POLICY BRIEF AND RECOMMENDATIONS FOR AN **ENABLING ENVIRONMENT** FOR **COMMUNITY NETWORKS** IN BRAZIL

November 2021

POLICY BRIEF AND RECOMMENDATIONS FOR AN **ENABLING ENVIRONMENT** FOR **COMMUNITY NETWORKS** IN BRAZIL

Lead author
Adriana Labardini Inzunza

Co-author
Bruna Zanolli

Contributors
Carlos Rey-Moreno
Débora Prado
Mike Jensen
Nils Brock
Peter Bloom
Raquel Gatto
Steve Song

Proofreading
Lynne Stuart and Lynn Wellburn

Publication coordination
Débora Prado and Lori Nordstrom

Graphic design
Monocromo

Cover illustration
Gustavo Nascimento

Acknowledgements
We are grateful for the inputs received from all interviewees and the experts from Anatel and the UK Embassy. We would like to particularly acknowledge the guidance from the Local Advisory Committee of this project, namely: Debora Prado (APC), Diego Canabarro and João Vasconcelos (Internet Society), Diogo Moyses (IDEC), Flávio Wagner (ISOC Brasil), Luca Belli (FGV-Rio), Marcelo Saldanha (Instituto Bem Estar Brasil), Marina Pita (Intervozes), Paulo José Lara (Artigo 19), and Paulo Lima and Adriane Gama (Projeto Saúde e Alegria). We are particularly grateful for the contributions from Cristiane Gonzales (researcher, representing Coalizão Direitos na Rede) and Marcelo Saldanha (Instituto Bem Estar Brasil).

This policy brief was produced as part of the initiative "Supporting Community-led Approaches to Addressing the Digital Divide", a project implemented by the Association for Progressive Communications (APC) in partnership with Rhizomatica, with support from the UK Government's Digital Access Programme.

Published by APC 2021

Creative Commons Attribution 4.0 International (CC BY 4.0)
https://creativecommons.org/licenses/by/4.0/
Some rights reserved.
ISBN 978-92-95113-47-3
APC-202111-APC-R-EN-DIGITAL-337

TABLE OF CONTENTS

EXECUTIVE SUMMARY 1

INTRODUCTION 9

SECTION 1
WHERE DOES BRAZIL STAND TODAY IN TERMS OF AFFORDABLE ACCESS?

1.1 Progress made in access and penetration and the prevailing gaps 14
- 1.1.2 Connectivity gaps in Brazil 16
- 1.1.3 Satellite connectivity 22
- 1.1.4 Brazilian e-Government Initiative (GESAC) and Internet for All 22
- 1.1.5 Other highlights of digital efforts in Brazil 23

1.2 The challenges of rural coverage and accurate data 25

1.3 Who and where are the unconnected communities in Brazil? 29
- 1.3.1 Indigenous, African descendant and other traditional people in Brazil 30
- 1.3.2 Underserved urban and peri-urban communities 32

1.4 Challenges and opportunities linked to the context of the COVID-19 pandemic 32

SECTION 2
COMMUNITY NETWORKS: WHAT ARE THEY?

2.1 Origins, goals and principles governing community networks 39

2.2 Community networks, gender equality and diversity 43

2.3 Impact on communities 50

2.4 Community network models throughout the world 52

2.5 Community networks in Brazil: Costs and characteristics 64

2.6 Key pillars for sustainable community networks 72
- 2.6.1 An enabling regulatory, legal and policy environment fit for communities 72
- 2.6.2 Sound community governance for collective decision making 73
- 2.6.3 Economic sustainability 74
- 2.6.4. Technical expertise and champions willing to learn by doing 75
- 2.6.5 Involvement of women and diverse groups in the community network initiatives 76
- 2.6.6 Digital skills as a community member and developer of solutions and local content . . . 76
- 2.6.7 Roles of different actors in community network sustainability 76

SECTION 3
BRAZIL'S PRESENT REGULATORY AND POLICY FRAMEWORK

3.1 Service licensing regimes under the LGT (General Telecommunications Act) and Anatel Regulations: Collective v. restricted, Public v. private, Concession v. authorisation . . . 79
- 3.1.1 Collective interest services 81
- 3.1.2 Small collective interest providers (PPP) 82
- 3.1.3 Restricted interest providers (non-commercial regime): Is the Limited Private Service (SLP) regime fit for purpose? 84

3.2 Spectrum management: Planning, allocation and assignment 93

3.2.1 Spectrum for collective interest (commercial) services. 94
3.2.2 Spectrum for restricted interest providers (SLP: private networks/non-commercial services). 95
3.3 Shared spectrum 96
3.3.1 Authorisation-exempt spectrum when using restricted radiation equipment 96
3.3.2 Spectrum sharing in IMT bands for local access 97
3.3.3 Spectrum sharing in TV white spaces 99
3.4 Hardware and firmware used by community networks 100
3.5 Access to backhaul and passive infrastructure by community networks 102
3.6 Satellite connectivity through GESAC for remote and isolated communities 104
3.7 FUST and FUNTTEL 104
3.8 Community radio in Brazil: The aim to meet the Inter-American Commission on Human Rights' standards for freedom of expression and equality 108

SECTION 4

VOICES OF DIFFERENT STAKEHOLDERS INVOLVED IN RURAL CONNECTIVITY, COMMUNITY NETWORKS AND DIGITAL INCLUSION FROM THE PUBLIC, PRIVATE, SOCIAL AND ACADEMIC PERSPECTIVES

4.1 Methodology 111
4.2 Summary of interviewees' answers by stakeholder type and topic 112
4.2.1 Interviews with rural and peri-urban actors from community networks. 112
4.2.2 Interviews with different stakeholders on barriers to community networks in Brazil . . . 114
4.2.3 Answers from different stakeholders around FUST, TAC and coverage obligations . . . 119

SECTION 5

RECOMMENDATIONS FOR POLICIES IN BRAZIL TO ENABLE COMMUNITY NETWORKS

5.1 Permanent dialogue between communities and Anatel 121
5.1.1 National and international good practice and international framework 121
5.1.2 Recommendations for Anatel 122
5.2 Access to spectrum frequencies for community networks: Anatel 123
5.2.1 National, international good practice and international framework 123
5.2.2 Recommendations 124
5.3 Licensing and registration procedures: Anatel 126
5.3.1 International good practice 126
5.3.2. Short-term recommendations: Anatel 127
5.3.3. Medium term: A specific regime for community networks and community media . . . 129
5.4. Policies on open access to backhaul networks and wholesale markets 130
5.4.1. International good practice. 132
5.4.2 Recommendations: Anatel and FUST council 132
5.5. Universal Service Fund (FUST) redesigned to support community network projects and FUNTTEL funding for development of Brazilian FLOSS and hardware for such networks . . . 133
5.5.1. International good practice. 133
5.5.2 Recommendations for FUST and FUNTTEL managing councils and Ministry of Communications 134

5.6. Promoting national industry of hardware for community networks and FLOSS developments by easing homologation requirements, import taxes and access to subsidies 134
5.6.1 Domestic and international good practice 135
5.6.2 Recommendations for Anatel and the federal government 135
5.7 Freedom of expression, pluralism and community broadcasting: Ministry of Communications and Anatel 136
5.7.1 International good practice 136
5.7.2 Recommendations for Anatel and MCom 137
5.8 Open data at the granular (town or village) level: Passive and active infrastructure maps and backhaul and backbone coverage maps 138
5.8.1 Recommendations: Anatel and MCom 139
5.9 Leading collaborative work with other authorities: Anatel 140
5.9.1 International practice 140
5.9.2 Recommendations for collaboration 140
5.10 Affirmative actions for gender equality 143
5.10.1 International practice 143
5.10.2 Recommendations 143

ABBREVIATIONS AND ACRONYMS 145

APPENDIX 1
SPECTRUM BANDS OR SUB-BANDS RELEVANT TO COMMUNITY NETWORKS, CURRENTLY DESTINED FOR SLP 147

APPENDIX 2
SMALL-SCALE OPERATOR ACCESS TO LICENCE-EXEMPT SPECTRUM: COUNTRY COMPARISON 150

APPENDIX 3
TELEVISION WHITE SPACES REGULATION AROUND THE WORLD 152

EXECUTIVE SUMMARY

In January 2020 the Brazilian National Telecommunications Agency (Anatel) acknowledged the contribution that community networks make, in developing and developed countries, to the universalisation of access, and decided that such networks may operate in Brazil by using the limited private service authorisation regime (SLP). Consistent with this line of thinking, the agency proposed a number of projects that complement each other and are intended to increase access through providers of various sizes, including community networks and small operators, in the 2021 Structural Plan for Telecommunications Networks (PERT).[1] The projects do not mention explicitly how community networks will be enabled or supported by each (or some) of these projects, but many possibilities exist for creating regulatory, policy and funding opportunities for local, small-scale operators that, with affordable technologies already in the market, may sustainably provide internet connectivity, community media and voice and data communications on a non-profit basis.

The footprint of community networks is still small in Brazil. This is due to the limited awareness of the existence of these community-owned infrastructures and the opportunities to self-provide communications services, and also due to regulatory barriers and lack of technical skills, especially among rural or remote communities, or communities of vulnerable people.

The Association for Progressive Communications (APC), with support from the UK Digital Access Programme and the collaboration of Anatel and a diverse committee of experts working in different organisations with communities or in universal access projects in Brazil, has identified barriers, challenges and opportunities to enable Brazilian community networks by recommending key regulatory and policy changes that would make a difference in areas such as access to spectrum, backhaul, funding, technical training and licensing.

The policy brief we hereby present to Anatel includes recommendations and specific proposals to enable community networks in Brazil, considering extensive research in both the global and Brazilian context, the state of the art of these small, not-for-profit players and the findings and experiences of 32 interviewees all related in some capacity to Brazilian community networks: internet access, spectrum management, the digital divide or research on information and communications technology (ICT) projects.

We hereby summarise the priority areas that need to be addressed and the recommendations to reduce barriers and unlock the potential of Brazilian community networks.

[1] https://sistemas.anatel.gov.br/anexar-api/publico/anexos/download/7838beeae0e7f5837d491fd26413cb46

PRIORITY AREAS	SUMMARY OF RECOMMENDATIONS
Open dialogue with communities	
Anatel	**Near term** • Open a dialogue channel with communities, meso organisations, academia and technical community supporting community networks, with purpose, agenda, goals and indicators to be mutually agreed upon. • Plan towards creating a formal community networks committee. • Advocate at the Telecommunications Universal Service Fund (FUST) to include community network representatives in the council.
Anatel/National Indigenous Foundation (FUNAI)	**Near term** • Consult Indigenous and tribal communities according to International Labour Organization (ILO) Convention 169[2] on the issues of community network regulation and policy impacting Indigenous and quilombola communities.
Anatel	**Mid term** • Create a community networks committee, similar to the small-scale providers' committee operating within Anatel.

[2] https://www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:12100:0::NO::P12100_ILO_CODE:C169

PRIORITY AREAS	SUMMARY OF RECOMMENDATIONS
Affordable access to spectrum	
Anatel	**Near term** **a) Spectrum used by restricted radiation equipment** • Review technical restrictions on the gain for point-to-point (PtoP) – 2.4 GHz. • Review 10 MW/MHz power limits and Effective Isotropic Radiated Power (EIRP) in 5150-5350 MHz for backhaul links. • Review limits to antenna gain in 5725-5850 MHz for PtoP links. • Consider adding bands such as 24 and 60 GHz for PtoP and point-to-multipoint (PtoMP) links for community networks/SLP. **b) TV white spaces** • Allow for the experimental use of TV white spaces when regulations and database are ready. Only symbolic fees to be charged, or none in underserved areas (sandbox for experimental community network use). **c) High frequency radios for remote areas** • Enable access to high frequency (HF) multichannel frequencies and expedite authorisations for community networks (first as SLP) and for the registration of stations. • Reduce public price for the right to use radio frequencies (PPDUR)/ installation inspection fee (TFI) per station or coverage area for community network use.
Anatel	**Mid term** **a) Shared local access to licensed international mobile telecommunications (IMT) spectrum: "Use-it-or-share-it" policy for personal mobile device (SMP) authorisations.** Not as a secondary market but as a secondary use authorised and managed by Anatel. Five-year sharing for wireless community networks in rural and remote areas. **b) Sharing of 5G spectrum for community networks, not as a secondary market** through a public reference offer for SMP which would exclude not-for-profit providers. Instead include use-it-or-share-it policy managed by Anatel. **c)** Designate IMT bandwidth for **rural local wireless access under a community network** regime (non-profit) in communities where there is no scarcity of wireless broadband access, in different bands, especially those under 1 GHz, where affordable equipment is available. **d) Spectrum access for backhaul at low fees** • Review the Act 4800/2020[3] to consider including special enabling conditions (including low fees) for community networks/SLP using the 10.5 and 11 GHz bands for backhaul links (PtoP and PtoMP) in localities with fewer than 200,000 people.

[3] https://sso.acesso.gov.br/login?client_id=sistemas.anatel.gov.br&authorization_id=17bc6859cbc

PRIORITY AREAS	SUMMARY OF RECOMMENDATIONS
Licensing procedures	
Anatel **SLP simplification**	**Near term** • Simplification of community networks/SLP authorisation and/or registration procedures.[4] • Broadening authorisation and registration exemptions for community network SLPs (to include internet access connectivity beyond a single property) for rural homes in a small village would be enabling. • Extend the interpretation of condominium in Article 12 (Resolution 720/2020) so that community networks in rural or remote communities need no authorisation under Article 12.
Anatel **Community network special regime**	**Mid term** **a) Wi-Fi, Wi-Fi mesh community networks** • No authorisation, no registration of equipment required when using only restricted radiation equipment. To only notify start of operations as a community network to Anatel, with a sustainability plan. Consider an off-line format for communities with no internet access. **b) Wired or wireless community network providing any other community services or broadcast media using fibre or equipment of restricted radiation** • No authorisation required for community networks with fewer than 5,000 subscribers. • Registration of equipment used for Wi-Fi backhaul Wi-Fi bands. • Authorisation required for spectrum use in other than Wi-Fi bands. • Discounted PPDUR, TFI and any other applicable fees for community networks. • Clear rules to be eligible for a community network regime with the understanding that the network is a community-owned and managed network infrastructure designed to serve the community's communication and information needs, preferences and values on a not-for-profit basis. • Affordable access to backhaul. Preferential rates in public backhaul networks for community networks.

[4] http://sistemas.anatel.gov.br/se/

PRIORITY AREAS	SUMMARY OF RECOMMENDATIONS
Open access to backhaul networks	
Anatel **Anatel/CADE (competition regulator)**	**Near term** • Open wholesale backhaul public reference offers (PRO) for SLP/ community networks. • Allow for a special PRO for non-profit providers (community networks). • Anatel negotiates reduced priced backhaul for community networks in public sector backhaul networks and state satellite. • Demand transparency in backhaul markets as few use wholesale offers negotiation system (SNOA). • Open access policies for backhaul for community networks (non-profit) both in coverage obligations in spectrum auctions, Conduct Adjustment Agreements (TACs) and rural internet service providers (ISPs). • Initiate the investigation of backhaul-relevant markets or a market study on backhaul PRO.
FUST and FUNTTEL	
Anatel	• Propose a seat for a community network representative on the councils of FUST and the Fund for the Technological Development of Telecommunications (FUNTTEL).
FUST and FUNTTEL councils	• Allocate funding to community network projects in every region of the country specifically for initial CAPEX. • Prioritise funding for women-led, Indigenous or quilombola community networks in underserved communities.
FUNTTEL council	• Anatel advocates before FUNTTEL for considering SLP or community networks as possible beneficiaries of funds when they are developing technology for community networks such as LibreRouter.[5]

[5] https://librerouter.org

PRIORITY AREAS	SUMMARY OF RECOMMENDATIONS
National industry development	
Federal government	• Import tax exemption or significant reduction for community network equipment, components and free/libre and open source software (FLOSS). • Further incentivise the use of open source in the development of standards of routing and Wi-Fi technologies. • Incentivise through tax exemption and FUNTTEL/FUST funding, use of technologies for community networks such as routers and antennas, especially those that use FLOSS, from local, small not-for-profit manufacturers.
Anatel	• Lower or exempt homologation fees (type approval) of non-profit FLOSS technologies and exempt type approval of equipment which has only changed firmware.
Community media promotion	
Ministry of Communications **Broadcasting secretariat** **Anatel**	• Allocate more FM frequencies for community radios. • Relax power limits (25 W) and distance coverage (1 km). • Support Bill PL 10637/2018 which has senate approval. • End the criminalisation of genuine, non-profit community radio broadcasters as it is contrary to Inter-American standards of freedom of expression. • Launch campaign on the importance and nature of community radio. • Provide training to federal police and Anatel about standards of freedom of expression and human rights-based law enforcement. • Dialogue with communities for a strategy to promote community television and support radio and audiovisual content as key to pluralism. • Incentivise the digitalisation of broadcast radio and choose an open standard like Digital Radio Mondiale (DRM), that is not-for-profit, open-source and widely used internationally.

PRIORITY AREAS	SUMMARY OF RECOMMENDATIONS
Transparency and open data for community networks	
Anatel and Ministry of Communications	• Increase efforts around granular open data on access and backhaul networks.
Anatel	• Collect and publish precise information on authorised or registered SLPs that operate as community networks in each municipality. • Increase transparency of actual occupation of IMT, VHF and UHF bands and PtoP and PtoMP bands. • Create a community network and media website similar to the small-scale internet service providers (PPP) portal.
FUNAI and Anatel	• Gather and publish maps of coverage and services in Indigenous territories and quilombos.
Gender equality affirmative actions	
Anatel **Ministry of Communications** **FUST** **FUNTTEL** **State/local governments**	• When designing or implementing ICT policy, apply a gender perspective methodology to anticipate possible unintended impacts, bias and barriers. • Include affirmative action policies that benefit women's digital inclusion, access to community networks, devices, content and technical training. • Conduct periodic surveys, focus groups and dialogue with women from diverse contexts, age, race and socioeconomic groups. • Develop indicators, statistics, and gather data with gender and race perspectives.

PRIORITY AREAS	SUMMARY OF RECOMMENDATIONS
Recommendations for collaborative work	
Anatel **PPPs** **National Teaching and Research Network (RNP) and universities** **Wi-Fi Brasil, Brazilian e-Government Initiative (GESAC) and Internet Para Todos** **Telebras**	• Backhaul and capacity building. • Collaboration between community networks and PPPs, which could become backhaul providers while the community networks may service the first mile.[6] • Collaboration of RNP by providing access to their points of presence (PoP) at low or no cost. • Educational collaborations between community networks, RNP and universities by providing capacity building for community networks' needs, while they can exchange practical field knowledge and serve as test beds. • GESAC/Wi-Fi Brasil projects could increase bandwidth so their internet can be distributed along the community territory by the community networks. In addition, Wi-Fi Brasil could have a special category of applications to contemplate such networks. • Telebras could donate satellite backhaul capacity or fibre broadband to community networks in exchange for the first mile being done by the networks. In addition, the institution could provide capacity building on satellite backhaul and fibre backhaul. • Anatel can lead these collaborations by advocating in favour of community networks.

[6] Given the vital role that community networks can play in providing connectivity to the billions left behind by current strategies that see local access as the "last mile", we prefer to use the term "first mile" to reinforce the centrality and importance of local access for end-users in connecting those who remain unconnected. More information available at: https://www.apc.org/en/node/35657

INTRODUCTION

In this challenging year (2021), the world is more aware than ever of the need to end the digital divide, and the lack of access as a structural barrier to equality, social welfare, productivity, digital transformation and the achievement of sustainable development goals.

Telecommunications infrastructures are increasingly enablers of access to information, freedom of expression, education and health services, commerce, cultural heritage, work and employment and they are a key tool for the democratic participation of citizens and responsive governments.

Brazil is no exception. In this vein, the Brazilian Law 12,965/2014, also known as "Marco Civil da Internet" established in Article 7 that "Internet access is essential for exercising citizenship."[7] Thus, it is an urgent and high priority for the people of Brazil to universalise affordable access to fit-for-purpose communications, which include the internet and any telecommunications networks and broadcast media, and to address the backlog in connectivity gaps with innovative paradigms. The National Agency of Telecommunications (Anatel), together with the broad participation of local communities and interested parties, can have a major impact on connecting unconnected people and communities through new regulatory and policy paradigms and resources. Community networks have proven to be sustainable in multiple dimensions, as important complementary models of connectivity and enablers that contribute to bridge gaps in rural and remote unserved areas, and in peri-urban slums and settlements with the potential to bring millions of people into the information society. Furthermore, in the context of the COVID-19 pandemic, the forced lockdown and economic hardship that brutally struck the world, with a prolonged impact at individual, community and national levels, bottom-up digital inclusion strategies are critical.

The pandemic made it evident that those who were adequately connected and skilled showed more resilience in enduring the arduous changes, and could access information, education, continued schooling and work, online services, banking and interaction with the government, while maintaining communications with families and friends. The unconnected people could not.

Since the world rapidly migrated to a digital life after the COVID-19 pandemic took hold in early 2020 (and also due to the ongoing digital transformation process), most human activities are switching to digital, automated, or otherwise online modes, leaving those unconnected doubly excluded. However, addressing these gaps through local complementary networks requires enabling policies, affirmative action from the state and incentives to reach sustainability, now that technological innovation has made network equipment more affordable.

[7] http://www.planalto.gov.br/ccivil_03/_ato2011-2014/2014/lei/l12965.htm

TOWARDS THE SUSTAINABLE DEVELOPMENT GOALS (2030)[8]

Information and communications technologies have been identified as enablers for the 2030 Sustainable Development Goals (SDGs). They can enable and expedite citizens' access to health care, education, remittances, information, e-commerce, e-government, emergency alerts, protection of the environment and biodiversity, gender equality and poverty reduction. Specifically, SDG 9.c speaks of building resilient infrastructures, promoting inclusive and sustainable industrialisation and fostering innovation, a goal to which the International Telecommunication Union[9] (ITU) contributes since efficient and affordable ICT infrastructures and services allow countries to participate in the digital economy and to increase their overall economic and social wellbeing. However, millions of people belong to the most disenfranchised populations: women, girls, Indigenous and traditional people, people with disabilities – those who are not making use of the internet due to the lack of affordable access or skills with which to use it.[10]

In the case of Brazil, slow economic growth and high levels of inequality may prevent the country from meeting poverty reduction targets within the timeline set for the SDGs. Poverty in Brazil is forecast to decrease gradually but will not reach zero by 2030 as 8.8 million people (4% of the population) could still be living on less than USD 1.90 per day.[11] In this context universal access to ICT, supporting local content creation, capacity building and universal service funding are seen as critical inputs to meet the goals.

Brazil faces challenges with electricity and rural roads, both impacting the deployment of rural ICT. In 2012 the country reached 97% in terms of rural electricity access. According to the World Bank's Rural Access Index, which measures the percentage of the population living within two kilometres of an all-weather road, Brazil has had some of the lowest rural access rates. In 2001 it was an estimated that 53% of the population had such access. In 2015 an estimated 13.6% of Brazil's total road infrastructure was paved, with 0.26 paved roads per thousand hectares, compared to the Organization for Economic Co-operation and Development (OECD) average of 3.29 or the Indian figure of 9.88.[12]

OPPORTUNITIES FROM TECHNOLOGICAL INNOVATION

Globally, as technology evolved, fibre deployment, wireless access and efficient spectrum management technologies have become widely available and more affordable. As a result, rural communities around the world are increasingly considering alternatives to commercial models to become digital, since markets have not served them due to high capital and operating costs and low profitability margins. Across the world, communities

8 https://sdgs.un.org/goals

9 https://www.itu.int/en/about/Pages/default.aspx

10 ITU News. (2018, 23 October). ITU's approach to using ICTs to achieve the United Nations Sustainable Development Goals. *ITU News*. https://www.itu.int/en/myitu/News/2020/05/13/12/31/ITUs-approach-to-using-ICTs-to-achieve-the-United-Nations-Sustainable-Development-Goals

11 Scott, A., Bohl, D., Hedden, S., Moyer, J., & Hughes, B. (2017). *Sustainable Development Goals Report: Brazil 2030*. Frederick S. Pardee Center for International Futures. https://pardee.du.edu/sites/default/files/BRAZILReportPardeeCenter %281%29.pdf

12 Ibid.

are debating why, how and when communications infrastructures should be introduced in their communities, by whom and under what terms and models. In the process a wide range of possibilities has emerged for communities to connect sustainably and deploy different kinds of infrastructures to serve community needs locally, with lower capital and operating expenses.

In order for unconnected communities to benefit from such technological innovation and lower prices, lowering regulatory and policy barriers is absolutely essential. In most countries around the world, legal frameworks affecting telecommunications were tailored for large commercial operators, incumbents, national licences, and market dominance, in an attempt to transition away from a legacy state monopoly model to one of few large new entrants, which would either compete with the incumbent or replace it. Regulations were then passed to protect consumers, allocate radio spectrum with exclusivity rights and national licences, a policy that left many unconnected in remote, rural and low-density population areas, where there was no business case for deployments by large operators. These national spectrum assignments left large portions of unused wavebands in remote areas due to a lack of use-it-or-share-it policies, to the detriment of affordable services for people living in these areas. In this respect, the current mechanisms used to regulate large operators are unsuited for small, local operators and even less for not-for-profit community networks. This underscores the view that there should not be a "one-size-fits-all" regulation.

As we will see later, an enabling environment that recognises asymmetries among geographic areas, players, citizens and models is one that promotes sustainable local infrastructures and services by lowering regulatory barriers and allocating public resources including spectrum access, light licensing, funding and tax incentives, so that bottom-up connectivity models may flourish where market failure prevails.

THE IMPORTANCE OF COMMUNITY NETWORKS IN BRIDGING THE DIGITAL DIVIDE

In the context of the information society, the Sustainable Development Goals for 2030 rely significantly on ICT tools. So do several human rights, such as equality, freedom of expression and access to information. Community-led connectivity and community broadcast media initiatives may trigger local economic growth and inclusion. These strategies are more likely to gain ownership by community members who are not consumers but owners and co-designers of their own communications projects, to fulfil their specific needs under the shared vision of common goods, shared assets, community participation and technical capacity-building, all of which improve community resilience and agency. In this regard, legislators, policy makers and regulators would become enablers of inclusion and autonomy at community level. These groups have a unique role in facilitating access to essential public inputs instead of providing end user services that are seldom sustainable for governments and are seen as a paternalistic approach. Enabling essential inputs such as affordable access to spectrum, open access to backhaul or backbone networks, light licensing or licence exemption, as well as access to universal service funding to finance community networks, are aimed at promoting inclusion. These enabling policies are being adopted in many countries of the global South, and even in the global North, where rural communities and Indigenous people have been able to connect with others

and create their own media and content on their own terms and stimulate their local economies, protect their territories, language and culture.[13]

Recognising that community networks are complementary models of digital access and media is an important first step towards creating an enabling environment. No one single telecommunications network type or regulatory model may do the job. To be successful, network architecture and regulatory strategies should recognise local needs and visions, cultural differences and barriers including gender, age, ethnicity, geography and income.

Public policy and regulation design should consider such barriers, local needs and preferences of communities so that they may choose the network and services that better suit their aspirations and possibilities. Policy and regulation, when flexible and technologically neutral, may be in a better position to allow the unconnected to connect themselves on their own terms, especially when it comes to Indigenous peoples, quilombolas[14] and tribal communities which have internationally recognised rights to their own communications media, cultural identity and self-determination.[15]

WHAT IS THIS POLICY BRIEF ABOUT?

In January 2020, Anatel, aware of the digital inclusion challenges in Brazil, explicitly acknowledged the importance and contributions of community networks:

> An initiative that has been growing in the current market is that of community networks. Under Public Consultation no. 20/2018 on the Structural Plan for Telecommunications Networks (PERT), individuals, civil entities, and associations provided input on how to strengthen community access, and addressed the asymmetries found among community providers. (...) Some countries such as Argentina and Mexico have already regulated their community networks. In Brazil, community networks may operate following the guidelines of Anatel Resolution no. 617/2013, which regulates private limited services (SLP).[16]

To enable bottom-up connectivity models, policy makers can start by asking what would incentivise communities to invest time, learning efforts and community resources to launch their own community networks.

This policy brief explores how to better build community network policies stemming from Anatel's important recognition, so that community communications can be sustainable, autonomous, inclusive, locally relevant, empowering for women and men of

---

[13] Aboriginal Peoples Television Network: https://corporate.aptn.ca/about/ and K-Net, a First Nations (Indigenous) multi-ICT service provider in Canada: https://knet.ca/

[14] According to Daiane Araújo, quilombos emerged as refuges for Black people who escaped repression during the entire period of slavery in Brazil, between the 16th and 19th centuries. The inhabitants of these communities are called quilombolas. After abolition, most of them preferred to continue living in the villages they formed. With the 1988 Constitution, they gained the right to own and use the land where they had settled. Today Brazil has more than 15,000 quilombola communities. See: https://www.genderit.org/feminist-talk/contribution-bell-hooks-and-paulo-freire-construction-community-networks.

[15] These derive mainly from the American Convention of Human Rights, the American Declaration of the Rights of Indigenous Peoples, the United Nations Declaration of the Rights of Indigenous Peoples and the International Labour Organization Convention 169, all ratified by Brazil, as well as the Inter-American Commission of Human Rights' principles and its standards of freedom of expression for inclusive and plural media.

[16] https://www.gov.br/anatel/pt-br/regulado/universalizacao/redes-comunitarias

all ages and can promote the self-determination of Indigenous and traditional groups. The foundations and practices supporting sustainable community networks, through an underlying policy environment in Brazil that acts as a holistic enabler of a more diverse and decentralised digital ecosystem.

This policy brief is structured as follows:

Section 1 summarises (using official statistics) the current position of Brazil in terms of broadband access and affordability, radiocommunications, community radio, spectrum policy, universal service programmes and the internet ecosystem. This section also describes the main challenges in local access and digital inclusion and highlights the importance of community networks as contributors to sustainable and affordable access and to the empowerment of communities, women and Indigenous and quilombola groups, among others.

Section 2 focuses on community networks: origins, goals, principles; the potential impacts of community networks on gender equality and community economies, development and sustainability. We then explore the diversity of community network models, featuring several case studies of such networks around the world, using easy-to-follow tables which classify these networks according to different criteria and describe the community network movement in Brazil. This section ends with a brief explanation of the key conceptual elements for sustainable community networks, that is, to create an enabling policy and regulatory environment that makes community network design, deployment, operation and management easy, affordable, upgradeable, sustainable and autonomous, with very low, if any, barriers to entry.

Section 3 describes the legal framework in Brazil that governs licensing, spectrum attribution, allocation and use, regulatory asymmetries between large and small operators with no significant market power, the state of the art in backhaul and backbone networks, satellite access in remote areas, the FUST status, broadcast radio, and whether the SLP regime is a good route to enabling community networks in underserved communities or quilombos.

Section 4 summarises the findings, vision and experiences of all the interviewees, affiliated to diverse organisations or communities which have been involved with community networks or with digital inclusion efforts or the internet ecosystem, mainly in Brazil, but also in other Latin American countries, sharing their views on the barriers, challenges and opportunities for community networks in Brazil. These include the voices of community members, civil society, technical and advocacy organisations, academia, government and Anatel officials.

Section 5 delivers policy and regulatory recommendations based upon our research and good practice in other countries where community networks are taking off after an enabling environment fit for inclusion and innovation was put into place.

SECTION 1
WHERE DOES BRAZIL STAND TODAY IN TERMS OF AFFORDABLE ACCESS?

1.1 PROGRESS MADE IN ACCESS AND PENETRATION AND THE PREVAILING GAPS

As described below, Brazil has made substantial progress in broadband connectivity. The Structural Plan for Telecommunications Networks (PERT)[17] reports that 97.3% of the population is now covered by 4G networks, and 87.15% of at least one town or village in every municipality; however, that does not equal universal access. Locality-level coverage maps and road connectivity are important to provide information on real geographic and population coverage to facilitate decision making for communities, investors and government, so that funding and coverage obligations actually target the unconnected communities. PERT does not mention any policy for community networks as part of its strategies, but it could include them in next year's edition.

As of December 2020, fixed broadband (FBB) subscriptions reached 36 million, that is, 49.72% of households have FBB.[18] As to mobile broadband subscriptions (MBB), they reached 234.1 million, i.e. 97.2 lines per 100 inhabitants, higher than Mexico and Colombia but substantially below the OECD average of 112.8/100 people.

The government of Brazil has launched a significant number of connectivity subsidy programmes in the last 10 years; however, their actual cost, benefits and sustainability are not readily apparent. Contracts for these subsidised services can last for no more than five years, and rural connectivity programmes have often been replaced with new ones by incoming administrations.

1.1.1 PLANO NACIONAL DE BANDA LARGA 2010

In 2010 Brazil launched its first major broadband project – the National Broadband Plan (PNBL). At that time the country had a population of 190,755,799 inhabitants, out of which 29,830,007 (15%) lived in rural areas. According to Brazil's Institute of Geography and Statistics (IBGE) the 2020 population number is estimated at 212,186,800 inhabitants, with the rural population decreasing to 19,719,486 people (9.3%). This highlights the continuing high level of urban-rural migration which underscores the lack of rural services, a worrying finding as we see people migrating to cities where access to basic services and livelihoods is apparently more feasible.

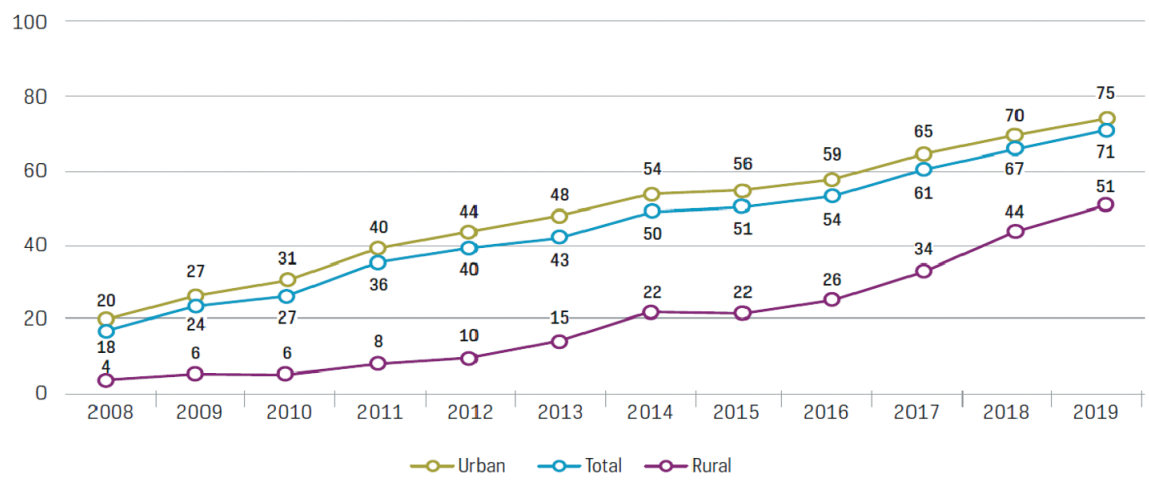
In 2010 the country had 15 million subscribers of fixed broadband (FBB) and 20 million subscribers of 3G mobile broadband (MBB). As of 2020 FBB penetration more than doubled to 36,344,670 subscribers (17.22%

[17] https://www.gov.br/anatel/pt-br/dados/infraestrutura/pert-1

[18] Ibid. There were 72.4 million households in Brazil as of December 2020. Of these, 36 million had a broadband connection, i.e. 49.72% of households were connected. However, we have to take into account that the 2020 census did not take place due to the COVID-19 pandemic and therefore the total estimated population and households considered in 2020 by Anatel is only an estimate of 211,755,692 people.

Figure 1

HOUSEHOLDS WITH INTERNET ACCESS, BY AREA (2008–19)
Total households (%)



Note: Since 2014, this indicator has also included home networks connected through mobile devices.

penetration) and MBB subscribers increased more than 10 times in 10 years to 234,067,474 (a 110.93% penetration). These figures are higher than Mexico's and Colombia's and lower than Chile's, according to the OECD's *Telecommunication and Broadcasting Review of Brazil 2020*.[19]

Internet access at household level has increased consistently over the last 11 years as seen in Figure 1.

This ICT Households Survey considers for the first time both mobile and fixed broadband connections at home level. It shows a lesser rural-urban gap of 24 points.[20]

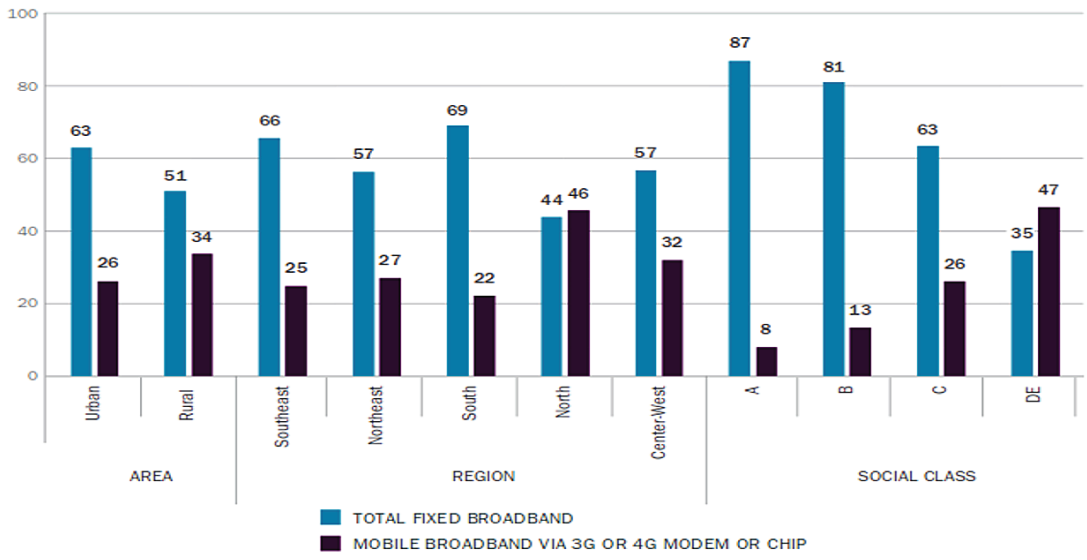
However, the ICT Households Survey of 2018 (Figure 2) showed the breakdown of both mobile and fixed broadband access in households, an important indicator that should be taken into account.

[19] OECD. (2020). *Telecommunication and Broadcasting Review of Brazil 2020.* OECD. https://www.oecd.org/digital/broadband/oecd-telecommunication-and-broadcasting-review-of-brazil-2020-30ab8568-en.htm

[20] https://www.cetic.br/media/docs/publicacoes/2/20201123121817/tic_dom_2019_livro_eletronico.pdf

Figure 2.

HOUSEHOLDS WITH INTERNET ACCESS, BY TYPE OF CONNECTION, AREA, REGION, AND SOCIAL CLASS (2018) Total number of households with internet access (%)



1.1.2 CONNECTIVITY GAPS IN BRAZIL

In rural areas, income disparities impact on the number of people who use connectivity and how they do so. For example, in the Northern region access is achieved by and large through mobile broadband as it is more affordable, and due to zero rating policies that allow for the largest, sponsored communication apps to reach the underserved, but only by giving them "free" access to a very limited internet experience if they do not have a data plan. This limited experience is summed up as WhatsApp, Instagram and Facebook. In fact, in 2017 55% of

Figure 3

HOUSEHOLDS WITH INTERNET ACCESS (% total households)

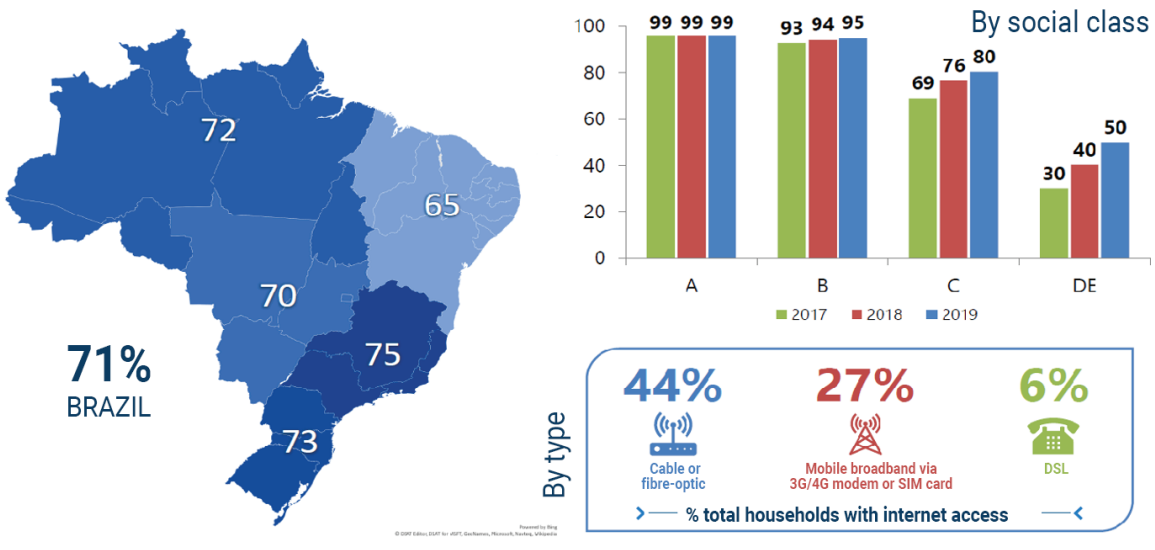
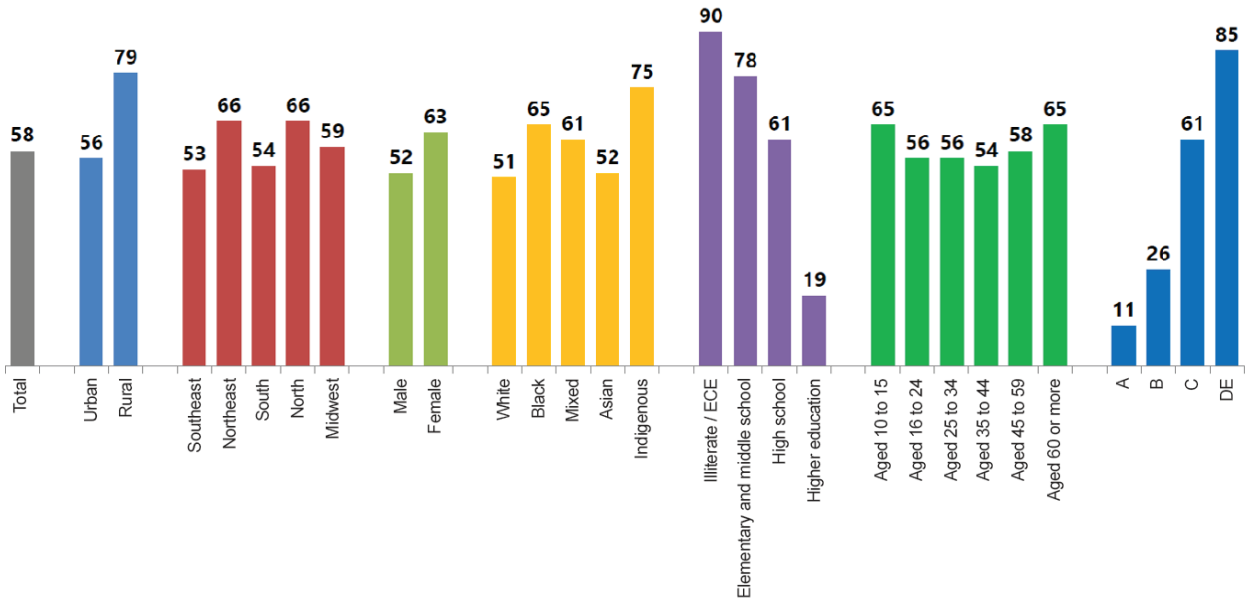


Figure 4

INTERNET USERS WHO ONLY USED MOBILE PHONES (% total internet users)



Source: ICT Households Survey 2019 (https://cetic.br/media/analises/tic_domicilios_2019_coletiva_imprensa.pdf)

Brazilians thought that there was nothing else on the internet besides Facebook, according to Mozilla's *Internet Health Report*.[21]

In addition, in rural communities where fixed broadband is unavailable or unaffordable for low-income groups, Wi-Fi is not an option in many households. In quintiles D and E, 29% of the people surveyed by CETIC.br in 2018 said they did not have internet access at home as it was too expensive, while 5% said that it was due to a lack of coverage in their neighbourhood.[22]

Figure 3 summarises the different connectivity gaps in Brazil in terms of internet users.[23]

It is important to note that the survey considers an internet user to be any person who has been connected at least once in the previous three months, regardless of the quality of service, device used, length or purpose of connection, as this is the definition the ITU adopted to develop this indicator.

