location. In addition to Facebook and Instagram (11,600 followers) – which they publish weekly and try to include interactive posts – Online Telecom has a YouTube channel with institutional videos. It runs a 24-hour service
Nevoli Telecom	Service offered: Broadband. This company's website lists the pricing for its fiber optics and radio Internet plans. It frequently publishes on social networks, advertising plans or technology. Its Facebook page has an average of ten posts per month and its Instagram account has 2,430 followers

(Continued)

Table 2.6. (*Continued*)

Providers	Overview
InfoRR	Service offered: Broadband. "The Internet has finally arrived in the countryside." This company has a website, and Facebook and Instagram pages (1,455 followers). It has a visual brand and layout for advertising on social networks. It publishes frequently – an average of nine posts per month on Facebook – and makes efforts to interact with the public on social media
TC Net	Service offered: Broadband. This company has a website with information about its services, a customer area, and a call center. It has professional profiles both on Facebook and Instagram (4,006 followers). It has an average of 15 posts per month on Facebook. It uses Instagram stories to post information about its "Plans," "Tips," and "Promotions"
InforTread	Service offered: Broadband. This company's website offers little information about its plans, but it has a customer area. It only uses one social network, Facebook, but does not have any recent posts. This company does sell shares in the municipalities where it operates
Você Telecom	Services offered: Broadband and Landline. This company's website lists the municipalities it services and their individual plans. It has online customer help. Its social networks are active; it has a visual identity and publishes weekly. It maintains weekly Facebook and Instagram posts (2,697 followers). It has a YouTube channel with advertising videos. It has an Internet + landline combo, and depending on the plan, offers unlimited calls to local landlines for the first 12 months
Unonet	Services offered: Broadband, TV (Unonet TV), and on demand (UnonetPlay). This company offers a login and password to Internet subscribers to use for its *on demand* service. It posts frequently on social media. It has an average of 20 posts on Facebook and its Instagram has 4,854 followers

Source: Available on companies' websites and social media, 2019.

This chapter demonstrates the relevance of small Internet providers for the expansion of fixed broadband in less commercially attractive regions (in terms of subscribers, income, and distance). Small providers have been growing over recent years and are now present in 70% of Brazilian municipalities. An important fact about PPPs is the speed at which their services have evolved over the last four years: 3.7 million accesses in 2016; 5.3 million in 2017; 7.5 million in 2018; and 9.9 million in 2019 (Julião, 2020). These companies are responsible for increasing the number of municipalities serviced, especially through fiber optics, which accounted for 5.9 million accesses in December 2019 (Anatel, 2020a).[11] They are also responsible for offering higher quality service and faster connection speeds. We can say that small providers contribute to the dissemination of fiber optic technology, important for modernizing the internalization of Internet access in locations that have previously fallen outside the market of large operators.

The participation of small providers does not equate to massification. The fact that a provider makes fiber optic infrastructure available to a certain municipality does not mean that it has conditions (or obligations) to serve the wholesale market, as stated in current regulations. The volume of data operations via fixed

broadband, the SCM is still controlled by the following large companies: Claro (operated by the Carlos Slim group from Mexico); Vivo (from the Spanish group Telefónica); Oi (from the Brazilian group Telemar), TIM (from the Italian group Telecom Itália), and Algar (from the Brazilian group Algar Telecom). Including small providers and medium-sized providers, all these companies made up a market of 32.6 million active contracts in December 2019.

The performance of smaller providers helps to improve the provision of services in smaller towns and creates a basic infrastructure in low-income municipalities, especially those with very low MHDI. In this sense, it is important to continue overcoming legal bureaucratic obstacles and promote the harmonization of regulatory frameworks in order to expand the insertion of small Brazilian companies in larger markets. The performance of small and medium private entrepreneurs to meet the demands of communication does not exempt the state from promoting public policies of free access to the Internet in low-income locations. In fact, this is paramount to reducing the digital divide.

ACKNOWLEDGMENTS

NOTES

1. According to: the 2010 Anatel Annual Report, 2019 Anatel Data on mobile phones, IBGE 2010 Census, and IBGE 2019 Population Estimates.

2. The information on Brazil uses the database from the Brazilian Information Network NIC.br through the Regional Center for Studies on Information Development (Cetic.br).

3. The report is one of the data collection initiatives commissioned by Facebook under the *Data for Good* system which, in addition to analyzing the levels of Internet inclusion in the world, maps other topics of global interest such as electricity distribution, natural disasters, and population density.

4. The classification per country and analysis categories are available at: https://theinclusiveinternet.eiu.com/explore/countries/performance?category=overall.

5. Melgaço (PA), Fernando Falcão (MA), Atalaia do Norte (AM), Marajá do Sena (MA), Uiramutã, (RR), Chaves (PA), Jordão (AC), Bagre (PA), Cachoeira do Piriá (PA), Itamarati (AM), Santa Isabel do Rio Negro (AM), Ipixuna (AM), Portel (PA), Amajari (RR), Anajás (PA), Inhapi (AL), São Francisco de Assis do Piauí (PI), Itapicuru (BA), Manari (PE), Caxingó (PI), Ipixuna do Pará (PA), Afuá (PA), Jenipapo dos Vieiras (MA), Santo Antônio do Içá (AM), Satubinha (MA), Olivença (AL), Pauini (AM), Cocal (PI), Cocal dos Alves (PI), Betânia do Piauí (PI), Maraã (AM), and Assunção do Piauí (PI).

6. The House of Representatives is considering a proposal to hold off introducing the General Law on the Protection of Personal Data until August 2022. They argue that there is not enough time for all regulatory proposals to be discussed by society and approved by the National Authority of Data Protection (ANPD) by August 2020. The Authority is composed of a Board of Directors, personal data protection and privacy councils, in addition to internal affairs, ombudsmen, its own legal advisory body, and administrative and specialized units necessary for the application of the General Law (Agência Câmara de Notícias, 2020).

7. The Internet Information Service and Providers Association is a non-profit, non-governmental civil society which brings together Internet companies that provide access, information, *backbone*, or services in the southern region of Brazil.

8. SNOA supervision is handled by the Wholesale Offers Supervisory Entity, using Anatel's competition regulations to independently manage product offers in the wholesale market and follow up on requests.

9. Anatel Survey 2019. The evaluation considers the following indicators: offer and contracting, operation, collection, service channels, telephone service, resolution and repair, and installation capacity.

10. The Gini Index extends from 0 to 1, with 0 representing a situation of total equality, where everyone has the same income, and 1 means deep income inequality; that is, only a few people hold all the income of the place.

11. In December 2018, Brazil was ranked sixth in the world in terms of main fixed broadband markets, with more than 31 million accesses (Anatel, 2020b).

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