With regard to mobile services according to access technology, the coverage per municipality as of 2020 as reported by PERT is illustrated in Figure 5. The total number of municipalities in Brazil is 5,570. A single base station may be installed somewhere in a municipality but that does not mean that the entire municipality has service.

[21] https://internethealthreport.org/v01/

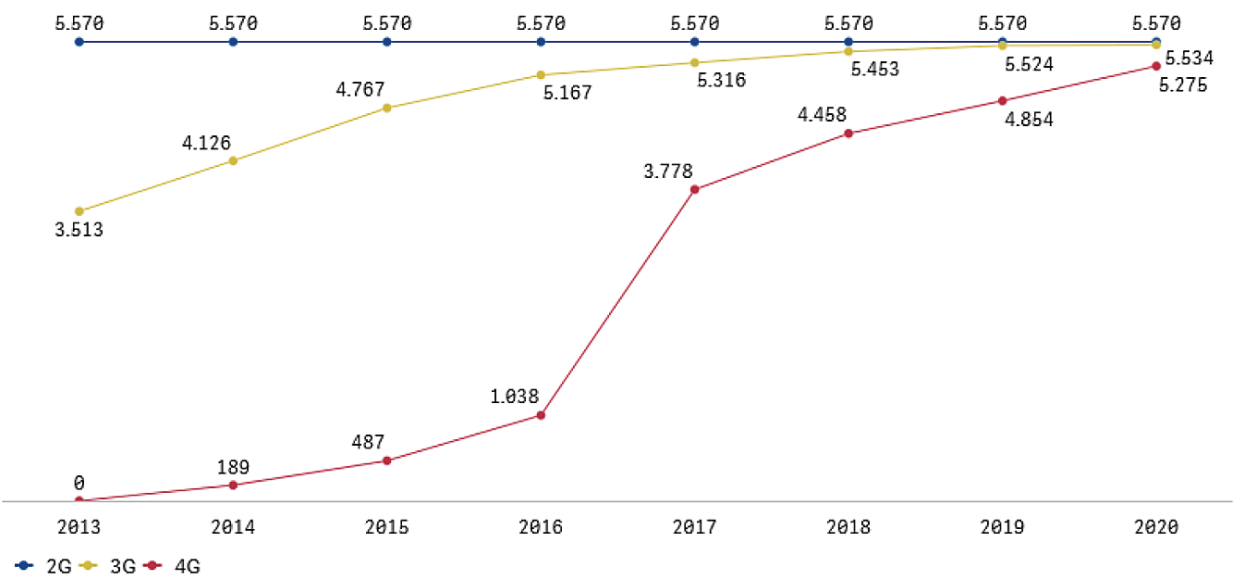
[22] https://cetic.br/pt/tics/domicilios/2018/domicilios/A10A/

[23] Ibid.

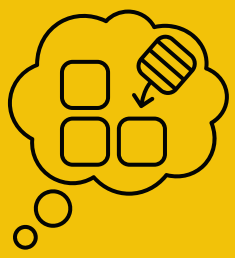
Figure 5

TECHNOLOGY COVERAGE BY MUNICIPALITY

Growth in the number of municipalities covered by each technology (as of Dec 2020)



INSIGHT 1



Statistics at the national and municipal level are relevant but not sufficient to measure rural access and inclusion. Granular open data per locality is crucial for an accurate digital inclusion policy. Actual mobile service coverage in highways and roads across the country is important as well. Granular data on backhaul networks is key for any project planning and for the regulator's decision-making process.

Table 1 from PERT illustrates a breakdown of infrastructure and mobile service coverage, per town or village that is not a municipal seat, from which it is to be noted that there are 8,930 of these towns/ villages with only 2G coverage or none, with a total population of 3,759,655 inhabitants (54.72%).

A granular map of the unserved or underserved places or villages by technology or network type including broadcasting (commercial, public and community radio) is crucial for well-informed decision making.

To some extent we can see the huge differences in mobile telephony and fixed broadband (FBB) density per state, respectively, in the maps in Figures 7 and 8.

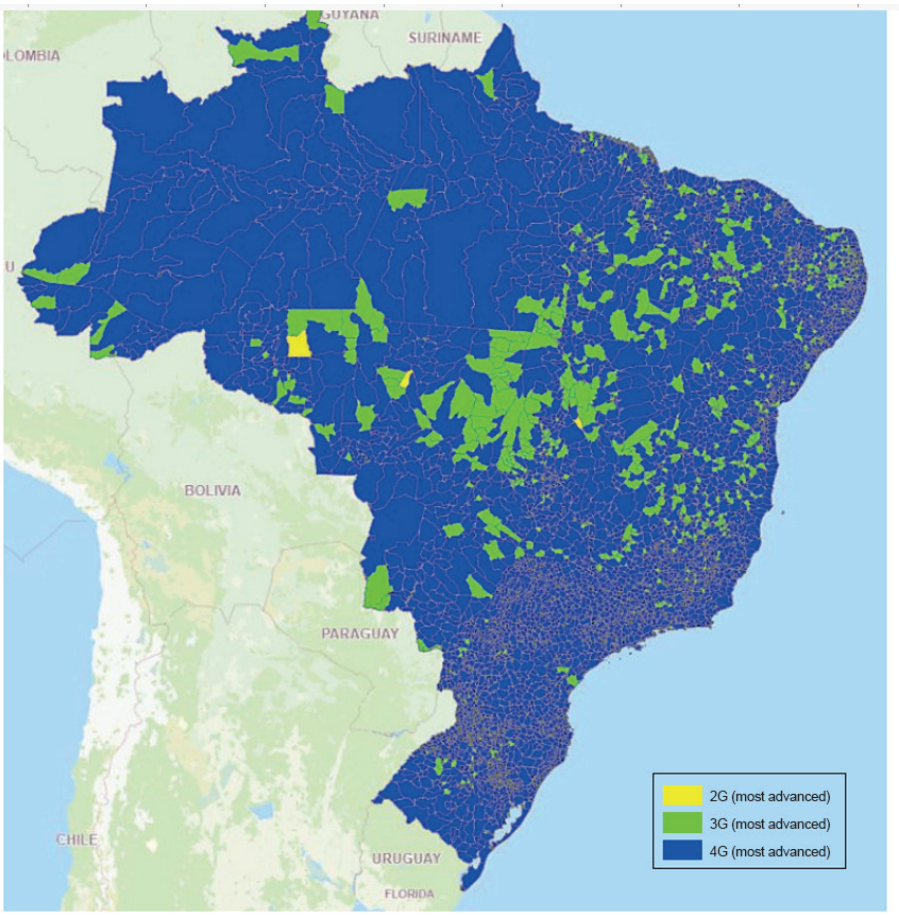
Table 1

COVERAGE IN TOWNS/VILLAGES THAT ARE NOT MUNICIPAL SEATS IN BRAZIL		
Description	Quantity	%
Towns/villages that are not municipal seats with 4G stations	5,681	34.82
Towns/villages that are not municipal seats with 3G stations	1,707	10.46
Towns/villages that are not municipal seats with 2G stations or no coverage	8,930	54.72
Total number of towns/villages that are not municipal seats in Brazil	**16,318**	**100.00**
Description	**Quantity**	**%**
Population in towns/villages that are not municipal seats with 4G stations	16,920,721	77.61
Population in towns/villages that are not municipal seats with 3G stations	1,122,200	5.15
Population in towns/villages that are not municipal seats with 2G stations or no coverage	3,759,655	17.24
Total population in towns/villages that are not municipal seats in Brazil	**21,802,576**	**100.00**

Source: Anatel (December 2020).

Figure 6

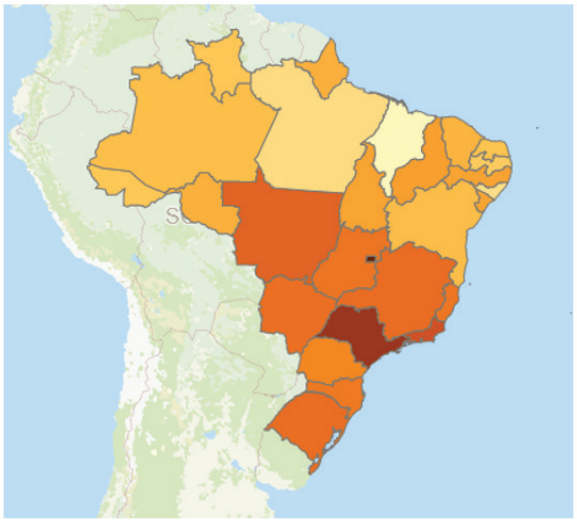
DISTRIBUTION OF MUNICIPALITIES BY PMS TECHNOLOGY



Source: Anatel website (http://www.anatel.gov.br/setorregulado/telefonia-movel-universalizacao).

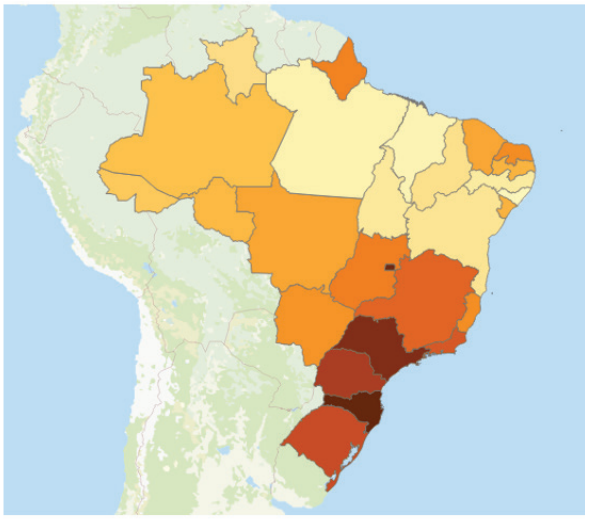
Figures 7 and 8

MOBILE TELEPHONY
(the darker areas have more density)



Source: https://www.Anatel.gov.br/paineis/acessos/telefonia-movel

FIXED BROADBAND
(the darker areas have more density)



Source: https://www.Anatel.gov.br/paineis/acessos/banda-larga-fixa

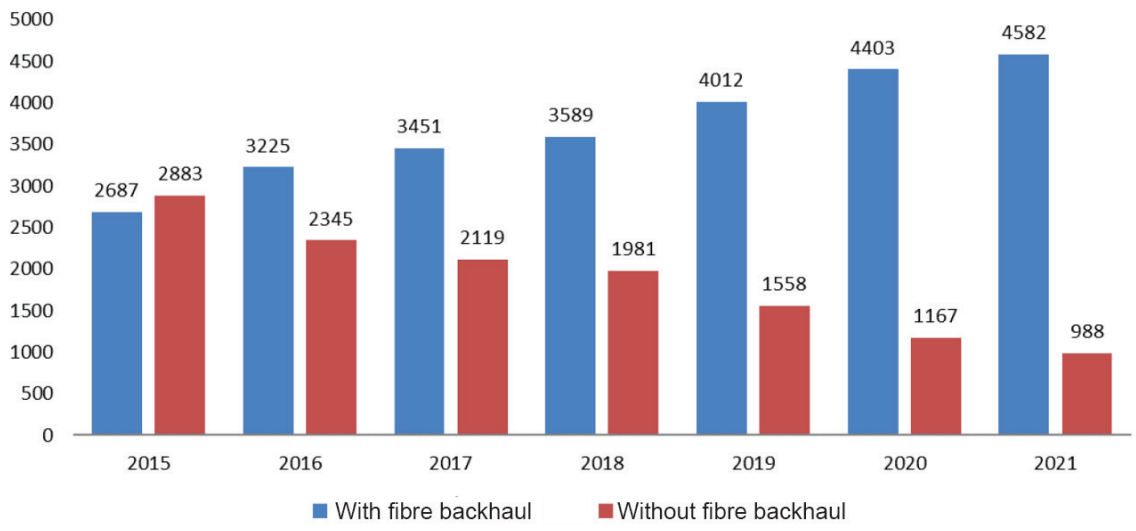
FIBRE

The share of fibre in broadband connections (FTTH) rose from 0.43% to 24% between 2010 and June 2019.[24]

On the issue of fibre-based backhaul, PERT reports 998 municipalities with no fibre backhaul, of which 53% belong to the Northern and Northeastern regions and Minas Gerais.

Figure 9

EVOLUTION OF MUNICIPALITIES SERVED WITH FIBRE BACKHAUL

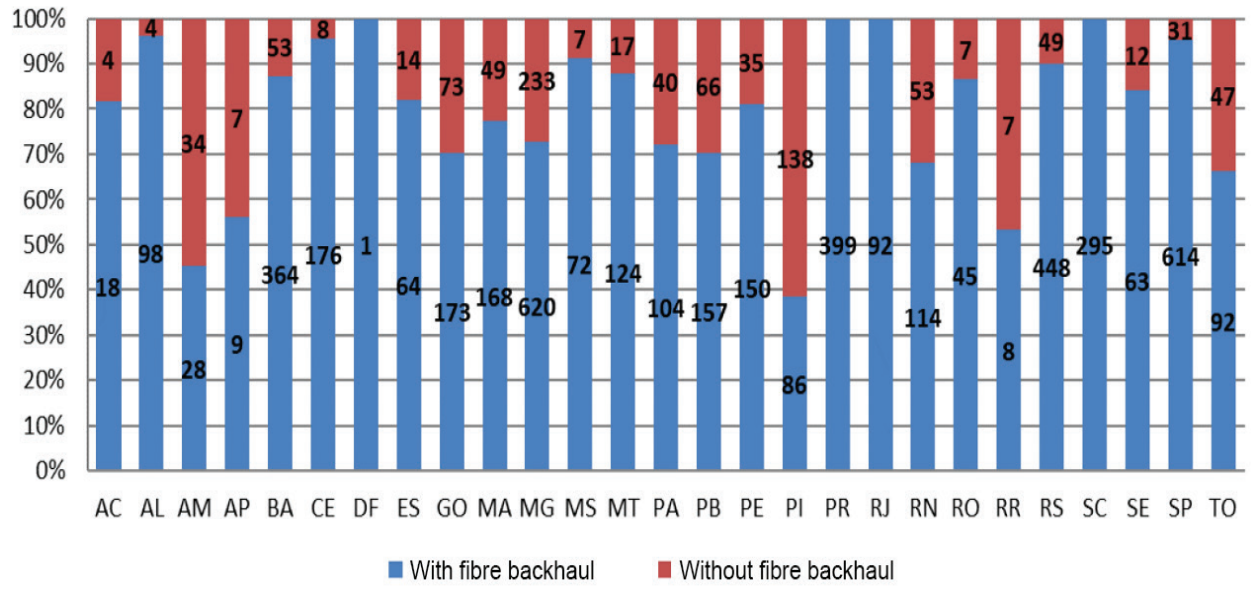


Source: Anatel Data Portal (Feb. 2021)

[24] OECD. (2020). Op. cit.

Figure 10

DISTRIBUTION OF MUNICIPALITIES PER STATE WITH AND WITHOUT FIBRE BACKHAUL



Source: Multimedia Communications Service (SCM) Providers (2020)

The distribution of municipalities with and without fibre backhaul is shown in Figure 10.

In fact, the most recent emphasis in Anatel's efforts towards universalisation has shifted towards bringing fibre to municipal level, as revealed by its recent *Plan General de Metas de Universalização* (PGMU V), binding from 2021 to 2025, which mandated that coverage duties imposed on FBB operators must be delivered with fibre deployments in all such municipalities, villages, isolated urban areas or rural conglomerates that have no fibre. Similarly, for mobile operators, their coverage obligations of 4G deployments, shall be complied with high-capacity data transmission networks, i.e. fibre backhaul.[25] Unfortunately, the increasing presence of fibre in a given city of a municipality does not mean smaller rural villages are connected. An incentive for this to happen would be that all this growing backhaul networks be subject to open access policies. However, wholesale operators without substantial market power have no open access obligations, and those who have, are only bound to honour the offers in SNOA to commercial providers, not to SLP (limited private services providers). The abundance of fibre is curtailed by this fibre feudalism that leaves non-for-profit operators, including community networks, out of the non-rivalrous network that fibre networks carry.[26]

[25] Carreño, I. (2020, 30 November). Nuevas metas de universalización de Brasil buscan conexión con fibra en municipios desatendidos. *DPL News*. https://digitalpolicylaw.com/nuevas-metas-de-universalizacion-de-brasil-buscan-conexion-con-fibra-en-municipios-desatendidos

[26] Song, S. (2021, 29 March). A Penny Black Broadband Strategy. *Many Possibilities*. https://manypossibilities.net/2021/03/a-penny-black-broadband-strategy; Song, S. (2018, 3 October). Fibre Feudalism. *Many Possibilities*. https://manypossibilities.net/2018/10/fibre-feudalism

IDEA 1

Affordable access to wholesale backhaul through transparent, non-discriminatory terms for SLP. Very accessible prices would incentivise local broadband connectivity, benefiting also larger networks through increasing traffic in rural areas. In short: wholesale offers of operators both with and without substantial market power (SMP) for non-profit community networks accredited as such would be a powerful incentive for such networks to formalise. In the case of state-owned backbone networks like the ones in Amazonia, subsidised backhaul services for community networks that connect otherwise unconnected communities would have a great impact in coverage.[27]

1.1.3 SATELLITE CONNECTIVITY

Forty-five geostationary commercial satellites (30 foreign and 15 Brazilian) are in operation.[28] Ku band is number one, followed by C, Ka and the AP30B Ku-band. In all they have a 293 GHz capacity, 74.2% occupied. In PERT, Anatel acknowledges the fact that it has no accurate data about satellite backhaul stations, location, capacity, satellites provisioning it, frequency bands used, but it is gathering information to fill this gap. In addition, four firms operate in the country using non-geostationary satellites.

1.1.4 BRAZILIAN E-GOVERNMENT INITIATIVE (GESAC) AND INTERNET FOR ALL

The GESAC programme is currently one of the two legs of the overarching "Wi-Fi Brasil" programme,[29] under the Ministry of Communications in cooperation with Telebras.

Created in 2002, the programme has recently been updated with the Ministry of Communications Order n. 2460,[30] issued on 23 April 2021 and effective from 3 May 2021.

GESAC offers free broadband services through satellite and terrestrial broadband connections in schools, public health clinics, Indigenous villages, international border stations

[27] Throughout this report you will find IDEA or INSIGHT boxes on different issues. These come from either interviewees or good practices and studies on community networks across the globe. They provide ideas on specific solutions, possible avenues or reflections on a given topic.

[28] https://informacoes.anatel.gov.br/paineis/espectro-e-orbita/satelites-em-operacao-comercial-no-brasil

[29] https://www.gov.br/mcom/pt-br/acesso-a-informacao/acoes-e-programas/wi-fi-brasil

[30] https://www.in.gov.br/en/web/dou/-/portaria-mcom-n-2.460-de-23-de-abril-de-2021-315795564

and Indigenous and quilombola communities as well as telecentres.[31]

In particular, through Telebras, it can reach isolated communities in the Amazon region. The programme is in its fifth edition (Brazilian law allows service contracts with a maximum duration of five years). By mid-2018, it had 4,500 access points and was served by Oi, Embratel and Vivo. In 2018, the contract was transferred to Telebras, to use its satellite to serve schools, health centres and border points. As of April 2021, it had connected 13,875 public sites. According to MCTIC, the goal for GESAC was to cover, from 2019 onwards, 5,000 additional public spaces, with more than 50% of them belonging to the Ministry of Education. The GESAC connections acquired by the Ministry of Education are part of the initiatives of the Connected Education programme.[32]

1.1.5 OTHER HIGHLIGHTS OF DIGITAL EFFORTS IN BRAZIL

- There has been successful development and expansion of internet exchange points (IXPs). There are currently 33 in operation throughout the country, and Brazil stands second among OECD countries with its number of IXPs, as seen in Figure 11.[33]
- Brazil holds 71% of all autonomous system numbers (ASN) and 72.6% of all IPv6 blocks allocated by LACNIC, in Latin America and the Caribbean,[34] that is, 8,431 (with 7,426 in use) with important regional disparities (the Northern region holds only 355 while the South-east holds 40.8%, i.e. 3,112).[35]
- A sound policy of regulatory simplification for small fixed internet

[31] The OECD review of 2020 documents the evolution of GESAC programmes: The original programme foresaw the installation of 3,500 access points in 2,700 municipalities. The broadband connections are paid for by the federal government and supplied by private companies, which benefit from exemption from the state-level taxes imposed on telecommunication services [ICMS]) through an agreement with the Brazilian National Council of Finance Policy (*Conselho Nacional de Política Fazendária*, CONFAZ). The GESAC programme was extended in 2017 (Ministerial Ordinance No. 7154 of 2017), under the name Internet for All. This programme aims to include broadband access at lower prices for people living in communities without or with inadequate broadband access, targeting primarily the most vulnerable communities in rural and remote areas as well as in urban peripheries. The programme foresees tax incentives for ISPs in the exemption from the ICMS tax. However, due to issues regarding the tax exemption arrangement with CONFAZ, which would cover, in principle, only satellite connections, MCTIC is currently working on a revision of the GESAC/Internet for All programme. The proposed solution is to separate the GESAC programme, with connections being paid for by the government, from the Internet for All programme, which would incentivise ISPs to provide internet access in remote locations at affordable prices. The Internet for All programme will restart once the Ministry of Communications, Technology, Innovations and Science (MCTIC) finishes the negotiation of a separate ICMS exemption for the programme with CONFAZ. Internet for All operates through partnerships between MCTIC and municipalities and is implemented by operators accredited by the ministry. To participate in the programme, municipalities must sign an agreement with MCTIC. This agreement defines the municipality's obligations, such as the guarantee to provide the basic infrastructure for network deployment. The municipalities indicate the places to be covered by the programme. Residents at these municipalities can directly contract internet connection services offered by operators, without the intermediation of the ministry. Internet for All does not offer free services for individuals but companies have to provide services "at a fair and reasonable price". According to the programme, operators have the freedom to define such prices, and municipalities may supervise service provision.

[32] This programme (*Programa de Inovação Educação Conectada*) was established in 2017 (Decree No. 9 165) to subsidise the universalisation of high-speed internet access and promote the use of digital technologies in basic education institutions. The programme is being rolled out in three phases. Phase 1 (2017 to 2018) aimed to develop the plan and reach 44.6% of students; phase 2 (2019 to 2021) aims at reaching 85% of the student base and starting the programme evaluation; phase 3 (2022 to 2024) has set the goal of reaching 100% of the students.

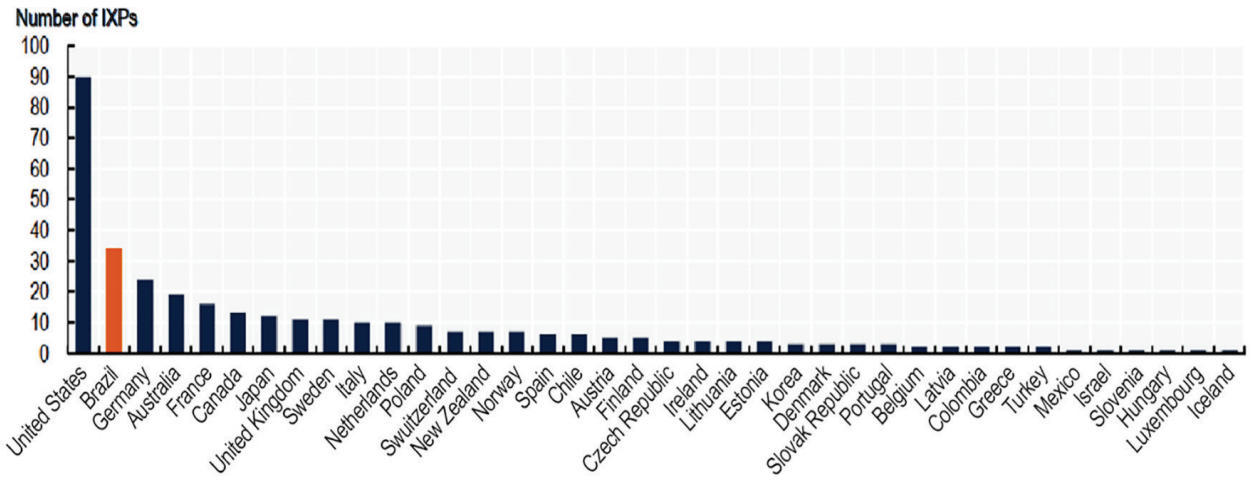
[33] https://ix.br/localidades/atuais

[34] https://www.lacnic.net/1037/2/lacnic/lacnic-assignments-statistics

[35] https://ix.br/localidades/brasmap

Figure 11

NUMBER OF IXPs IN BRAZIL AND IN OECD COUNTRIES (2019)



Note: Only IXPs listed with at least three participants are included.
Source: Packet Clearing House (2020), *Internet Exchange Directory* (database), https://www.pch.net/ixp/dir (accessed on 18 February 2020).

providers (with less than 5% market share in the relevant markets and up to 5,000 accesses) to increase coverage and competition.

- An expedited and inexpensive authorisation for multimedia communications services (SCM) may be obtained from Anatel for these small operators or if serving up to 5,000 users, the SCM licence is waived by the regulator only requiring registration with Mosaico,[36] the all-digital licensing and filing system created by Anatel.
- A longstanding policy of strengthening the institutional structure for the internet governance ecosystem. According to the OECD, the Brazilian Internet Steering Committee (known by its Portuguese acronym, CGI.br), jointly created by the minister of science and technology and the Ministry of Communications[37] in 1995, is still an avant-garde example of best practice for the multistakeholder governance of the internet ecosystem at national level.
- Incentives for the national industry of software and audiovisual content. The best known are *Lei do Bem*, Law 11,196/2005[38] that allows fiscal incentives for companies investing in research for development and innovation (RD&I) and the former called *Lei Rouanet*, Law n. 8,313 of 1991, which outlines incentives such as federal income tax reduction to companies and individuals when resources are applied to cultural products and services, movements, capacity building and development.[39]

36 https://sistemas.anatel.gov.br/se/

37 Interview with M. Vinicius from Anatel, April 2021.

38 http://www.planalto.gov.br/ccivil_03/_ato2004-2006/2005/lei/l11196.htm

39 http://www.planalto.gov.br/ccivil_03/leis/l8313cons.htm

- Wi-Fi Brazil is a programme of the federal government in partnership with Telebras to provide satellite internet access in 13,785 public sites: schools (9,900), health clinics (600), police posts and other public service premises in remote areas, and in 500 indigenous or quilombola villages, and other sites where the Ministry of Communications identifies that no affordable broadband is available.[40] Of those 13,785 access points, 10,826 are rural and 2,959 urban, geographically distributed as shown in the interactive map displayed on the programme website.[41]

- Anatel resolution on the 6GHz band for Wi-Fi6E

  On 25 February 2021 Anatel's board of commissioners approved the technical requirements for unlicensed use of the 6GHz band – from 5.925 MHz to 7.125 MHz for Wi-Fi 6E, enabling wide channels (a 160MHz bandwidth) and gigabit transfer rates. This decision was grounded in public consultations 82/2020, and formal inputs from interested parties, including the agency's spectrum use committee, the WiFi6E Coalition and Coalizao para Direitos na Rede.42 It lifted some width limitations, allowing mostly indoor equipment (LPI) and very low power ones (VLP), to avoid interference beyond the building in certain conditions. After this decision, Anatel is now researching the possibility of further outdoor use, without interfering with services granted for primary use. According to the Brazilian WiFi6E Coalition, composed of various technology-related actors from industry manufacturers, ISPs associations, internet platforms and technical community bodies:

  > Anatel's decision reveals a significant change in the paradigm of the legal scarcity of this asset by recognising an unlimited potential for applications and uses for a traditionally limited and expensive resource. It establishes a new level of democratisation of the traditional measures related to the assignment and allocation of spectrum, improving consumer choice, innovation, connectivity and access.[43]

1.2 THE CHALLENGES OF RURAL COVERAGE AND ACCURATE DATA

As in the rest of the Latin American region, the urban-rural gap remains a challenge. The ITU has illustrated this in Figures 12 and 13.[44]

Brazil's large territory of 8.5 million km^2, and a rural population sparsely distributed in the Amazon and other regions, has made it difficult to reach universal service goals. PERT indicates that over 6 million Brazilians are totally unconnected due to lack of access but many more cannot afford it even if available or have limited-service options.

Commercial mobile network coverage is found in only 10% of Brazil's immense territory, where 90% of the population lives, concentrated especially in big cities.

40 https://www.gov.br/mcom/pt-br/acesso-a-informacao/acoes-e-programas/wi-fi-brasil

41 https://www.gov.br/mcom/pt-br/acesso-a-informacao/acoes-e-programas/wi-fi-brasil

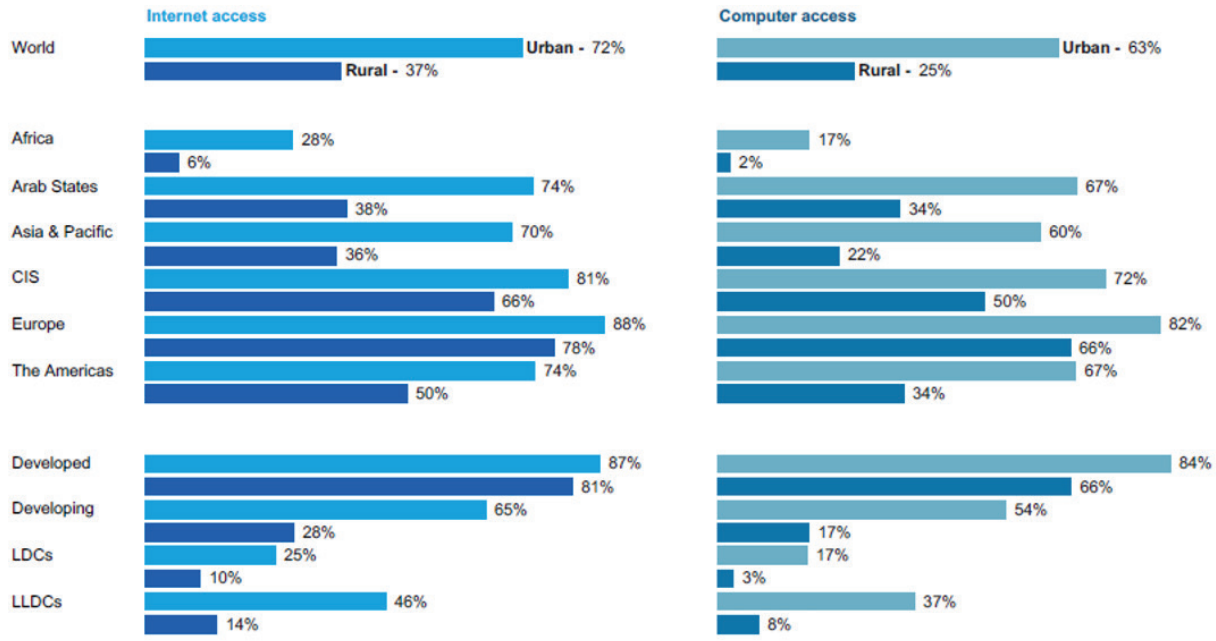
42 https://direitosnarede.org.br/2020/12/10/cdr-apoia-consulta-da-anatel-sobre-destinacao-total-da-faixa-6ghz-para-nova-geracao-de-tecnologia-wi-fi_

43 https://isoc.org.br/files/Contribuicao_Coalizao_WiFi6E_CP_82.pdf_

44 ITU. (2020). *Measuring Digital Development: Facts and Figures 2020.* International Telecommunication Union. https://www.itu.int/en/itu-d/statistics/pages/facts/default.aspx

Figure 12

INTERNET ACCESS AT HOME IN URBAN AREAS TWICE AS HIGH AS IN RURAL AREAS
Percentage of households with computer and/or internet access at home, 2019*



*ITU estimate. Note: Insufficient data available to produce estimates for SIDS.Source: ITU

The distribution of the digital inclusion progress is thus troublesome. According to PERT, FBB accounts for 10.5% of all telecommunications access in the country (323 million) and the PPPs have expanded broadband access in rural areas, but the FBB market is still highly concentrated within four large operators with substantial market power. In addition, the country's highways in the Northern and Northeast regions are only connected at 35%. An important highlight is the fact that the presence of fibre backbone in a given municipality has proven not only to improve the speed of connections but also the number of accesses, according to PERT.

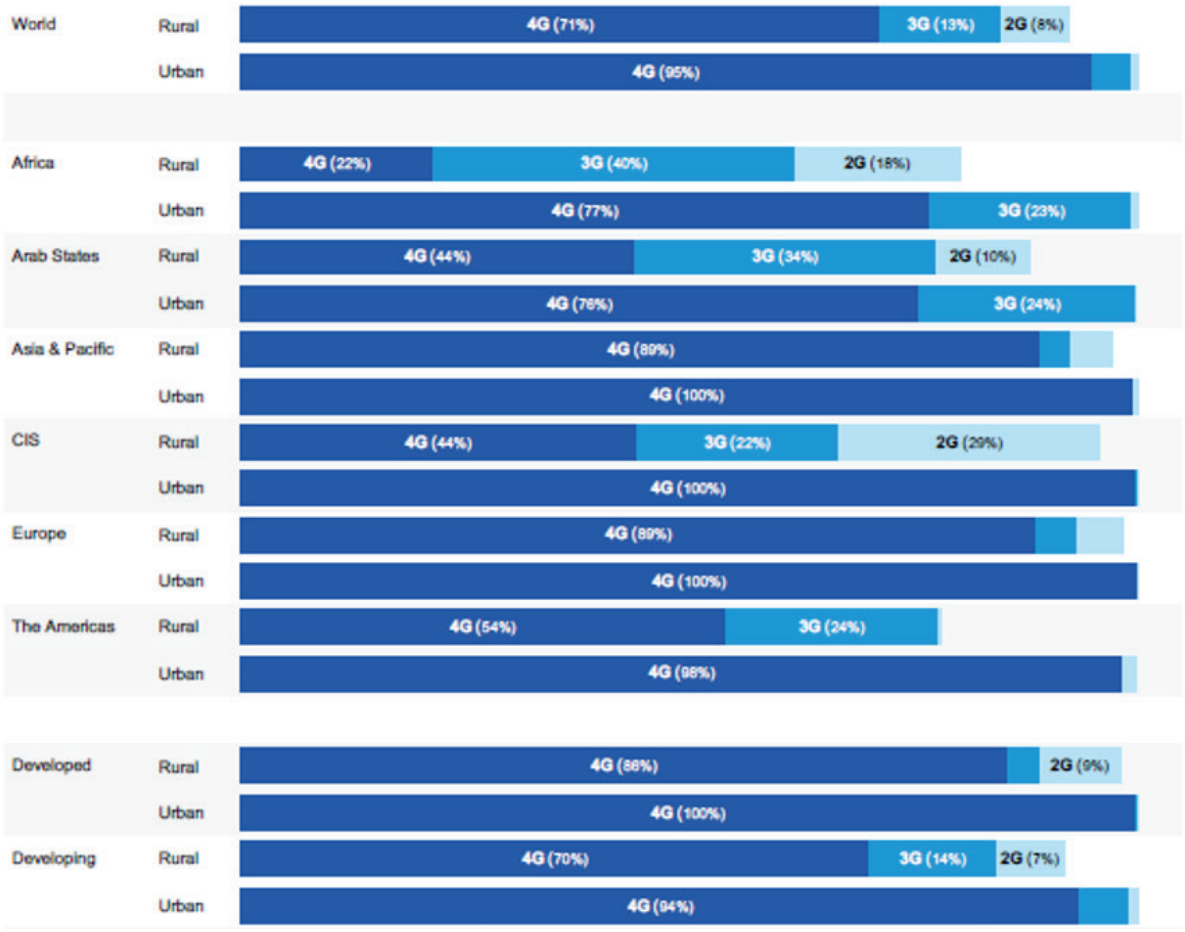
PERT reports that 4G networks are present with at least one served town or village in 5,275 municipalities (out of 5,570) where 98% of the population lives, and 3G had an equivalent coverage of 99.8%. However, these figures do not indicate the actual coverage at the town or village level.

Municipalities are huge and many rural areas are not covered except for the municipal seat. Therefore, this indicator does not show the actual population and territorial extension covered.[45] On the other hand, since small-scale internet service providers (ISPs), referred to in Brazil as "PPPs" (Prestador de Pequeno Porte), have no reporting obligations, Anatel's statistics only partially include their coverage and penetration footprint, therefore an accurate map of actual network coverage (both access and backhaul) by locality and internet infrastructure is required to accurately identify target towns and villages to cover or improve broadband access.

45 OECD. (2020). Op. cit.

Figure 13

MOBILE-BROADBAND NETWORK COVERAGE: DEVELOPING COUNTRIES' RURAL AREAS STILL PENALISED. Population coverage by type of mobile network and area, 2020*



While virtually all urban areas in the world are covered by a mobile-broadband network, many gaps subsist in rural areas. In LDC's, 17 per cent of the rural population has no mobile coverage al all, and 19 per cent of the rural population is only covered by a 2G network.
*ITU Facts and Figures 2020

In spite of granular data gaps, there are indications that more than one type of access gap does exist. Table 2, taken from the ICT Households Survey of 2019,[46] shows the different internet access gaps by area, region and family income level.

Affordability and quality of service are crucial factors. As mentioned below, FBB in Brazil has not reached affordable levels according to the ITU study.[47] In other cases, because of the offered speeds, it cannot be considered meaningful access. According to the ITU Broadband Commission, by 2025, entry-level broadband services should be made affordable in developing countries at less than 2% of monthly gross national

[46] Regional Centre of Studies for the Development of the Information Society. (2019). *TIC Domicílios 2019*. https://cetic.br/pt/tics/domicilios/2019/domicilios/A4/expandido/

[47] Broadband Commission for Sustainable Development. (2020). *The State of Broadband: Tackling Digital Inequalities: A Decade for Action*. https://www.broadbandcommission.org/publication/the-state-of-broadband-2020/

Table 2

DIFFERENT INTERNET ACCESS GAPS BY AREA, REGION AND FAMILY INCOME LEVEL			
Internet access (%)		**Yes**	**No**
	TOTAL	71	28
Area	Urban	75	25
	Rural	51	49
Region	Southeast	75	25
	Northeast	65	35
	South	73	27
	North	72	28
	Midwest	70	30
Family income	Up to 1 on minimum wage	55	45
	1-2 on minimum wage	69	31
	2-3 on minimum wage	83	17
	3-5 on minimum wage	91	9
	5-10 on minimum wage	92	8
	More than 10 on minimum wage	97	3
	No income	51	49
	Do not know	69	30
	Did not reply	67	32
Socioeconomic range	A	99	1
	B	95	5
	C	80	19
	DE	50	50

Source: CGI.br/NIC.br, Regional Centre of Studies for the Development of the Information Society. (Cetic.br), Survey on the use of information and communication technology in Brazilian households – ICT Households 2019.

income (GNI) per capita, down from the previous 5% target.[48]

When it comes to ICT price trends as reported by the ITU,[49] Brazil ranked 79th in affordability of mobile voice and data with a low consumption basket of USD 13.68 plus 40.2% VAT (USD 19.15) with unlimited calls and SMS and a 3 Gb cap, which represents 1.8% of GNI per capita (USD

[48] Ibid.

[49] ITU. (2020). *Measuring Digital Development: ICT Price Trends 2019*. International Telecommunication Union. https://www.itu.int/en/mediacentre/Documents/Documents/ITU-Measuring_Digital_Development_ICT_Price_Trends_2019.pdf

9,140).[50] This would leave out the lower quintiles with lesser per capita income. Only five countries in the Americas region (USA, Bahamas, Canada, Costa Rica and Chile) had a mobile-data basket that accounted for less than 1 percent of GNI per capita.

The ITU report ranks Brazil 45th (out of 173) countries for affordability of an average fixed broadband basket of USD 10.92 plus VAT and other taxes (USD 17.74) at 2 Mbps speed which represents 1.4% of GNI p.c. Both the speed and the cost for a low-income rural population may be unaffordable or meaningless options. In a 2020 price briefing about service affordability by ITU and the Alliance for Affordable Internet (A4AI),[51] Brazil appears to have affordable prices in mobile broadband baskets, where available, of low and high use representing 1.43% of GNI per capita, that is, well under the 2% threshold of the Broadband Commission. In contrast, FBB in Brazil, says the report, is 2.51% of GNI per capita and thus unaffordable. In the ICT Households Survey 2019 figures shown in Table 2, 45% of Brazilians with one minimum wage income (BRL 1,050 or USD 199) do not have internet access.

As in all Latin American countries, wide inequalities prevail in Brazil: among different Brazilian regions, between men and women, urban and rural areas, Indigenous, tribal and quilombolas, on one side, and white populations on the other, as well as among socioeconomic quintiles. As of December 2020, 8,930 towns or villages, with a total population of 3,759,655, had no coverage at all or only had 2G coverage.[52]

In a context of increasing rates of COVID-19 infections, and prolonged lockdowns, people in unserved or underserved rural areas are in urgent need of affordable and meaningful connectivity and communications to access information, education, healthcare, receive emergency alerts, payments, and communicate with other people. Small internet service providers have indeed contributed greatly to expand FBB in Brazil, accounting today for over 30% of the FBB market, but in the smallest and remote villages of Indigenous, traditional or quilombola people, PPPs do not offer services or not at an affordable price, we were told by some community members.

1.3 WHO AND WHERE ARE THE UNCONNECTED COMMUNITIES IN BRAZIL?

To some extent, from the above maps and data available in PERT and Anatel's data portal, it is clear how many rural towns and villages and territories have no coverage for mobile service (SMP) and also which municipalities have no fibre networks. However, it is less clear, at least for the general public, who exactly the unconnected are, and where they live, whether they are Indigenous, quilombolas, or from other traditional groups, what they do for a living, their ethnicity, gender, what other basic infrastructures they lack or have, (electricity, water, roads, schools, healthcare clinics, etc.). In any attempt of governments to support, fund or enable any communications and connectivity project and earmark resources and policies for remote and rural communities, it is important to have an accurate map

[50] This average figure is far from the reality of many people. According to this, the monthly income would be around BRL 4,351 (USD 761.66). The minimum wage in Brazil is actually BRL 1,050 (USD 189.64) and half of the inhabitants do not earn that much. As a result, even the 2% ITU threshold would be unaffordable for millions of Brazilians.

[51] https://a4ai.org/extra/baskets/ITU/2020/fixed_broadband_basket

[52] Anatel. (2021). Op. cit. The total population in towns and villages that are not municipal seats in Brazil is 21,802,576 people.

of the target population: who they are and where they live, preferably with layers of open data that enable the communities, governments, civil society organisations and development banks to jointly make informed decisions *with* the communities, based upon the relevant socio-demographic information about their living conditions, available infrastructures and environmental and cultural contexts.

1.3.1 INDIGENOUS, AFRICAN DESCENDANT AND OTHER TRADITIONAL PEOPLE IN BRAZIL

According to the "The Indigenous World 2020" report,[53] the Indigenous population in Brazil is made up of 896,917 people, distributed in 305 ethnic groups. The largest one is the Tikúna. Due to the expansion of hydroelectric, timber and mining companies and violence, the report adds, their territories and their livelihoods have been affected. Consequently, we see an increasing migration to urban areas; 36.2% now live in urban areas and 63.8% in rural areas.[54]

The territory with the largest number of Indigenous people is the Yanomami Territory, in the states of Amazonas and Roraima, with 25,700 inhabitants. Of this group, 73.4% of the Indigenous population aged five years or older speaks one of the 274 Indigenous languages.

Among Indigenous persons over the age of five, 37.4% speak an indigenous language *only*, while 76.9% also speak Portuguese. Some 502,783 Indigenous people in Brazil live in rural zones and 315,180 in urban zones. Currently, there are around 713 Indigenous areas, in territories 117,387,341 hectares wide. This means that 13.8% of the land in the country has been reserved for Indigenous peoples. The majority of these territories are concentrated in the Amazon.

In South America Brazil is the country with the largest known concentration of Indigenous peoples in isolation, in the states of Acre, Amazonas, Amapá, Goiás, Maranhao, Mato Grosso, Pará, Rondônia, Roraima, and Tocantins. Currently, there are 107 records of the presence of Indigenous peoples in isolation in the Amazon region.

IDEA 2

MAPPING THE UNCONNECTED INDIGENOUS AND QUILOMBOLA LOCATIONS IN COORDINATION WITH FUNAI AND CONAQ.[55] The first step in a connectivity strategy for indigenous and tribal communities is to know who they are and where they are located. Their livelihoods, public services available, ethnicity, social organisation systems and communications needs or preferences. These groups have the right to self-identification as Indigenous; their voice is essential in this regard.[56]

---

53 IWGIA. (2020, 11 May). The Indigenous World 2020: Brazil. *International Work Group for Indigenous Affairs*. https://iwgia.org/en/brazil/3616-iw-2020-brazil.html?highlight=WyI4OTYsOTAwIiwicGVvcGxlIiwicGVvcGwiLCI4OTYsOTAwIHBlb3BsZSJd

54 Ibid.

55 National Network of Black Rural Quilombola Communities. http://conaq.org.br

56 The Indigenous Peoples Statute establishes, in Article 3, that the term "Indigenous or Forest Persons refers to individuals of pre-Columbian origin and descent who identify and are identified as belonging to an ethnic group whose cultural characteristics distinguish them from national society." http://www.planalto.gov.br/ccivil_03/leis/l6001.htm

IDEA 3

MAPPING INFRASTRUCTURES AND SERVICES IN EACH INDIGENOUS TERRITORY

Once that is done, mapping any available infrastructures and services that can be used in such remote areas, if any: towers, backhaul, backbone, points of presence, IXP; broadcast TV and radio towers, solar panels, are all very important pieces of information indispensable to designing sustainable local connectivity projects for indigenous and tribal groups. As an example, in Mexico IFT mapped mobile coverage in each Indigenous territory.[57]

According to the report, Brazil adhered to the United Nations Declaration of Indigenous Rights (2007) and the American Declaration of Indigenous Rights (2016) and has signed Convention 169 of the ILO. The 1988 constitution recognises Indigenous peoples as the natural owners of the land and guarantees them the right to it. The exploration and extraction of minerals from Indigenous lands can only be done with the authorisation of the national congress after listening to the affected communities who must be guaranteed a share in the benefits of mining activities. While the eviction of Indigenous peoples from their lands is prohibited, they are still often forced to leave.

In 2019 the legal processes of demarcation related to Indigenous lands were revoked, putting them in jeopardy as land ordinances or permissions in favour of Indigenous communities may be revoked. Also, the Fundação Nacional do Índio (National Indigenous Foundation or FUNAI), the federal body directly linked to the demarcation of indigenous lands, is working with a reduced budget. Starting in January 2019, a decree that assigns the responsibility of certifying the protection of Indigenous territories to the Ministry of Agriculture, was issued. All these changes make it even more urgent for Indigenous and tribal communities to have access to reliable and sustainable communications for their subsistence and for emergency situations.

For that reason, it is critical that every government entity planning any public policy or intervention impacting these groups be previously consulted under the community's protocols, for a free, previous and informed consent by Indigenous communities. This right is recognised by the Brazilian state in the Federal Constitution of 1988, and the 2002 ratification of the ILO Convention 169 on Indigenous and Tribal Peoples. Because of this, Indigenous peoples, the quilombolas (communities of African descent) and other traditional peoples and communities are recognised as collective subjects.[58]

---

57 FTI. (2019). *Cobertura del Servicio Móvil en Los Pueblos Indígenas con Base en Información Proporcionada por los Concesionarios en el* Año *2019*. Federal Telecommunications Institute. http://www.ift.org.mx/sites/default/files/contenidogeneral/usuarios-y-audiencias/coberturamovilpueblosindigenas2019.pdf

58 IWGIA. (2020, 3 December). Failure to comply with autonomous consultation protocols during Covid-19 in Brazil. https://www.iwgia.org/en/brazil/3923-failure-to-comply-with-autonomous-consultation-protocols-during-covid-19-in-brazil.html

1.3.2 UNDERSERVED URBAN AND PERI-URBAN COMMUNITIES

As mentioned above, 36% of Indigenous people in Brazil have migrated to urban centres for various reasons. In addition, the rural exodus is a reality all over the country, where impoverished populations migrate to urban centres in search of work and better living. It is a common fact that there is deep poverty not only in the rural areas of the country but also in urban and peri-urban areas of Brazil. Low- or absent-income populations live in favelas, where basic services are often scarce or absent. So, those informal settlements in peri-urban areas experience very poor connectivity, compared to that of wealthy neighbourhoods nearby, or if available, they cannot afford FBB and try to share one connection among several neighbours as documented by CETIC.

The shortage of telecom infrastructure on the periphery of Brazilian cities resulted in 43% of favela residents without access to an internet signal through 3G or 4G in their homes or with a low-quality service[59] and this scenario is becoming worse with the pandemic, as people have to struggle to access income. Sadly, 55% of students living in favelas were without access to their studies during the COVID-19 pandemic, of which 34% were unable to participate in classes due to their difficulties in accessing the internet.[60] Internet connectivity is also needed to access emergency aid from the government.

Another factor worth highlighting is how the zero-rating policy affects more vulnerable people, that often share devices and have a pre-paid 3G or 4G internet connection, that means that for most of the day their only experience on the internet is through the zero-rating platform services like WhatsApp and Facebook, leading to a misconception of what the internet is and what it offers. For example, the *2017 Mozilla Internet Health Report*[61] showed that for 55% of Brazilians, Facebook was the internet, while in the US this number was 5%.

Argentina has very successful cases of urban community networks in peripheral settlements ("barrios") with financing from the government's universal service fund for capital expenditures (community internet deployment) but fully sustainable by the community members under the coordination and leadership of NGOs such as AFOC in the Atalaya Sur Villa 20 home broadband project.[62] It now connects 250 households and another 250 authorised by Enacom, the Argentinian regulatory agency.

1.4 CHALLENGES AND OPPORTUNITIES LINKED TO THE CONTEXT OF THE COVID-19 PANDEMIC

In March 2020, states, citizens, employers, employees, schools, factories and offices had to shut down within a few weeks, without prior notice, in order to reduce the risks of spreading the COVID-19 virus. Those societies and economies which were highly digitised with both universal internet access and penetration, skilled citizens with experience to use ICT tools for work, learning, management and government tasks, were more resilient and

[59] Julião, H. (2021, 4 May). Internet 3G e 4G não chega ou é ineficiente em 43% dos lares nas favelas. *Teletime*. https://teletime.com.br/04/05/2021/internet-3g-ou-4g-nao-chega-ou-e-ineficiente-no-lar-de-43-dos-moradores-de-favelas/

[60] Observatório Terceiro Setor. (2020, 11 November). 55% dos alunos que moram em favelas estão sem estudar na pandemia. https://observatorio3setor.org.br/noticias/55-dos-alunos-que-moram-em-favelas-estao-sem-estudar-na-pandemia/

[61] Mozilla. (2017). *Internet Health Report v.0.1 2017*. https://internethealthreport.org/v01/about/

[62] http://www.proyectocomunidad.com/atalaya-sur/

adaptable to a sudden mostly-online life at home. Data traffic in households increased between 30 and 40% in Latin America, which no operator ever thought would happen in the short term at residential level. Connected cities did better to the extent that households had affordable high-speed broadband access sufficient to support online education, work, entertainment, commercial and banking transactions, video conferencing and the like. Underserved areas lived a different reality.

As of 2019 there were 133.8 million (74%)[63] internet users in Brazil.[64] However, the number of connected users on computers has decreased in the last five years, with a total 42% of internet users using computers in 2019 down from 80% in 2014, due in part to the increase in the use of mobile phones. In the two lowest socioeconomic quintiles and in rural areas, 85% and 79% respectively of people access the internet exclusively with a mobile phone, something that may impact the learning and working experience negatively.[65]

As for households, 28% of them, i.e. 20 million homes, have no internet access, as revealed by the ICT Households Survey 2019.[66] In rural areas, 50% of households lack a fixed broadband connection. As the lockdown period kept extending during 2021, in many cities and towns due to new outbreaks of the virus or increasing number of cases, lack of affordable high-speed broadband at home has had an increasingly negative impact for all: teachers and students, workers, government, commercial activity, patients and physicians and women, and thus the demands of COVID-19 have raised the sense of urgency in a way that no single stakeholder was able to raise in the previous decade.

Recent research by CGI.br's *Painel TIC COVID-19* (COVID-19 ICT Panel) reveals enlightening data about distance education and telework (working from home) in Brazil, and the divides in students of different socioeconomic quintiles, the barriers and opportunities with remote education which students in elementary, secondary and university education faced during 2020 with the lockdowns.[67]

A few indicators are given here, as samples, taken from the research:

- 82% of internet users (16 years old and over) enrolled in schools and universities will continue their studies with remote schooling.
- 36% of them had difficulties continuing academic studies due to lack of broadband access or poor quality of connection.
- 38% of internet users with jobs worked from home during the pandemic.
- 30% of internet users with jobs sold products or services through digital messaging apps.

When asking what barriers existed to continued remote learning, the answers varied according to economic class, as illustrated in Figure 14.

63 While 77% use it in urban areas, only 53% use it in rural areas.

64 Regional Centre of Studies for the Development of the Information Society. (2019). Op. cit.

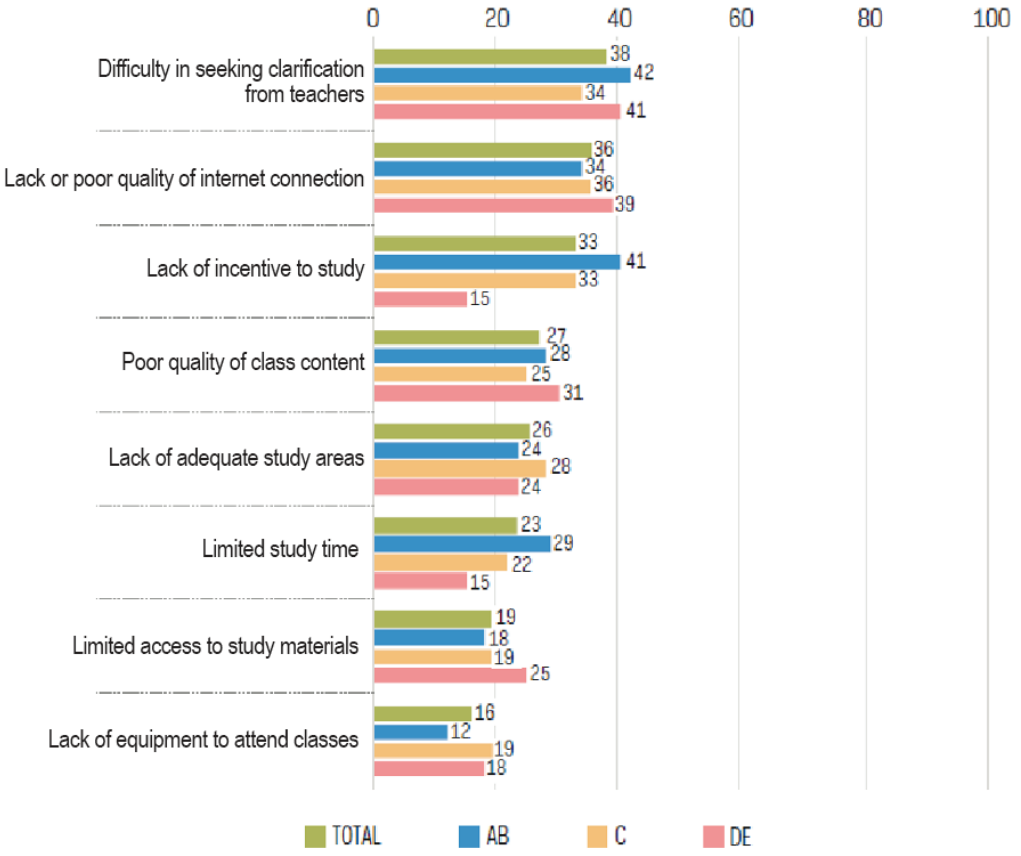
65 Ibid.

66 Ibid.

67 The COVID-19 ICT Panel aims to collect information on internet usage during the COVID-19 pandemic. The target population for the study is internet users aged 16 years and over in Brazil. Internet users are individuals who have accessed any internet services in the three months prior to the interview, according to the methodological recommendations of the ITU. See: Cetic.br., et al. (2020). *Study on internet usage in Brazil during the COVID-19 pandemic*. Cetic.br, NIC.br, CGI.br. https://www.cgi.br/media/docs/publicacoes/2/20201104182616/painel_tic_covid19_3edicao_livro%20eletr%C3%B4nico.pdf

Figure 14

BARRIERS TO REMOTE STUDYING OR WORKING, BY SOCIAL CLASS
Number of internet users aged 16 years and over attending school or university (%)



Source: ICT Households Survey 2020 (https://cetic.br/media/analises/tic_domicilios_2020_coletiva_imprensa.pdf)

And the terminal devices with which Brazilian students connect to school, also show a divide, as shown in Figure 15.

For work or business activities, the terminal devices mostly utilised during the pandemic by internet users, with differences by age groups, education level and economic quintile, are illustrated in Figure 16.

Access, affordability, and digital skills are important to end inequalities in the Latin American region. New connectivity models, frameworks, mindsets and paradigms able to create a disruptive policy strategy of inclusion are urgently required to bridge the gaps. Countries can no longer afford the digital divide and business as usual will not do the job.

In Brazil, COVID-19 has hit Indigenous peoples, quilombolas and other traditional peoples, especially hard. The Amazon Environmental Research Institute and the Coordination of Indigenous Organizations of the Brazilian Amazon suggest the rate of Indigenous people affected by COVID-19 to be 84% higher than the national average.

Incidentally, the Articulation of Indigenous Peoples of Brazil (APIB) indicates that 158 of the 305 indigenous communities in Brazil have been affected by COVID-19.[68] As of 16 September 2020, 31,851

[68] IWGIA. (2020, 3 December). Op. cit.

Figure 15

MOST FREQUENTLY USED DEVICES TO ATTEND SCHOOL OR ENGAGE IN REMOTE ACTIVITIES, BY SOCIAL CLASS

Number of internet users aged 16 and over attending school or university (%)

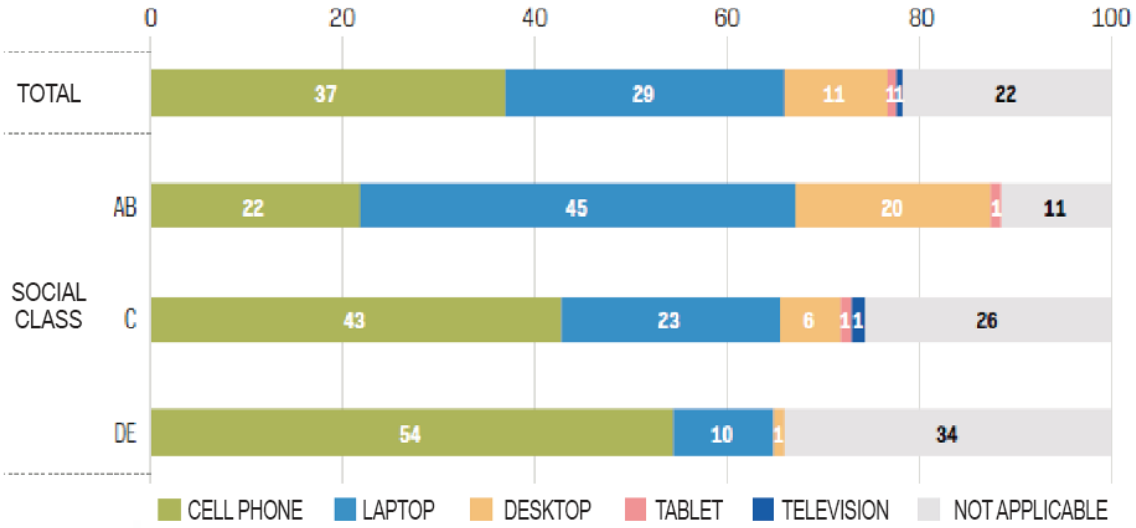
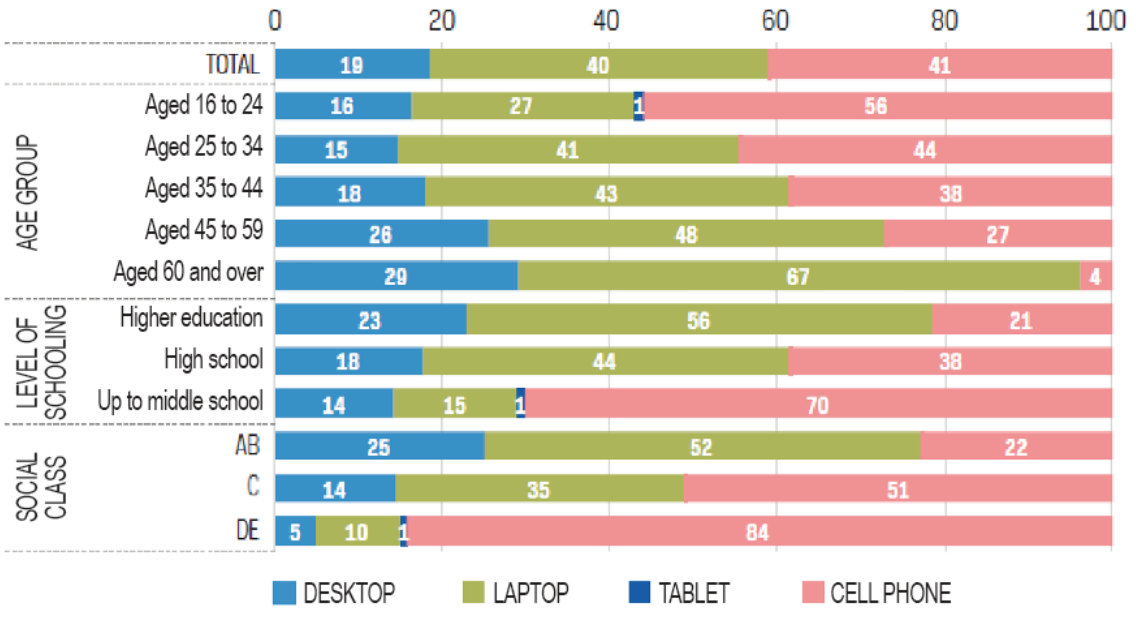


Figure 16

MOST FREQUENTLY USED DEVICES TO WORK REMOTELY DURING THE PANDEMIC

Internet users aged 16 and over who worked remotely during the pandemic (%)



Indigenous people were infected, and 806 fatalities were recorded. For these communities, which have suffered the deaths of their tribal elders and wise men and women, this has meant losing references to ancestral knowledge. One of the greatest losses was the passing of Professor Higino Tuyuka, a protagonist within the history of the struggle of the 23 communities of the Rio Negro basin in the

Northwest area of the Amazon. The over 800 Indigenous deaths each have a name and a wealth of knowledge transmitted by oral tradition from generation to generation, which have been interrupted by COVID-19. In addition to this tragedy, the communities are being deprived of their mourning rites due to restrictions set in place to avoid further contagion.

By means of an enabling regulatory and policy environment, flexible enough to promote different models, players, scales and visions of communications and connectivity, Brazil can seize the emergency crisis to open up new possibilities for digital inclusion, education, health services, productivity, pluralism, gender equality and the sustainable development of communities.

How can this be achieved? By continuing to unleash change where technological change has already occurred: in areas of urban and rural mesh networks, access to spectrum for SLPs, tax and tariff exemptions for telecommunications equipment, new models to finance rural projects in the hands of communities and not only large operators. Funding of as little as USD 10,000 dollars could get a community network started and, as Jane Coffin of Internet Society stated at CITEL's "Connecting the Unconnected" forum on 15 April 2021, community networks have proven to be sustainable and promoters of local economies.

At the World Telecommunications for Development Conference (WTDC) she said that the big change we need to make happen is in licensing frameworks, open mapping of infrastructures, open standards, access to spectrum, technological neutrality and a profound change in universal service funds.

We need to enable bottom-up strategies for universal access where commercial models, let alone global models have not been able to trigger local development through ICT. The challenge is no longer exclusive to the public and private sectors. The social sector is a key player in subsistence economies and may contribute to local connectivity and communications with local infrastructures and content creation in remote and rural areas, with the aid of the public sector's flexible frameworks, subsidies and incentives as affirmative action that is fundamental to achieve equality.

SECTION 2
COMMUNITY NETWORKS: WHAT ARE THEY?[67]

Community networks are collectively owned and managed communications networks, not for profit and community-goals oriented. They are built as commons of either Indigenous, Afro-descendant or tribal communities, as well as civil society organisations, as an expression of their rights to communication, under principles of democratic participation, equality, gender equality, diversity and pluralism.

The information about the network design and management is open and accessible, allowing for its expansion by users. Community networks promote local services and content, net neutrality and the execution of interconnection and transit agreements free of charge with such other networks that offer reciprocity.

This definition is embedded in the Declaration of the First Latin American Summit of Community Networks, held in Argentina in 2018.[70]

In that same year, Bruno Ramos, head of ITU Americas, wrote the preface to *The Community Network Manual: How to Build the Internet Yourself*, highlighting the following:

> The International Telecommunication Union (ITU) has in its DNA the vision of an information society, empowered by the interconnected world, where telecommunication/ information and communication technologies enable and accelerate social, economic and environmentally sustainable growth and development for everyone. […] Connectivity enables the exchange of information and knowledge between individuals and communities, enhancing human development in a global sphere. However, in developing countries, not all people have access to ICTs, being left out of this new Information Society and therefore without any

[69] We understand this to mean an enabling environment for digital inclusion at community level, one that allows for any means of electronic communication and infrastructure, data, content and services both online and offline, to be chosen, owned and managed by each community, as a fit solution to its local development and sustainability needs, regardless of the technology and architecture used. A given combination of ICT tools to access information, education, health services, commerce, government services, emergency situations and human communication, exercise freedom of expression and other fundamental rights within the community. Thus, our digital inclusion analyses and proposals do not exclusively cover internet connectivity, but we do use the term as a generic one for access to electronic communications and media and audiovisual content. We believe that each community should be able to choose from different services or networks: voice communications or community TV or radio broadcasts, and/or internet access. Others may be interested in creating access to locally relevant content through an intranet. In other cases, because of the challenging geography in the Amazonia, a village may have to opt for voice and text HF radio communication using solar-powered batteries where an internet solution is not feasible, for example in the Amazon rainforest, or for technical, economic or cultural reasons. It is up to each community to decide. We thus see an enabling environment for community networks as a flexible, open and technologically neutral set of policies and affirmative actions for vulnerable groups, that enable the right solution for the specific needs of each community according to its own idiosyncrasies and context.

[70] See Appendix 1 in Baca, C., Belli, L., Huerta, E., & Velasco, K. (2019). *Community Networks in Latin America: Challenges, Regulations and Solutions*. Internet Society. https://www.internetsociety.org/wp-content/uploads/2018/12/2018-Community-Networks-in-LAC-EN.pdf#page=51

possibility of choice, including to be able to choose another growth and development path.

This lack of access to an information society ensues from the difficulties in the provision of telecommunication services, resulting from the economic incapacity or technical inability to implement it. Therefore, it is necessary *to think of alternatives to the current forms of telecommunication service provision, either through proposals of new governmental public policies, by stimulating competition and the entrance of new private agents or by encouraging new formulas of social organisation in favour of a common goal.*

Ramos also stated:

> Within the many available options to narrow the access gap, community networks have the ability to gather some important items for sustainable development: social organization with shared objectives, cultural and educational balance, government definitions – with specific regulatory measures aimed at motivating interconnection to the backhaul and backbone of already consolidated companies in the market – and cost and benefits sharing among the related communities.
>
> As an alternative to the traditional private investment options, these initiatives make this possibility of building access networks in regions with low financial returns well adapted to the cases of establishment of access networks, both wireless and by fibre, particularly in isolated and rural areas. This phenomenon is justified by the fact that regions with low attractiveness to conventional investment establish themselves as an ecosystem of similar characteristics, both in terms of resources and demands.[71]

Besides narrowing the access gap, there are underlying fundamental rights bearing community communications that should be in the centre of any dialogue, policy proposal and connectivity project:

- The right to self-determination by Indigenous and Afro-descendant communities. (Convention 169 ILO and the American Declaration of Rights of the Indigenous Peoples).
- The right to network self-determination[72] stemming from rights to associate, access information, freedom of speech and to benefit from scientific progress.

The community network movement has become more visible internationally in the last decade and its potential impact is acknowledged in several international recommendations and instruments such as ITU-Development Recommendation D-19 (2014) to its members, for rural and remote access. In paragraphs 3, 5, 10 and 11 it recommends that:

> Paragraph 3. Community access to ICT facilities and services is particularly important in rural and remote areas. Business models which can achieve financial and operational sustainability can be operated by local entrepreneurs supported by a variety of initiatives. These facilities, where necessary,

[71] Ramos, B. (2018). Prologue. In A. Belli (Ed.), *The Community Network Manual: How to build the Internet yourself*. IGF, ITU, ISOC & FGV. http://bibliotecadigital.fgv.br/dspace/handle/10438/25696

[72] Belli, L., et al. (2018). *The Community Network Manual: How to build the Internet yourself*. IGF, ITU, ISOC & FGV. http://bibliotecadigital.fgv.br/dspace/handle/10438/25696

should also be supported by FUST as an essential component of rural communications.

Paragraph 5. Local institutions, such as village committees should be involved in planning and implementing ICT facilities.

Paragraph 10. It is important to consider small and non-profit community operators, through appropriate regulatory measures which enables them to access basic infrastructure under fair conditions [...].

Paragraph 11. It is also important that administrations, in their radio-spectrum planning and licensing activities, consider mechanisms to facilitate the deployment of broadband services in rural and remote areas by small and non-profit community operators.[73]

Adherence to this movement of enabling and supporting community networks is growing as technological innovations make equipment more affordable. In 2019, the UN Secretary-General's High-level Panel on Digital Cooperation affirmed that "[c]reating the foundation of universal, affordable access to electricity and the internet will often require innovative approaches, such as community groups operating rural networks or incentives such as public sector support."[74]

2.1 ORIGINS, GOALS AND PRINCIPLES GOVERNING COMMUNITY NETWORKS

Community networks first emerged[75] in the pre-internet era, in the 1980s, when the early email and e-bulletin board systems (BBS) became networks and were adopted by people enthusiastic about technologies that could be built up using the early dial-up modems and personal computers. FidoNet[76] or Unix-to-Unix Copy Protocol (UUCP)[77] made it possible and affordable to connect people around the world using email and newsgroups at a time when these were only available to very few users in computer science labs. At this time APC facilitated the use of email and maintained discussion forums by and for NGOs with other important international and national organisations that needed to listen and talk to civil society.

As the commercial internet grew in the 1990s and after the birth of the world wide web, FidoNet and UUCP yielded to the first ISPs who offered the whole internet as opposed to only email and newsgroups. Yet they relied on dial up over copper phone lines, which made it slow and expensive.[78] So again, in the global North something to overcome those problems

---

[73] ITU. (2017). *World Telecommunication Development Conference (WTDC-17): Final Report*. ITU. https://www.itu.int/en/publications/ITU-D/pages/publications.aspx?parent=D-TDC-WTDC-2017&media=electronic

[74] UN Secretary-General's High-level Panel on Digital Cooperation. (2019). *The Age of Digital Interdependence.* https://www.un.org/en/pdfs/DigitalCooperation-report-for%20web.pdf

[75] In the early 20th century rural communities in the United States organised as cooperatives to share rural infrastructures like copper telephone cables for the local exchange services. Later they set up community antenna TV to bring broadcast channels to communities not covered by over-the-air TV signals, by cable. For a detailed history of the emergence and evolution of community networks, see: Song, S., et al. (2018). Introduction: The rise and fall and rise of community networks. In A. Finlay (Ed.), *Global Information Society Watch 2018: Community Networks.* APC & IDRC. https://giswatch.org/en/report-introduction/introduction-chapter-0

[76] Fidonet. (1989). *FidoNet Policy Document*. https://www.fidonet.org/policy4.txt

[77] The term generally refers to a suite of computer programmes and protocols allowing remote execution of commands and transfer of files, email and net news between computers. See: https://en.wikipedia.org/wiki/UUCP

[78] Song, S., et al. (2018). Introduction: The rise and fall and rise of community networks. In A. Finlay (Ed.), *Global Information Society Watch 2018: Community Networks*. APC & IDRC. https://giswatch.org/en/report-introduction/introduction-chapter-0

was created that could be considered a community network: FreeNet, an outlet offering free of charge dial-up access and public terminals to allow citizens to participate in discussion fora about local issues. These evolved into community ISPs. Another important milestone in the development of community networks was open-source firmware. In 2003, the manufacturer of Wi-Fi access points, Linksys, was compelled to release the source code it had used to modify a software used in the firmware of its access points, due to the fact that such software was subject to a general public licence which mandated releasing any software changes into the public domain. This enabled experimentation, innovation by Wi-Fi hackers and the invention of mesh networks where access points could connect to each other as peers to form a decentralised network. Then commercial wireless networks 3G and 4G came into existence with higher transmission capacity and more affordable offers in urban contexts where competing networks existed. Gradually, community networks started to focus more (for a while) on FBB, using principles such as the common pool of resources as developed by renowned economist and Nobel prize winner Elinor Ostrom.[79] She studied the interaction of people and ecosystems for many years and proved that the use of exhaustible resources by groups of people (communities, cooperatives, trusts, trade unions) can be rational and not lead to depletion (tragedy of the commons), without government intervention.[80] This principle is the foundation of the world's largest community network, guifi.net[81] in Catalonia, Spain built on shared fibre deployments.[82]

As we will see later in this section, community networks may embrace all sorts of affordable and sustainable technologies: radiocommunications, broadcasting, wireless access, Wi-Fi networks, mesh Wi-Fi, fibre broadband and satellite backhaul. The choice should lie with the community.

Community radio stations were the cornerstone of community organisation and creativity. Community mobilisation allowed for learning about radio broadcasting, content production and conduction, media management and community knowledge-sharing. Community radios around the world brought local empowerment, pluralism, citizen engagement in community and national affairs, awareness of gender, race, ethnicities equality and diversity issues; and gave local audiences and local economies access to diverse ideas, views, cultures and visions and a channel where they could become visible locally.

After almost 30 years since the invention of the internet, the IGF Digital Coalition for Community Connectivity (DC3) delivered the Declaration on Community Connectivity[83] through an open and participatory multistakeholder process. Crafted between 2016 and 2017, it was the first international consensual document to lay out the principles and characteristics of internet community networks. According to this document, community

79 Ibid.

80 https://en.wikipedia.org/wiki/Elinor_Ostrom

81 https://guifi.net/en/what_is_guifinet

82 For more in-depth details on the history of community networks, their characteristics and case studies from 43 countries, see: Finlay, A. (Ed.) (2018). *Global Information Society Watch 2018: Community Networks*. APC & IDRC. https://giswatch.org/sites/default/files/giswatch18_web_0.pdf

83 https://www.intgovforum.org/multilingual/index.php?q=filedepot_download/4391/1316

networks have “the potential as a vehicle for transformation that increases the agency of all community members, including fostering gender-balance.”

The declaration states that community networks are structured to be open and free, and to abide by network neutrality. Further, community networks are recognised by:

- Collective ownership: the network infrastructure is managed as a common resource by the community where it is deployed.
- Social management: the network infrastructure is technically operated by the community; open design: the network implementation and management details are public and accessible to everyone.
- Open participation: anyone is allowed to extend the network, as long as they abide by the principles and design of the network.
- Promotion of peering and transit: community networks should, whenever possible, be open to settlement-free peering agreements.
- Promotion of the consideration of security and privacy concerns while designing and operating the network.
- Promotion of the development and circulation of local content in local languages, thus stimulating community interactions and community development.

INSIGHT 2

Policies and regulation enabling community networks that recognise these characteristics and the community development and self-determination spirit, may easily transition to an enabling framework and policies, to facilitate the prosperity of such networks as opposed to communities adapting to a framework designed for commercial, urban and global networks or for private or intra-corporate communications.

PRINCIPLES AND NEW PARADIGMS UNDERLYING COMMUNITY NETWORKS

How is network self-determination a right to free development of network infrastructure stemming from other long existing fundamental rights recognised by international human rights instruments and by many constitutions at the national level?

Belli[84] argues that such a digital right is founded on the freedoms of association, and expression; the right to access information and the right to self-determination as well as to the right to enjoy the benefits of scientific progress

[84] Belli, L. (2017). *Network Self-determination and the positive externalities of Community Networks.* FGV Direito Rio. http://bibliotecadigital.fgv.br/dspace/handle/10438/19924

and its applications. He further explains that with RFC 7962[85] the Internet Research Task Force provided a documented taxonomy of several alternative network deployments at community level, whether as wireless ISPs, rural utility cooperatives, or shared local wireless resources. Not only do communities wish to be in communication and connected but to have access to relevant content or develop it, in their own terms of cultural development. The variety and challenges of these projects result in different models, services and network architectures, depending on local needs and aspirations.

Therefore, even if a city, rural area or settlement like a quilombo is already served by a commercial operator such as a small provider, a community has the right to self-determine the kind of technology, sustainability and affordability model it wishes to procure for its members, and therefore may decide to self-connect.

Multiplayer, multi-model ecosystem: Recognising the importance of new players and networks in bridging the digital divide in rural and remote areas, where large-scale operators and business models or government-subsidised plans have failed to deliver affordable, sustainable and meaningful services and content, not only because the new local players have lower capital expenditures and operating expenses, but also because community ownership and management empowers members and increases agency in deciding what kind of infrastructures and services the community wants to better serve its own development goals and culture.

Positive externalities for community development: Community networks boost the local economy. Under Fernand Braudel's three-tiered building of the economy, the work of this great economic historian[86] teaches us a lesson: subsistence economies, national economy and global economy have different structures, players, competition levels and models that global economy seems to overlook: subsistence economies are not market driven. Market dynamics may not apply and regulations created under such global or national markets paradigms and rationales are not necessarily fit for purpose. In this context, cooperatives, non-profits and community-based decision-making organisations are, in some circumstances, in a better position to meet the local needs of communications and connectivity and gain socio-cultural, technical and financial sustainability and ownership.

Local knowledge and voices are critical for ownership and efficiency: The needs, aspirations and geographical, cultural, socioeconomic and political conditions of each community should shape their connectivity project, and not the other way around. Their active participation is critical.

Gender perspective methodologies should be used to identify needs, context, barriers and potential impacts of community networks policy on women.[87]

---

85 https://tools.ietf.org/html/rfc7962#page-8

86 Braudel, F. (1979). *Civilisation Matérielle, Économie et Capitalisme, XV^e-XVIII^e*. Armand Colin.

87 This provides a gender evaluation methodology that allows for policy makers to consider gender issues before making decisions regarding ICT inclusion. See: APC. (2009, 20 August). ICTs and women's equality: APC and the gender evaluation methodology (GEM). *APCNews*. https://www.apc.org/en/news/icts-and-womens-equality-apc-and-gender-evaluation-methodology-gem

2.2 COMMUNITY NETWORKS, GENDER EQUALITY AND DIVERSITY

"We understand the term technological infrastructure in an expansive way, encompassing hardware, software and applications, but also participatory design, safe spaces and social solidarities."[88]

Inclusion by design means women and men of all ages, races, ethnicities and sexual orientations have the incentive, knowledge and voice to participate in the process of designing, building and managing the infrastructures, content and services that integrate community networks, with a sound community governance model and gender and diversity perspectives.

"Digital communication technologies are anything but neutral, and only when developed by the community as a whole, can they aspire to be inclusive, horizontal, and not colonising."[89] For centuries the discrimination of women and minorities in decision-making processes has been part of many patriarchal communities across the globe and such exclusionary practices reproduce in technology-based societies, firms, products and connectivity projects, having prevailed as normal for so long. Stereotypes, gender-based roles in communities and society have marginalised girls and women from engaging in the development and design of technology. Engineering and coding education is still seen as a white man's business and women technicians, inventors, engineers, developers, managers, executives, coders, in both the global North and South are still in the minority. This prevalent gender exclusion may easily be reproduced in communities where women have neither a voice nor a vote on community decisions. Narrower access to education by girls and women, giving preference to boys and men while the former are kept in private roles of family care and housekeeping, all unpaid tasks, exacerbates inequalities. It has thus been a concern for researchers of community networks, to empirically measure their impact in inclusion of women whether Indigenous, Afro descendant, young or old, especially in rural areas, where most of these networks are deployed. Nicola Bidwell[90] conducted field research in communities of six countries on the impact of community networks in gender and age inclusion. The study targeted four groups of people engaged with six community networks: network leaders, technicians and champions; network operators, managers and volunteers, and network users and non-users. It reveals important findings, gender gaps in technical work, gender-based roles and how women are sought in some communities as volunteers to feed the men, or bring water and carry other things to the sites but without any recognition nor payment for those tasks, as opposed to the technical work of men. However, the study reveals, when women somehow manage to sneak in "secretarial chores" that actually involve learning to use the technology and manage a community network, then they learn

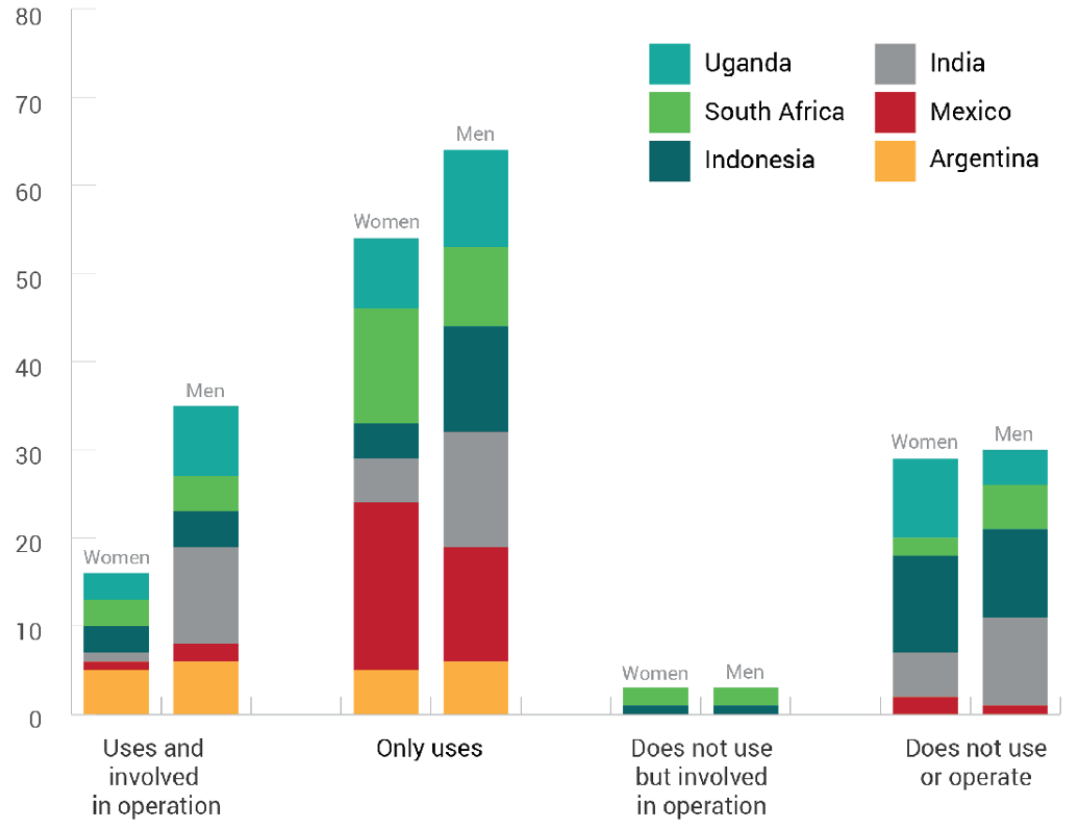
88 Toupin, S., & Hache, A. (2015). Feminist autonomous infrastructures. In A. Finlay (Ed.), *Global Information Society Watch 2015: Sexual rights and the internet*. APC & Hivos. https://www.giswatch.org/en/internet-rights/feminist-autonomous-infrastructures

89 Zanolli, B., Jancz, C., Gonzalez, C., Araujo dos Santos, D., & Prado, D. (2018). Feminist infrastructures and community networks. In A. Finlay (Ed.), *Global Information Society Watch 2018: Community Networks*. APC & IDRC. https://giswatch.org/en/infrastructure/feminist-infrastructures-and-community-networks

90 Bidwell, N., & Jensen, M. (2019). *Bottom-up Connectivity Strategies: Community-led small-scale telecommunication infrastructure networks in the global South*. APC. https://www.apc.org/en/pubs/bottom-connectivity-strategies-community-led-small-scale-telecommunication-infrastructure

Figure 17

NUMBERS OF PEOPLE WHO ARE INVOLVED IN VILLAGE-LEVEL OPERATIONS, USED AND/OR DID NOT USE THE LOCAL ACCESS NETWORK WHO SPOKE IN INTERVIEWS, FOCUS GROUPS, OBSERVATIONS AND MEETINGS



technical skills and get paid, which gives them some degree of independence and recognition. Figure 17, obtained from Bidwell's study, summarises some of those findings.

We have highlighted and summarised several findings and lessons from Bidwell's study and the research done by Brazilian feminist activists working with communities quoted above, which are valuable to consider when drafting an inclusive community network policy in Brazil.

- Inclusion starts with raising awareness of the existence of community networks and the fact that every community can build and manage their own network if they choose to.
- When designing a community network project, local leaders, managers or coordinators must monitor that both men and women, young and old, may be users or understand the reasons for their exclusion. In Indonesia a few community members were not aware of the existence of their network or its content, and thus did not use it.[91] Some were illiterate and could only use voice applications as they did not read or write their language. Again, this occurs more often among women.

[91] Ibid.

INSIGHT 3

This project also produced a Community Networks Manual and a video campaign, explaining what community networks are and what they can do for communities when women and men of all ages and ethnicities participate in them. These materials can inspire communities to plan and design their own horizontal and inclusive models of community networks. By highlighting the importance of inclusion and diversity in communities, they also aim to raise awareness and call for action against gender and racial inequality. Learn more at: https://www.apc.org/en/ManualCN

- Deep-rooted discrimination has normalised the exclusion of women and outside organisations supporting community networks may raise awareness of any exclusionary practices rooted in the community so that they can eliminate those. Because of the smaller size of rural communities, specific practices and behavior are more visible and can thus be more easily dealt with. A community has strong incentives to be inclusive as it is the only way to achieve sustainability, a growing universe of technically skilled members and users and to contribute to the community's common goals.
- Without the participation of women and men of different age groups and ethnicities, in all three roles, community network projects may prove unsustainable: socially, technically and economically as only unified and equally informed communities can overcome short- and long-term challenges.
- In certain Indigenous contexts such as in the state of Pernambuco, an FM community radio may be the best option to initiate cohesion, awareness and skills building to support women and reduce violence and from there, other technologies and networks can follow with due training and resources. Therefore, a policy of promoting women broadcasters in Indigenous communities through easy and affordable access to spectrum frequencies for a radio station, is essential both for media pluralism, community development and gender equality.

IDEA 4

Reserving frequencies for community FM radios should be a part of a spectrum planning strategy. This occurs in Argentina and Uruguay where 33% of the total broadcast radio frequencies are reserved for Indigenous and community radios (rural and urban), free of charge for the spectrum use and licensing. In Brazil too, Indigenous communities, quilombolas, riversiders and other communities of citizens engaged with diversity, equality, environmental protection and human rights, to mention a few, should be able to easily and affordably access broadcasting frequencies for non-religious, non-partisan community media, as an important enabler of freedom of speech, pluralism, democracy, community economy and the right to their own communications in their territories, as an internationally recognised human right.

- Organisational structures and power relations in communities will reflect on community networks. If power asymmetries exist, they might become visible to outsiders who should make communities aware of their existence and the potentially harmful effects on the whole community, not only women. When planning a network project these differences should be accounted for so that in each stage or step, they can be dealt with.
- Language exclusion may be more frequent with women, and this may be reproduced in a community network if equipment, software, interfaces or manuals and available content are in English only, although clearly this will also affect men.
- Voice-driven applications are essential in many scenarios where people, especially women, speak but do not read or write a given language.
- Some communities may prefer an offline community network (intranet) over one online, to prevent a new form of colonialism, hegemonic and patriarchal structures and loss of local wisdom, culture and language. Some women interviewed actually said that the introduction of internet access in their community made men more violent and in search of aggressive sex due to the exposure of ruff porn websites and lack of education around them.
- Women's access to user devices is a problem in many rural communities, as they might depend either on their husbands, fathers or brothers to share a phone, tablet or laptop at certain times, a huge gap for women. If they do not have an income, it is more difficult for them to own a phone or computer or to pay for top ups or access a Wi-Fi connection only when a device is lent to them, losing privacy and independence. All these gaps ought to be noted and challenged locally. Communities need support to gather data about the demographics, characteristics and forms of exclusion they face so that critical evaluation can help community networks to improve.
- Funding opportunities that require community networks to deliver indicators aimed at comparing them with commercial operators discourage communities from measuring any gaps, thus reproducing the same exclusions that large operators have. Rather, demonstrating how easy it is to identify bias or exclusion at community level, not only is an added benefit of community networks but can set benchmarks for better practices by the large operators. Indicators should also not be emulated from commercial networks.
- Support of community networks incorporating gender and age perspectives in their local decision-making processes is important to curb exclusion. The sustainable social enterprise business model canvas for instance, is a useful tool for community networks to identify inclusion and the participation of women by design as a value proposition.[92]
- When it comes to including women in community networks and other technological projects, representation is important, so there is a need for more women to be present and recognised in the community network scenario. If a network is designed, built and governed

[92] Burkett, I. (2020). *Using the Business Model Canvas for Social Enterprise Design*. The Yunus Centre & Griffith University. https://www.socialenterpriseauckland.org.nz/wp-content/uploads/2020/02/social-enterprise-business-canvas.pdf

mainly by white men from outside the community, the likelihood of Black and Indigenous women engaging with the project is very low. It would not be inclusive by design.

IDEA 5

We see many possibilities for the empowerment of women in ICT in Brazil. It has highly skilled and committed feminist digital activists making a difference in rural areas launching women-led community networks.[93] Such efforts should be documented, financially supported and replicated across the country with local variations. Brazilian digital women activists are not only highly skilled in technical, social and governance issues of community networks but have also gained the trust and respect of several communities, something easier said than done when at the beginning men would not recognise nor trust the expertise and skills of these champions. The social value created by these women in Brazil should be more visible, financed by universal service and technology innovation funds.

IDEA 6

As we will learn in section 4, feminist activists of Brazil have suggested an open and earnest dialogue between them and different Anatel teams as a very important source of sensitisation and innovation, on how to weave an enabling environment for digital inclusion, how to access an unused spectrum on a secondary basis for community use may close the gender digital divide as opposed to issuing one-size-fits-all policies for the "unconnected". How are we to give a voice to women and men and diverse groups about what kind of community networks and content they wish to build and run?

Zanolli and others[94] have shared inspiring cases of feminist initiatives in Brazil and Mexico. One features Casa dos Meninos where a collective of mothers in Sao Paulo who used digital tools to mobilise other women to demand children's day-care facilities in certain neighbourhoods that had none. From that success story they built a local mesh network to unite efforts for different local demands and needs.

[93] Zanolli, B., et al. (2018). Op. cit.; Brazilian organisations such as the Maria Lab Collective, Coding Rights, the Nós por Nós Collective and the Transfeminist Network of Digital Care have also been engaging with ICT initiatives led by women.

[94] Ibid.

GENDER INCLUSION IN BRAZIL: ICT AND INTERNET POLICIES

According to the UNESCO report *Assessing Internet Development in Brazil*,[95] most current and previous Brazilian national strategies and policies for internet development, such as PNBL, E-Digital and Plano Nacional de Conectividade (PNC), have little or no mention of gender-specific goals for digital inclusion policies for women. Regarding the legal framework for gender equality in Brazil, the country made significant advances with the Special Secretariat for Women's Policies at the time when it had ministry status and was linked to the presidency of the republic, until 2015. In 2013, the secretariat created a National Plan of Policies for Women (Plano Nacional de Políticas para as Mulheres),[96] which planned the "Promotion of women's access to cultural goods and information technologies and support for free and alternative media" in the following ways: "Contribute to the access of women to the benefits of broadband" and "Promote training for the digital inclusion of women, broadening access to ICTs, considering ethics, race, sexual orientation, gender identity, generation, and women with disabilities." Unfortunately not much progress has been made since then.

At an international level, the UN 2030 Agenda has among its SDGs Goal 5: to "achieve gender equality and empower all women and girls" and the ITU has Resolution 70: "Mainstreaming a gender perspective in ITU and promotion of gender equality and the empowerment of women through information and communication technologies", reinforcing the urgency of considering gender perspectives in all the fronts of access to the internet and ICTs.

A 2021 publication from CGI.br on ICT, internet governance and gender[97] brings multiple challenges and tendencies for addressing gender gaps in ICTs and internet governance. We highlight the points made in the report by Flávia Lefèvre Guimarães[98] on recognising the many layers of discrimination present in ICTs and internet access regarding not only gender but also class and race. She highlights the lack of gendered data regarding internet and ICTs access and the ultimate need of such data to better create public policies that are effective in addressing the gender gaps and how women have less access to broadband connectivity and computer devices, leading to a limited use of the internet, accessed mainly through their phones with restricted data plans and many limitations, reducing opportunities and prospects for sustainable development for women and girls, especially for poor and racialised women.

Top-down and bottom-up strategies are required to tackle women's underrepresentation in the public sector (and in any other, for that matter). Women's voices and participation in decision-making boards and entities at the highest level are as important as at entry level and in mid-management positions. In this regard, the federal government, taking into consideration that women are not represented on Anatel's board of directors, as the five members appointed by the president after approval by the senate are men as well as in other key ICT-related organisations (as reported in the UNESCO

95 https://cetic.br/media/docs/publicacoes/8/20200117094619/Assessing_Internet_Development_in_Brazil.pdf

96 https://oig.cepal.org/sites/default/files/brasil_2013_pnpm.pdf

97 https://cgi.br/media/docs/publicacoes/4/20210422084146/ColetaneadeArtigos_TIC_GovernancadaInternet_Genero_digital_CGIbr.pdf

98 Ibid.

2019 report),[99] could foster a much needed policy of affirmative action in Anatel, CGI.br and other key ICT-related organisations, to promote gender parity and diversity with progressive annual goals in terms of hiring women and promoting experienced women in the agency so that they are promoted to top positions as well as other related actions of equal pay, flexible schedules, paternity and maternity leave, etc.

We would like to highlight the United Kingdom's initiative on this very issue. In 2015, Ofcom, the UK communications regulatory agency, issued and launched a diversity and inclusion strategy with specific goals and targets on gender and diversity (age and ethnic):

> Five years ago we set ourselves targets to improve our workforce diversity by 2020. On gender, we committed to an equal split of men and women across the organisation, and for women to make up 40% of senior roles. We also sought to increase the proportion of colleagues from minority ethnic backgrounds in senior roles from 9% to 13%. I'm encouraged that we have achieved an equal gender balance and exceeded our target for women in senior roles. Ofcom was named this year by *The Times* as a Top 50 Employer for Women.[100]

In Brazil, Anatel is committed to ITU and UN Women initiatives to promote awareness of the need to achieve digital gender equality at both the global and national levels: "Global Partnership for Gender Equality in the Digital Age"[101] and "Girls on IT Day".

There is a need for ICT and internet policy makers and regulators in Brazil to involve more women in all roles in the ICT and internet sector, but especially in decision-making roles. Brazilian women, who make up 50.9% of the total population, are underrepresented in these important areas, and without them it is less likely that policy will be tailored with a gender perspective.

Such a perspective is crucial to adequately address gender-based needs, barriers and risks that women face, both in accessing ICT and in the process having to deal with online violence, sexual harassment, affordability of devices, gaining digital skills that empower them economically, biased algorithms, among others. In addition, there is a need to guarantee that when women are online they do not suffer from online harassment and gender-based violence (GBV). NGOs like SaferNet,[102] Internet Lab,[103] MariaLab,[104] Coding Rights[105] and Coalizão Direitos na Rede[106]

---

[99] "Anatel is managed by a Board of Directors composed of five members (five-year term) selected and appointed by the President after approval by the Senate. There are currently no women on the Board. Since its creation, there have been 18 members of the Board, and only one woman (with a specific term from 2008 to 2012). The MCTIC structure, on the other hand, is composed of a minister and six immediate assistance agencies. There were no women in leadership positions in these bodies. In August 2018 when this research was conducted CGI.br was composed of 21 members (terms of 3 years) from the government (four members), the corporate sector (four members), the third sector (four members), and the academic community (four members). There were only three women on the Committee at the time of writing. Considering the make-up of the last three Committees (from 2011 to August 2018), around 10% of these positions were held by women." UNESCO. (2019). *Assessing Internet Development in Brazil Using UNESCO Internet Universality ROAM-X Indicators*. https://cetic.br/media/docs/publicacoes/8/20200117094619/Assessing_Internet_Development_in_Brazil.pdf

[100] Ofcom. (2021). *Making Ofcom work for everyone: Ofcom's diversity and inclusion strategy*. https://www.ofcom.org.uk/__data/assets/pdf_file/0012/210900/diversity-and-inclusion-strategy-report-2019-20.pdf

[101] https://www.itu.int/en/equals/pages/default.aspx

[102] https://new.safernet.org.br

[103] https://www.internetlab.org.br/pt

[104] https://www.marialab.org

[105] https://www.codingrights.org

[106] https://direitosnarede.org.br

have worked extensively with online GBV and LGBTQIA+ online violence. Policy makers should always keep in mind that their decisions may impact women and other vulnerable groups very differently than they impact white men.

IDEA 7

For instance, Anatel, Ministry and the FUST Council, among other government authorities, may align incentives to promote the participation of women in ICT and community networks through FUST and state funding. If the council channels FUST resources to community networks projects which include women and Indigenous people in most roles: design, leader, technical and management coordinator, operation, content developer, so that funding is given to initiatives of such networks which embrace women of different age groups and different ethnicities who are actively participating and making decisions on all aspects of the community networks, that would be a good practice, as followed recently in Costa Rica.[107] Also, training women to build autonomous hardware and to develop open source software is a process worth igniting so that more women engage in learning to create and use ICT tools. This is really empowering.

Because gender, race and age inclusion goals are transversal issues that have to be taken into account for policy and regulatory design and implementation, we highlight them early in this brief, to raise awareness of the need to design and assess policy using gender and inclusion lenses so that appropriate affirmative action may be taken in community network policy making to achieve inclusion and equality.

2.3 IMPACT ON COMMUNITIES

We cannot emphasise enough the increasing value of being connected to the internet and other means of communication that enable us to express ourselves and access and search for information, education, training, ideas and opinions which are key to fully exercise rights to information and communications and freedom of expression. Moreover, as most human activities (economic, transactional, political, recreational, academic and professional, cultural, social, scientific, altruistic and emergency services) migrated to the digital ecosystem at an accelerated pace after the COVID-19 lockdowns, to the point where many interactions demanding a physical presence have been abandoned, for example interacting with government, people and communities that remain with no affordable access to networks will face a double exclusion from society as they might not be able to exercise their civil and political rights in real life or online.

Jensen,[108] on studying 16 different models of community networks across the world, provides a clear broad picture of the local and global benefits of community networks not only for community members but also for commercial operators who benefit from an increase in traffic demand from such networks.

[107] https://a4ai.org/studies/closing-the-digital-divide-with-universal-service-leadership

[108] Bidwell, N., & Jensen, M. (2019). Op. cit.

It is true that coverage by large mobile operators has increased over the last decade in Latin America (although not primarily with 4G networks) in remote rural areas and that the satellite footprint is practically universal. But as one digs deeper, there are barriers of affordability of services and equipment. Large commercial infrastructures are either unsustainable for their owners with huge operation expenses or services are unaffordable for the potential users. For instance, TIC Mexico, an Indigenous community network licensee with licensed spectrum for a 2.5 G mobile network, offers a flat monthly rate of MXN 42 (USD 2.1) for unlimited local calls and SMS, and off-net calls cost around USD 0.02 per minute which is a more affordable expenditure than a comparable prepaid package from a large mobile operator (if one was available in TIC covered area, which usually has a really short life during which it can be redeemed: from 7 to 30 days). Deficient connectivity is also cited by Jensen's research as a reason to prefer community networks.

Besides affordable communications, there are important local development and sustainability benefits reported by the community network representatives interviewed by Jensen and also positive externalities of community networks as researched by Luca Belli.[109]

We highlight some below as being very important for consideration by policy makers and regulators, who have spoken about the urgent need to build local community resilience and reactivate economies after the COVID-19 pandemic and economic slowdown.

- Indigenous and quilombola/ traditional communities see their own infrastructures as a tool to exercise their right to self-determined communications and to preserve their territories, biodiversity and their cultural heritage.
- Communities have witnessed community networks as enablers of local economy growth and therefore uplifting "such as providing income generation or employment opportunities."[110]
- By becoming makers as opposed to consumers, community members gain many capacities: technical, financial, managerial and decision-making skills that empower them in other areas as well. This is especially important for the empowerment of women, leading to economic independence and elimination of domestic violence.
- Communities need partners such as universities, local governments, NGOs, meso organisations, and by establishing these alliances both parties expand their access to knowledge and resources and provide invaluable knowledge and lessons in a reciprocal fashion.
- Community networks allow for the members to benefit from locally tailored services, content and applications without having to give their personal data away to an operator.
- As a common good, community networks may provide better and more affordable services, devoting more to infrastructure, training, and less to costs of sales and marketing.
- Community networks are job creators and allow for other small businesses to flourish by providing not only affordable connectivity, but alliances, innovation by other players and collaboration

[109] Belli, L. (2017). Op. cit.

[110] Bidwell, N., & Jensen, M. (2019). Op. cit.

among diverse institutions and citizens. One example is guifi.net, the world's largest community network, in rural Catalonia, Spain, which is a cooperative of fibre-based infrastructure as a common-pool resource.

- Community networks in remote inaccessible places such as Nepal, are the foundation for quality healthcare, education, commerce and management of emergencies.
- Such networks are a critical tool capable of protecting biodiversity, Indigenous cultures and language, natural resources and forests from constant fires and unsustainable extractivist activity. They are indispensable as tools for emergency alerts for Indigenous communities.
- Several community networks give rise to technology developers, creating their own content through intranets, servers, and open-source hardware such as the LibreRouter of AlterMundi in QuintanaLibre, Córdoba, Argentina.[111]
- They promote innovation and are enablers of other human rights that may become accessible and affordable through digital platforms, for example education and health services.

2.4 COMMUNITY NETWORK MODELS THROUGHOUT THE WORLD

As briefly mentioned above, there is a wide array of community networks across the globe, mostly in rural unserved areas but also in urban slums or informal settlements in the outskirts of large cities in the global South. Their architecture, services, sustainability models and scope are varied depending on their needs and goals, the legal and regulatory environment, the availability of affordable spectrum frequencies and backbone infrastructures, universal access funding for network, content and training, and whether they hold a solid governance model or not. Tables 3 and 4 attempt to showcase different kinds of community networks which have an assortment of models, regimes and features.

[111] See https://altermundi.net/documentacion, for guides, notebooks, instructions and videos on how to build, manage and learn about community networks.

Table 3

COUNTRY	COMMUNITY NETWORK	TYPE OF NETWORK	SERVICES OFFERED	LICENSING TYPE AND COST	BACKHAUL TYPE	SUSTAINABILITY MODEL	
				Light licence or exempted	***Fibre, MW links, satellite***	***Receives subsidies, spectrum, backhaul access, USF quotas, tax breaks***	***Not-for-profit/ for-profit SMME***
Córdoba, Argentina	QuintanaLibre AlterMundi[112]	Mesh networks: Decentralised wireless networks using Wi-Fi routers and LibreMesh firmware. Uses broadband surplus from National University of Cordoba. Leverages on MIMO (multiple-input and multiple-output) technology.	Internet and VoIP calls	Licence for non-profit operators, exempt from payment of fees, under Resolution 4958 of 2018.	PtoP 5GHz Wi-Fi	Argentina ENACOM committed to assign USF resources to AlterMundi In 2020 funded CAPEX for broadband for another project of informal settlements connectivity. (Atalaya Sur).	Not for profit

[112] Giudice, J. (2018). Convergences: AlterMundi's experiences and challenges. In A. Finlay (Ed.), *Global Information Society Watch 2018: Community Networks.* APC & IDRC. https://giswatch.org/en/country-report/infrastructure/mexico

COUNTRY	COMMUNITY NETWORK	TYPE OF NETWORK	SERVICES OFFERED	LICENSING TYPE AND COST	BACKHAUL TYPE	SUSTAINABILITY MODEL	
				Light licence or exempted	***Fibre, MW links, satellite***	***Receives subsidies, spectrum, backhaul access, USF quotas, tax breaks***	***Not-for-profit/ for-profit SMME***
Oaxaca, Veracruz, Guerrero, Chiapas and Puebla, Mexico	Telecomunicaciones Indígenas Comunitarias, A.C.[113]	2.5G cellular network. Each base station is owned by a community. There are 14 in all covering 63 Indigenous communities.	Mobile calls, text messages, internet and VoIP calls off-net	Spectrum licence, under the social purpose category, a community network, not-for-profit licence created by the Mexican legal framework specifically for Indigenous communities. It includes a 2.5 +2.5 Mhz assignment in the 850 Mhz band, (no auction) for use in rural municipalities of under 2,500 habitants in five states of the country plus a blanket licence to provide other services nationally, wired, or wireless if more spectrum is allocated to this entity. A supreme court decision from 2021 ruled on full exemption for use of spectrum as an affirmative action for the effective exercise of rights to Indigenous people.	Satellite link for redundancy, provided by the Mexican Ministry of Communications at no charge. Microwave links using Wi-Fi in some cases provided by local wireless ISP. Recently IFT granted TIC a social licence for a PtoP link in the 11 GHz band, a milestone for community networks.	No	Not for profit. Users who are also community members and thus owners, are charged approximately USD 2 per user per month, for unlimited calls and SMS on net, of which USD 1.25 is a direct income to the community and USD 0.75 is set aside for the association.

→

[113] https://www.tic-ac.org; for more details see Baca Feldman, C., et al. (2018). Community networks in Mexico: A path towards technological autonomy in rural and indigenous communities. In A. Finlay (Ed.), *Global Information Society Watch 2018: Community Networks*. APC & IDRC. https://giswatch.org/node/6058

COUNTRY	COMMUNITY NETWORK	TYPE OF NETWORK	SERVICES OFFERED	LICENSING TYPE AND COST	BACKHAUL TYPE	SUSTAINABILITY MODEL	
				Light licence or exempted	*Fibre, MW links, satellite*	*Receives subsidies, spectrum, backhaul access, USF quotas, tax breaks*	*Not-for-profit/ for-profit SMME*
Catalonia, Spain	guifi.net[114]	Fibre and mesh networks: decentralised wireless networks using Wi-Fi routers and firmware, fibre using water pipes. Unlicensed spectrum.	Broadband internet	Licencia Procomún Inalámbrica.[115] When the network uses radio spectrum that does not require a licence, no administrative authorisation is required either. When users share content over the network, including access to other networks such as the internet, implicit in any communications network. It is understood, of course, that they are self-serving, or adding their respective self-benefits. It is not a service to third parties. Neither is it necessary to have authorisation or administrative notification (Art. 6.2 of the General Telecommunications Law 32/2003).	The guifi.net Foundation, a telecommunications operator registered at the telecommunications operators register, run by the Spanish National Market and Competence Commission, participates as an autonomous system in the internet and exchanges traffic at up to 30 Gbps in CATNIX, the Internet Exchange Point (IXP) of Catalonia.	Yes	Economic model based on the commons model and the collaborative economy, through the deployment of a joint network infrastructure and a sustainable and fair economic exploitation. More than 20 companies carry out professional activity on the commons network and also do so simultaneously and in coordination with the participation of individuals, volunteers and associations. This is possible thanks to the development of governance tools that define the terms and conditions under which economic activity can be carried out through commercial exploitation.

→

[114] http://guifi.net/

[115] https://guifi.net/es/ProcomunInalambrica

COUNTRY	COMMUNITY NETWORK	TYPE OF NETWORK	SERVICES OFFERED	LICENSING TYPE AND COST	BACKHAUL TYPE	SUSTAINABILITY MODEL	
				Light licence or exempted	***Fibre, MW links, satellite***	***Receives subsidies, spectrum, backhaul access, USF quotas, tax breaks***	***Not-for-profit/ for-profit SMME***
Eastern Cape, South Africa	Zenzeleni Community Networks[116]	Hybrid: consisting of five GHz PtoP links on the backbone, as well as PtoP and PtoMP links in between the main access nodes, combined with mesh technology among the rest of access nodes.	Dedicated internet services to business, hospitals and schools in the area, as well as uncapped public Wi-Fi services at USD 2.2 per month	Private network and reseller exemptions granted by ICASA	PtoP 5 GHz Wi-Fi	Yes, the wholesale internet connectivity has been paid for by the usage (fixed and public Wi-Fi) since 2017.	Not for profit. Negotiates wholesale prices with ISPs. Maintains and operates a telecom network. Reinvests surplus. Operates and maintains solar charging stations to augment financial sustainability of telecommunication services.
Nepal	Nepal Wireless Networking Project[117]	Wi-Fi networks: network backbone connected with Motorola Canopy radios at 5.8 GHz; first-mile connections to the villages use wireless ethernet (802.11b/g standard) radios at 2.4 GHz from various manufacturers.	Internet and VoIP calls	Light licence, fee for starting up about USD 1.50 per year	Canopy radios in 5.8 GHz	No	Not for profit. To ensure financial sustainability, the management committees charge about USD 15 to 30 per month depending on the bandwidth used, per community. The monthly fee, paid by the community centres, individual users, local businesses, rural schools and rural clinics, is used to pay for the internet bandwidth cost and to incentivise the technical support team.

[116] Luca de Tena, S., & Rey-Moreno, C. (2018). Challenging inequality in post-apartheid South Africa: A bottom-up, community-led business model for connectivity. In A. Finlay (Ed.), *Global Information Society Watch 2018: Community Networks*. APC & IDRC. https://giswatch.org/en/country-report/infrastructure/south-africa

[117] Sæbø, Ø., Sein, M. K., & Thapa, D. (2014). Nepal Wireless Networking Project: Building infrastructure in the mountains from ground up. Communications of the Association for Information Systems. *Communications of the Association for Information Systems, 34*. https://doi.org/10.17705/1CAIS.03411

COUNTRY	COMMUNITY NETWORK	TYPE OF NETWORK	SERVICES OFFERED	LICENSING TYPE AND COST	BACKHAUL TYPE	SUSTAINABILITY MODEL	
				Light licence or exempted	*Fibre, MW links, satellite*	*Receives subsidies, spectrum, backhaul access, USF quotas, tax breaks*	*Not-for-profit/ for-profit SMME*
Canada	K-Net	A First Nations ICT service provider connecting about 80 communities over satellite and fibre optics, it has even set up its own cellular phone network. Started (in 1994/95) with BBS, help desk, later as a WAN broadband for schools and health centres. In Aboriginal communities.	Cellular, FO, satellite and wireless internet access. Uses community distribution networks. Managed LANs for schools and health organisations. Mobile 3G network to 80 Aboriginal communities, in Ontario, Manitoba and Québec.		Fibre, satellite, MW links, mobile network. It started by creating local PoP for internet. Industry Canada created the Smart Communities Project to allocate funding for community networks. K-Net won a grant to develop broadband applications.	Yes, from federal, regional and local actors. CAPEX investment mostly by federal programmes.[118] CAD 49.9 million in 9 years	Set up as a social enterprise (not for profit) and community-owned infrastructure with strong emphasis on technical training for Sioux communities. K-Net received 1 satellite transponder for BB from Industry Canada (90 MHz bandwidth).
United Kingdom	Broadband for the Rural North (B4RN)[119]	Full fibre 1 Gbps network	Rural broadband		Fibre	Yes, vouchers	A not-for-profit, community-owned cooperative
Kenya	Tunapanda Net[120]	Internet, Wi-Fi links	Internet access, e-learning platform, content creation, digital training for teachers, technical support for schools, community centres	Not yet licensed due to the lack of an existing licensing framework for community networks. However, the Communications Authority of Kenya is in the process of creating a licensing framework for community networks.	Fibre	No	Community-based organisation

[118] For detailed information on CAPEX and OPEX for K-Net: https://tspace.library.utoronto.ca/bitstream/1807/24748/6/Fiser_Adam_P_201006_PhD_thesis.pdf

[119] Allmann, K. (2020, 2 July). The remote British village that built one of the fastest internet networks in the UK. *The Conversation*. https://theconversation.com/the-remote-british-village-that-built-one-of-the-fastest-internet-networks-in-the-uk-137946

[120] https://tunapanda.org/

COUNTRY	COMMUNITY NETWORK	TYPE OF NETWORK	SERVICES OFFERED	LICENSING TYPE AND COST	BACKHAUL TYPE	SUSTAINABILITY MODEL	
				Light licence or exempted	***Fibre, MW links, satellite***	***Receives subsidies, spectrum, backhaul access, USF quotas, tax breaks***	***Not-for-profit/ for-profit SMME***
Uganda	BOSCO: Battery Operated System for Community Outreach[121]	Solar power plants: 30 KW, 6 KW; low power (10 to 20 W max) computing equipment; PtoP wireless internet connection; internal network system VoIP telephony and Linux / free open source software	BOSCO Uganda mainly does internet connectivity (Wi-Fi), solar installation, ICT training and capacity building. It owns 55 ICT centres, some of which are found in schools, community centres and religious organisations, located at 10 districts. Six centres are in refugee camps. Geographical coverage: 160 km + 11 towers	Not yet licensed. In 2020, the Uganda Communications Commission introduceda holder of Communal Access Licence that will be authorised to establish, operate and provide communal access to telecommunications services to a particular community. Although it is suitable for community-based, not-for-profit entities, it is too expensive.	Fibre	Receives funding from donors but with the COVID-19 pandemic this was significantly reduced. They negotiated with NITA U and reduced the price of bandwidth by half but it is still very expensive for them.	Self-described as a "Faith-based not-for-profit organisation". Their ICT centres called Bardege ICT generate a little revenue from internet sales and computer literacy training. They have also started offering such trainings to institutions and partnering with other institutions to offer internship training for a small fee.

[121] https://boscouganda.com/

COUNTRY	COMMUNITY NETWORK	TYPE OF NETWORK	SERVICES OFFERED	LICENSING TYPE AND COST	BACKHAUL TYPE	SUSTAINABILITY MODEL	
				Light licence or exempted	***Fibre, MW links, satellite***	***Receives subsidies, spectrum, backhaul access, USF quotas, tax breaks***	***Not-for-profit/ for-profit SMME***
Colombia	Red INC, Jxa'h Wejxia Casil and Red Comunitaria Mani	Calls and SMS (Red INC); internet and intranet (Jxa'h Wejxia Casil) and internet (Red Comunitaria Mani)	GSM 2G (Red INC); internet access to three Indigenous communities, one peasant community and a group of ex-combatants ((Jxa'h Wejxia Casil) y Internet access in a rural area of the municipality of Mani, Casanare to more than 10 farms, an open access point and a rural school.	Not yet licensed due to the lack of an existing licensing framework for community networks. An agreement was made with the Ministry of ICT to implement a pilot project in a community, and the 900 MHz band was used on behalf of the ministry. Currently it is participating in the CRC regulatory sandbox to advance with the regulatory review to implement 2G and 4G community networks.	Fibre (Jxa'h Wejxia Casil and Red Comunitaria Mani)	Community members pay for service.	Not for profit. The community does volunteer work for the administration and maintenance of the network.

Table 4

COUNTRY	COMMUNITY NETWORK	OWNERSHIP/MANAGEMENT	LEGAL STRUCTURE	PARTNERSHIPS	COMMUNITY SERVED
		OPERATED TOTALLY OR PARTIALLY BY THE COMMUNITY	*FOUNDATION, COOPERATIVE OR M-SME*	*MESO ORG*	*GEOGRAPHY AND ETHNICITY*
Córdoba, Argentina	QuintanaLibre AlterMundi	Totally by the community. AlterMundi encourages the deployment of the network, but it does not manage it. Therefore, decisions concerning network growth and maintenance are made by the network users.	AlterMundi Organization de Sociedad Civil, responsible for the coordination of the community and support.	Rhizomatica, APC, ISOC	Villages of Cordoba
Oaxaca , Veracruz, Guerrero, Chiapas and Puebla, Mexico	Telecomunicaciones Indígenas Comunitarias, A.C.	Totally owned by the community. Receives technical support and training from TIC, the cooperative of served communities. TIC facilitates analysis of viability and technical issues but decisions concerning network growth, operation and maintenance are made by the communities.	Broad self-regulation based on the internal norms of the communities themselves and the associations they have created TIC A.C., where A.C. stands for Asociación Civil, a common denomination in México for foundations or not-for-profit entities.	Rhizomatica and REDES, A.C.	Oaxaca State, Indigenous communities plus one remote community in Guerrero
Catalonia, Spain	guifi.net[122]	Owned by the community. The guifi.net Foundation encourages the deployment of the network, but it does not manage it. Therefore, decisions concerning network growth and its maintenance are made by network users.	The guifi.net Foundation, a non-profit organisation responsible for the coordination of the community and the provision of deployment support for the users.		Catalonia, Valencia, Balearic Islands, Madrid, Andalusia, Asturias and the Basque Country
Eastern Cape, South Africa	Zenzeleni Networks	Owned by the community. Zenzeleni has evolved as follows: An umbrella non-profit company (Zenzeleni Networks NPC), and the local community-owned and operated ISPs (the Mankosi and Zithulele cooperatives). The members of the cooperative are elders – men and women – from different community villages, and decide who hosts mobile charging stations and hotspots, as well as who sells the vouchers. The NPC manages the backhaul and provides other support services to the coops.	Not for profit and Cooperative	Zenzeleni[123]	Eastern Cape Province, Native African
Nepal	Nepal Wireless Networking Project	Owned by the community. NWNP provides technical support to build the network and connect facilities. Servers and routers at the base stations are maintained by the NWNP. Each local management committee appoints a technical person to troubleshoot and fix technical problems and to provide support for the users in the village. In case the problem cannot be solved, NWNP sends help to fix the problem	Not for profit M-SME "sharing company"[124]		Over 200 remote mountain communities in Nepal, different Nepalese ethnicities. Base stations located in Kathmandu, Pokhara and Gorakha

→

[122] http://guifi.net/

[123] https://zenzeleni.net/our-partners/

[124] Sæbø, Ø., Sein, M. K., & Thapa, D. (2014). Op. cit.

COUNTRY	COMMUNITY NETWORK	OWNERSHIP/MANAGEMENT	LEGAL STRUCTURE	PARTNERSHIPS	COMMUNITY SERVED
		OPERATED TOTALLY OR PARTIALLY BY THE COMMUNITY	*FOUNDATION, COOPERATIVE OR M-SME*	*MESO ORG*	*GEOGRAPHY AND ETHNICITY*
Canada	K-Net	K-Net has had a tremendous evolution and expansion but it remains a community-owned and -managed infrastructure. At local level each community decides and manages local ISP and for other assets, it has enterprise governance.	Not-for-profit entity, there is a Fund for federal originated investments, and rules on what it can do with any exceeding revenues.	Strong partnerships with federal, regional and local governments, private sector, Bells, and Telesat and other civil society organisations.	First Nations of East and West, Sioux and other nations in Northern Ontario
United Kingdom	B4RN	Rural communities in Northern England. All revenues go to communities.	Community benefit societies		Rural North England
Kenya	Tunapanda Net	Operated and maintained by Tunapanda Kibera CBO with support from community social and economic groups and community schools. The CBO responsibilities include network deployment and management, resource mobilisation, partnerships and training. The community groups support local mobilisation and advocacy, network deployment and operational activities such as mast fabrication, infrastructure build, network support and maintenance. The connected partner centres, hosting and securing equipment.	Community based organisation		Urban communities, extreme low-income at East Africa such as Kibera (Nairobi informal settlement)
Uganda	BOSCO: Battery operated system for community outreach[125]	The community operates and maintains the centres. The Centres are entirely owned by the community members. BOSCO comes in to support when the community needs advanced technical support.	A not-for-profit organisation under the trusteeship of the Catholic Archdiocese of Gulu.	Projects of APC and Internet Society Donors and partners can be found at their site.	Rural communities of people from Internally Displaced People's (IDP) camps in Gulu, Northern Uganda
Colombia	Red INC, Jxa'h Wejxia Casil and Red Comunitaria Mani	The operation and administration of the networks is done by community members. Colnodo has a support desk through which it provides support on technical or administrative issues when communities request it. In the case of RedINC, the agreement for the 2G pilot and participation in the regulatory sandbox has been made by Colnodo.	Community-based organisation	Colnodo, ISOC, APC	Rural area of Buenos Aires El Cauca, Maní Casanare, Silvia and Caldono in Cauca, Colombia

[125] https://boscouganda.com/

As can be seen from the descriptions above, and those of many other community network cases flourishing around the world – as portrayed in the Global Information Society Watch (GISWatch) 2018 study of 43 case studies from over 40 countries plus the Caribbean region[126] – the purpose, scope architecture, services and legal nature of these cases vary widely but if we were to classify community network in three categories, they would be:

- Infrastructures for the self-provision of services
- Infrastructures for the provision of services to third parties, not only community members
- Hybrid cases in which each community member owns a node or certain infrastructure that becomes part of the whole network for the use of all contributors of all sorts as a common pool, like guifi.net in Catalonia or Broadband for the Rural North in England.

The first category (at least in the telecommunications-based world) is a classic: a private network versus a public network. The former serves only a given group and is not interconnected to other networks for voice termination, nor are their users. In contrast, a public network is a public, state-owned or commercial infrastructure, a carrier that is mandated to provide service to any user within its reach, and to communicate its users with the users of any other public networks through interconnection.

Erick Huerta[127] explains that a private community network is typically a non-profit effort by community members that own or share infrastructures that become commons. It may be a cooperative like TIC AC in Oaxaca, an indigenous cellular voice network with a licensed spectrum, or an internet access mesh network using Wi-Fi such as AlterMundi's QuintanaLibre network in Argentina. TIC AC is a private network and it would therefore usually be licence exempt, but because TIC holds GSM spectrum it required a special "social purpose" licence from the Mexican regulatory agency, IFT, which, under the 2013 constitutional reform, was mandated to grant social purpose licences and spectrum assignments (directly, out of auction and free of charge) to community and Indigenous applicants requesting: a) a community broadcast radio or TV system; b) a licence for a wired network, cable, fibre or DSL for all possible services; or c) a wireless community telecommunications network for telephony, data, multimedia subject to spectrum availability in rural areas with under 2,500 inhabitants. If a community in Mexico wants to connect its members through an internet Wi-Fi network thus using unlicensed spectrum, it needs no licence if it is a non-profit private network.

In the second category, a community network provides services to third parties as well. According to Huerta, the regulatory regime in these cases varies country by country and also depending on whether it intends to use licensed spectrum bands or is interconnected to other networks. In the latter cases, it could be subject to a public provider licence, with numbering, QoS

[126] Finlay, A. (Ed.) (2018). Op.cit.

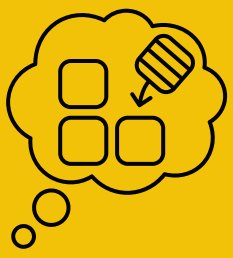
[127] Huerta Velazquez, E. (2018). Legal framework for community networks in Latin America. In A. Finlay (Ed.), *Global Information Society Watch 2018: Community Networks*. APC & IDRC. https://giswatch.org/en/infrastructure/legal-framework-community-networks-latin-america

obligations, standards, etc. For example, this is the case for a recent MVNO created by multiple cooperatives in Argentina or B4RN in Northern England. Both are community-owned networks, provide access to their members and serve third-party users and therefore fall under public interest regime as public-service operators and for profit, regardless of the network architecture or services offered. It is thus, the community's goals, network purpose and commercial or non-commercial goals which trigger asymmetric legal regimes in the same way this occurred with community broadcasting. Community based, non-profit radio or TV stations are granted in most countries complying with freedom of speech and media pluralism obligations, a broadcast licence with spectrum to serve one or more communities with non-commercial programming and local content.

Small commercial operators in the internet ecosystem, such as ISPs, that typically serve smaller cities and some rural areas, also contribute to universal access, to competition, innovation and investment. Brazil has been successful in promoting their development as complementary players expanding broadband access, through licence-exemption policies, that have made it possible for them to hold an important market share of FBB (around 30%). They are not community networks as their infrastructure is not community owned and yet regulatory asymmetry has been secured to them as small internet providers (PPPs, after the acronym in Portuguese for Prestadores de Pequeno Porte). The same policy could apply to community networks, in order to allow them exemption through broader authorisation, funding through FUST, affordable access to backhaul and affordable access to spectrum frequencies so that they can also contribute to expanding connectivity. As we will see later in the report, these two "small providers" should start a dialogue to identify possible synergies and collaboration and common interests.

Most regulatory regimes still differentiate between these two basic kinds of networks based on who they serve and whether they are interconnected or not. However, not all private networks are community networks. For a long time corporations have had private networks for intra-corporate data and VoIP between offices or branches in different locations within a country or even abroad but the fact that this did not provide access to a public network enabled the former to exist under a pretty much unregulated status unless they were using licensed spectrum, as there was no public interest to protect, no consumers and no commercial exploitation in a private network. Whether it was built by an outside telco provider, or in-house by the firm, was irrelevant, unlike a community network that is characterised by being owned, designed, built and managed with the participation of the whole community.

INSIGHT 4



It is true that not many countries have created a specific licence type or regime for community networks as described earlier in this brief. A few which have are Mexico, Argentina, Canada and South Africa. The key issue is whether communities can easily formalise their networks through an accelerated and affordable licensing regime or licence exemption, affordable access to spectrum, backhaul and universal service funding, (for infrastructure, technical training or content creation) through simple procedures. Not every community has access to e-government portals or is acquainted with them and few have a digital signature or bank account for instance, in impoverished areas. When designing an enabling licensing regime, it is important to take into account economic, geographic and cultural asymmetries of community applicants who may not have those skills or identification tools precisely because they have been excluded from the information society.

2.5 COMMUNITY NETWORKS IN BRAZIL: COSTS AND CHARACTERISTICS

Some government projects of digital inclusion like “Telecentros” and “Ponto de Cultura Digital” were mentioned by civil society organisations and community members as a strong reference for what later would become community networks. Those public digital inclusion projects targeting the peri-urban and rural areas were the first point of contact with digital technologies for many. They have created a space that highlights the importance of access and digital inclusion and has fostered the desire to self-connect in some community members and the desire to keep working in the digital inclusion and access field in many staff members and volunteers that have worked on such projects. Some of the remaining infrastructure of the projects is still functional, serving communities with computers and internet access, although nowadays smartphones are the main devices accessing hotspot internet provided by these projects, mainly through GESAC connectivity. The community radios also saw the potential of internet access for their communities and saw themselves as possible actors to fill the gap left by ISPs and public policies in delivering reliable and accessible internet connection to their neighbourhoods and communities. Although, in practical terms, they were unable to foster many community networks, they were present in the discussions and have contributed with their history of building community communications.

It is accurate to say that most of the people disconnected from the internet are the Indigenous, the quilombolas, the Black population, the “mestiços” and all the traditional populations living in riversides and agricultural and extractivists practices, in the so-called Deep Brazil

("Brasil Profundo"). These people usually lack more than only internet access and are often without access to other basic human rights such as the right to housing; work and income; sanitation, drinking water and electricity; land; gender and race equality and leisure and culture. So, it is fair to say that internet access is required not only to address the lack of connectivity itself but to help remedy other structural exclusions.

It is in this context that community networks have started emerging in Brazil, still at an experimental and embryonic phase but with some strong characteristics. There are community networks from the Tapajós river to the Ribeira Valley, in the South of São Paulo state Most were able to start with the technical, administrative and implementation assistance of meso national organisations like NUPEF, IBE (Instituto Bem Estar Brasil), and ARTICLE 19 Brasil, or with the support of public universities like UFPA (Universidade Federal do Pará) and with plenty of volunteers from communities and individual activists. The technical community also plays a key role in the implementation and technical support, with a strong mention of the Coolab organisation and the LibreMesh and LibreRouter project. Among the national and international foundations and development agencies that have contributed funding are the Banco do Brasil Foundation, the Association for Progressive Communications (APC), the Internet Society, Rhizomatica, LACNIC's FRIDA programme, the Ford Foundation, the Swedish International Development Cooperation Agency (Sida), the International Development Research Centre (IDRC), and the United Kingdom's Foreign Commonwealth and Development Office (FCDO).

The community network initiatives in Brazil have a strong component of feminism and other pro-inclusion and diversity movements. There is significant participation of women playing administrative, articulation and technical roles and there is space for more women to participate in community networks, as local knowledge and dialogue is highly valued by community members wanting to avoid any hierarchical structures.

There are also exemplary community networks worth sharing: an experimental network built for agricultural women that was designed and implemented by female brains and hands, producing hands-on-based knowledge on how to minimise gender and race gaps in technical environments; the MariaLab collective created an outstanding guide for community networks, with a popular education methodology;[128] while the "Nós por nós" collective from the Portal Sem Porteiras, has made a podcast featuring a dialogue with the community's women during the advance COVID-19.[129]

There were some experimental mobile networks using GSM technology in two community networks, both received experimental access to the spectrum for two years but are not operating anymore. We highlight the one that took place in Boa Vista do Acará, Pará, with the help of Lasse[130] from UFPA (Federal University from Pará). It got a licence for scientific use of the 900 MHz frequency for GSM and used it for two years and then renewed for a further two years. After four years of the project, they tried

[128] https://www.marialab.org/infraestruturas-feministas

[129] https://portalsemporteiras.github.io/nos-por-nos/nodecast

[130] https://www.lasse.ufpa.br

to renew the licence for the second time but it was reported that the experimental GSM network stopped because the second renewal of the licence was taking too long, almost two years (the same period for which the experimental licence lasts). They said that the second renewal demanded that the applicant submitted a new project, which was impossible, since they were still experimenting with the GSM mobile network with the same community, free of charge, making trials of different setups and researching community needs, and also starting to research LTE technology. The regulatory barriers for the granting of this educational experimental licence were said to have influenced the decision of some researchers to withdraw from the project.

It is worth mentioning that there are some key differences between a PPP and a community network, the latter is a community-designed, -owned and -managed infrastructure, not for profit and created to address a community's needs, values, culture and idiosyncrasy, while a PPP is a small commercial enterprise that has a light regulatory burden and may serve up to 5,000 subscribers in any location with either fibre or radio of restricted power. An average PPP could have around 4,000 subscribers.[131] As to the community networks we have interviewed, they expressed serving between 15 to 150 families. In addition, PPPs have access to wholesale markets as they are collective interest providers, SCM as opposed to community networks, which for the time being are enabled under the SLP regime, that is a restricted interest provider, which has many limitations (which we will analyse in Section 3). SLPs do not have the legal right to access wholesale markets, so they have to purchase internet at retail prices when ISPs are not willing (and most of them are not) to offer a wholesale internet bandwidth.

We estimate there are 20 to 30 of these networks currently operating in Brazil, located in different parts of the country, but mainly in the South, East and Northern regions. We highlight some of their characteristics below:

- Most community networks organise themselves in neighborhood associations as a legal person with CNPJ, mostly in rural areas.
- The use of connectivity benefits educational, cultural and leisure purposes but is also beneficial in facilitating social demands like: access to government projects and benefits; economical activities and communications among community members.
- Of the eight interviewed, two had a SLP licence and two were in the process of obtaining one. The other four had not yet acquired an SLP licence, but all used restricted radiation equipment only.
- Most of the community networks in Brazil use Wi-Fi for access and commercial backhaul as final user. One of the main challenges is the cost of backhaul and internet access, as SLPs are not able to access the wholesale market; therefore these networks cannot get robust internet connectivity.
- In fact, *only one* of the interviewed networks had access to wholesale internet. It had built backhaul through a 5.8 GHz link and was granted a free space in a tower to raise the antenna (and was awaiting authorisation from

[131] Figures obtained from an interview with a representative of ABRINT, Basilio Perez. Section 3 addresses the PPP regime in more detail.

Anatel to use an adjacent frequency band for more throughput). Even though they have access to backhaul, the price paid is BRL 10.50 (USD 1.98) per Mb, almost twice as much as the one paid at the local point of presence, BRL 6 (USD 1.13). The only reason they gained access to the backhaul is because the PPP sympathised with the community network. Usually the ISP denies wholesale prices and bans the network from sharing the internet connection among community households, which is the only way to make it affordable for many low-income dwellers.

- In remote communities away from cities, the internet connection comes from a satellite internet provider, but still only as a retail service, and the communities are not able to afford or even to have access to a dedicated internet link.
- Plenty of community networks use mesh networks and free/libre and open source (FLOSS) technologies.
- There are significant issues involved in keeping the network working due to the lack of technical knowledge amongst community members and the financial impossibility of having full-time technicians for it.

Tables 5a and 5b show information from eight community networks that were interviewed for this research. This includes their history, their current status, technology used, what kind of service they offer and at what price, whether they have access to wholesale internet, regulation status and more.

In Section 4 (the voices of different stakeholders involved in rural connectivity, community networks and digital inclusion from the public, private, social and academic perspectives) there are further findings related to the interviews.

Table 5a

COMMUNITY NETWORK DETAILS	RIVERSIDE COMMUNITY. State of Pará, North region. Community association with corporate tax registration according to the National Registry of Legal Entities (CNPJ)	RURAL AREAS. Quilombo. State of Goiás, Midwest region. Supported by a community association with corporate tax registration (CNPJ	RURAL AREAS. Extractive groups. Quilombo. State of Maranhão, North region. Community association with corporate tax registration (CNPJ)	RURAL AREAS. State of São Paulo, Southeast region. Community association with corporate tax registration (CNPJ)
RELATIONSHIP WITH COMMUNITY NETWORK / MOTIVATION	Resident Community network manager	Resident Community network staff and volunteer	Resident Community network manager	Resident Community network manager
COMMUNITY NETWORK BACKGROUND	It emerged from the IDDS Amazon summit in 2016 . The network has existed since 2018. An internet network, connected through the Federal University of Pará	It emerged in 2017 with the support of the Mocambos Network, the Tainã Cultural Centre, and volunteers. The community built on improvements that were already taking place in another quilombo in the region, which makes use of tourism activities.	It emerged from a conversation between local actors. NUPEF delivered training to the community, and the community provided a workshop for 20 people, including young people and women.	Inspired by an experimental network, they brought people together and started working. COOLAB supported them with equipment and technical assistance. The community network grew further in 2019 thanks to APC support.
WHAT KIND OF SERVICES DO THEY PROVIDE? WHAT IS THE COST PER FAMILY?	They currently provide internet access via hotspots at schools and primary healthcare centres (and have also tested telephone services). Free of charge	They currently provide internet services, but there was a time when it provided VoIP and experimental GSM telephone services, but these were discontinued. The community association covers internet costs.	Internet with a computer and printer (small computer lab). Young people can study and do research there.	Internet, with captive portal and local server. They pay BRL 30 (USD 5.43) per member or per household, in addition to equipment and installation fees. Some people cannot afford this: they get their costs covered, and offer the community network something in return.
INFRASTRUCTURE (TECHNOLOGY, COVERAGE RADIUS, AND NUMBER OF BENEFICIARIES)	There were 10 open Wi-Fi spots: five near the school, and five near the farmers' association, as well as a 5.6 km link that extended internet access from the university to the school. The network can be used by 30 to 40 people at the same time. Uses Ubiquiti Airgrid Technology	There are currently eight Wi-Fi spots (but they are being expanded), benefiting around 60 families, and covering a 25 km radius. However, often people have to walk up to 5 km to connect to the network. The entire network route is 70 km long. Technology used is a simple PtoP Mikrotik modem	There are 11 routers that serve 150 of the 500 families living in the area.	100 devices are connected. Consumer internet from local provider, 30 Mbps
INTERNET CONNECTION (LINK ACCESS AND TYPE)	Internet link from the Federal University of Pará, 100 Mbps.	Internet from local provider, 20 Mbps, end-user link, BRL180 (USD 32.61). High loss exists, some areas get less than 2 Mbps.	HuguesNet, end-user satellite internet. The community is considering changing to a new local provider. There is a fee per family of BRL 10 per month (USD 1.81). It is enough to cover costs, and when there is money left over, it is kept for extraordinary expenses for the network, if necessary.	End-user internet from local provider, 30 Mbps. The community network has issues with this local provider, which insists they are breaking the law, even though they have SLP. Maintenance requests take too long to be solved.
FOREIGN INVESTMENT (HAS THE COMMUNITY NETWORK RECEIVED ANY EXTERNAL FUNDING?)	Support from UFPA and IDDS Amazon	Banco do Brasil Foundation (Mocambos Network project), German institutional support, individual donations, and Rhizomatica (equipment and GSM implementation)	NUPEF provided equipment, technical training, and covered the first 6 months of internet costs.	APC and incentives under the Aldir Blanc Law (to purchase equipment)
TECHNICAL ASSISTANCE AND PARTNERSHIPS (WHO SET UP THE NETWORK?)	Voluntary assistance from a UFPA student	Assistance from volunteers, Tainã Culture House	NUPEF and the National Council for Extractive Populations; partnership with SESI; training workshops	Residents with technical knowledge, and COOLAB support for equipment and technical assistance
REGULATORY STATUS (DO THEY HAVE AN SLP LICENCE? OR A LICENSED SPECTRUM?)	The community network does not have an SLP licence. They only use unlicensed spectrum.	They had a GSM trial licence, but it expired, and the network was disabled.	They do not have an SLP licence. They only use unlicensed spectrum.	They have an SLP licence, but only use unlicensed spectrum.

COMMUNITY NETWORK DETAILS	RIVERSIDE COMMUNITY. State of Pará, North region. Community association with corporate tax registration according to the National Registry of Legal Entities (CNPJ)	RURAL AREAS. Quilombo. State of Goiás, Midwest region. Supported by a community association with corporate tax registration (CNPJ	RURAL AREAS. Extractive groups. Quilombo. State of Maranhão, North region. Community association with corporate tax registration (CNPJ)	RURAL AREAS. State of São Paulo, Southeast region. Community association with corporate tax registration (CNPJ)
BARRIERS	Lack of technical expertise and training for community members. Volunteers are not paid. Unstable energy supply, with blackouts and equipment damages.	Very high illiteracy rate, and lack of interest from the government. Projects lack continuity, and are not interconnected. Difficulties in distribution, forming cooperatives, and creating community-based organisation. Leaders have to face Herculean tasks.	Internet signal sometimes goes down, and maintenance teams take a while to fix it.	ISP boycott – they do not want community networks to distribute the signal. The community is tied to this provider, who keeps threatening them. Internal issues include lack of personnel; lack of money to pay staff; shortage of technical staff (concentrated knowledge); gender and technology issues and difficulties in training more people in technology.
GENDER INCLUSION	Only one woman. Women find it harder to participate due to housework commitments and lack of pay.	No women from the community involved in maintaining the community network. Lack of female representation, and a very conservative and sexist approach. At the same time, local coordination work is mostly done by women, but they do not see themselves as local agents.	Balanced network management: two women manage the network (a community leader and a resident), together with two men (a bricklayer and a maintenance technician). The women are members of a women's organisation, and encourage other women to engage in the network. They also try to provide specific training based on the interests of women and their roles as babassu coconut breakers.	The majority are women, but they deal mostly with administrative and social issues. There are currently six full-time women, and another three that are less engaged. Male technicians. Women have views on technology and gender, and have attended several technical workshops (which waned with the pandemic). Women are now trying to identify a local server.
COMMUNITY NETWORK SUSTAINABILITY (RESPONDENTS DID NOT DIFFERENTIATE BETWEEN SUSTAINABILITY WITHIN THE COMMUNITY NETWORK AND IN THE COMMUNITY AS A WHOLE)	No specific model. To achieve sustainability, they believe that they need to train local people in technical and financial areas, and expand access to funding for training and capacity building.	Better use of the Cerrado; extractive activities; people need to see examples of economic sustainability	NUPEF training helped with planning: they tackled community planning collectively, and are open to partnerships, but do not think about autonomy. They see partnerships as a strength. The internet helps with the search for new projects and resources.	They rely on membership fees for now, but this is not enough. They also receive money from public projects. Decision-making is collective, but split into sectoral groups.
FUTURE OF THE COMMUNITY NETWORK	They want to expand environmental action. The community does not have selective collection and correct disposal for waste. They think that the community network could help with partnerships in this area.	They want to create a project database to cross information and expand resources and mutual collaboration. They want an empowered community, which is financially independent, with more vision.	They would like to have a community radio to publicise their efforts and activities. They dream of creating a cultural centre to support women and youth and of women's empowerment in the face of prejudice and violence. They also want healthcare centres for women.	They increasingly seek the development of neighborhood autonomy. They want to expand community work models, bringing together school, recycling, and agroecological initiatives.
HOW HAS COVID-19 AFFECTED THE COMMUNITY NETWORK?	At the beginning of the COVID-19 pandemic, their Wi-Fi repeater broke down, and they were unable to fix it due to isolation measures. At school lightning incidents affected some routers, and they have not yet been able to fix them.	The internet connection is paid for by associations that benefit from tourism. With the pandemic, their activity has decreased significantly, making it difficult for them to pick up the internet bill.	---	In the beginning, women were more interested in technical issues: they held periodic workshops, but these became very rare during the COVID-19 pandemic.

Table 5b

COMMUNITY NETWORK DETAILS	RURAL AREAS. Quilombo. State of São Paulo, Southeast region. Community association with corporate tax registration (CNPJ)	RURAL AREAS. State of Rio de Janeiro, Southeast region. Community association with corporate tax registration (CNPJ)	PERIURBAN AREA. State of São Paulo, Southeast region. Social movement settlement	RURAL AREAS. State of Pará, North region. Extractive reserve. Riverside and indigenous population
RELATIONSHIP WITH COMMUNITY NETWORK / MOTIVATION	Community network implementing volunteer	Community network implementing volunteer	Resident community network manager	Technical officer responsible for the community network
COMMUNITY NETWORK BACKGROUND / HOW DO THEY SEE IT?	The network was created to facilitate a sales group for agroecological products from an association of rural producers	The oldest network operating in Brazil, in operation since the time when telecentres were more common. IBEB in partnership with UENF , through telecentre project, with the goal of creating a community telecentre	The community radio was born out of the need to communicate within the MSTS settlement, which was very large. They had 11 kitchens, and needed to report and be able to communicate with everyone quickly. It started with the idea of a lamp-post radio. After they got the equipment, people from surrounding areas started to listen. This encouraged them to build a better studio and install internet access, so that they could broadcast online. After that, they decided to create a community internet network.	They started with a short-wave communication project (analog-voice) in 2015. They ran digital transmission experiments and, since 2018, they have carried out tests in Mexico and Brazil under a project with Rhizomatica. They developed much cheaper equipment than common HF transceivers (development of local technology).
WHAT KIND OF SERVICES DO THEY PROVIDE? WHAT IS THE COST PER FAMILY?	Internet and local area network (mini Raspberry Pi server)	They provide internet access, with two local servers with a community portal (blog, local communication channel, radio and TV web services, file repository [video on demand] and local e-commerce).	Community radio and community network with three hotspots, a micro server, and internet connection for the radio studio	Communication via messenger and email (radio on HF). Encrypted internal network between base stations: sends text, audio and image files with specific compression
INFRASTRUCTURE (TECHNOLOGY, COVERAGE RADIUS, AND NUMBER OF BENEFICIARIES)	Three Wi-Fi spots with password and routers hosted by three local producers. They serve around 15 families.	They use Mikrotik antennas and RouterOS, and distribute directly to homes. They serve about 150 families.	They use three CPE antennas and home routers. They serve community radio and its listeners. For families in the settlement, the radio benefits about 300 families.	There are 10 base stations with a distance of up to 600 km between them.
INTERNET CONNECTION (LINK ACCESS AND TYPE)	End-user satellite internet provider HughesNet, 30 Mbps. BRL 300 (USD 54.4) per month	The internet link arrives at a place 10 km away from the community. They managed to install an antenna on a tower, and get a high-usage link, 300 Mbps connection. Local wholesale purchase (without protection of their right to interconnection). Price is usually negotiable at the point of presence at BRL 6 (USD 1.08)/Mbps, but the price they pay is BRL 10.50 (USD 1.9). As the idea is to serve everyone, people pay different amounts, the average value is BRL 35 to 40 (USD 6.4 to7.25), speed ranges from 3 to 10 Mbps for end users.	100 Mbps end-user connection, donated by a social movement	Internet paid for by ISA office. Connection is poor.
FOREIGN INVESTMENT (HAS THE COMMUNITY NETWORK RECEIVED ANY EXTERNAL FUNDING?)	Feminist Internet Research Network (FIRN) research project – APC, equipment, workshops and internet donated for 1 year	CAPEX, access to resources and support for the first year of the community network	Equipment donated by Artigo 19 NGO; cash collections; MTST; and activists. Support from SESC with paid workshops	Partnership with ISA and local indigenous NGOs
TECHNICAL ASSISTANCE AND PARTNERSHIPS (WHO SET UP THE NETWORK?)	Volunteers of the FIRN research network – APC and partnership with feminist organisation that works at the quilombo	IBEB supported implementation, technical knowledge, and training. Also UENF, IFF, and APC	Volunteers, with equipment and workshops provided by Artigo 19 NGO	Rhizomatica

COMMUNITY NETWORK DETAILS	RURAL AREAS. Quilombo. State of São Paulo, Southeast region. Community association with corporate tax registration (CNPJ)	RURAL AREAS. State of Rio de Janeiro, Southeast region. Community association with corporate tax registration (CNPJ)	PERIURBAN AREA. State of São Paulo, Southeast region. Social movement settlement	RURAL AREAS. State of Pará, North region. Extractive reserve. Riverside and indigenous population
REGULATORY STATUS (DO THEY HAVE AN SLP LICENCE? OR A LICENSED SPECTRUM?)	Partially, in the name of an individual who supports the network	SLP in 2020. They are in the process of obtaining a licence for their frequency.	No, but they want to get at least a provisional licence	They are obtaining SLP. Difficulties due to technical issues
BARRIERS	Local mountainous topography makes it difficult to extend the network: there is no decent telephone or data signal in the region. Lack of access to internet via wholesale link; small local providers use satellite from Hugues and do not offer wholesale purchase.	Access to funding sources. Training and stability of technicians (four or five community technicians have come and gone, but the pay was not enough to retain them). Every new technician has to be trained from scratch.	Community violence; lack of sport, culture, and leisure options for young people. This makes it difficult for people to be engaged.	There is a difficulty in complying with the legislation, as SLP is just a channel. Legal issues are complicated due to transnational potential. Broadcast can only use one channel. HF telecommunications cannot have interference. Technical officers are external.
GENDER INCLUSION	The project was brought to the community by a group of women farmers with only women volunteers (technicians and coordinators). Training workshops were mixed, but the participation of young women was reduced. Men ended up taking over the technical aspects of installing and managing the network. The community started to value the group of women farmers more, as they brought the internet to the community.	Technicians are men. For heavier maintenance services, there was no interest from women in getting involved. A universal problem, especially in rural areas, where women are already burdened with multiple care roles. They realised that women are more interested in lighter tasks, and girls are interested in managing local platforms. Women are expected to get more involved in other technology-based services.	There are few women involved. Most women feel a little shy. Women's engagement takes time, but was a reality before the pandemic. They believe it is related to low self-esteem and lack of familiarity with technical equipment.	Association leaders have more women. In the community, nurses and teachers are most respected.
COMMUNITY NETWORK SUSTAINABILITY (RESPONDENTS DID NOT MAKE A DIFFERENCE BETWEEN SUSTAINABILITY WITHIN THE COMMUNITY NETWORK AND IN THE COMMUNITY AS A WHOLE)	The women farmers network is discussing how to pay for the internet. Currently, connection is still being paid for by the project. They also plan to expand the network with community resources.	They are stable. Building on partnering and association principles, they established rules with users. Equipment on loan. There is a membership fee.	They do not want to be tied to any commercial group, although they accept cultural support. They have already raised funds to build a studio and received support for the purchase of equipment, as well as free internet. They have also received donations in kind from the community to build the studio.	Business model, SSB radio, paid phone calls. Pay-as-you-go model, generating local market
FUTURE OF THE COMMUNITY NETWORK	They want to extend the reach of the community network, and also have a local server with more applications. They want young people to get more involved in order to prevent them from leaving the area, or feeling alienated. They want the network to help defend their quilombola land, traditions, and ways of life, and promote agroecology. They care about digital security and internet misuse.	They want to start working with fibre.	They want more community unity, leisure, sports, showing the positive side of the community, and football and radio projects and community network. They hope that the community will participate more, and that they can put more pressure on the department of culture and the government through the radio and the community network. They are aware that fun, peace and interactivity between neighborhoods improves the problem of violence and promotes culture.	They would also like the network to have geomapping, educational resources, and bulletin boards.
HOW HAS COVID-19 AFFECTED THE COMMUNITY NETWORK?	The network was in the process of being implemented when the pandemic began, and its expansion was prevented. The remaining three nodes (already purchased) are waiting for a more favorable time for installation.	---	Delay in opening and structuring the studio and internet connection at the community network	---

IDEA 8

An open dialogue between different Brazilian communities and Anatel and policy makers would be an important new paradigm that would facilitate better understanding of each other. This would be similar to what Anatel has done with PPPs by creating a committee for the exchange of ideas, problems and proposals. In 2014 the Mexican Agency IFT initiated a series of round tables with Indigenous communities interested in community radios and networks and two years later an International Fora of Indigenous Media was hosted by IFT in Oaxaca with dozens of different groups from North, Central and South America to facilitate understanding of the different visions of the world. A shift in the way public policy and regulation is crafted by IFT was made possible.

2.6 KEY PILLARS FOR SUSTAINABLE COMMUNITY NETWORKS

2.6.1 AN ENABLING REGULATORY, LEGAL AND POLICY ENVIRONMENT FIT FOR COMMUNITIES

There is extensive debate on how law and policy can trigger social change by removing or lowering regulatory barriers and getting rid of red tape. This could involve introducing affirmative action to support vulnerable groups of people, women, and communities traditionally lacking access to services, education, infrastructures and livelihoods, and transferring public resources (as subsidies) where market failures exist, where external factors leave certain regions or groups excluded when the market is not willing to invest in infrastructures which have a low return on investment.

We have already mentioned that most telecommunications laws and regulations created upon privatisation of the telecommunications industry were aimed at harnessing incumbents and granting licences to other big players who would face challenges in competing with the former state monopoly.

In the era of a national carrier as a natural monopoly (usually state owned) and economies of scale, it was unthinkable that smaller operators or several providers could exist and compete. As time passed, the internet came into existence, giving birth to an unimaginable ecosystem of technologies, protocols, services, applications and content. Access and transport networks equipment became much more affordable and innovation in spectrum management resulted in the possibility of sharing spectrum. All this innovation made it possible for new entrants to serve smaller communities on a commercial or non-commercial basis, whereas large operators would not.

Figure 18

NETWORKS DIVIDED INTO FIVE GROUPS IN RELATION TO COMMUNITY INVOLVEMENT

This meant that much has changed in the last decade. However, many laws and regulations have remained the same, for example, paradigms as spectrum auctions, licences for a single service in spite of convergence, business plans and capital requirements, and certified engineers, and huge licence and spectrum fees and compliance bonds, heavy reporting rules and even rate regulation and consumer protection rules for every operator, all created barriers. Obviously this scheme, designed for big players in an oligopoly, is not fit to promote investment in and deployment of small networks and community networks which are even smaller than a small ISP, at least in rural areas.

2.6.2 SOUND COMMUNITY GOVERNANCE FOR COLLECTIVE DECISION MAKING

Communities with good governance models may be more resilient than others as they are capable of making decisions and allocating scarce resources or reducing conflict in a democratic and efficient way. This is, as we explained before, at the core of a sustainable and autonomous community network.

The need and motivation to start such a network is the first condition, the second is a community governance association with which any supporting partners – like Nupef – could interact.[132]

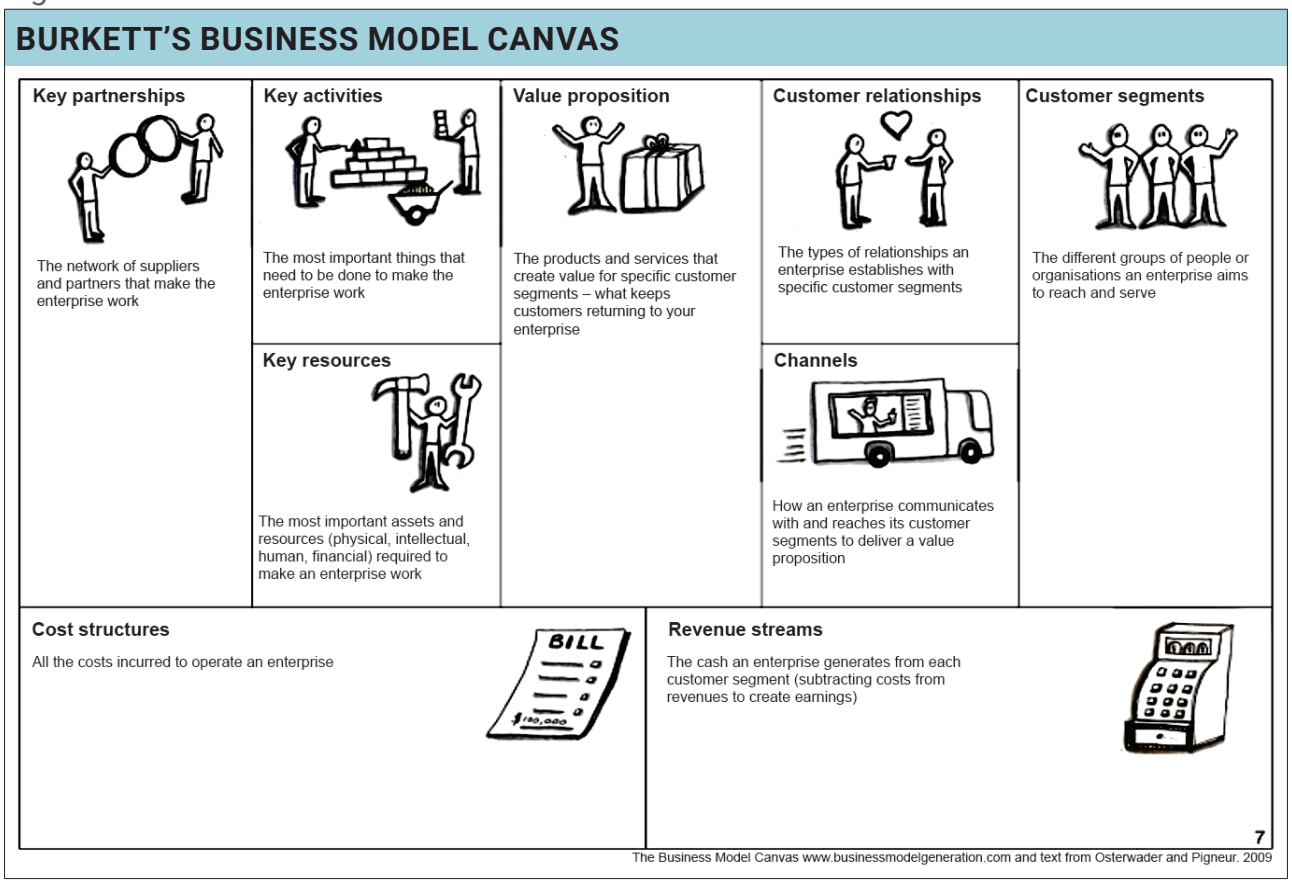
Without governance, there is no way to build a consensus as to the need, nature and type of connectivity or communication system required, and the best way to manage it. Overall, community participation is essential and as members gain skills, they increase their engagement and autonomy in making decisions concerning the network. In many cases umbrella organisations, or technical expertise is at first provided by universities, think tanks or other NGO supporting the community. Jensen[133] illustrates levels of community involvement as shown in Figure 18.

There are many kinds of collaboration. If there is a common pool of resources, each member owns and shares an element of a network, such as fibre or a node, or members share the cost of a link or a site for a router and everyone may use the network. Rural energy production

[132] Finlay, A. (Ed.) (2018). Op. cit.

[133] Bidwell, N., & Jensen, M. (2019). Op. cit.

Figure 19



cooperatives like the ones in Costa Rica are now also providing internet access and are a good example of community involvement for growth.

If everyone co-owns the infrastructure, each person should have one vote, meaning every man and woman, young and elderly, Indigenous and quilombolas or riversiders, and such a degree of inclusion needs to be built into the network by design and constantly nurtured.

2.6.3 ECONOMIC SUSTAINABILITY

Across the world a number of models are used to sustain network finances: non-profits, cooperatives and small for-profit networks. In each case they require asymmetric rules and affirmative actions to achieve what neither the market nor the governments have been able to achieve: sustainable operation. Community projects must have a value proposition for the intended services, a business model for capital expenditure and operating expenditure, a sustainable technological model and a skilled team of community women and men in constant training. The Community Network Manual 2021[134] addresses these issues in more detail. The goal is to have a clear vision and path as to how an organisation creates, delivers and captures value.[135]

Methodologies like Burkett's business model canvas[136] for social enterprise

[134] https://www.apc.org/en/ManualCN

[135] Osterwalder, A., & Pigneur,Y. (2010). *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers.* John Wiley and Sons.

[136] Burkett, I. (2020). Op. cit.

design, illustrated in Figure 19, are good starting points.

Jensen[137] analyses some of the revenue streams adopted by community networks: community member contributions, grants from foundations, government funding, donations, municipal funding or tower sharing, or tax breaks, cost-based rates for users, volunteers, etc.

2.6.4. TECHNICAL EXPERTISE AND CHAMPIONS WILLING TO LEARN BY DOING

The big challenge for communities is to gain the knowledge, expertise and practice to fully understand communications technologies, programming, open-source software and firmware, spectrum management techniques, among many others, so that they gain true autonomy for network design, operation, management and development. Local men and women of all ages and ethnic groups should be encouraged to enroll in training programmes and hands-on experimentation. For women this is especially important but requires community and external organisations to take the time and resources to provide family care facilities and personnel while the women are in training, otherwise they simply decline learning opportunities. This and other gender equality measures must be taken into account when designing training, network installation or repairs so that women can take an active role.

Most of the documented community network cases have included the support of a technical community or specialised civil society organisation or university engineering department that provides and shares knowledge with community members. As examples we have Rhizomatica, REDES A.C., Nupef, Coolab, Colnodo and Sulá Batsú. In some cases, such as AlterMundi and guifi.net, community members were highly skilled professionals able to do network design and teach the rest with very interesting and didactic dynamics.

In any case, constant training, workshops in person and online, such as the ones organised and facilitated by REDES A.C. in Mexico, ITU Academy and IBE Brasil's workshop to learn to navigate the waters of Mosaico and Anatel licensing processes, are some of the learning resources available for community network starters. The websites of APC and the Internet Society have valuable information resources and peer learning tools for community networks, in terms of technical aspects, but also for the governance and management of projects.

IDEA 9

An important role for the Brazilian government at the federal and state level would be to facilitate funding and partnerships with universities and technological institutes to develop training programmes for community networks in rural areas and urban quilombos funded by the state. FUST could also devote some resources for the development of programmes by competitive and renown local institutions for technical and management training programmes for community networks for people with non-technical backgrounds.

[137] Bidwell, N., & Jensen, M. (2019). Op. cit.

2.6.5 INVOLVEMENT OF WOMEN AND DIVERSE GROUPS IN THE COMMUNITY NETWORK INITIATIVES

We have already pointed out the importance of inclusion-by-design policies in all types of connectivity and media community projects. Inclusion has an impact on the sustainability of a community network. Barriers must be removed in order for women and vulnerable groups to participate actively in the network. An important step is to facilitate access to capital for women entrepreneurs of rural communities. The Mexican government, in collaboration with the Central Bank of Mexico and the Inter-American Development Bank, issued "social gender bonds" with which credit for rural women will be granted to finance their agricultural activities. A similar project could be designed for women who launch a digital project at community level.[138]

2.6.6 DIGITAL SKILLS AS A COMMUNITY MEMBER AND DEVELOPER OF SOLUTIONS AND LOCAL CONTENT

It is important to bear in mind demand-side issues. An efficient community network project has users' preferences, digital skills, language and cultural barriers and needs at the forefront of its priorities especially when they have an impact on the development of the whole community. Users of such a network are not consumers, they are actors, owners and developers of the network and its services. Similarly they can also, with due support and subsidy, create content, solutions, intranets, community guides and digital training programmes. All this activity may result in more traffic and network usage, not only for communication, but also for livelihoods, health information, trade of local products, online education, ancestral knowledge and culture transmission to younger generations, mentoring and coaching by women, defence of the territory and biodiversity and emergency alert systems for community safety and sustainability.

These uses of ICT tools and eventually the provision of access to community centres, telemedicine rural centres or local schools may increase demand and generate extra revenue to reinvest in community network development and evolution.

2.6.7 ROLES OF DIFFERENT ACTORS IN COMMUNITY NETWORK SUSTAINABILITY

For both planning and regulating or enabling community network models, it is important to identify the role of each stakeholder involved in contributing to sustainability. Table 6 is just a sample of the definitions that are needed.

[138] For more information on gender bonds see: https://www.iadb.org/en/news/mexico-issues-first-social-gender-bond-national-stock-market-through-fira

Table 6

ROLES OF DIFFERENT ACTORS IN COMMUNITY NETWORK SUSTAINABILITY					
Sustainability pillars	**Role of community members**	**Role of civil society and advocacy groups**	**Role of regulators/ policy makers, public funds such as FUST**	**Roles of technology and technical knowledge organisations/ Academia**	**Role of private sector**
Governance and institutional development	Indigenous or tribal, subject to their own norms of organisation and government shall develop a mechanism for participation of all members on equal footage. To agree on decision making processes that are inclusive and efficient.	To accompany community efforts to the extent that communities ask for it and respect their right to network determination and their preferences and aspirations.	FUNAI can work together with Anatel in capacity building on issues such as indigenous people rights and the need for affirmative actions to fight asymmetries. For indigenous and tribal communities, the State of Brazil is bound to Convention 169, thus, prior consultation procedures are mandatory. Besides, a space such as a committee on community networks may be a good governance space to reach agreement.	The terms under which communities and technical organisations shall work together should be very straightforward and with clear principles and realistic expectations.	Consider new ways of partnering with communities, by providing affordable backhaul, access to infrastructure, which may stimulate traffic to the operators' networks.
Technology	Gain knowledge and understanding of the potential and risks of the technology and what each can do for the community. Have constant awareness dialogues on risks and bias in technology.	Participate in capacity building, technology awareness, contribute to the technological independence of communities.	Lower requirements for community networks, related to project endorsement by a certified engineer, which is unaffordable to them.	Training programmes funding and partnerships with universities and organisations. Clinic for iT students to teach and work with community networks, doing hands-on workshops.	Provide funding for training on ICT technologies, workshops on FLOSS, technology trends in wireless access and backhaul, on fibre-based ISP for community networks,. Design a programme that opens access to their transport and internet service networks for communities for free in exchange for being credited for complying with coverage duties.
Financial		Facilitate training for community network management and finance grants proposals, FUST applications. Identify funding opportunities.	Fee reductions on spectrum use for community networks, like those done for public entities. Tax rebates on equipment imports and homologation.	FUST and other funding for CAPEX, training, content creation, the inclusion of women in community networks, equipment homologation for such networks.	
Operational	Internal organisation, community network governance, recruit, recognise and promote community work.			Training, documenting community network operations manuals.	Donate equipment or organise boot camps.

Sustainability pillars	Role of community members	Role of civil society and advocacy groups	Role of regulators/ policy makers, public funds such as FUST	Roles of technology and technical knowledge organisations/ Academia	Role of private sector
Capacity building/ technical, management and content creation			Ancine programmes may include local and Indigenous content creators support and training programmes.	Digital literacy programmes for users	
Cultural/inclusion	Make their work visible, culture and contributions and struggles to preserve nature and biodiversity. Work on a community network that reflects the values and culture of the community.			Protect Indigenous and Afro-Brazilian autonomy and support gender and diversity programmes and funding. Culturally pertinent regulatory procedures and requirements.	
Legal/regulatory	Propose a simplified regime for community networks that is inclusive, affordable, flexible and a sandbox plan with different community network projects to work on.	Participate in consultations, round tables and fora with different policy makers to explain regulatory barriers and opportunities.	Consider the potential benefits to promote an enabling regime for community networks and start a dialogue through an ad hoc committee.	Provide evidence-based research and surveys dealing with community networks in Brazil (eg. the CGI.br research project).	Contribute to stimulating traffic from rural areas by enacting open access policies that may increase traffic in their own infrastructures and enable rural and other communities to connect.

SECTION 3
BRAZIL'S PRESENT REGULATORY AND POLICY FRAMEWORK

In this section we summarise the most relevant legal and regulatory aspects in order to provide telecommunications services. There is currently no specific authorisation regime for community networks and not even a definition of them. A convergent system of authorisation to provide any and all feasible services does not exist either, not even for commercial operators. We compare regimes for commercial services (collective interest) to those of private use (restricted interest) that are not for profit (SLP). In the commercial regime and we distinguish small enterprise operators (PPPs) from large operators. We highlight the fact that the SLP regime, although a good start, is not fit to enable sustainable community networks, as it was created for other purposes. We do understand that the SLP regime was the existing mechanism, as explained to us by Secretary Artur Coimbra who said that SLP was the available regulatory window to swiftly enable community networks, with no legal reform required, but as we explain in this section the SLP has many restrictions or barriers. In different scenarios community networks may need to use additional bands other than those supporting Wi-Fi; they need data interconnection and to become an autonomous system, they also require access to affordable backhaul and wholesale internet and to be enabled as a non-for-profit service providers with special considerations regarding tax or licence fee exemptions, like public entities and citizen radio. In fact, institutions or municipalities are tax-exempt for their local networks since they contribute to the public interest: the universalisation of services just like community networks.

3.1 SERVICE LICENSING REGIMES UNDER THE LGT (GENERAL TELECOMMUNICATIONS ACT) AND ANATEL REGULATIONS: COLLECTIVE V. RESTRICTED, PUBLIC V. PRIVATE, CONCESSION V. AUTHORISATION

Under the General Act of Telecommunications of 1997 (Lei Geral de Telecomunicações, (LGT)) telecommunications services may be classified, according to the target users, as of collective or restricted interest.

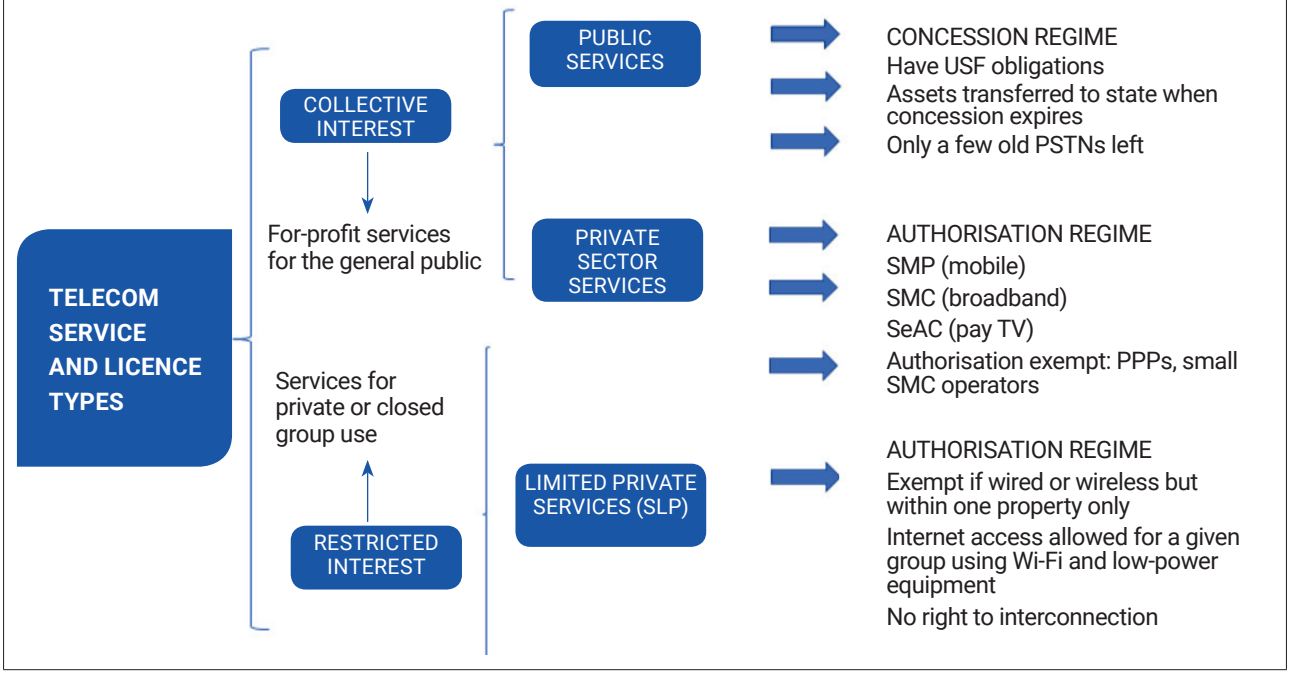
As to services of restricted interest, LGT authorised Anatel to issue the conditions for their provision. Under this category Anatel merged different restricted-interest service regulations and issued Resolution No. 617 in 2013 which regulates all SLPs, including a variety of services and radiocommunications equipment. We will return to these services in the next sections.

Other restricted interest services are limited mobile maritime services (SLMM); limited mobile aeronautic services (SLMA); citizen radio and amateur radio but these are not mentioned in detail as they do not relate to community networks.

Also, according to the licence regime, services may be public or private. The former are subject to universal service and continuity obligations through a concession. A service deemed public and collective and subject to a concession and can be provided only

Figure 20

TELECOM SERVICE AND LICENCE TYPES



during the life of the concession. When it expires, the assets utilised for service provision have to return to the state of Brazil. This is the old model used as a concession to a private entity to provide a utility or a public service, originally to be provided by the state, as historically these public services were provided by a state monopoly.

Up until 2019, the LGT established fixed telephony (STFC) as the only service subject to a concession regime.

A general concession plan was issued in 1998 (Plano Geral de Outorgas, PGO) providing guidelines to issue new authorisations, in the three areas into which it divided the country for local services. Initially one authorisation was granted per service area to new fixed telephony providers. At the same time, incumbents had a grant of fixed telephony.

To date, fixed telephony can be provided both publicly (under a concession) or privately, through an authorisation. In 2019 the LGT was amended to enable the remaining concessions of fixed telephony to transition to a private service authorisation regime with some investment conditions.

Private, collective services are considered a commercial activity of Brazilian private firms, who compete with other firms through their own network or services and because of information asymmetries and public interest reasons, are subject to certain consumer protection and quality obligations. They require an authorisation, and to be eligible, they must meet certain credentials and technical and financial capabilities. Authorisations have an indefinite term or duration.

Finally as non-telecommunications services, there are Serviço de valor adicionado (SVA) value-added service providers, which do not require any authorisation or registration. Over-the-top platforms and applications belong here as

Table 7

CATEGORIES OF SERVICES IN THE BRAZILIAN REGULATORY FRAMEWORK				
Type	**Service**	**Legal regime**	**License type**	**Legal framework**
STFC	Fixed telephony	Public Private	Concession Authorisation	Law 9472. Law 13,879
SMP	Mobile telephony/ trunking/mobile broadband	Private	Authorisation	Anatel Resolution 477
SCM	Fixed broadband and leased lines	Private	Authorisation Waiver for PPPs	Anatel Resolution 614
SeAC	Pay TV, any technology	Private	Authorisation	Law 12485 and Anatel Resolution 581
SMGS	Global mobile satellite service	Private	Authorisation	Resolution No. 277 September 26, 2001

does a legacy internet connection service, which is an authentication of the user in the network that originated in the past, using dial-up services.[139]

All the above licensing regimes or exemptions are for the provision of services only. They do not include spectrum access. To use spectrum, a separate authorisation is required. Spectrum allocation to a private firm for collective services, is in most cases the result of winning an auction or bid. But for certain more restricted uses of spectrum like, for instance, a private network (SLP), it can be a direct light authorisation from Anatel or a situation where authorisation is not required as we will see further below.

In spite of the simplification and expediting efforts, players need an authorisation for each service, something that contrasts with the increasing convergent ecosystem. A class licence or blanket licence for any services that may be technically feasible to provide would be desirable, as recommended by the OECD review.[140] That would lower entry barriers to converged networks and markets but would require legislative amendments. Also, a specific regime for community networks is desirable, and could be achieved through Anatel regulation, since the SLP regime, as we will see below, is not entirely fit for purpose.

3.1.1 COLLECTIVE INTEREST SERVICES

The Brazilian framework recognised more than 60 types of services, which Anatel simplified and reduced to five large categories as explained in Table 7.

These are all commercial services, i.e. private sector providers offering any of the above services for profit, as a collective interest service. Here "private" is understood to be "private sector", as

[139] According to the OECD, this distinction poses some tax arbitrage problems, as some commercial providers operate as SVAs, totally unregulated, and compete with small providers of SCM that are fixed ISPs paying high local taxes.

[140] OECD. (2020). Op. cit.

provider of commercial services to the public, not private as in a private network, which is more what a restricted interest regime (SLP) embraces.

The LGT and Anatel differentiate collective interest services from restricted interest services depending on the recipients of the service, whether the general public can access them or if they are restricted to a limited group of users (like in a private network) that have something in common, for instance residents of a condominium. There are requisites for obtaining an authorisation for the provision of private, collective interest services (applicant must be a Brazilian company and prove certain qualifications or capabilities. The process is now simpler and takes around three weeks (down from six months). The cost of the licence fee was reduced from BRL 9,000 (USD 1,701.5) to 400 BRL (USD 75.63).

From 2020, authorisation holders for a given service do not need a new authorisation for each additional service to offer. They only need to register the new service with the Anatel data portal (*Banco de Dados*).

Another type of authorisation belongs to mobile virtual network operators (MVNOs). For "full MVNO" they require authorisation. Resellers only require a commercial contract with an MNO and a certification. The MVNO model in Brazil has not thrived. It accounts for a very low market share of 1% and number of factors could explain this.[141] A community MVNO (reseller) would be an interesting possibility for certain rural communities that could efficiently manage sales, operations, a local brand and customer service. However, that assumes that at least one of them has coverage in remote towns and villages where the community MVNO would be interested in offering mobile services under a not-for-profit special PRO. However this does not yet exist and other MNOs are refusing to offer roaming services to any MVNOs not associated with them under a national MVNO agreement. These very restrictive roaming and MVNO rules, or anticompetitive practices from MNOs, are huge barriers for small MVNOs and appear to be anticompetitive, as MNOs have incentives to raise barriers to MVNOs through limited or expensive roaming offers or demand exclusivity clauses which would freeze MVNOs. A full diagnosis of the MVNO agreements, roaming prices and conditions is important to identify what exactly is causing this mobile PPP to stagnate and whether there could be options for not-for-profit MVNO buying wholesale services at lower prices given the fact that they will not add a mark-up.

3.1.2 SMALL COLLECTIVE INTEREST PROVIDERS (PPPs)

An important achievement of Anatel, lowering entry barriers through eliminating the requirement of an authorisation, should be highlighted as it has triggered investment and competition by new local internet access players. Under the recent Resolution 720/2020, SCM providers who have no more than 5,000 subscribers need no authorisation from Anatel. This simplified regime for PPPs only applies if the network uses wireline (fibre, for instance) or if wireless, if it only utilises restricted radiation equipment.[142] To qualify as a PPP, an operator must have less than a 5% national market share.

[141] The 2020 OECD review explains in detail the barriers to MVNOs, especially in terms of roaming issues and pricing from the MNO.

[142] Resolution 614/2013.

The PPP asymmetric regime has been very successful in incentivising small ISPs, i.e. PPPs. It has increased coverage and fibre deployments throughout Brazil.

PPPs providing internet access as SCM small providers are expanding internet access using fibre optics, constantly increasing their market share. These providers are already present with optical fibre in 3,777 municipalities, of which 1,108 are served by only these small providers, i.e. 20% of the country's municipalities. PPPs accounted for 14,158,073 subscribers at the end of 2020, or 39% of all SCM accesses. They started offering Wi-Fi based access, and as they generated demand, they deployed fibre to homes, town by town.

It is worth mentioning, however, that PPPs have different arrangements for backhaul and are not subject to access obligations such as wholesale reference offers, as they do not have substantial market power.

The participation of all companies in the sector in this process is essential to identify which municipalities are already served, in order to prevent them from receiving any type of public funding, since they already have service. The registration and publicity of this information aims to promote transparency in the decisions of public agencies and also enable greater efficiency for the investments to be made (public and private).

The authorisation-free regime developed by Anatel for SCM PPPs (Resolutions No. 694 of 2018 and 720/2020)[143] and a very light regulatory burden regime, was an effective enabler for investment. They are serving medium-sized and small cities that were not served by large operators, and which now account for 29% of the fixed broadband market share. There are more than 17,217 FBB ISPs, out of which 6,243 are PPPs[144] (with less than 5,000 access lines each) across 3,777 municipalities, as mentioned above. If we consider only fibre-based fixed broadband, PPPs account for a 57.5% market share.[145]

Resolution No. 698 created the Committee of PPPs where industry, Anatel and the Ministry of Communications, among others, have a seat. There is a portal[146] with information and guidance resources for them.

First, it established a committee of small telecommunications service providers with Anatel (CPPP), as a space to recommend improvements to the applicable regulations, consolidating the demands of the small providers' sector and proposing measures to stimulate the provision of the service. The committee, on a permanent basis, aims to advise Anatel's board on:

- Regulatory improvements
- Consolidation of the demands of the sector represented by its members
- Preparation of studies and propose measures to stimulate the provision of services by small providers.

The committee is responsible for:

- Monitoring the emergence of new technologies to evaluate their impact on the aspects of convergence, competition and network expansion in the provision of telecommunications services in the country.

[143] https://www.anatel.gov.br/legislacao/resolucoes/2018/1159-resolucao-698

[144] https://informacoes.anatel.gov.br/paineis/outorga-e-licenciamento

[145] https://informacoes.anatel.gov.br/paineis/acessos/panorama

[146] https://www.gov.br/anatel/pt-br/regulado/prestadoras-de-pequeno-porte

- Proposing training actions in matters directly or indirectly related to the provision of telecommunications services by small businesses; technical assistance, guidance for compliance before Anatel and applications procedures.
- Commenting on proposals in rule-making inquiries related to the promotion of the activities of small suppliers, and other cases that it deems pertinent.

IDEA 10

Anatel may also open a dialogue and support space for community networks through a community network committee where unserved and underserved communities can be listened to and proposals for community networks may be presented to Anatel. A portal specific for community networks within the Anatel website, with all the information, manuals, guidance for registration, authorisations and compliance, authorisations-not-required cases, spectrum frequencies options for community networks; data and maps with backhaul facilities and other needed infrastructures, would be extremely helpful.

WHO QUALIFIES AS A PPP?

According to Resolution 694, an economic interest group with a national market share of less than 5% in each retail market in which it operates, would qualify. In turn, Act 6,539, of October 2019, stated that the providers not belonging to the economic groups of Telefónica, Telecom Americas (Grupo Claro), Telecom Italia (Grupo Tim), Oi and Sky / AT&T are considered small providers. A PPP may provide any of the following service categories: multimedia SCM (multimedia communication services); STFC (fixed telephone service); SMP (personal mobile service) and SeAC (conditional access service or pay TV). The purpose of the PPP guidance portal is to assist new entrants with their compliance process, including obligations before FUNTTEL (MCTIC) and Condecine (Ancine). See Table 8.

3.1.3 RESTRICTED INTEREST PROVIDERS (NON-COMMERCIAL REGIME): IS THE LIMITED PRIVATE SERVICE (SLP) REGIME FIT FOR PURPOSE?

In 2020, the SLP system became the regulatory door which Anatel opened for community networks, when it declared that the SLP category would be the vehicle through which community networks could operate in Brazil, as private, restricted services. However, community networks, especially those of Indigenous, Afro-descendant, and other vulnerable communities, may need more enabling affirmative action than a SLP framework can offer. Both registration and authorisation procedures, that require online engagement using a digital signature, raise a barrier for these communities. The obligation to retain a CREA engineer that has to certify or endorse the technical project and procedures and fees for equipment registration were also identified as barriers. Anatel could consider another

Table 8

LICENSING REGIME FOR PPPS UNDER DIFFERENT SERVICE CATEGORIES (ALL OF COLLECTIVE INTEREST)					
PPP service	**Authorisation required**	**Exemption of authorisation**	**Registration at Mosaico (prior)**	**Compliance with: (regardless if exempt of authorisation)**	**Fees, duties, FUST, FUNTTEL contribution**
SCM	+5,000 access subscribers	Up to 5,000 subscribers, no use of numbering resources, no use of spectrum (only cable, fibre or other confined networks or use of spectrum with restricted radiation equipment)	Yes. To be renewed annually and duty to keep registration information updated.	Consumer protection= simplified obligations if less than 5,000 subscribers +5000 means accessibility obligations; QoS indicators; notice of service interruptions.	BRL 400 (USD 75) for authorisation FUST contribution. If Simples National regime then exempt If not exempt then 1% gross revenues to FUST and FUNTTEL=0,5%: Exempt if Simples National. Others: 0,5% gross income TFI for licensed radiocommunication equipment and TFF annually
STFC	Authorisation	As above	Yes	As above	As above
SMP	Authorisation	As above	Yes	As above	As above
SeAC	Authorisation	As above	Yes	As above	As above

more affordable technical endorsement of community networks projects without barriers, especially in cases where an SLP authorisation is unnecessary. Above all, the limited scope of services, equipment and frequency bands that the SLP regime can offer communities, subject to high spectrum fees, makes it a non-adequate regulatory vehicle to enable community networks. We look at the reasons below.

Article 75 of LGT provides that:

The telecommunications activity restricted to the limits of a building or movable or immovable property will not require a concession, permission or authorisation, subject to the terms defined by Anatel.

A few years after the LGT came into force, authorities laid out in a FAQ document (2003) the scope and examples of typical SLP uses, portraying the context and vision that authorities had at that time for SLP (both SLP and SLE).[147]

Limited service was defined as “a telecommunications service destined for the private use of applicant (SLP) or for the provision to third parties who

[147] https://www.anatel.gov.br/Portal/verificaDocumentos/documento.asp?numeroPublicacao=200634&assuntoPublicacao=null&caminhoRel=null&filtro=1&documentoPath=200634.pdf

are members of a given group or entity that carry out a specific activity (limited specialised service SLE)". A natural person or a legal entity often interested in installing a private network could apply SLP although it was not the only service.

A private network is a non-public service for the purpose of facilitating telecommunications to a single person or group of persons through an entity (the applicant) through distributed points, in the fashion of a private network. That is why it is classified as a restricted interest service, it is not a carrier, and does not offer services to the public.

According to the FAQ document, the typical uses of this private network where radio frequencies were used, are PtoP or PtoMP links using both public and private transportation services: for police, firefighters, rural plantations linked to remote urban premises, cooperatives, highways, railways, electric power companies, different public entities in municipal, state or federal jurisdictions.

SLP private networks may also be wired, using fibre for instance, as long as their use is restricted, for private purposes and a well-defined group of users exists, but these are more complex as they could require rights of way or access to ducts or poles to deploy the fibre.

As to the question of whether there is a geographical limit to the coverage of an SLP network, the 2003 document states that both the authorisation for the SLP and for the radio frequencies to be used may cover cities, municipalities or regions depending upon the terms and conditions of each authorisation. If, however, all users to be communicated are in the same "edification or property whether movable or immovable", then both authorisation and registration are not necessary.[148]

Radio taxis, warehouses, condominium dwellers, buses, trains, trucks, safety crews, agrobusinesses, earth exploration through satellite links, scientific applications, are examples of these restricted services in different bands.

These applications seem aimed at urban uses or for industrial, scientific and medical applications and we found no evidence that uncommunicated community members in rural and remote areas were originally considered as possible users of SLP to provide themselves an adequate means of telecommunication where none is available. However, as we saw in Section 2, private networks are exactly what many community networks are: for example, the mobile network owned by indigenous communities in Oaxaca, Mexico,[149] communities with a licence to use spectrum in the 850 MHz band for a private, non-profit wireless service (voice and text) to communicate internally and with all users of other communities that are also members of the network.

With this background in mind for SLP, Anatel passed Resolution No.617/2013 10 years later, which regulates SLP together with a number of other regulations dealing with frequency allocation for wireless SLP, equipment licensing and certification, among others.

Article 3 of Resolution 617, defines SLP as:

> A telecommunications service, of restricted interest, operated nationally and internationally, in a private regime, intended for the private use

[148] Articles 12 and 13, Resolution 720/2020.

[149] Telecomunicaciones Indígenas Comunitarias (TIC A.C.) https://www.tic-ac.org

> of the applicant or to be provided to members of a given group, selected by the provider according to criteria established by it, and covering multiple applications, including data communication, video and audio signals, voice and text, as well as the capture and transmission of scientific data related to satellite earth exploration, meteorological assistance, satellite meteorology, space operations and space research.

The authorisation to operate the SLP is issued by Anatel for an indefinite period of time as it is not considered to be a commercial or for-profit activity since it is a means of self-provision or group provision of certain communications services.

According to the LGT and Article 12 of Resolution 720/2020, an SLP authorisation is not required for

> Such restricted interest telecommunications activities confined to the limits of a single building, including condominium properties of any kind or movable or immovable goods or properties, except if using radiocommunications equipment that is not deemed as restricted radiation as defined by Resolution 680, which regulates restricted radiation equipment.

In contrast, when an SLP service intends to reach users beyond a single property or condominium using a support network either wired or through radio equipment of restricted radiation, and no numbering is required, then Anatel may also exempt the applicant on a case by case basis. To that end, an applicant must register in Mosaico before it starts operating and update information annually as well as comply with Anatel 's regulations on service and radio communications equipment.[150]

According to Anatel data, there are 15,465 registered/authorised SLP providers, most of them with an authorisation, a minority with an exemption. When one searches how many SLP authorisations and exemptions have been granted in several Northern, Northeast and Western states,[151] the total is 3,049, (2,992 authorisations and 57 exemptions) that is, around 20% of the total. Again, the states with less connectivity are not using the SLP regime as much as the other regions as there are so many restrictions for the exemption and limitations to the kind of services that a SLP may provide.

Is the profile of SLP users nowadays more that of an urban dweller or business perhaps? Are those SLP just an ancillary service for internal

---

[150] Resolution 720/2020, Article 12. Telecommunications activities that are restricted to the limits of a single building, including condominiums of any nature, or movable or immovable property, do not require authorisation, except when they involve the use of radio frequencies through radiocommunications equipment that do not meet the definition of restricted radiation.
Art. 13. Authorisation for the exploitation of telecommunications services is waived in cases in which the supporting telecommunications networks use exclusively confined means and/or radio communication equipment with restricted radiation, provided that numbering resources are not used for that provision.
§1. In the case of collective interest telecommunications services, the exemption provided for in the heading of this article applies only to those providers with up to five thousand (5,000) accesses.
§ 2. Service providers that benefit from the waiver provided for in the heading must notify Anatel prior to the launch of their activities through Anatel's own electronic system.
§3. The exemption provided for in the heading does not exempt providers from their obligation to comply with all conditions, requirements, and duties established in primary and secondary legislation.

[151] Sergipe, Roraima, Rondônia, Rio Grande do Norte, Piauí, Pernambuco, Pará, Maranhão, Ceará, Amapá, Amazonas and Acre.

communication of crews, landlord owners, public safety officers, logistics and transportation corporations that also have access to collective interest services in urban areas?

From the long list of SLP entities including persons, corporations, commercial venues, we cannot assume they are for the use of unconnected rural communities, although there may be a few. The name of the licensed or licence-exempt entity may be indicative of the nature of services but not always; and we can definitely not know how many of these 15,465 SLP are for the use of a rural community in the form of a community network as a community-owned and -managed infrastructure.

We consider that it is important to assess the barriers or limitations of the SLP regime in detail, including spectrum access, for different types of Brazilian communities. During our interviews with communities, they mentioned that the legal procedures, the online application or registration, the need for a digital signature and (at that time) an engineer to certify the project, were obstacles, especially in areas where no access is available and they do not therefore interact digitally with authorities. According to the Inter American Court of Human Rights, the impact on some vulnerable groups is to de facto restrict their freedoms and exacerbate exclusion.[152] A community network-specific regulatory regime (including use of spectrum) would be able to address such obstacles in a way that application requirements and procedures are simple, culturally pertinent and easy to comply with. Indeed the authorisation and registration exemption are a good start but because they only apply for SLP seeking connectivity within a property which uses equipment of limited radiation, unless Anatel interprets that homes in a single rural community are analogues of a condominium, these authorisation/registration exemptions may not benefit rural communities and they would have to at least seek registration and also would remain restricted in terms of access to licensed bands, and prevented from demanding data interconnection, numbers, access wholesale markets of backhaul and internet.

Looking at Resolution 617/2013 and Resolution 680/2017 we highlight:

- A long list of frequency bands that may not be used by restricted radiation equipment (Article 70. Resolution No. 680/2017).[153] See Table 9.
- The frequencies that may be used with restricted radiation equipment – and are thus authorisation exempt under article 75-A of PERT – have strict power and distance limits.[154] See Table 10.

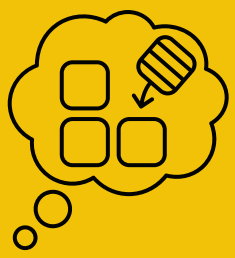
[152] Narsene Dorzema et al. v. Dominican Republic, Ruling of 24 October 2012, para. 234, 235.

[153] https://informacoes.anatel.gov.br/legislacao/resolucoes/2017/936-resolucao-680#tabelal

[154] Regulation on restricted radiation radiocommunications equipment – Art. 2-II. Restricted radiation radiocommunications equipment refers to any equipment, apparatus, or device that uses radio frequencies for various applications, and which have emissions producing an electromagnetic field with an intensity within the limits established in this Regulation, and meet the technical requirements for certification.

- All equipment used requires an Anatel-approved certification number to be publicly visible.[155]
- Very specific scientific applications such as earth exploration, science, transportation, communication among crews or fleets, urban business internal communications and radio taxis were the services that originally triggered the SLP regime.
- Prohibition to interconnect with other SLP or with collective interest networks although a support network of an SLP may be connected to the internet as long as it uses unlicensed spectrum and transmitters are restricted – radiation equipment, otherwise it would need an authorisation for use of frequencies for instance for PtoP links that may not be destined for SLP.
- No right to access the wholesale markets of services and infrastructures, as SLP are non-commercial networks and do not qualify for accessing public reference offers.

INSIGHT 5



The last two items are important restrictions of the SLP regime that hinder community network development. Because SLPs were explicitly allowed to provide internet access, interconnection to exchange data traffic should not be prohibited and therefore this would enable accessing wholesale internet market instead of buying retail internet packages.

[155] Art. 4. Restricted radiation equipment operating as established in this Regulation must have a certification issued or accepted by Anatel, in accordance with Anatel's regulations.
Art. 5 Restricted radiation equipment must display, in an easily visible place, or in a prominent place in the instruction manual provided by the manufacturer, information on the implications of its operation, in the following terms: "This equipment is not eligible for protection against harmful interference, and must not cause interference in properly authorised systems."
Art. 5-A. SLP exploitation does not depend on authorization in cases where the telecommunications networks supporting the exploitation of the services use exclusively confined means and/or radiocommunications equipment with restricted radiation.
§1. Service providers that benefit from the waiver provided for in the heading must notify Anatel prior to the launch of their activities through Anatel's own electronic system.
§2. Service providers that benefit from the waiver provided for in the heading must update their registration data every year by January 31, through Anatel's own electronic system.
§3. The exemption provided for in the heading does not exempt providers from the obligation to comply with the conditions, requirements and duties established in the legislation and regulations (amended wording).
Art. 6. All restricted radiation equipment must be designed to ensure that only the antenna sold with the equipment is used, except under specific conditions described in the technical requirements for product certification.

Table 9

RADIO FREQUENCY RANGES WITH USAGE RESTRICTIONS[156]			
MHz	**MHz**	**MHz**	**GHz**
0,09-0,11	16,69475-16,69525	1.435-1.646,5	10,6-11,7
0,495-0,505	16,80425-16,80475	1.660-1.710	12,2-12,7
2,1735-2,1905	21,87-21,924	2.200-2.300	13,25-13,4
4,125-4,128	23,2-23,35	2.483,5-2.500	14,47-14,5
4,17725-4,17775	25,5-25,67	2.690-2.900	15,35-16,2
4,20725-4,20775	37,5-38,25	3.260-3.267	20,2-21,26
6,215-6,218	73-74,6	4.200-4.400	22,01-23,12
6,26775-6,26825	74,8-75,2	4.800-5.150	23,6-24
6,31175-6,31225	108-138	5.350-5.460	31,2-31,8
8,291-8,294	149,9-150,05	8.025-8.500	36,43-36,5
8,362-8,366	156,52475-156,52525	9.000-9.200	38,6-46,7
8,37625-8,38675	156,7-156,9	9.300-9.500	46,9-57
8,41425-8,41475	242,95-243		71-76
12,29-12,293	322-335,4		Acima de 81
12,51975-12,52025	399,9-410		
12,57675-12,57725	608-614		
13,36-13,41	960-1215		
16,42-16,423	1.300-1.427		

Table 10

GENERAL EMISSION LIMITS (FOR RESTRICTED RADIATION EQUIPMENT)		
Radio frequency band (MHz where not specified)	**Electric field strength (microvolt per metre)**	**Measure distance (metres)**
9-490 kHz	2400/*f*(kHz)	300
490-1705 kHz	24000/*f*(kHz)	30
1,705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

[156] Commas indicate decimals to the right. Source: https://informacoes.anatel.gov.br/legislacao/index.php/component/content/article?id=1411

If other radio frequencies are to be used by an SLP holder with equipment that is not of restricted radiation, then prior authorisation must be obtained from Anatel, pursuant to Section 163 of the LGT. Technical conditions are established by specific regulations (Resolution No. 671/2016) depending on the band of interest.

We believe that other service categories, mainly SCM, SeAC and SMP, should have a special category and regulatory framework for community networks acting as non-profits, as the SLP regime may not address the needs of every community wishing to connect its members. Furthermore, a specific community network regime would be fit for purpose. The SLP regime addresses other non-commercial communication needs which relevant for internal communications of different kinds of groups or organisations but was not created for connecting people in communities with broadband services, telephony, or radios, and therefore an ad hoc licensing and spectrum access regime should be considered, so that communities can connect themselves when market or government options are absent, unaffordable or inadequate for them. Given the technology innovation in access networks, fibre, spectrum sharing and open-source software and hardware, communities now have technology options.

Community networks may need to access spectrum in different bands, for different services, not only Wi-Fi based internet access, any other where low-cost equipment is available, both for access and backhaul.

APPLICABLE FEES AND ESTIMATED COSTS TO OBTAIN AN SLP AND/OR SPECTRUM AUTHORISATIONS

When applying for an SLP authorisation, fees apply for the right to exploit telecommunications services (PPDESS) and, when radio frequencies are used, fees are paid for the right to use radio frequencies (PPDUR). There is no fee when an authorisation is not required. However, the registration of transmission stations of SLP authorisation-exempt providers is also mandatory. We have identified the estimated costs of official and private fees for obtaining an SLP authorisation or registration in Table 11.

Table 11

FEES AND COSTS FOR SLP AUTHORISATION OR REGISTRATION	
Service authorisation fee (PPDESS)	SLP – BRL 20 (USD 3.75)
Mandatory registration (STEL) for SLP covering more than a single property) (Dispensa Autorização / Radiação Restrita)	Free
Spectrum use authorisation fees (PPDUR) Resolution 695/2018 Art. 4 **Limited mobile maritime and limited mobile aeronautic (SLMM, SLMA)** **Limited private service (SLP)** **For federal, state and municipal governments and judicial and legislative branches and public foundations, the fees for SLP spectrum use have[157] a discount of 90%.** **Citizen radio, amateur radios (CR, AR)** **Community broadcast radio**	For SLMM, SLMA (limited mobile maritime and limited mobile aeronautics) BRL 100 (USD 18.75) per authorisation of use of spectrum for a period of 10 years. For SLP, fees vary according to several factors considered in a formula: bandwidth, coverage area, region, population to be served, duration of use. It may be estimated per station or per area.[158] In the case of frequencies adjacent to the licence-exempt bands, the value was around BRL 1,100.00 (USD 206) per station. (Interviewee said). For CR, AR, BRL 10 (USD 1.87) per authorisation of frequency for a 20-year period. For community radio/ station BRL 100,00 (USD 18.75) for up to 10 years.
Engineer certified with CREA for the spectrum use authorisation per transmission equipment (required at the time of writing)	This value varies. However, in the Mercado Livre e-commerce platform, there were professionals charging between BRL 250 and BRL 400 (USD 46.87 and USD 75) to get the first licence, as it had become a market.

[157] Art. 5. Direct public sector bodies within any branch of federal, state, municipal, or federal district governments shall be granted a 90% discount on the sum obtained through the formula contained in Art. 4 of this Regulation.

[158] Anatel. (2019). Amendments to PPDUR. https://sistemas.anatel.gov.br/anexar-api/publico/portal-publicar/documentos?numeroPublicacao=349559

3.2 SPECTRUM MANAGEMENT: PLANNING, ALLOCATION AND ASSIGNMENT

Spectrum management is subject to Resolution 671 (2016), Spectrum Use Regulations (RUE),[159] which specifies authorisation requirements, exemptions, and more generally the country's objectives and principles in spectrum management.

Principles:

- The fact that radio-frequency spectrum is a limited resource, constituting a public good, managed by the Agency.
- Efficient and adequate use of the spectrum.
- Rational and economic use of the spectrum.
- Expanded use of telecommunications networks and services.
- Authorisation for the use of radio frequencies for consideration.

Objectives:

Article 2 The regulation of the use of radio frequencies has as its main objectives:

- Promote national development, especially for the exploitation of telecommunications and broadcasting services.
- Ensure that the entire population may have access to telecommunications and broadcasting services.
- Democratise access to the radio-frequency spectrum, in order to stimulate social and economic development.
- Serve the interests of national security and defence.
- Enable the exploitation of educational, general and public interest information and entertainment services.
- Facilitate the development of scientific research.

The highlighted principles and objectives are important as a legal foundation for new paradigms aimed at a more democratic access to spectrum where there is market failure, where commercial operators are leaving licensed spectrum underutilised in areas where the return on investment is low. Even where large operators have coverage obligations as a result of an auction design or TAC agreements, their operating expenses may be huge in remote areas with extremely difficult access. The absence of roads, energy or sufficient revenues for a large-scale company often make them give up or cover only the centre of each municipality but no further. In such and similar scenarios, there is a third option (the second, state provision of service on a top-down scheme, is seldom sustainable): to allow local, unserved communities to use that spectrum and operate a not-for profit community network as a local wireless network teaming up with the operator who holds the spectrum licence, for instance, for roaming purposes, backhaul, numbering, capacity building, etc. Local access through spectrum sharing in the IMT bands is proving a successful model in rural England where Ofcom is granting local licenses for wireless broadband and private LTE networks for an annual, affordable fee. The community networks may also partner with PPPs so that they provide wholesale internet access and transit through their fibre network increasing traffic, and therefore revenues. It may be a win-win solution.

[159] Anatel. (2016, 2 November). Resolution 671. https://informacoes.anatel.gov.br/legislacao/resolucoes/2016/911-resolução-671

SPECTRUM BANDS ATTRIBUTION, ALLOCATION AND ASSIGNMENT

Under the current state of affairs, following ITU guidelines, Anatel publishes a Spectrum Attribution, Allocation and Distribution Plan[160] (Plano de Atribuição, Destinação e Distribuição de Faixas de Frequências no Brasil). This is updated regularly and includes the telecommunication and broadcasting services that have been attributed by ITU-R to a given band range as primary or secondary service in a given region of the world (Brazil is in region 2). It also includes Brazil's distribution of different blocks, channels or sub-bands within a band for different services, including SLP services, where community networks may find a regulatory entrance. This plan was approved by Resolution 716.[161]

Once bands and channels within bands have been attributed and allocated to different service categories and distributed among them, Anatel may assign bands or frequencies through an auction, or through direct authorisations where supply is higher than demand and for authorisation-exempt bands, such as WI-FI, where authorisation is not required but the equipment using the band must in most cases be registered at Anatel, as seen in Section 3.1.2 above with SLP.

3.2.1 SPECTRUM FOR COLLECTIVE INTEREST (COMMERCIAL) SERVICES

When more than one entity is interested in a given spectrum band for collective interest services, spectrum is assigned through an auction in accordance with an attribution previously published in the attribution plan. Authorisations for spectrum for SMP services previously lasted 15 years and could be renewed for a similar term, with payment of a fee equivalent to 2% of the licensee's revenues within the authorisation area. Under Law 13879 of October 2019, spectrum authorisations may be renewed indefinitely even if someone else is interested in those frequencies. This is a concern for competition goals and for spectrum efficiency goals if the operator is underutilising the authorised frequencies.[162] Eleven spectrum auctions took place in Brazil from 1997 to 2015. More than 480 MHz have been placed in the market for IMT bands. Since 2008 Anatel has included coverage obligations in the auctions except in the 700 MHz auction, which is surprising as it is a "coverage" band. Coverage obligations have been a positive tool in expanding coverage to several municipal seats or cities but not in smaller and remote villages). It should be noted that for the 5G bands to be auctioned this year by Anatel, the proposal now being reviewed by the Federal Courts of Accounts (TCU), is to cover the spectrum price in 90% with investment in deployment, and only 10% in a monetary bid together with rural and roads coverage with 4G networks.[163]

Current spectrum caps are 35% for bands under 1 GHz and 30% for bands between 1 to 3 GHz.[164] Anatel has also included obligations to use Brazilian equipment or software in some auctions, except in the last auction of 2015.

---

160 Ibid.

161 Ibid.

162 One area of concern, especially for coverage targets, is the 450 MHZ band that was authorised to winners of the 2.5 GHz auction for coverage purposes but for eight years remained unutilised due to lack of equipment for LTE in those years. Later on the SMP like Vivo challenged Anatel's order, demanding the return of the band. If they win the case they may keep it, whether they use it or not, and with indefinite renewals, operators may concentrate unutilised spectrum to the detriment of the public interest. For more on this band see the OECD 2020 review, pages 164-165.

163 OECD. (2020). Op.cit.

164 Anatel. Resolution 703/2018. https://informacoes.anatel.gov.br/legislacao/resolucoes/2018/1178-resolucao-703

Auctions are only open to collective interest operators, that is, commercial providers that need spectrum to provide public services. Both SMP – wireless fixed and mobile services – and SCM – mainly high-capacity internet services – are reserved for commercial entities, therefore excluding community networks from offering those to their communities.

3.2.2 SPECTRUM FOR RESTRICTED INTEREST PROVIDERS (SLP: PRIVATE NETWORKS/NON-COMMERCIAL SERVICES)

As an authorisation-exempt SLP, community networks are only entitled to use spectrum without the need of prior authorisation when using restricted radiation equipment in different bands, namely Wi-Fi. It is true, as you can appreciate in Appendix 1 that several bands or band segments have been attributed or even destined for SLP services or to "all telecommunications services" but actually being granted an authorisation to use spectrum with non-restricted radiation equipment for a community network holding SLP status, is not free of challenges.

This again impacts negatively on community networks, together with the fact that as an SLP a community network may not provide mobile or multimedia services because these are reserved for commercial providers.

As mentioned above, the Attribution Plan does however list a number of bands, sub-bands or channels as attributed and destined for fixed or mobile SLPs (as primary or secondary service). Such a list is included as Appendix 1. We included the bands across the spectrum that we considered could be relevant for community networks under a SLP regime, thus excluding radio aeronautics, meteorology, radio navigation, mobile maritime and space exploration and earth exploration that are not of community network interest.

Bands that are very important for community network backhaul, PtoP and PtoMP links for instance, such as the 11 GHz band do not appear attributed for SLP specifically.

Thus, we emphasise the need of a specific service and spectrum regime for non-profit players such as community networks that may enable any mobile or fixed communications service to be offered on a non-profit basis to communities by communities. Currently, internet access by an SLP is only possible through Wi-Fi bands. For other services, challenges prevail.

Under Article 7 of Resolution 671/2016,[165] the use of a radio frequency, band or radio frequency channel is reliant on the previous existence of an attribution to a radiocommunications service which has also been allocated to one or more telecommunications or broadcasting services or application in Brazil, compatible with the intended use.

Exceptionally, under Article 7A,[166] Anatel may authorise the use of a frequency,

[165] Anatel. (2016). Resolution 671. Op. cit.

[166] "Art. 7-A. Anatel may exceptionally authorise the use of radio frequencies, or radio-frequency channels or bands, without prior allocation to intended services, for a period not exceeding five (5) years, provided that this is associated with the exploitation of telecommunications services of restricted interest, in a limited geographic area, according to criteria defined by Anatel through a relevant Superintendency Act, after evaluation of technical feasibility.
§1 The authorisation referred to in the heading of this article shall preferably be issued to meet the need to implement telecommunications systems in areas not covered by collective interest services.
§ 2 The authorisation provided for in the heading of this article cannot be used for the purpose of fulfilling an obligation relating to the implementation and/or expansion of telecommunications networks for the provision of collective interest services.
§ 3 In the event described in the heading of this article, the operation of radio communications stations may not cause harmful interference or claim protection against harmful interference from any regularly installed system."

band or channel without prior allocation to the intended service, for a period not exceeding five years, provided its use is associated with the operation of telecommunication services of restricted interest, SLP, in a defined geographic area according to criteria defined by Anatel's competent superintendent after an evaluation of technical feasibility. In such cases the temporary authorisation for secondary use is provided by Article 7A. There are few cases of community networks under the SLP regime that have been authorised to use certain frequencies under Section 7A. This spectrum framework is not consistent with the principles and objectives of the democratisation of spectrum access, service universalisation and technological neutrality. Community networks need to have access to both licensed and unlicensed bands for access and backhaul, to provide different radiocommunication[167] services, not only internet access, where there is availability either because the band or frequencies have not been assigned or because the authorised operator is not using the band in certain towns and villages and thus Anatel may order that it is shared on a secondary basis, not as a lease but for universal service goals, on a non-profit basis.

3.3 SHARED SPECTRUM

3.3.1 AUTHORISATION-EXEMPT SPECTRUM WHEN USING RESTRICTED RADIATION EQUIPMENT

Wi-Fi has been a success story around the world when it comes to expanding affordable internet access, benefited both consumers and providers. It can be used both as a first-mile (access) technology and for PtoP or PtoMP links, that is, as a backhaul technology. When regulations were modified in the United States allowing certain bands, mainly 2.4 and 5.8 GHz to be used for internet access on a secondary basis along with industrial, scientific and medical uses as primary uses, this launched the global standard for the wireless connection of devices, with huge economic and social impact. Then states developed their own technical rules: power limits, frequencies, for equipment using such standards in order to avoid harmful interference. Interestingly, such rules differ somewhat from country to country as seen in Appendix 2. Brazil has higher restrictions in the 5 GHz band for backhaul links that are very important for community network connectivity. Anatel could consider relaxing those power limits, perhaps in the upper segment of the 5 GHz band.

As to Wi-Fi 6E, this was a major accomplishment by Anatel, releasing all 1,200 MHz in the 6 GHz band as spectrum for indoors Wi-Fi 6E. This allows the use of the spectrum on an authorisation-exempt basis when using restricted radiation equipment. Since part of the band is intensively utilised by satellite operators in Brazil, sharing it for backhaul links may require a dynamic spectrum technology using automated frequency control, that is, a database that manages opportunistic spectrum sharing, as the United States decided for this band using light licensing and a database to avoid interference with satellite and fixed service providers.

[167] In Brazil there is no frequency band with use exempt from authorisation, as a whole. For this to occur, it is necessary that the equipment to be used in the band is radiation restricted, according to technical characteristics that vary from band to band.

3.3.2 SPECTRUM SHARING IN IMT BANDS FOR LOCAL ACCESS

Spectrum sharing between a primary user and a secondary user of a band, frequency or set of frequencies is regulated by RUE. It defines sharing as the use of a band, frequency or channel by more than one service provider in the same geographic area, simultaneously or not and without causing any harmful interference between them.

A primary user has the right to protection from a secondary user who has no such right except from other secondary users.

Interestingly, Article 19 §2 of RUE provides that a primary user of spectrum, with coverage obligations, has no obligation to allow spectrum sharing to a secondary user, but is allowed to do so. If he has no coverage obligations then Anatel may unilaterally authorise a secondary user according to the following rules:

The interested party would notify the primary user of his/her intention to use the spectrum. If the primary user does not reply within 90 days, explicitly stating a specific date when she will start using the spectrum on a primary use basis, then Anatel may authorise secondary use for a period to be determined in each case. Anatel may even authorise such use until the date on which the primary user starts using it. The interested party must appear before Anatel to submit her application once she has notified the primary user.

The main problem with this framework is that an already authorised secondary user will stop using the spectrum six months after receiving notice from the primary user saying that he intends to use it. This may disincentivise any possible user in a secondary capacity, from investing in such use if it may be recalled by the primary user. Currently Anatel is reviewing RUE to evaluate a possible extension of up to five years, as the current six months' notice is extremely short. This is an ongoing debate at Anatel.

Large commercial operators claim that voluntary sharing among MNOs (SMP) through RAN sharing is the only sharing that makes sense. Instead of deploying infrastructure in rural or less profitable areas, operators agree to use each other's spectrum and access another's network to expand their services using a competitor's network for efficiency reasons, or so they claim. These agreements have proliferated since they are mutually beneficial to MNOs. However, spectrum sharing of licensed spectrum of such SMP not using it in certain rural and remote areas is less likely to occur because community networks may currently not be mobile service providers (SMPs) but only SLP. As we will see in Section 5 this may be a wonderful opportunity to implement convergence and expand mobile services to rural and remote areas through community networks that, using SMPs' unused spectrum, could provide local access to their communities. An outstanding example is Ofcom's Local Access Licence in nine different IMT bands already licensed nationally. Applicants file a request for spectrum sharing, indicating purpose, frequency band, bandwidth, power and location. Ofcom contacts the primary user MNO and grants a licence for three years subject to a one-time fee of £950 on a secondary use basis. The licence can be extended only if the primary user agrees.[168] Shared access licence is another shared spectrum innovation in

[168] https://www.ofcom.org.uk/__data/assets/pdf_file/0037/157888/local-access-licence-guidance.pdf; in addition, https://www.internetsociety.org/wp-content/uploads/2020/06/Siew-Yoon-AUC.pdf provides an overview of other Ofcom decisions regarding spectrum sharing in other bands, called shared-access bands.

the 1800 MHz guard band: 2390-2400 MHz, 3.8-4.2 GHz and 26 GHz bands, where managed by Ofcom and after an interference risk assessment, it can license shared use on a first-come-first-served basis, and affordable fees of £80 or £320 a year.

For the upcoming Brazilian spectrum auction of four bands, for 5G networks, an interesting provision appears in Anatel's proposal. The winners shall have a *primary use, non-exclusive allocation of frequency blocks*. That means that secondary use of spectrum is a possibility. However, under Section 10.1 of the Anatel document it appears as if such secondary use will be subject to a secondary market regime, something similar to spectrum lease, "Radiofrequências nas faixas de 700 MHz, 2,3 GHz, 3,5 GHz e 26 GHz" (5G spectrum). This has not been an efficient solution in other countries in the region, due to the high transaction costs for commercial operators, and unwillingness to foster more competition. This primary-user management of spectrum sharing would also probably not be affordable for community networks. An Anatel-managed spectrum-sharing mechanism would secure access to such networks in critical areas to be covered, if authorised at affordable prices:

> 10.1. The winning bidder shall, as of 1 January 2026, issue and keep available a public offer of the right to use radio frequencies, referring to the sub-range of the corresponding lot, in all municipalities where there is no use of it, in a system indicated by Anatel, with a view to allow the use of the band, on a secondary basis, by an interested third party, observing the provisions of the Radio Frequency Spectrum Use Regulations approved by Resolution No. 671, of 3 November 2016.
>
> 10.1.1. In the case of the radio frequency sub-range from 3,300 MHz to 3,700 MHz, the obligation provided for in this item will only be due after 2 (two) years from the dates defined for the beginning of its use, pursuant to item 6.3 of this Annex IV.

Our recommendation is to phrase it as a secondary use clause, not subject to a commercial public offer by the operator. Instead, Anatel's authorisation under the rationale of use-it-or-share-it policy applies and a reduction in spectrum-use fees for the primary holder.

Setting aside spectrum for community networks is also a good incentive to promote deployments. This was the case in Mexico where some bandwidth was reserved for IMT in rural towns and villages. The Mexican regulator IFT issues an annual frequency allocation plan for all types of uses: commercial, public, private and social, meaning community and Indigenous broadcasting and telecommunications. In the case of the IMT spectrum for Indigenous community networks, in 2015 IFT destined 10 MHz in the 850 MHz for Indigenous wireless access licensees in rural towns and villages with fewer than 2,500 people. TIC A.C. was the first Indigenous non-profit to apply. It was first awarded an experimental licence and then the spectrum licence plus a convergent licence (all services included) to provide any other services on a non-profit basis. TIC has 18 sites connecting 64 Indigenous communities. More recently they have applied for more spectrum to upgrade their network to 4G.

In Brazil, although there is an allowance in the Spectrum Use Regulations (Article 36, § 2, I) to reserve frequency bands or sub bands for "social and digital inclusion projects", frequency sharing today does not include sharing with SLPs, only between collective interest providers (commercial providers).

3.3.3 SPECTRUM SHARING IN TV WHITE SPACES

In 2020 Anatel opened a public consultation to regulate the introduction of dynamic sharing spectrum called TV white spaces, which utilises the idle spectrum allocated for over the air television broadcasting as its primary use, for use on a secondary basis to provide voice, broadband and SLP services. Anatel's commissioner Emmanoel Campelo spoke of the VHF and UHF bands in rural areas[169] and mentioned that in these areas, where there is less use of such frequencies for TV, the potential benefits are higher.

The key issue in authorising this secondary use for rural access is whether the technology is cost efficient in low-income areas, that is, whether the equipment is fit for purpose. In the meantime, authorising secondary use of white spaces subject to rules and a light authorisation in cases where risks of interference are very low, could be explored by Anatel after conducting the necessary tests in rural and remote areas.

INSIGHT 6

According to these rules, if a community network under the SLP regime were to need PtoP links for backhaul using a band subject to authorisation, for instance, to transport traffic from the access networks to the nearest IXP or point of presence, it would need to invoke article 7A and find available frequencies (e.g. 7 GHz band) for such links and if not already destined to that purpose in the plan, seek authorisation for up to five years in the hope that during that time the regulator would destine some channels for this use for SLP. Understanding the radio communication needs of different communities in remote and protected territories, to identify certain frequencies and bands that are of their interest so that Anatel may destine them to SLP in the plan, would be an enabling practice towards democratising spectrum access for the unconnected.

We understand that the rules for spectrum sharing and for a secondary use of spectrum are undergoing a thorough revision within Anatel. This is a unique opportunity to enable affordable access to spectrum in HF, VHF, UHF, IMT and microwave bands for rural communities where spectrum is sub utilised in hundreds of towns and villages in Pará, Amazonas, Maranhao and other Amazonian territories with low risk of harmful interference.

[169] Carreño, I. (2020, 1 June). Brasil consulta sobre abrir espacios en blanco de TV para banda ancha y telefonía. *DPL News*. https://digitalpolicylaw.com/brasil-consulta-sobre-abrir-espacios-en-blanco-de-tv-para-banda-ancha-y-telefonia

3.4 HARDWARE AND FIRMWARE USED BY COMMUNITY NETWORKS

An enabling environment for community networks should not disregard the issues around telecommunications equipment, software and firmware. The innovation occurring in self-connected communities has resulted in technology development in other Latin American countries. It is important that such innovation benefits Brazilian networks and that import tariffs and homologation costs are reviewed and incentives are put in place for the manufacturing of such hardware in Brazil, in order to accelerate and increase the odds of sustainability of new community networks using FLOSS and open hardware. Below are two examples of technologies used in such networks in Brazil and some constraints reported by their developers and implementers.

LIBREMESH AND LIBREROUTER

In Argentina, the organisation AlterMundi[170] describes itself as:

> An experienced group of activists of free community networks and free software, who have joined together to form an NGO to facilitate the deployment of these networks in digitally excluded areas, taking into account the particular characteristics of our region. The main objective is to develop a set of free software tools, documentation and open hardware for the deployment of low-cost and high-performance free community networks by people without prior specific training.

Through the development of LibreMesh and LibreRouter,[171] AlterMundi has enabled firmware and hardware for community networks that is easy to use and maintain. LibreRouter is a "plug-and-go" device made of a router and antennas that creates a mesh network and operates in unlicensed Wi-Fi bands of 2.4GHz and 5.8 GHz.

During the last year, in spite of all the difficulties due to the COVID-19 pandemic, AlterMundi was able to implement 10 new community networks using LibreRouter,[172] a device that helps create a mesh network using what they call a "geek free" community network. The hardware is a solution that solves the technical barriers faced by the networks in implementing and maintaining the system. LibreRouter and AlterMundi provide an example for the international group of community network advocates and technicians, by providing great FLOSS and best community practices. LibreRouter operates in networks in the following countries: Argentina, Brazil, Colombia, Ecuador, Mexico, Italy, India, Indonesia, the Democratic Republic of Congo, Kenya and Spain. Overall, more than 300 LibreRouters were distributed in the following countries: Argentina, Germany, Brazil, Colombia, Cuba, Spain, India, Indonesia, Italy, Kenya, Malawi, Mexico, Myanmar, Nigeria, Rwanda, Thailand, Uganda and Zimbabwe.[173]

There has been some coordination and research (mainly in Argentina, but also in Brazil) around the possibility of importing only the main components and assembling the routers nationally. Participants are now applying for

[170] https://altermundi.net

[171] https://librerouter.org

[172] AlterMundi. (2020, 2 November). Nuevas Redes Comunitarias de Internet en Argentina durante la pandemia. https://altermundi.net/2020/11/02/nuevas-redes-comunitarias-de-internet-en-argentina-durante-la-pandemia

[173] SAn. (2021, 13 April). Novedades de la distribución de equipos. *LibreRouter*. https://librerouter.org/es/novedades-distribucion-de-equipos

subsidies in order to be able to create their own small factories and amplify the reach and use of each LibreRouter.

LIBREROUTER IN BRAZIL

LibreRouter was already homologated in Brazil in July 2020[174] with the support of AlterMundi, Portal Sem Porteiras, Coolab[175] and APC. According to them, in order to achieve homologation they had to hire a specialised company that charged around BRL 20,000 (USD 3,778), a significant amount of money for a non-profit (small-scale) hardware developer and communities requiring networks. In addition, they made the following remarks:

- Today the legal procedures and requirements for homologation are the same for big and small developers: Ubiquiti, TPLink and AlterMundi fall into the same category making it very hard for the small developers to reach sustainability and compete.
- The need to have a new homologation certificate every time there is a new firmware release or even small adjustments in hardware weighs much heavier on small manufacturers, making them less motivated to develop and homologate equipment and new firmware versions on a regular basis, in the way that big companies do.
- Nowadays, LibreRouter is manufactured in China. When imported to Brazil the price doubles due to import taxes, making a device cost twice as much for end users which makes it financially impossible for millions of unconnected people to buy one.
- Currently there are around 15 units of LibreRouter in Brazil that were acquired with international funding, each came to the country at a cost of around USD 320, a very high price for communities. For example, in Argentina, the device lands in the country with a cost of around USD 205, still a very high price for Argentinian community networks who are trying to assemble it nationally to reduce costs and incentivise small national industries.
- The use of LibreRouter has demonstrated an easy way to foster self-made, easy-to-deploy-and-maintain mesh networks in small communities.
- In addition, there is concern from manufacturers regarding scheduled obsolescence of routing devices such as routers and antennas, since small changes usually lead to the exchange of devices along with the exchange of specific components, generating a lot of unnecessary e-waste. LibreRouter is therefore designed with easily replaceable components which last longer.

THE BRAZILIAN EXAMPLE OF THE HERMES PROJECT

The HERMES (High-frequency Emergency and Rural Multimedia Exchange System) project was created by Brazilian developers and the NGO Rhizomatica. Both architecture designs and software are free and open source. It provides affordable digital telecommunications over shortwave/HF radio using a simplified visual interface accessed via smartphone or computer, allowing for the transmission and reception of data (chat, audio, documents, photos, GPS coordinates, etc.) that can be easily encrypted and password protected by the sender. This technology

[174] SAn. (2020, 27 August). LibreRouter Homologado no Brasil. *LibreRouter*. https://librerouter.org/librerouter-homologado-no-brasil

[175] Coolab. (2020, 25 August). Libre Router Homologado no Brasil. *Coolab*. https://www.coolab.org/2020/08/libre-router-homologado-no-brasil

was nationally developed, along with equipment which was much cheaper than a common HF transceiver, as tested in Mexico and Brazil. It is currently in use on a community network in the state of Pará, North Region, at an extractive reserve of riversiders and Indigenous populations. They have implemented 10 radio base stations with a distance of up to 600 km between stations. Brazilian developers have mentioned the following difficulties related to homologation and the import of hardware components:

- They import everything, from discrete components to already assembled boards, and when the hardware gets to Brazil it costs twice as much or more, making it extremely difficult to amplify the use and reach of this useful HF technology.
- They mention the need for a simpler homologation approval and suggest a self-approval, as with amateur radio equipment. This is key to facilitate and diminish costs for the homologation approval of national technology and also to facilitate the local tailoring of technology, so they can achieve easier and faster homologation processes for technologies developed for non-profit community networks.
- They have also mentioned major hindrances with SLP licensing since there is currently no regulation in the HF band for the use of multiple channels for digital transmission, to allow regulatory operation of HF broadband transceivers. The width of the channels themselves – 3 kHz or less – comes from a time when HF was used only for analogue phone and telegraph radio and therefore not adapted to current possibilities – using greater bandwidth for greater throughput. Although, according to Anatel's Frequency Attribution Plan, there are multiple band ranges from 2.5 to 27 MHz for SLP, there is the need for licences with multiple channel assignments, to allow a cognitive choice of channels in order to optimise transmission, or to simply allow for communication (since on HF some bands work better than others depending on the time of day).

3.5 ACCESS TO BACKHAUL AND PASSIVE INFRASTRUCTURE BY COMMUNITY NETWORKS

A community network providing internet access under an SLP regime, needs access to affordable backhaul and to an internet PoP. The same holds true for SCM providers who offer FBB and need to acquire wholesale internet. The difference is that SCM are commercial providers and SLP are not, so the former may access the wholesale market through either SNOA or the wholesale input supply system (SOIA) while SLP cannot as they are restricted interest operators.

The result of this is that the few mesh networks existing in Brazil must buy broadband packages from PPPs at retail prices and distribute that bandwidth among community members. However, sometimes that is also prohibited as PPPs do not allow buyers to distribute the signal among several households, but sharing a FBB subscription is the only affordable option for households in poor rural communities.

Access by SCM and SMP to wholesale dedicated lines, passive infrastructure through a centralised virtual market (SNOA) managed by Anatel is one of the strategies used. Resolution 683/2017 mandates that all new infrastructures have to consider future sharing with third parties unless there is a risk of interference among antennas, collective interest services were jeopardised or if exposure to electromagnetic fields exceeds the limits. All operators must publish which of their infrastructures are available for sharing and a timeframe to migrate such information

to SNOA, which lists reference prices. According to the OECD, however, operators often find lower prices in private dealings outside of the SNOA.[176] When it comes to players with significant market power, the resolution decrees that they must publish a public reference offer. But again, this has not been enough: affordable backhaul is not available for community networks.

Because extremely expensive backhaul for small operators has become a common problem in all our areas, it is important to stress the need for market and competition research and assess the pricing models of backhaul in Brazil. It is common to see incredibly high prices for small ISP and community networks that do not buy as much bandwidth as large-scale operators. According to Reed-Sanchez[177] for instance, large operators buying a Gigabit connection can get it for USD 0.40/Mbps or even less in Miami, but an ISP in Nicaragua and generally in Central America buying less capacity has to pay USD 10/Mbps even in the vicinity of high-capacity fibre and undersea networks. Why? "Supply-and-demand forces" said Cable & Wireless and the company Ufinet when interviewed by Reed-Sanchez. Authorities should make a thorough investigation of market conditions in different relevant backhaul markets, demand more transparency of prices and proceed accordingly.

Whether this means that substantial market power is being used to fix prices in these areas by backhaul providers or that collusive practices are taking place, or that a market failure of a different sort is affecting prices, it is something the telecoms regulatory agency and Conselho Administrativo de Defensa Econômica (CADE), the competition regulator, should be concerned about, as backhaul internet is an input that represents around 36% of the total operational costs of an ISP, according to Reed-Sanchez' estimations.

Beyond backhaul, community networks should be able to benefit from all sorts of infrastructure sharing or access on a wholesale basis, in the same way that commercial operators are migrating to this more efficient sharing model or entity holding the SLP licence. The same holds true for poles, ducts, rights of way and towers, the more open access there is for community networks and SLP providers to these facilities, the more rural coverage and competition Brazil can enable. According to the presidential decree 9,612 of 17 December 2018, deploying backbone and backhaul networks in underserved areas is a priority. The decree also emphasised the need for Anatel to prioritise coverage obligations when settling investment commitments from operators, especially through TACs or through spectrum auction design. Anatel has established that new backhaul infrastructure should be made available to any operator on an open wholesale access basis. The OECD review also supports such a step.[178] Including community

[176] OECD. (2020). Op. cit.

[177] Recommended reading on backhaul pricing in Central America which is limiting developing countries: Reed-Sanchez, E. (2020). *Boom or Bust. A Tale of Rural Connectivity, the Business of Micro ISPs, Community Networks, and the Backhaul Conundrum*. City University of New York. https://descargas.lacnic.net/lideres/edwin-reed/edwin-reed-sanchez-informe.pdf

[178] Through this approach, an operator non-compliant with regulatory obligations can invest in broadband networks rather than pay fines. In practice, TAC agreements have faced difficulties with TCU audits (Box 5.4. and Chapter 4). In particular, it is challenging for Anatel to observe the counterfactual investment level in broadband networks by operators in the absence of those commitments. This is especially true given that operators choose towns and villages for investment in the TACs. These agreements raise another relevant issue. The investment in networks negotiated via TAC should comprise open access obligations, which has not been the case at present, in order to foster infrastructure sharing and access by other service providers. See: OECD. (2020). Op. cit.

networks in that scheme would be an important step to promote community connectivity.

3.6 SATELLITE CONNECTIVITY THROUGH GESAC FOR REMOTE AND ISOLATED COMMUNITIES

As explained above, when moving away from the SLP and spectrum regulatory regimes, GESAC has been the only option available for isolated communities, especially in remote locations in North and Northeast regions. These places are typically off the grid, with no roads or telecommunications services, where the only available option is satellite connectivity for schools, municipalities, public spots of Indigenous, quilombos or traditional peoples in the Amazon territories. One interviewee said that the only option has been GESAC, "We cannot afford a private company satellite connectivity deal and it is not even clear to us if private satellite internet services are offered in these remote areas, even if a satellite footprint covers them."

During the COVID-19 pandemic, with an increasing number of infected people in remote villages needing urgent healthcare, the work of civil society groups like Saude & Alegria[179] has been essential for the most vulnerable people. They provide hygiene kits, medical attention on a boat, food supplies and ventilators. For many years this organisation and communities had satellite connectivity from GESAC, with a 10 Mbps download throughput, which they treasured. Recently, with prolonged lockdowns and increasing numbers of patients with COVID-19, demand in these areas has peaked and speeds dropped to 1 Mbps, preventing effective communication during daytime hours, when villages have electric power. After 10:00 p.m. the group's diesel generator shuts down, and so does connectivity. Additionally, there is the need to connect more locations in the area and we were told that GESAC is not accepting or processing new contracts, which are the only hope for communications with the more vulnerable. The GESAC website,[180] showing maps of available PoPs, traffic and use volumes in each state, together with an online application for connectivity if the applicant is a school, telecentre, Indigenous, quilombo or a traditional community, is impressive. Unfortunately, the increase in demand after the COVID-19 lockdown has caused delays in serving connectivity requests. In regions where GESAC satellite connectivity is the only option, this is critical. One of our interviewees, working on health services in isolated Amazonian villages, emphasised the need to increase openings for more connectivity requests, at least twice a year for the SGDC-1 satellite.

3.7 FUST AND FUNTTEL

After 20 years of contributions by operators to the fund, the amounts accrued by FUST, which total approximately USD 4.21 billion, are shown in Table 12.[181]

For the first two months of 2021, FUST had accrued the following resources: contributions of 1% on gross revenues from all operators of collective interest, plus resources from fines (FISTEL) and authorisation fees (see Table 13).

[179] https://saudeealegria.org.br/en/home

[180] https://simmc.c3sl.ufpr.br/ - /pid

[181] As of 21 April 2021, USD 1 = BRL 5.57.

Table 12

TOTAL COLLECTION OF THE TELECOMMUNICATIONS UNIVERSAL SERVICE FUND (FUST). BRL, MILLIONS			
YEAR	**ALLOCATIONS RECEIVED FROM FISTEL**	**CONTRIBUTIONS AND CHARGES**	**TOTAL**
2001	700.00	345.19	1,045.19
2002	700.00	399.44	1,099.44
2003	100.36	430.30	530.66
2004	221.75	399.42	621.17
2005	72.14	418.73	490.87
2006	131.24	401.90	533.14
2007	560.65	480.91	1,041.56
2008	754.79	551.27	1,306.06
2009	733.38	562.36	1,295.74
2010	221.05	612.36	833.41
2011	1,815.60	721.60	2,537.20
2012	945.03	782.25	1,727.28
2013	699.91	810.67	1,510.58
2014	699.73	845.40	1,545.13
2015	700.00	864.36	1,564.36
2016	700.00	732.27	1,432.27
2017	322.94	735.83	1,058.77
2018	203.06	651.87	854.93
2019	580.53	634.79	1,215.33
2020	279.14	620.94	900.08
2021**	210.09	102.36	312.45
Total	**11,351.40**	**12,104.23**	**23,455.62**

Source: SIAFI.

Table 13

TOTAL COLLECTION OF TELECOMMUNICATIONS UNIVERSAL SERVICE FUND (FUST) LEGAL ALLOCATIONS — 2021	
REVENUE/ALLOCATIONS	**FUST**
CONTRIBUTION	102,360,066.67
FINE	207,915,285.69
GRANT	2,176,032.13
OWN REVENUE	250.00
TOTAL	**312,451,634.49**
ALLOCATION IN MILLIONS (BRL) FUST	
As of Feb 2021 Source: SIAFI.	

According to the OECD review, most of those resources have not been used for universal service programmes, as often happens in many countries. Instead, they are sent to the general treasury of the government to cover other needs. It was not until December 2020 that the Congress of Brazil finally voted to reform Article 81 of the General Communications Act[182] and Law 9998[183] (FUST) of 2020 to allow the allocation of FUST resources to finance the expansion of broadband networks as opposed to telephone services. President Bolsonaro, however, partially vetoed this reform alleging that it harms the public interest for different reasons. In the case of veto to Article 1 of Law 9998, regarding funding programmes in rural and urban areas with a low HDI for programmes for telecommunications services; technological innovation in telecom services in rural areas and expanding access to telecom services in the country, the federal government explained that such restriction of municipalities with a low HDI is unfair, difficult to implement and gives competitive advantage to providers who may receive funding vis a vis those who would not.

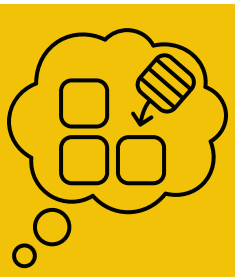
Congress has overturned all vetoes and approved a budget of BRL 3.5 billion (USD 690 million) from FUST to ensure the connectivity required for teachers and students to continue schooling activities during the pandemic.

According to the bill, the funding should go mainly towards mobile internet offerings, with fixed broadband provision possible if that option is cheaper or in cases where mobile services are not viable. Schools can also benefit from the funding if local education authorities consider it to be essential for their activities.

[182] http://www.planalto.gov.br/ccivil_03/leis/l9472.htm

[183] http://www.planalto.gov.br/ccivil_03/leis/l9998.htm

INSIGHT 7



We see a great opportunity for FUST's Conselho Gestor to redesign resource allocation rules and targets so that new small-scale players, such as unconnected and vulnerable groups in remote areas where commercial SCM or SMP providers will not invest, may apply for the funding of a community network which costs a fraction of a commercial deployment. Communities of quilombos, Indigenous and traditional peoples with a community network project under an SLP regime could be granted preference for funding, as an affirmative action for equality and which would trigger an incentive to formalise their project through an SLP authorisation or exemption. Technical and legal advice should be offered by Anatel to Indigenous communities and other unconnected groups on how to file proposals to FUST and these should not compete with applications for the IoT, agrobusiness or smart cities, but have separate earmarked funding. It is good practice for inclusion. in an example, Mexico's IFT hired staff to advise Indigenous and Afro-descendant communities wishing to apply for a community network or radio and for compliance matters.

It is estimated that approximately 18.3 million students and 1.5 million teachers will benefit from the measures set out in the proposals. The groups prioritised to receive the government-funded connectivity provided by the state are the beneficiaries of social programmes, as well as pupils and teachers of schools in Indigenous communities or quilombolas.[184]

We do not know if FUST will also redesign the mechanisms of its fund allocation and target beneficiaries. Acknowledging the role of community networks in universalising connectivity as Anatel has done would open up possibilities of fund network projects, especially those engaging women and Indigenous and quilombola groups.

FUNTTEL is also an important fund, managed by the Ministry of Communications. It is mainly integrated with contributions from telecom operators (0.5% of gross revenues). FUNTTEL funds may only be invested in the telecom sector for purposes of technological development of research and academic institutions, public and private in Brazil, that are not for profit; telecommunications service provider corporations, that are Brazilian as well as Brazilian manufacturers or suppliers of the telecom sector.

Although services of restricted interest, SLP are telecommunication services and Anatel could lead an effort to make sure that FUNTTEL includes them in their funding programmes when developing technologies for community networks.

[184] Mari, A. (2021, 2 June). Brazil passes bill to fund connectivity for students and teachers. *ZD Net.* https://www.zdnet.com/article/brazil-passes-bill-to-fund-connectivity-for-students-and-teachers

3.8 COMMUNITY RADIO IN BRAZIL: THE AIM TO MEET THE INTER-AMERICAN COMMISSION ON HUMAN RIGHTS' STANDARDS FOR FREEDOM OF EXPRESSION AND EQUALITY

Community media is characterised as infrastructures, content and services owned by a community, whether geographic (urban or rural), ethnic, linguistic, gender based, or of any other kind, managed, operated and led collectively by a community to address community needs, goals and aspirations. The Inter-American Commission on Human Rights has expressed that these media may have different sustainability and governance models but as long as they are not for profit, community managed and independent from political, partisan or private interests, they can be considered community media. In its Freedom of Expression Standards for Free and Inclusive Broadcasting, the commission noted:

> Freedom of expression demands from States that not only do they refrain from actions that may hinder the free exercise of such freedom but also that they adopt measures to secure such rights in conditions of equality and non-discrimination. Thus, any obstacles that hinder certain social sectors to access media shall be removed and also secure the inclusion of the vulnerable or marginalised in communication media. In several occasions the IACHR and the Special Rapporteur for Freedom of Expression have acknowledged that community broadcasting media in our region have a fundamental role for the effective enjoyment of freedom of expression and access to information. In different statements, they have emphasised that it is necessary that the States legally recognise these media and that spectrum frequencies are reserved for this type of media.[185]

In Brazil only one national channel, 101, is destined for the secondary use of FM community radios. Generally, such radios use channel 200, but in some areas channel 285 is used as well.[186] However, in some cities the community radio channel is even more marginalised in the FM bandwidth, occupying the 87,5MHz[187] frequency and therefore excluded from many radio receivers. The other 100 are commercial or public radios. As of 2018 there were 4,872 community radios in the country, up from 4,150 in 2010, which means that there was less than one station per municipality. These not-for-profit broadcasters are only granted authorisation as stations of 25 W with a maximum height of 30 m for its irradiant system, which establishes a coverage of only up to 1 km Under Law 9612.[188] In addition, any community within a radius of 4 km is automatically an adversary of another community in accessing a concession for community radio, which implies that many of them are not even getting the chance to apply for a new licence. According to Teleco, by 2012 the government said that 5,557 municipalities had a community radio, i.e. 99.8 % of the population. However, the low power, short

[185] IACHR. (2010). Estándares de Libertad de Expresión para una Radiodifusión Libre e Incluyente. Translated from Spanish for this brief.

[186] Teleco. (2019, 23 August). Rádio no Brasil. https://www.teleco.com.br/radio.asp

[187] Such as Radio Heliópolis, a 30-year-old community radio in the city of São Paulo.

[188] http://www.planalto.gov.br/ccivil_03/leis/l9612.htm.

distance reach of these stations puts this estimate into question.[189]

According to the World Association of Community Radio Broadcasters (AMARC), the estimated number of community radios before the legislation was about 30,000. After the validation of the law that instituted the community radio services in 1998 it was 9,612. This number is now around 12,000, of which only a minority of 4,872 have a licence, as mentioned above. Anatel's records show that between 2002 and 2015, 13,247 community radios were closed, while in the same period only 3,765 community radio licences were granted.[190] Many of those stations were genuine community radios, where the community participates, decides, informs, and yet they were prosecuted with criminal charges under law 9612. Community radio has a long history of serving the public interest of communities, addressing their needs with local information, promoting the local economy, adding to leisure time and culture and helping to communicate with residents about crucial issues such as vaccination campaigns, public health, domestic violence, the rights of youth and many others.

According to the OECD, Brazil needs to review its broadcasting policies, procedures and licensing criteria. Promoting local content is as important as promoting pluralism, freedom of expression and increasing the number of independent media across the 8.5 million km2 territory. Community radios can contribute hugely to that end. People in rural and urban communities have the right to have access to diverse, plural local media that can give them a voice. The OECD considers that:

Community radio broadcasting should be streamlined and subject to compulsory timelines to avoid unnecessary delays. More importantly, a converged and independent regulator should confer licenses. It should guarantee transparency, equal access and an objective and impartial selection for interested parties. To reiterate an earlier recommendation, neither the President nor Congress should participate in the awarding of broadcasting licenses. The process should include only the sector or converged regulator.

The regime establishes additional requirements for parties interested in setting up a community radio service. These include, for example, meeting requirements for local community coverage; a board of directors formed by residents of the community and use of low power in the transmission of their programming. In addition, community radio services are banned from inserting commercial advertising and on forming networks of community broadcasters.

Community broadcasters foster constitutionally protected values such as national and regional identity and contribute to the production and transmission of domestic and regional content. Therefore, Brazil is encouraged to move towards more flexible licensing requirements (e.g., considering removing low-power transmission obligations). Moreover, it could allow some limited advertising to make operations financially viable. On

[189] Ibid.

[190] Malerba, J. (2016). Community Radios at the Limit: crisis in politics and competition for the common in the era of convergence. PhD thesis, UFRJ. http://www.pos.eco.ufrj.br/site/download.php?arquivo=upload/tese_jmalerba_2016.pdf

the one hand, such measures could incentivise the creation of community radio stations.[191]

Regarding ongoing projects that intend to change the current legislation, there is Bill PL 513/2017, approved by the senate, that proposes an increase from 25 W to 150 W and from one FM station to two for community radios.[192] This change would benefit many (especially rural) areas due to the increase of signal strength in peri-urban areas, where communities live close together and are potential competitors for the same radio frequency. But that is a longwinded way in which to expand and promote community radios' sustainability without the leadership of an enabling policy.

Bill PL 2750/2020 proposes a truce, so that community radios with suspended operation may be turned on again due in the time of the pandemic. The bill allows community radio stations that are suspended, restricted or revoked to apply for a new temporary licence to operate on a temporary basis, in order to support the adoption of measures to contain the COVID-19 epidemic. In doing so, it fully recognises the important role of these stations in remote and rural areas which are totally unserved or underserved, to provide access to information in times of the COVID-19 pandemic and the huge potential loss for the population if these were to be shut down. If the bill passes, the MCom will authorise the operation of the broadcaster in summary procedure, for a period of six months, without charging fees, fines or taxes.[193]

In this research, there was a mention of the role that community radios played in the rise of community networks under the SLP regulation, as the community radios expressed their interest in becoming small internet providers for their communities, as mentioned by Artur Coimbra, current telecommunications secretary and formerly in charge of the broadcasting division. Coimbra shared that years ago the legal solution they had found to permit community radios to obtain the small internet provider status was to adjust the regulation of the private military service to allow the non-profit sector to provide services to third parties in a remunerated manner. He stated, "That was the way it was done at the time. I confess that since that time I have not kept up, so I do not know if many community radio stations have sought this, I know that one or the other tried and had difficulties with Anatel, especially at regional level." Since then, not much has changed regarding the rise of community radios as community networks, although the international community and NGOs see this junction as a positive one, especially as community radios foster community administration, technical maintenance and citizen organisation, things that are much needed for a community network to succeed.

[191] OECD. (2020). Op. cit.

[192] Senado Noticias. (2018, 10 July). Aprovado projeto que aumenta potência das rádios comunitárias. https://www12.senado.leg.br/noticias/materias/2018/07/10/aprovado-projeto-que-aumenta-potencia-das-radios-comunitarias

[193] https://www.camara.leg.br/propostas-legislativas/2252939; Haje, R. (2020, 28 May). Projeto permite que rádio comunitária com operação suspensa volte a funcionar devido à pandemia. *Agência Câmara de Notícias.* https://www.camara.leg.br/noticias/665270-projeto-permite-que-radio-comunitaria-com-operacao-suspensa-volte-a-funcionar-devido-a-pandemia

SECTION 4

VOICES OF DIFFERENT STAKEHOLDERS INVOLVED IN RURAL CONNECTIVITY, COMMUNITY NETWORKS AND DIGITAL INCLUSION FROM THE PUBLIC, PRIVATE, SOCIAL AND ACADEMIC PERSPECTIVES

4.1 METHODOLOGY

This study has involved a variety of experts, researchers and stakeholders. In particular, a committee composed of members from civil society, academia and the technical community with years of experience supporting community networks in Brazil was established at the beginning of the research. The committee provided advice at different stages of the document development, including defining its structure and providing feedback about its contents. Similarly, the working group from Anatel responsible for the project validated the structure and was consulted to increase broader representation of the views included in it. Both committees assisted with identifying interviewees as well as relevant documentation to inform the report.

The proposed recommendations are informed by a survey of self-identified community networks in Brazil, extensive stakeholder consultation, and a review of legal framework in the country, Anatel practices as well as international good practice.

There were semi-structured interviews carried out with eight community networks of different contexts in Brazil, that represent the main characteristics of the existing networks of this type in the country. The interviews were conducted in different regions of the country, from rural to peri-urban areas, in traditional communities like Indigenous, quilombola and riverside populations and people on the outskirts of big cities that struggle to have financial access to connectivity. Many statements overlapped and we have sorted them in categories below.

Besides these interviews with different community members, the team conducted semi-structured interviews with 26 people representing four stakeholder groups: academia, private sector, public sector and not-for-profit organisations. Interviews were based on a guiding questionnaire that sought to understand the challenges faced by the existing telecommunication operators in Brazil with regards to licensing, fees, spectrum and administrative costs when deploying and operating a network, as well as their recommendations for change. Additionally, it sought to hear their views on community networks, their role in the provision of first-mile connectivity especially in underserved areas, and recommendations on what could be done to create a more enabling environment for their growth. Of those, only 22 interviewees authorised us to collect and represent their information (displayed below) and so there might be a slight difference in the absolute numbers.

It is important to mention that the sole purpose of those interviews is to collect a wide range of views and experiences from those who are somehow related to communities seeking connectivity but also from those that are in the position of making decisions for public policies in this direction,

and to hear the perspectives from those that lie in between, like the NGOs and activists that are supporting and advocating for the growth of community networks. Similarly, we included private sector representatives from large telecommunications operators, PPPs and satellite providers. This is not intended to be a survey with a statistical sample of proportional representation of different stakeholder groups. The goal of interviews was to listen to diverse voices from diverse stakeholders.

4. 2 SUMMARY OF INTERVIEWEES' ANSWERS BY STAKEHOLDER TYPE AND TOPIC

Where a particular interviewee consented to be quoted and identified, we will do this when relevant to this policy brief.

4.2.1 INTERVIEWS WITH RURAL AND PERI-URBAN ACTORS FROM COMMUNITY NETWORKS

SOCIAL CHARACTERISTICS OF THE INTERVIEWED COMMUNITIES

- Most community networks organise themselves into neighborhood associations with the National Register of Legal Entities (CNPJ) to guarantee basic human and environmental rights in their territory.
- Connectivity is used mainly for educational, economic and cultural purposes but also for social demands such as: access to government projects and benefits; access to land and demarcation, the recognition of cultural heritage and social practices; environmental rights (for example campaigns against illegal mining and lodging and trespassing on Indigenous and quilombola lands); selling agricultural products for income; strengthening the young population; access to leisure and culture; fight against domestic violence and prejudices; and strategic communications from local leaders.

GENERAL BARRIERS

- Lack of access to public funding to implement and grow the networks.
- Lack of public policies and the presence of the state in their territories.
- Unstable electricity source (burnout of equipment and high cost to maintain networks with electric generators).
- High illiteracy and/or digital illiteracy rates.
- Difficulties in generating income to pay for internet access and purchasing personal equipment like laptops and mobile phones.
- Difficulties in generating income to have dedicated technicians that can grow and maintain the community network.

TECHNICAL DIFFICULTIES

- Costs and technical knowledge are required to implement, operate and maintain the infrastructure.
- Most community networks need external technicians for network maintenance. In towns and villages that are difficult access it is a struggle to receive maintenance or even to communicate in order to receive troubleshooting advice.
- As it represents more traffic, sellers would rather sell retail internet at lower volumes and higher prices. There is only one case where a community network managed to obtain a wholesale offer making their services more affordable to its members.
- Persecutions from the local ISP can happen when the community network shares the internet connection among neighbours to make it affordable (even if it has a SLP status).
- There are high import tariffs for network equipment or components that could be assembled locally (like LibreRouter).

REGULATORY ISSUES

- Interviewees estimated that half of community networks either have a SLP status or have applied for it. For the rest, the need to have a digital signature and the lack of experience in digital government to use Anatel's e-government tools makes the process difficult.
- Most of the networks use licence-exempt spectrum and restricted radiation equipment, but those that need licensed spectrum are struggling to get licences.
- For those communities that need to use licensed spectrum for backhaul, the fact that an authorisation for secondary use may end if the primary user claims the spectrum, discourages infrastructure investment from a secondary user. Anatel could perhaps arbitrate these cases and promote a robust secondary use-it-or-share-it policy that allows the secondary user to use the spectrum for much longer than six months.
- In remote places like the Amazon, with little access, no electric power, challenging topography, intense forest density and a low-density population, a communications system like long distance radio communication using HF has proved to be an efficient solution for communities in that region and for emergency communications, such as the aforementioned HERMES project. However, the challenge for them has been to access a multi-channel authorisation, this has proven very difficult to be approved and would leave the population unconnected.

GENDER INCLUSION BARRIERS

- In general, it is harder for women to get involved in the technical aspects, there are some general assumptions from the communities (male and female) that technical jobs are more demanding and therefore must be performed by men, and that women do not understand or are not fit to do the technological and electrical tasks.
- Women struggle to participate in community network meetings due to a lack of self-confidence and because they have responsibilities due to second or third jobs inside their house (i.e. having to cook, care for children and elderly, cleaning, etc.) and the lack of any payment for that hard work.
- There is a strong lack of representation that prevents women from seeing themselves as part of the technical implementation and core maintenance team of a community network, and, at the same time, there is conservative and patriarchal thinking and judging from the community males.
- On the other hand, women's leadership in communities has been growing and being more respected.
- Women tend to perform activities in networks that have long been considered women's tasks, such as secretarial jobs, caretaking, making space for articulations and meetings.
- In general, women tend to be more interested and involved with tasks like the production of content for the local network, administration, digital skills like web programming and managing the local server.

SUSTAINABILITY

- The interviewees tended not to separate the community's economic sustainability from that of their community network.
- The financial sustainability of the network is an important issue, most follow a model of individual payment in proportion to the financial possibilities of each family and the service used,

some have inclusive policies, like scholarships in exchange for some small job related to the community network.

- In general terms, communities believe that the internet and the community network can help them to increase their income and improve the quality of life of the residents and their families, including accessing funding grants from diverse projects and looking for external resources.
- There is no single model for sustainability. It is closely associated with the existing community organisation and governance, but most organise themselves in community-based associations with a legal entity.
- All the community network representatives interviewed needed external resources for equipment and technical knowledge to start the network, most obtained them through meso-organisations, international funding, universities, donations, volunteers or crowdsourcing.

AIMS FOR THE FUTURE OF THE COMMUNITY NETWORKS

- The interviewees tended to associate the community's vision for the future with that of the network, indeed they mentioned that connectivity may help them achieve their dreams.
- People want to amplify social and environmental actions such as the selective collection of solid waste, recycling, agroecology, having a cultural centre that reaches out to youth and supports women, women's empowerment against domestic violence, a women's health centre, increasing their models and expertise on community development and collective labour, the defence of the territory, traditions and ways of life, improving public education and educational resources and to increasing the self-esteem of community residents.
- They want their community to be more financially independent.
- Some stated they want to have community radio or want to better integrate the community network with existing community radio.
- Technology-specific needs for the future include working with fibre to provide better internet connections, geo mapping and BBS stations.

COVID-19 STEP BACKS

- Interviewees have stated that COVID-19-related constraints made it harder to provide maintenance services and expand works of the community network due to social distancing measures.
- Also, due to lockdowns some communities that benefited from tourism have felt much impact and found it more difficult to pay internet link costs.
- Some regular technical workshops had to be interrupted with no plans to reschedule them due to pandemic restrictions.

4.2.2 INTERVIEWS WITH DIFFERENT STAKEHOLDERS ON BARRIERS TO COMMUNITY NETWORKS IN BRAZIL

PUBLIC POLICY AND REGULATORY ISSUES

The highlights of the public policy and regulatory issues that were mentioned, according to the stakeholders' group breakdown, are:

FROM ACADEMIA

- Community networks are not directly addressed in existing public policies and regulations; PERT has made no mention of them. SLP is not fit for purpose as it has too many restrictions.

- There are two clusters of public policies to be addressed regarding community networks: connectivity for those unconnected and the added value for those connected (digital services and local content).
- FUST should be redesigned to fund community networks and especially projects where women lead and actively participate in them.

FROM THE PRIVATE SECTOR

- There are improvements from recent regulatory changes to adjust asymmetries between big telcos and small providers, as well as lifting some of the side administrative and regulatory requirements.
- However, this is insufficient. It is still an over-regulated market while the tendency should be to have less regulation to allow innovation and expansion.
- Outrageously high taxes including state taxation and import tariffs are really holding the sector back.

FROM THE PUBLIC SECTOR

- Bureaucracy and legal frameworks are important for stability and predictability, but they are not written in stone. They can and should change to adapt to society and market needs.
- Anatel has created a study group around community networks to better understand how they can address the underserved communities not served by PPPs.
- Anatel has never created a community-network-specific regulation and has no formal recognition of such networks on the regulation but wanted to include them as SLPs in order to encourage their creation. Anatel does not want to be a fiscalisation-only actor but rather aims to help increase community networks and connectivity.
- Anatel recognises that at first they had a stronger hand in the fiscalisation or enforcement of the PPPs (that came from the experience of fiscalising big companies) and that led to a restraint from the PPP's side. However, as asymmetries of regulation were created and PPPs organised themselves in associations, a dialogue was opened with Anatel. Today the fiscalisation unit is more aimed at security issues of infrastructure, such as towers, and of users. A similar approach would be used for community networks.
- There is an opportunity with the current revision of regulations to use spectrum to facilitate access to spectrum for underserved areas.
- Anatel believes that community networks and PPPs could find opportunities for partnerships.

FROM COMMUNITIES

- There is a need to lower the requirements to allow community networks to register with Anatel; access funding and training programmes.
- There is a need to review policies to access spectrum, in particular for high frequencies for regions like Amazonia.
- There is a need to expand the offer and speed of satellite connectivity, in particular for regions like Amazonia.
- Private sector satellite internet is unaffordable for vulnerable rural communities.

FROM NGOS

- The so-called "third sector", meaning not-for-profit organisations and non-governmental ones, i.e. civil society entities, should be recognised as equal actors in the public policy-making process which is currently dominated by government and private sector voices.

- The existing public policies and regulations have shown that they are not sufficient to connect all.
- There is a need to democratise access to spectrum for underserved communities, including backhaul links. A powerful move by Anatel has been the recent decision to open the 6 GHz band for unlicensed Wi-Fi.
- There is a need to review access policies that bring forward diversity and democratisation of technologies.
- There is also a need to shift the policy maker's mindset towards consumer protection by focusing on internet speed rather than package caps.
- From the technical community
- In a country as large and diverse as Brazil the SLP regime is not enough to connect Indigenous, quilombola, riverside and peasant communities.
- A holistic framework for community networks is required. This will enable capacity building and learning to use and manage spectrum for the well-being of communities. Communities can learn from each other and by carrying out the required tasks.

TECHNICAL ISSUES

Interviewees from local communities and civil society organisations have said in unison that there is a lack of or insufficient technical skills. Therefore, in order for community networks to blossom, people need technical training and support from deployment to maintenance. One interesting suggestion is to partner with local universities as professors and students with engineering skills that are closer to those communities could be better placed to help in overcoming this barrier. Training of women is especially important to narrow the digital gap, and address gender discrimination and old stereotypes in communities. RNP also has a key role in providing access to its backbone and other resources. Members of the technical community observed that states in Brazil have foundations that could be interested in supporting communities with technical training. An example of such a group is the Innovation and Science Ministry in Rio Grande do Sul, or RUTE, a research institution on connectivity for telemedicine projects.[194]

GOVERNANCE, SOCIAL AND CULTURAL ISSUES FOR THE COMMUNITIES

Bruno Ramos, ITU Regional Director for the Americas, recalled that Brazil has adopted regulatory asymmetries for some time now, but the game changer for small ISPs has been to coordinate among themselves creating associations and a united front to allow continuous dialogue with Anatel. That is a proven successful model that could work for community networks' advocacy.

Many local communities and civil society organisations' representatives interviewed reinforced the importance of understanding and prioritising the choices of communities. This means empowering a community to choose their own communication (type, method etc.), the path to appropriation of the technology and the network itself and to design solutions driven by their own goals and priorities. In this sense, the importance of establishing a shared governance and collaboration has been mentioned.

On the other hand, challenges described by the interviewees have been related to:

- Current mechanisms which might be reinforcing existing inequalities and exclusion (racism, gender gap, harmful behaviour).

[194] https://rute.rnp.br/

- The need to address the inequalities and consequently gap in access for woman and girls in some communities.
- Resistance from leaders to a change of mindset. Not all communities are familiar with shared governance for collective interest.
- Some communities based in conflict zones are also afraid to connect and be exposed and may prefer other offline communications such as an intranet and community radio. Mesh networks can easily be hacked.
- Women in communities want to learn and participate in community networks but because of their heavy domestic tasks, prevailing stereotypes and prejudice, men do not see them as active players in technical or management roles.
- Imbalances in power relationships among men and women or white and Black people exist and impact communities.

ECONOMIC AND FINANCIAL ISSUES

FROM THE PRIVATE SECTOR

For the private sector, the fiscal regime is really burdensome. The fact that multiple taxes are applied and spread into different levels – municipal, state and federal – creates a complex scenario for companies to comply with. Taxes are higher, similar to controlled markets like tobacco and alcoholic beverages, without much return. They raise the need for public investment to develop basic infrastructure in remote places in order to allow private companies to connect them.

They expressed the importance of Anatel facilitating ways in which community networks can be granted financial support from FUST, with its revised rules.

Communities have also raised the need for basic infrastructure development, for example in order to have access to electricity. Regarding funding streams, it has been mentioned that the current process hardly gives access to CAPEX.

FROM CIVIL SOCIETY

Suggestions were made for two concrete steps in regard to the economic and financial aspects for community networks:

- To update and/or create policies that can allocate proper resources for community networks. The recent FUST change provides opportunities, as stated by Anatel, but there could be others. State governments and their foundations could make grants or any available funds for digital connectivity more visible and accessible for community network projects.
- To improve the TAC's transparency: it is not clear under what criteria compromises to deploy infrastructure in a given location are made and enforced.

Anatel mentioned that they track locations with no connectivity through the IBGE census and since the last one is from 2010 there is a lack of mapping of the current peri-urban areas that have no FBB nor MBB. Since it is one of the criteria used to assess financial investment requirements from companies and universal funds such as FUST, TAC, "Obrigações de fazer" (to-do obligations), etc., it is important to make sure that coverage efforts correctly target unconnected towns and villages, people, favelas and quilombos.

ACCESS TO SPECTRUM ISSUES

ACADEMIA

- There is very little data available about spectrum usage that could be analysed by researchers to better understand the digital divide in the country.
- There is very little choice in spectrum bands for community networks, as

the regulator tends to equate them with ISPs when access to spectrum is considered. There should be spectrum for both, similar to commercial and community radios.

- There seems to be a tendency to regulate spectrum while considering only private interests.

PUBLIC SECTOR

- The range of interference in urban and rural areas is totally different and should be considered when designing the zones/areas for secondary use.
- It is important to consider spectrum options for backhaul in rural areas, as fibre will not reach everywhere. Options such as TVWS are interesting, as is 450 MHz, although unfortunately there is no easily available user equipment.
- Anatel states that spectrum licences are still predominantly bounced towards big companies and that there has been a lot of discussion, especially regarding 5G, of how to better attend to small actors. Discussions are being held regarding secondary use of the 5G spectrum, mainly for rural areas. It is believed that such discussions started a momentum in recognising the need for change and there is a search for models and examples for many different PPPs and community networks. Anatel mentioned that such networks could benefit from secondary use of spectrum and that learning from international experiences would help. One suggestion by the ministry was that this could be done by reviewing barriers within the spectrum-sharing regulations to provide more certainty for secondary users.

CIVIL SOCIETY ORGANISATIONS

- People do not understand the electromagnetic spectrum. This is particularly important for those whose communications needs are not covered, as they cannot advocate for spectrum access in the same way they do for other rights such as land tenure. Simultaneously, those regulating access do not understand the actual demands of the populations in terms of access to spectrum. An example of this is with 450 MHz. It has great characteristics for rural areas and was made available during the world cup to provide additional coverage in stadiums, but it has not been used since. There is currently much interest in 5G and IoT in this band, so it is unlikely that it will be used for public interest.
- Only commercial operators have access to the spectrum on a secondary basis. Even if a community network were commercial, the primary user can at any time request the spectrum to be returned, so there is no real incentive or security.
- There is lack of diversity on the bands available for community networks.
- The spectrum licence costs are very expensive and do not differentiate between rural and urban areas. In rural areas, especially in the Amazon, there is no risk of interfering with anyone, so complexity and cost of using spectrum there seem unjustified.
- It is important to make spectrum access for communities easier and more equitable.
- Policy makers and regulators should democratise access as provided for by the law. Communication is not merely a service, it enables human rights.
- Communities should be able to exercise their right to autonomy by using spectrum within their community; as long as they do not cause interference, use should not be restricted.
- There ought to be more frequencies allocated to public and community media, and digital radio should be implemented.

- Restricting community radios to a reach of only 1 km is abusive.
- The closer we move to a free use of spectrum, the closer society will get to freedom of expression.

4.2.3 ANSWERS FROM DIFFERENT STAKEHOLDERS AROUND FUST, TAC AND COVERAGE OBLIGATIONS

CIVIL SOCIETY ORGANISATIONS

- Digital gender inclusion requires government support. Financial support is required for feminist projects of community networks, that is, those designed with gender perspective and significant involvement of women, of all ethnicities and ages, in decision making and network design, governance, operation and management. It is the perfect time for FUST to consider allocating part of its funds to new players, to community networks led by women, for both technical training of women and for initial capital to set up networks. The participation of women will help with the sustainability of community networks and is essential for equality and inclusion. There is much to be done in communities to permeate a feminist vision of technology and the financial promotion of the representation of women could make a difference.
- PERT 2021 has identified the challenges of rural access and the inequalities of connectivity among regions and rural-urban areas. It does not elaborate on how its proposed projects will benefit community networks. Now that FUST may be allocated to broadband connectivity universal access projects, FUST's council should be aware that funding is required locally so that new players such as communities in underserved areas can build local networks, which would be less costly than a large, commercial network. Funding should not go to large operators. FUST and governments should acknowledge communities as potential players, not as users. A good incentive to obtain a licence or an exemption is to have access to government funding. FUST exists to support those left behind, and funds should not go to finance IoT, huge businesses or operators who cannot envisage a case for business in remote, rural areas.

TECHNICAL COMMUNITY

- The FUST reform was a huge victory. Congress did not transfer those resources to a general fund to tackle the sanitary emergency due to the COVID-19 pandemic, recognising the importance of universalisation of broadband. However, President Bolsonaro vetoed three public interest aspects: funding to public schools, funding for municipalities with a low HDI and others. Congress then reversed the vetoes.

ACADEMIA

- The FUST council has an opportunity to innovate for inclusion. It would not be fair to use that money for IoT or 5G investments as the market already does that. PPPs also seek funding. Many interest groups are watching FUST. Supporting community networks for a network infrastructure, capacity building and backhaul access, would be a game changer. Perhaps the second version will include more uses for the fund.

ITU AMERICAS

- FUST has a long history of use for other public needs. It will be hard to see it allocated for universal access, it is better to promote private investment.

ANATEL

- Regarding access to FUST, Anatel sees that community networks have to be fitted in a regulation in order to pledge and access it.
- There are regions like villages in Amazonia, where companies are obliged to operate, but there are reports of dilapidated infrastructure and even reports of abandonment of infrastructure by concessions, since their only goal is to comply with the obligation and afterwards the local population cannot afford to pay the bills and the service stops. Anatel has never stipulated that any access to infrastructure should be free; it always has to be paid for. But resources would have to come from somewhere and work, together with MCom, to ensure that people have money to access the networks. It is within the power of the ministry to provide financial aid (which can come as aid for equipment, for subscribers or to pay the bill), while Anatel's role is to guarantee the infrastructure through the implementation of FUST, TACs and 5G notice, for example. It would be good if FUST could finance capital investments of community networks.
- A new FUST law was proposed by Anatel and inspired by Ancine's audiovisual plan, which makes significant annual disbursements.
- Positive expectations for working together with the Ministry of Communications and FUST Council to have the committee formed and start using the resources. The committee intends to have financial agents all over the country that can be closer to the beneficiaries (for example, going to Caixa Econômica). It is currently relying on political will to make it happen.

TELECOMMUNICATIONS OPERATORS

- We understand that the reformed FUST rules only include collective service providers to apply for FUST funds. The council to be imminently installed should start allocating funds for investment. We are not sure they can be allocated directly to low-income subscribers; we think they are only for investment projects and not for users.

SECTION 5
RECOMMENDATIONS FOR POLICIES IN BRAZIL TO ENABLE COMMUNITY NETWORKS

5.1 PERMANENT DIALOGUE BETWEEN COMMUNITIES AND ANATEL

5.1.1 NATIONAL AND INTERNATIONAL GOOD PRACTICE AND INTERNATIONAL FRAMEWORK

Listening and getting to know community network projects and underserved communities is important. They offer an innovative approach, original technical solutions and a unique vision of bottom-up connectivity models.[195] Creating a mechanism for Anatel and community networks representatives to work together and identify an agenda is crucial to build collaborative policies. Interviewees repeatedly emphasised the need for a committee with Anatel to agree on a work plan for community networks, with representation and governance principles. Even in the absence of community network associations which might not yet exist, triggering communication channels to agree on a collaborative agenda is important. Anatel knows this well after the successful creation of the PPP committee through Resolution 698. Bringing stakeholders to the policy table promotes understanding, co-responsibility and empathy.

In 2013 Mexico experienced a need for dialogue and a work plan through the regulatory agency IFT. First, it launched an Indigenous consultation process under Agreement No. 169 of the ILO, before issuing its community networks and broadcasting licensing guidelines, which in turn triggered regular – but not structured or formal – dialogues with not-for-profit operators and those in community radio. More recently, another dialogue was opened for community and Indigenous media and networks, facilitated by UNESCO on the request of the Mexican Federal Government.[196] It has been a year-long forum of exchange, working groups, peer collaboration and a mosaic of good practice. Although not a permanent forum, its methodology, representation rules, plural voices, and thematic working groups showed the importance of horizontal channels for dialogue and consensus building. Quite a few synergies, alliances and solutions have been implemented among the constituencies thanks to the forum.

Another example, which we learned of through the UNESCO forum, is the Colombian Permanent Table for Consensus, which has enabled the creation of the National Commission of Communication of Indigenous People.[197] Although this process has not yet concluded, the methodology and multistakeholder approach is good and acknowledges the need for affirmative action to achieve equality and freedom of expression, something that the Inter American Court of Human Rights has

[195] Antoniadis, P., et al. (2019). *Best Practices Guide for Community Networks*. netCommons. https://netcommons.eu/sites/default/files/d4.5_v1.0.pdf

[196] UNESCO. (2021, 12 April). Intercambio latinoamericano de mejores prácticas, programas y políticas para el fortalecimiento de medios indígenas y comunitarios. https://es.unesco.org/news/intercambio-latinoamericano-mejores-practicas-programas-y-politicas-fortalecimiento-medios

[197] https://concip.mpcindigena.org

repeatedly emphasised in order to balance and counteract centuries of exclusion and impoverishment of Indigenous and tribal groups.

In the case of Brazil, special mention must be made of the need to consult with Indigenous people and tribes according to international law[198] before any decision is made concerning connectivity or community networks and media. A number of international recommendations and standards for the protection of freedom of expression; right to communication and self-determination of Indigenous peoples should be the framework for any dialogue to be considered between Anatel or the Ministry of Communications[199] or any other government entities and Indigenous and quilombola communities.

Similarly, ITU-D Recommendations D-19, D-46 and the recent "Regional Priorities for the Americas 2022-2025" drafted by the Regional Preparatory Meeting for the Americas[200] highlighted the importance of community networks and an enabling environment by governments and regulators to ensure sustainability. In summary we identify these examples of good guidelines or practice:

- Brazil: PPP committee established within Anatel with mechanisms to sort out challenges and barriers, petitions and work together.
- UNESCO and the Mexican government project for strengthening community networks and community media and audiovisual content.[201]
- Mexico's IFT Indigenous people consultation for telecom and broadcasting licensing procedures (IOL) Convention 169
- European Union: Article 3.3.e) of the European Code of Electronic Communications provides that: "Member States, BEREC and the EU Commission, in fulfilling their missions pursuant to the code, should take due account of the variety of conditions relating to infrastructure, competition, end-user and consumers circumstances that exist in the various geographic areas within a Member State including local infrastructure managed by individuals on a not-for-profit basis."
- WTDC Americas Region Priority Agenda mentions community networks as an important alternative model for rural and Indigenous communities.

5.1.2 RECOMMENDATIONS FOR ANATEL

SHORT TERM

5.1.2.1 Anatel can take the lead in starting an initial dialogue with community network advocates from all regions where rural and urban are present or duly represented and where technical community, academia and civil society that have worked closely with communities in digital communication projects can also participate. The dialogue could include the following aims:

- Define purpose, expected results and scope of dialogue.
- Governance rules: who may represent whom, discussions, accords.

198 Convention 169, International Labour Organization.

199 Tauli-Corpuz, V. (2016). *Report of the Special Rapporteur on the rights of indigenous peoples on her mission to Brazil*. https://ap.ohchr.org/documents/dpage_e.aspx?si=A/HRC/33/42/Add.1

200 https://ctu.int/event/itu-regional-preparatory-meeting-for-wtdc-21-for-the-americas-rpm-ams/

201 All UNESCO sessions dealing with sustainability of community networks and media with international guests, including Anatel, are available at: https://www.youtube.com/playlist?list=PL-SV0KQqZNUntuvBqJgDcYC43iKXiJr3I

- Implementation rules.
- Agree on an initial agenda and calendar, taking into account Anatel's regulatory agenda 21-22 on topics such as SLP and use of spectrum regulations: secondary use of spectrum; TVWS regulations; coverage obligations in the coming auctions; participation in FUST council.
- Communities will have to find mechanisms to organise themselves, agree on governance rules, elect representatives to appear before Anatel and eventually before the committee.
- Identify specific goals and indicators to be included in the next edition of PERT.

5.1.2.2 Anatel, with advice from FUNAI, UNESCO and any other agencies specialised in Indigenous people's rights, should consult Indigenous and tribal communities in accordance with Convention 169 of the ILO before introducing any changes to SLP resolution, RUE, TVWS regulations, spectrum use fees or any other matter related to community networks by Indigenous peoples.

5.1.2.3 Anatel may support a motion for a community network representative to occupy a seat at the FUST and FUNTTEL councils.

MID TERM

5.1.2.4 As more community networks flourish and organise through a community networks association or the like, Anatel could work with them in integrating a community networks committee following the experience with the PPP committee and Resolution 698. This should not prevent Anatel from starting a dialogue and creating an agenda regarding community networks, as provided for above.

5.2 ACCESS TO SPECTRUM FREQUENCIES FOR COMMUNITY NETWORKS: ANATEL

As Michael Calabrese puts it, "the conventional wisdom that spectrum is scarce, particularly mid-band spectrum, persists despite the reality that most federal and commercial bands remain grossly underutilised and amenable to more intensive, shared use."[202] Spectrum sharing is an important ally of rural connectivity and efficiency.

5.2.1 NATIONAL, INTERNATIONAL GOOD PRACTICE AND INTERNATIONAL FRAMEWORK

- Brazil: opened 1,200 MHz of the 6 GHz band to licence-exempt use.
- Canada, South Africa and New Zealand: offered higher power EIRP limits for Wi-Fi backhaul than for access Wi-Fi. (See comparative table in Appendix 2).
- Mexico: locally licensed IMT spectrum for an indigenous not-for-profit wireless network in the 850 MHz band.[203] This was a direct spectrum assignment, free of charge. The Supreme Court of Justice eliminated spectrum use fees for Indigenous licensees on the grounds that affirmative action was required to achieve equality, inclusion and their right to their own communication means.
- United Kingdom: local access sharing with licensed but unused spectrum held by MNOs.[204]

---

[202] Calabrese, M. (2021, 7 January). Use it or Share It: A New Default Policy for Spectrum Management. *TPRC48: The 48th Research Conference on Communication, Information and Internet Policy*. https://ssrn.com/abstract=3762098

[203] See Section 3 above, and https://www.tic-ac.org/documentacion-tecnica

[204] https://www.ofcom.org.uk/__data/assets/pdf_file/0037/157888/local-access-licence-guidance.pdf

- New Zealand: managed spectrum park for local spectrum access licences.[205]
- See country comparative table of small-scale operator access to licence-exempt spectrum.[206] Technical restrictions exist.

5.2.2 RECOMMENDATIONS

5.2.2.1 SHORT TERM: ANATEL

Authorisation-exempt spectrum when using restricted radiation equipment: This is one of the most successful and high-impact cases for digital inclusion, standardisation of equipment and rural connectivity: Wi-Fi. Brazil has taken the lead in the region to repeat this success story by fully allocating the 6 GHz band to licence-exempt use for indoors Wi-Fi, aligned with RUE's goal of democratising spectrum access. Brazilian communities piloting Wi-Fi networks could greatly benefit from licence-exempt spectrum for PtoP and PtoMP links. Therefore, it is recommended that Anatel:

- Reviews its technical radiation restrictions to consider no limit in the gain for PtoP links in the 2.4 GHz band.
- Reviews 10mW/MHz Tc power limits and 200mW EIRP in 5150 to 5350 MHz band for PtoP and PtoMP links.
- Reviews 5725-5850 MHz to consider no limit in the antenna gain in PtoP.
- Considers including bands such as 24 and 60 GHz as licence-exempt for PtoP and PtoMP links of SLP.
- Considers exempting SLP from the obligation to register restricted radiation equipment in the STEL Registry when such equipment is used for backhaul, i.e. beyond the limits of a single property or condominium.

Television white spaces (TVWS): Evaluate if a Latin American approach to the database is cost-efficient and fit for rural connectivity in the region. TVWS technology is expensive. In remote rural areas there may be plenty of unused white space available for broadband that could be managed for a long time under light licensing and technical rules to avoid interference, without the requirement of database technology. Also, there will be some time between issuing TVWS regulations and the commercial availability of the geo-location database. Meanwhile, Anatel could allow for the immediate experimental use of white spaces, subject to no fees for community networks in underserved areas, as an important sandbox worth piloting. See Appendix 3 for a comparative table on TVWS regulation around the world.

HF radios for remote areas where internet is currently not a sustainable solution:

- For remote communities, like those in Amazonia, we identified a barrier to radiocommunication systems fit for purpose in the rainforest, for example HF radios providing voice, image and text communication applications. These require the use of frequencies that are not on the list of frequencies destined for restricted radiation equipment. This radiocommunication technology is efficient, simple, feasible in places with no power grid and sustainable for isolated communities like those in Amazonia who might prefer to use voice and image messages as they are illiterate in written Portuguese. This has been the only means of communication for isolated communities and is essential for emergency communications as well.

[205] https://www.rsm.govt.nz/licensing/licences-you-must-pay-for/managed-spectrum-park-licences

[206] See Appendix 2. Table provided and elaborated by Steve Song for the APC/UK-DAP and CA Report on Kenya.

- Our recommendation is to include allocation and distribution of more HF frequencies as an SLP community network, using digital communications in a multichannel setting as recommended by ITU-D Americas priority agenda[207] for Indigenous connectivity and emergency communications and to ease and expedite authorisations for HF services of communities.
- We believe that as a means of communication for vulnerable communities in Amazonia, spectrum fees per transmitter should be waived or given a 90% discount as is granted to government entities. Otherwise, the barrier to communications, access to information, emergency services and freedom of expression would remain discriminatory due to high fees.

5.2.2.2 MEDIUM TERM: ANATEL

Shared local access to licensed IMT spectrum: There are important opportunities for rural connectivity using these IMT bands, where affordable equipment exists. Low-cost LTE network equipment and handheld terminals open possibilities for local access in lower density areas where licensees have not deployed for financial reasons, even though they hold national spectrum licences in several bands. To leave this exclusive rights spectrum unused is inefficient and has a social cost. It could be handled in different ways:

- Spectrum attribution and allocation for rural local wireless access under an SLP regime (non-profit community network) in communities where, with the guidance of universities or technical communities like the one in Pará, wireless broadband access is possible in different bands, especially those under 1 GHz, where affordable equipment is available (for instance HF bands, 700, 850 and 900 MHz).
- We highlight the importance of reconsidering the policy of exclusive use of spectrum. For decades important portions of such spectrum have been left unused. Instead, a use-it-or-share-it policy is of paramount importance now that there are plenty of spectrum-sharing technologies.[208]
- Avoiding harmful interference is a priority that can be achieved by "traffic management" instead of parcelling the spectrum like real estate lots.
- Anatel's Mosaic system, a spectrum resource management platform used for applications for the exploitation of telecommunications services, could include different kinds of spectrum-sharing windows for social interest and restricted radiation equipment together with other kinds of sharing managed by Anatel and not by primary users.
- When attributing a band for rural access or backhaul it is important to make sure that affordable equipment exists for both PPPs and community networks, otherwise that attribution will remain unused, as happened with the 450 MHz band.
- As exists in the UK, a local access licence for unused IMT bands can expand rural coverage. Three-to-five-year licences at an affordable fee could

[207] Article 4: Establish that Community Network Owners requesting a license within the framework of the provisions of the Licensing Regulations for Information Technology and Communications Services approved by Annex I of Resolution No. 697-E / 2017 of the MINISTRY OF MODERNIZATION, will be exempt from paying the fee provided in Article 4, section 4.1 of the aforementioned Regulation.

[208] The Mexican regulator inserts this clause in the licences it grants mobile operators, for instance: "8.6. Services for secondary use. The Institute reserves the right to grant other authorizations for the use, development and exploitation of the frequency bands covered by this Radio Spectrum concession, or portions thereof, for secondary use. In such a case, the use of the bands subject of this Radio Spectrum concession shall have protection against harmful Interference."

be managed by Anatel, not as a public offer by the primary user but as a secondary use authorisation.

- We recommend promoting spectrum sharing for community networks through experimental licences of a longer duration than two years before reforming the RUE.
- The expected 5G spectrum bidding process in Brazil of four spectrum bands for mobile access has wisely stated that the winner shall have a primary use, non-exclusive allocation of frequency blocks. That means secondary use of spectrum is a possibility. However, under Section 10.1 of Anatel's "Radiofrequências nas faixas de 700 MHZ, 2,3 GHZ, 3,5 GHZ E 26 GHZ" document, it seems that such secondary use will be subject to a secondary market regime, something similar to spectrum lease, which has not been an efficient solution in other countries in the region, because of high transaction costs for commercial operators, and also the result of shutting down secondary use for SLP providers.
- Our recommendation is to phrase it as a secondary-use clause not subject to a commercial public offer managed by SMP. Instead, Anatel can manage the secondary use under the rationale that the use-it-or-share-it policy applies when the primary holder is not using the frequencies in a given area, for the public interest. This may have a positive impact as secondary use could trigger a reduction in spectrum use fees for the primary holder or count as compliance of coverage obligations.

Spectrum for backhaul and spectrum use fees: One of the current barriers limiting community networks is affordable backhaul. In certain scenarios PtoP or PtoMP links in licensed bands are critical, at affordable prices for non-profits.

- Anatel could consider reviewing Article 4800/2020 regarding licensing several bands above 2 GHz. Of special interest are the 10.5 and 11 GHz bands for SLP links for backhaul of community networks in towns and villages with under 200,000 people. Very low fees, if any, should apply and steps and requirements for the spectrum use authorisation could be simplified so that conditions and rules do not raise barriers against community networks.
- Because these network efforts are not for profit, owned and managed by vulnerable groups and serving social interest goals, it is important to have a differentiated policy of spectrum related fees for them. Spectrum use in licensed bands as SLP by public entities, governments and foundations is authorised with a 90% discount, as mentioned in Section 3. Also, citizen radios and amateur radios pay a low fee of BRL 10 (USD 1.86) per frequency for a 10 year period. A similar discount could apply for community networks (both in the SLP or special regime) for such networks to incentivise community connectivity projects.

5.3 LICENSING AND REGISTRATION PROCEDURES: ANATEL

5.3.1 INTERNATIONAL GOOD PRACTICE

- Mexico: "social purpose community and indigenous network and broadcasting licence" for spectrum use and for service provision.[209]
- Argentina: Resolution 4958/2018 which creates a special regime for community networks with light burdens

[209] Guidelines and formats for granting community and Indigenous networks and media concessions: http://www.ift.org.mx/industria/lineamientos-generales-para-el-otorgamiento-de-las-concesiones-que-se-refiere-el-titulo-cuarto-de-la

and is similar to value-added services regime.[210]

- The public consultation launched by the Communications Authority of Kenya in May 2021 for the adoption of a "Licensing and Shared Spectrum Framework for Community Networks" which includes a draft framework proposal.[211]
- Recommendation ITU-D 19 on simplifying requirements for licensing and spectrum access for both small operators and community networks.
- Supreme Court ruling in Mexico on licensing and spectrum use fees for Indigenous and Afro Mexican communities owning a community network, declares void any fees to be levied to these communities, on the grounds that affirmative action is essential for equality, inclusion and Indigenous rights to communications and media of their own.[212]

5.3.2. SHORT-TERM RECOMMENDATIONS: ANATEL

Simplification of SLP service and spectrum regimes to reduce barriers

The authorisation exemption introduced by Resolution 720/2020 was a major step towards simplifying entry for both restricted and small collective interest providers. However, in cases where you need no SLP authorisation or where Anatel may exempt you from one according to Articles 12 and 13 of the resolution are still very limited. Even if one is exempted, the interested community would still need to register with Mosaico (SEI).

In the interviews some community members considered this registration procedure to be a barrier. Especially in the case of Indigenous communities and other vulnerable groups, a Mosaico registration exemption could be granted by Anatel as recommended below. Understanding such barriers, through dialogue between Anatel and the communities will help them design simpler ways of registering a network as SLP exempt, as it is important for Anatel to be able to map and identify who, where and how each community network is operating under the registration-only regime.

An off-line, simplified registration option that can be filed before the closest city hall (*prefeitura)* or a printed format that may be mailed through the postal service could be an alternative.

Another option is to extend the non-authorisation regime of Article 12 to other kinds of dwelling properties for Indigenous and quilombos in rural and remote areas. This could be achieved by means of interpreting the concept of a condominium in broader terms, so that it can include rural and remote homes in a single community so that they could be connected using confined means or restricted radiation equipment without the need of any authorisation by Anatel under Article 13.

---

[210] Enacom Resolution 4958/2018. Article 8 of Enacom's community network regulation also exempts such networks from any fees and creates a specific community network licence regime with very light regulatory burdens.

[211] https://ca.go.ke/public-consultation-on-draft-licensing-and-shared-spectrum-framework-for-community-networks-in-kenya; draft proposal available at: https://ca.go.ke/wp-content/uploads/2021/05/Licensing-and-Shared-Spectrum-Framework-for-Community-Networks-May-2021.docx.pdf. The consultation closed in June 2021 and the authority is reviewing all submissions and has not issued any final decision yet.

[212] National Supreme Court of Justice, Primera Sala, Amparo en Revisión 603/2019. "This Court concludes that there is a constitutional mandate which provides for the existence of a differentiated way of access for indigenous communities to communications. Thus, these peoples are beneficiaries of a right of access to such conditions needed so that they can acquire, operate and manage their means of communications under the terms provided for by law." "This right comes along with a mirror obligation from the State to remove barriers and promote affirmative measures to level their opportunities to access."

Another complex procedure is the self-registration of radiocommunications stations that need a spectrum use authorisation (because the required radiation is above the restricted radiation limits). This is an online procedure accessed through the platform STEL (telecommunications services in Portuguese), which only works with an Internet Explorer browser, a non-neutral requirement which could also be a barrier.

Anatel, together with the community network roundtable or committee, can work together to identify the extent of this simplification so that it is culturally pertinent and without unintended discrimination. In the case of such networks of Indigenous, quilombola and tribal people, a consultation for informed and free consent should be conducted before making any decisions on licensing requirements.

In short, these are the main recommendations for simplification in the short term:

- Offer a culturally pertinent alternative to Mosaico SEI, for Indigenous and other traditional communities that poses no barriers for them. This could be an off-line format to fill and send to Anatel through the local authority, or the design an app-based registration form using a social media messaging app including an audio or voice note option.
- Extend the interpretation of "condominium" to rural and remote areas so that they qualify for exemption from registration. Where unlicensed spectrum is less used, such as in rural and remote areas (Indigenous and quilombola communities and rural settlements, for example) there is still a requirement to register in the Mosaico system as an SLP provider with a *dispensa de autorização* (registration exemption). Anatel should extend the benefit of registration exemption to rural and remote networks where there is no risk of interference; in the same way that urban condominiums of all sorts are exempted (by law, not by an Anatel dispensation) from such registration procedures. That way, quilombola and Indigenous communities in remote rural areas, where homes are close enough to be able to have line of sight and use a restricted radiation equipment to get Wi-Fi connectivity, could just have their community network without the need to register nor seek authorisation exemption.
- Simplify the procedures for registration/authorisation of stations using spectrum in licensed bands at STEL, as they are not accessible to many underserved communities.
- Discount PPDUR fees for use of licensed bands for community networks (such as HF and backhaul links). Fees should be very low as an affirmative action necessary for inclusion. A 90% discount, like the one afforded to public institutions, would be a good practice in the public interest.
- Create a portal specifically for community networks, like the one for PPPs with all the information dealing with service provision requirements (currently as SLP), authorisations, authorisation-not-required cases, use of spectrum, registration of equipment, technical rules for any SLP destined frequencies, fees, compliance, etc.
- Include in such a microsite, an accessible guide (both written and using video) to access and navigate the Mosaico portal, that shows step-by-step instructions to obtain both an authorisation exemption and an authorisation and to get spectrum use authorisation and license stations, if needed.

5.3.3. MEDIUM TERM: A SPECIFIC REGIME FOR COMMUNITY NETWORKS AND COMMUNITY MEDIA

Anatel

Allow for flexible experimentation of different community network models and services that are collaboratively designed, documented and assessed by communities and Anatel. Pilots will bring evidence on different models. Assess the possible costs and benefits of introducing a special regime for such networks (non-profit oriented) that are technologically neutral and for vulnerable communities, especially those of Indigenous and other traditional groups. Every affirmative action to be implemented towards equality, should efficiently address the specific barriers, vulnerabilities and cultural context of each community, whether urban or rural.

Community network regimes

- **For Wi-Fi community networks: No authorisation, no registration of equipment necessary**

  For community internet access service using only Wi-Fi and restricted radiation equipment or a wired connection, when only connecting one locality. (Similar to the current SLP, Article 12, 13 exemption regimes). The community network representative registers in Mosaico only.

- **Wired or wireless network providing any other community services or community media using fibre or equipment with restricted radiation**
  - No authorisation required for a community network with less than 5,000 subscribers.
  - Registration of any type of equipment
  - Spectrum use authorisation required when using non-restricted radiation equipment.
  - Discounted PPDUR, TFI and any other applicable fees for community networks
  - Clear rules regarding eligibility for a community network regime with the understanding that such a network is a community owned and managed infrastructure designed to serve a community's communication and information needs, preferences and values on a not-for-profit basis.
  - Affordable access to backhaul. Preferential rates in public backhaul networks for community networks.

In both of the above scenarios communities should meet the following criteria (when applicable):

- Be open to non-profit entities such as cooperatives, community-based organisations, NGOs and communities of Indigenous people or quilombolas.
- Community network scope is limited to sub-municipal coverage (as opposed to other SLPs which can have a national scope).
- Community managed and owned, with clear governance mechanisms.
- Document showing who the authorised community representative is as well as the CPF or CPJ.
- If applicable, a document showing incorporation of the non-profit legal person and by-laws (except in the case of Indigenous people or quilombolas who do not have to incorporate a legal entity to have standing as traditional communities).
- Minutes documenting that the community voted to own, install and manage a community network.

Benefits for communities

- Right to access frequency bands through an authorisation for primary or secondary use, depending on the band and its status.
- PPDUR discounts apply as in the case of government and public entities and foundations. A discount of 90% applies or an equivalent reduced fee as in the case of a citizen radio regime.
- Unified authorisation for a community network includes any possible telecommunications and broadcasting services, subject to frequency bands use authorisation, when needed.
- Data interconnection and access to wholesale offers is an option.
- Registration is valid until revoked for lack of compliance of rules.
- Anatel negotiates discounted backhaul rates for community networks in public sector backbone operators.

Project plan specific to community networks applying for authorisation

- Description of applicant community, location, size, whether it is Indigenous or not, quilombola, etc., community goals, community governance, gender, age and race inclusion mechanisms, the project concept, mechanisms to comply with not-for-profit status.
- Description of proposed network and services, coverage area, rollout plan, demand mapping, present and future community needs, barriers to access other networks, how the community was consulted or surveyed, how decisions are made and how this will encourage the participation of diverse community members, men and women in the community network management, operations, trainings, etc.
- Revenue stream: Provide information on the planned revenue stream from different sources or state funding to achieve sustainability and service improvements.
- Quality of service: Describe how to manage the quality of service and maintain quality services and information for users in a transparent manner and establish a channel to address users' concerns.
- Allow spectrum sharing first for secondary users. If risk of interference is present, consider dynamic sharing through database management.
- Consider a subsidy regime for accessing backhaul by vulnerable communities.
- Promote the collaboration of federal and state governments and community networks to develop robust technical training programmes and local content creation, green power generation alternatives and local smart community programmes with municipal and state incentives.

5.4. POLICIES ON OPEN ACCESS TO BACKHAUL NETWORKS AND WHOLESALE MARKETS

As mentioned in Section 3 above, one of the biggest financial challenges that community networks have is the lack of affordable backhaul internet. A truly competitive wholesale market, that does not discriminate against small ISP (SLP community networks) based on volume discounts, remains a work in progress. First, these networks should have access to wholesale markets, for both backhaul and any other infrastructures of operators with substantial market power.

Having to buy internet access at retail prices to serve a small community is certainly not sustainable for such networks. If, under Resolution 617, SLP

were entitled to provide internet access as non-commercial providers, then they should be entitled to access wholesale backhaul internet as well.

Even small PPPs with a SCM regime have difficulty finding good prices, when they have access to the wholesale market. Interviews showed that some PPPs have found better backhaul prices in private negotiations, rather than from the SNOA platform, which means there is discrimination and non-transparent rates per megabyte. Community networks should benefit from a public reference offer for small-scale community network backhaul internet because these players are not for profit and cannot buy terabytes of internet like ISPs in order to get the lowest prices.[213]

PERT made evident that access to fibre backbone triggers an increase in the number of accesses in a given municipality.[214] An important goal is therefore not only to promote the expansion of fibre backbone but also to make sure that the right affordable access policies are in place. Huge investments in national backbones have been made by governments or private public partnerships in Latin America to increase the reach of fibre, but the high prices or difficulty to access such transport networks have left them with very low demand, to the point of bankruptcy or termination of the partnership, again leaving rural communities behind, as happened in Peru. Therefore, it is important that Brazil reviews the access policies to national backbone networks. Undersea cable systems and the Rede Nacional de Ensino e Pesquisa (RNP) could also facilitate backhaul for local ISP, community networks at affordable prices to increase their traffic.

As for private sector backhaul networks, especially open access neutral carriers, as they call themselves, affordable backhaul offers should be mandated for community networks as part of a universalisation plan. In order to achieve that, both Anatel and CADE (the competition authority) should conduct a thorough investigation of market conditions in different backhaul relevant markets.

An investigation might result in findings such as the use of substantial market power to fix prices in these areas by backhaul providers, or collusive practices, or a market failure of a different sort. Whatever the outcome is, regulatory agencies Anatel and CADE should be concerned about expensive backhaul, which can drive the smallest PPP (and certainly a community network) out of business. Investigations will enable the competent authority/ies to work with the best set of tools to remedy this distortion which is holding back affordable high-speed rural broadband. There may be asymmetric regulation remedies, antitrust remedies, or the promotion of a FUST subsidy for the networks to be able to buy backhaul and maintain affordable broadband for communities.

[213] For example, the conflict between Grupo Azteca and the Peruvian government around the national fibre backbone network. The government claim that USD 100 million are to be paid annually to Azteca is not sustainable, when the network is only utilised at 3% of its capacity. An arbitration panel will decide the destiny of this partnership and meanwhile, millions of Peruvians lack access and affordable backhaul. See: Diario Correo. (2021, 24 May). Gobierno sobre anular contrato de Red Dorsal de Fibra óptica: "Veremos si entra un nuevo operador o el Estado lo administra". *DPL News*. https://digitalpolicylaw.com/peru-gobierno-sobre-anular-contrato-de-red-dorsal-de-fibra-optica-veremos-si-entra-un-nuevo-operador-o-el-estado-lo-administra

[214] "82.3% of municipalities, that is, 4,582, had fibre backhaul, up from 4,403 the previous year." Anatel. (2021). Op. cit.

5.4.1. INTERNATIONAL GOOD PRACTICE

- Spain's open access to fibre backbone for all operators.
- guifi.net pool of commons using shared fibre and other assets.[215]
- In Argentina the national fibre backbone managed by the state-subsidised access to its network for community networks in urban informal settlements (barrios).[216]
- The Mexican government's Ministry of Communications afforded satellite capacity for backhaul to the Indigenous community network TIC A.C. at no charge.

5.4.2 RECOMMENDATIONS: ANATEL AND FUST COUNCIL

- Consider including community networks (currently SLP) policy for enabling access to wholesale markets of different kinds with affordable and transparent backhaul pricing offers to avoid price discrimination through private dealings.
- Consider giving access to these networks to SNOA, to PoP for data exchange, and to have the right to interconnect, in a special not-for-profit category.
- In the case of new universalisation, competition and structural plans, consider including resources for community networks as potential beneficiaries of affordable open access to backhaul and infrastructure sharing.
- Consider an amendment of Resolution 617 for non-profit SLP community networks declaring that they have the right to access wholesale services, full duplex links and infrastructure markets and review Article 19 from Resolution 617/2013,[217] that bans SLP from the right to interconnect.
- Propose a policy within FUST to earmark funding for subsidised access to backhaul internet for community networks that provide internet where backhaul options are non-existent.
- Review TAC to require a special open access policy for community networks to SCM and SMP backhaul facilities and passive infrastructures, which would also increase traffic and thus benefit larger operators.
- Create a policy of free-of-charge satellite backhaul for community networks in remote areas where no other is available. This can be accomplished through Brazil's GESAC programme.
- As recommended in the section on spectrum, enable backhaul links in the licence-exempt bands by relaxing power and EIRP limits for SLP/community networks and also in the newly unlocked 6 GHz, allocate an upper segment of the band for backhaul links with a light licensing to avoid interference, depending on the extent of occupation of the band.

[215] https://guifi.net/pt-pt/node/54051

[216] UNESCO. (2021). Foro Latinoamericano para el Fortalecimiento de Medios Indígenas y Comunitarios. Mesa 3 Conectividad e Infraestructura. https://www.youtube.com/watch?v=-Dq9BkHvsxs&list=PL-SV0KQqZNUntuvBqJgDcYC43iKXiJr3I&index=9

[217] https://informacoes.anatel.gov.br/legislacao/resolucoes/2013/480-resolucao-617

5.5. UNIVERSAL SERVICE FUND (FUST) REDESIGNED TO SUPPORT COMMUNITY NETWORK PROJECTS AND FUNTTEL FUNDING FOR DEVELOPMENT OF BRAZILIAN FLOSS AND HARDWARE FOR SUCH NETWORKS

During our research and interviews, we consistently heard voices advocating for a new vision for FUST now that congress has authorised its reform and use for broadband connectivity. In this new scenario of multiple players and network types, and taking into account both supply and demand challenges and the existing gaps in Brazil, there are pretty amazing ideas to innovate FUST targets: new beneficiaries, target items to be funded, aligning incentives to introduce gender and race perspective in FUST allocations.

FUST has a one-time opportunity to align incentives by allocating funding to those community network projects that:

- Have taken Anatel approved training courses in partnership with academia or the technical community, on technical and managerial aspects of community networks.
- Have registered or obtained an SLP or community network authorisation exemption from Anatel.
- Include leadership by women or their participation in the community network design, management, installation or monitoring or indigenous or traditional peoples of all ages and genders as active participants in the network decisions, design or management.

5.5.1. INTERNATIONAL GOOD PRACTICE

Argentina

In Argentina, the community networks El Hormiguero and La Poderosa have received funding from the universal service funds to provide internet for their communities. El Hormiguero received approximately BRL 2 million (USD 3,728,340) from ENACOM.[218] The Argentinian USF programme (Aportes No Reembolsables) will be contributing a total of ARS 1,000 million (USD 9,899,130) for the purchase of network infrastructure for urban and suburban settlements that have no connectivity and have therefore organised themselves as community networks. The community installs and manages the network, mainly in public spaces, schools and squares and it trains community members in partnership with local NGOs. The government plans to fund connectivity for 4,416 popular neighbourhoods ("barrios").

Costa Rica

Universal Service Fund FONATEL under the president's office took policy actions as household connectivity had stalled. This culminated in the launch of CR Digital, a national plan designed to connect the whole country to the internet within two years. Through this plan, FONATEL received an injection of an additional USD 300 million and was designated the lead organisation for the five-phase plan. The first phase of this plan, *Comunidades Conectadas*, involved connecting communities through schools and community centres which lacked access. The second phase, *Hogares Conectados*, or connected homes, focused on providing every Costa Rican household with fixed-line

[218] ENACOM. (2020, 21 December). ENACOM entregó ANR por más de $36 millones a El Hormiguero. https://www.enacom.gob.ar/noticias/institucional/enacom-entrego-anr-por-mas-de--36-millones-a-el-hormiguero_n2943

internet access and devices needed to get online and use the internet. Families eligible for the programme typically include those who are poor, Indigenous, disabled, women, elderly or low-income entrepreneurs. FONATEL subsidises the cost of internet connections (up to 80%) and laptop purchases (up to 100%) for families who qualify for support, based on their household finances; Programme beneficiaries can visit participating service providers and the head of household signs a contract to receive their connection and equipment. After the subsidies are taken into account, families are expected to cover the remaining costs. Approximately 95% of the families who have participated in the programme to date are female-headed households, meaning that more women than before – especially those in rural areas – are benefiting from this plan.[219]

5.5.2 RECOMMENDATIONS FOR FUST AND FUNTTEL MANAGING COUNCILS AND MINISTRY OF COMMUNICATIONS

- Allocate funding to community network projects in every region of the country specifically for initial CAPEX requirements: infrastructure equipment, fees for backhaul legal and engineering. FUST may launch calls for grants to finance inclusive community networks; fund incubators of local media and connectivity innovation, capital for network infrastructure and promote the formation of non-profit partnerships for community networks that jointly apply for FUST funding. Such partnerships must include community members and, for example, academia, meso organisations that support community networks, municipal government, a technical adviser, etc.
- Priority is to be given to community network funding for Indigenous, quilombolas and women-led community network projects in underserved communities.
- Propose a seat for a community network representative at the FUST and FUNTTEL councils.
- Anatel advocates before FUNTTEL to consider SLP or community networks as possible beneficiaries of funds when they are developing technology for community networks such as LibreRouter.
- In the case of Indigenous communities and other traditional peoples interested in community network funding, affirmative action should apply so that this kind of community may access funding without competing with non-Indigenous projects.

5.6. PROMOTING NATIONAL INDUSTRY OF HARDWARE FOR COMMUNITY NETWORKS AND FLOSS DEVELOPMENTS BY EASING HOMOLOGATION REQUIREMENTS, IMPORT TAXES AND ACCESS TO SUBSIDIES

There is a strong path to be traced regarding the facilitation of equipment to implement and maintain community networks. Small manufacturers of FLOSS and open hardware devices have no economic and logistics capacities to compete in the routing equipment market. At the same time, import taxes make the cost of devices double when it arrives in Brazil and there is no access to subsidies for small manufacturers of FLOSS and open hardware devices, neither to buy nor to assemble the technology locally. This results in community networks that struggle with outdated technology and

[219] https://a4ai.org/studies/closing-the-digital-divide-with-universal-service-leadership

have difficulty accessing equipment to launch and expand their networks.

5.6.1 DOMESTIC AND INTERNATIONAL GOOD PRACTICE

Argentinians are trying to create technologies to address the technical difficulties of implementing and maintaining a Wi-Fi community network e.g. LibreRouter, mentioned in Section 3.9 above. In this country the networks El Hormiguero and La Poderosa received funding from FUST to provide internet to their communities and are using LibreRouter technology to do so. El Hormiguero received approximated BRL 2 million (USD 372,834) from ENACOM[220] (Ente Nacional de Telecomunicaciones). They are using these funds along with other network infrastructures, to support LibreRouter import and development, and are starting a national small factory of LibreRouter assemblies in the country, investing in the national technology development.

In Brazil, there is a recent precedent of tax reduction for VSAT antennas providing broadband connectivity in rural areas, according to Medida Provisória 1.018, as this is of public interest to universalise access.[221] The measure reduces the tax burden from BRL 201.12 (USD 37.49) to 26.83 (USD 5) for the installation inspection fee "Taxa de Fiscalização de Instalação" (TFI) due by the service providers at the time of issuing the licence certificate for the operation of each antenna. This reduction implies a decrease in the value of the operational inspection fee (TFF) payable annually by service providers for the inspection of antennas, which will go from BRL 67.04 (USD 12.5) to BRL 8.94 (USD 1.67), as the TFF is equivalent to 33% of TFI. Although it is good news to reduce taxes for VSAT antennas providing broadband connectivity in rural areas, there has to be mandatory proportional cost reduction to final users. At the same time, these tax reductions through Medida Provisória can be paths to cancel or significantly reduce other fees and import taxes that aim to contribute to the universalisation of internet service through community networks.

Another domestic reference is the HERMES project, created by Brazilian developers and Organization Rhizomatica. It provides affordable digital telecommunications over shortwave/HF radio using a simplified visual interface accessed via smartphone or computer, allowing for the transmission and reception of data (chat, audio, documents, photos, GPS coordinates, etc.) that can easily be encrypted and password-protected by the sender. Both architecture designs and software are free and open-source. This technology was developed nationally and created with equipment much cheaper than a common HF transceiver, and tested in Mexico and Brazil. It is currently in use on a community network in the state of Pará, North Region, at an extractive reserve of riversiders and Indigenous populations. They have implemented 10 radio base stations with a distance of up to 600 km between stations.

5.6.2 RECOMMENDATIONS FOR ANATEL AND THE FEDERAL GOVERNMENT

- Import tax exemption or significant reduction for community network's equipment and FLOSS.

[220] ENACOM. (2020, 21 December). Op. cit.

[221] https://www12.senado.leg.br/publicacoes/estudos-legislativos/tipos-de-estudos/sumarios-de-proposicoes/mpv1018

- Lower or exempt homologation fees for non-profit FLOSS technologies and facilitate type approval of such equipment that has passed through small changes in firmware, instead of demanding new homologation and charging the same fees.
- Encourage and value the manufacture and/or national assembly of components.
- Further encourage the use of open source technology in the development of standards of routing and Wi-Fi technologies.
- Technologies used in community networks as routers and antennas, especially those that use FLOSS and small not-for-profit manufacturers. This incentive to national small industry can be achieved by allocating certain FUST amounts to small manufacturers, assemblies and importers of equipment and FLOSS for non-profit providers and also tax reductions. See previous recommendation.
- Encourage the use of recyclable parts and components and parts to reduce the programmed obsolescence of community network devices such as routers and antennas and thus contribute to the reduction of electronic waste generated. Nowadays, it is often necessary to change the entire device, when it would be possible to change only a few parts.

5.7 FREEDOM OF EXPRESSION, PLURALISM AND COMMUNITY BROADCASTING: MINISTRY OF COMMUNICATIONS AND ANATEL

Community broadcasting is still very important for communities and there is a consensus among meso organisations, NGO, civil society and even Anatel members that community radios can lead community networks and also provide internet for the communities, thus facilitating community processes and citizen mobilisation needed for the sustainability of a network. In order for this to become a reality they need to be able to first continue with their broadcasting work with greater availability of spectrum, community radio licences, broadcasting channels, increase of signal strength and guaranteed freedom of speech, as well as a more open sustainability model which does not ban local advertising, as the Inter American Commission of Human Rights has emphasised: prohibiting community radio certain licit revenue sources is an indirect restriction of freedom of expression which violates Article 13 of the American Convention of Human Rights on freedom of expression.

In addition, radio broadcasting would greatly benefit from digitalisation, as has happened with digital TV. This would increase (up to 12 times) the number of channels available, since digital signal occupies less bandwidth and allows for multi channels. The digitisation process could make it easier to increase the channels for community broadcasting because it would optimise the radio spectrum. Technologies such as radio-defined software and cognitive radio could help redefine the current paradigm of scarcity of radio bands and allow for more community and commercial radio stations. It is very important for this purpose that a good process of digitalisation is chosen, in the same way that the Japanese pattern was implemented for digital TV in Brazil. Digital radio advocates have advocated for Digital Radio Mondiale (DRM) a European non-profit consortium that is open source and already used by many countries that have migrated to digital radio such as India, Russia and many European countries.

5.7.1 INTERNATIONAL GOOD PRACTICE

Several Latin American countries have recognised the public interest and the right of community broadcasting by

securing an equitable part of the spectrum for community communications.[222]

- Argentina guarantees one third of the total broadcast radio frequencies reserved for indigenous and community radios (rural and urban), through Article 89 of their Ley de Medios.[223]
- Ecuador guarantees 34% of spectrum to community media operations, through Article 106 of their Ley Orgánica de Comunicación.[224]
- Uruguay guarantees one third of spectrum to community radio operations, through Article 5 of their Servicio Radiodifusión Comunitaria.[225]
- Bolivia guarantees 17% of spectrum for community media and 17% for native Indigenous broadcast media, and intercultural and Afro-Bolivian communities, through Article 10 of their Ley General de Telecomunicaciones, Tecnologías de Información y Comunicación.[226]
- Mexico has a frequency reserve of 10% of AM and FM bands for community and Indigenous radio under the Federal Telecommunications and Broadcast Act of 2014.

5.7.2 RECOMMENDATIONS FOR ANATEL AND MCOM

- Increase the spectrum frequencies allocation for community broadcast and amplify the limits of low power (25 W) and restricted coverage (1 km) following the tendency of Latin American legislation to value community broadcast and to better serve rural locations, high density population locations, Indigenous, quilombolas and traditional populations.
- Secure a community radio frequency channel that operates well in most current and popular radio receivers, that is between 87,9 MHz and 107,9 MHz.
- Support the ongoing Bill PL 10637/2018,[227] already approved in the senate, to increase the number of community broadcast channels to two and the transmission power to 150 W.
- Support through public campaigning and legal advice for community radios to become community networks and advice about sources of funding and training so they can become community networks.
- End the criminalisation of community radios as a practice contrary to international human rights law and the Inter American Standards of Freedom of Expression.
- Collect and disseminate comprehensive data and information about the authentic community radios, including data on the closure of such radios and the criminal proceedings generated from inspection operations.
- It is important to differentiate between community radios that are not for profit and illegal stations that sell advertising for profit and do not contribute to the well-being of the community nor hold

[222] OBSERVACOM. (2019). *Libertad a medias: La regulación de los medios comunitarios en América Latina y su compatibilidad con los estándares interamericanos de libertad de expresión*. https://www.observacom.org/wp-content/uploads/2019/10/Libertad-a-Medias-Informe-2019-sobre-medios-comunitarios-y-libertad-de-expresio%CC%81n.pdf

[223] http://servicios.infoleg.gob.ar/infolegInternet/anexos/155000-159999/158649/norma.htm

[224] https://www.wipo.int/edocs/lexdocs/laws/en/ec/ec067en.pdf

[225] https://legislativo.parlamento.gub.uy/temporales/leytemp2823536.htm

[226] https://www.wipo.int/edocs/lexdocs/laws/es/bo/bo052es.pdf

[227] https://www.camara.leg.br/proposicoesWeb/fichadetramitacao?idProposicao=2182042

a licence to use spectrum. Community radio has an important social role and if stations do not have a licence it is in many cases due to the barriers to access frequencies, since 99% of them are for commercial and public radio.

- Raise public awareness of the importance and social role played by community radio and community broadcasters by means of public campaigns and sensitisation of the commercial broadcasters and the judiciary.[228]
- Provide training to the agents of the federal police and Anatel on how to treat community broadcasters with respect during inspection operations, in particular with respect to their rights to due process, contradictory and broad defence.
- Consider allocating channels for community television at the local or regional level for Indigenous and tribal groups for pluralism, cultural identity and freedom of expression goals.
- Consider assessing the digitalisation of radio broadcasting in Brazil and encourage that software-defined radio and cognitive radio be used for amplifying and optimising radio spectrum, to use digital radio, a pattern must be adopted, digital radio advocators recommend the non-profit open-source DRM pattern for digitalisation of radio.

5.8 OPEN DATA AT THE GRANULAR (TOWN OR VILLAGE) LEVEL: PASSIVE AND ACTIVE INFRASTRUCTURE MAPS AND BACKHAUL AND BACKBONE COVERAGE MAPS

The Access to Information Law defines the obligation of public bodies to provide open access to data, enabling automated access by external systems in open, structured and machine-readable formats. Brazil established its open data policy via the executive branch through Decree 8.777/2016.

The principles and guidelines of the policy are as follows:

- Observance of the publicity of databases as a general precept and secrecy as an exception.
- Guarantee of unrestricted access to databases, which must be machine-readable and available in an open format.
- Description of the databases, with sufficient information for the understanding of possible reservations regarding their quality and integrity.
- Unrestricted permission to reuse databases published in an open format.
- Completeness and interoperability of databases, which must be made available in their primary form, with the highest degree of granularity possible, or refer to the primary databases, when made available in aggregate form.
- Periodic updating, to guarantee the permanence of the data, the standardisation of information structures, the value of the data to society, and meeting the needs of users; and clear assignment of responsibility for the publication, updating, evolution, and maintenance of each open database, including the provision of assistance regarding the use of the data.
- The policy establishes that all databases or information not protected by law must be open to citizens. It also

[228] CIMA. (2017). *Estándares internacionales de libertad de expresión: Guía básica para operadores de justicia en América Latina*. https://www.cima.ned.org/resource/estandares-internacionales-de-libertad-de-expresion-guia-basica-para-operadores-de-justicia-en-america-latina/

states the obligation of the federal administration to publish their open data plans.

According to UNESCO, indicators of internet development as measured in Brazil by CETIC (which is a centre 2 of UNESCO), showed the country ranked #18 globally and scoring 58.86 out of 100 on the open data indicator.[229] We see opportunities for data interoperability and more granular information on access and backhaul infrastructure, which is geographically localised.

We are aware that Anatel and CETIC have been working very hard to publish accurate data about coverage, operators, licences issued and internet infrastructure. Anatel's data portal includes open data, interactive tools and dashboards. The challenge now is to collect and publish more granular data of the underserved and unserved towns and villages, identifying lack of mobile access, lack of FBB access, backhaul networks including microwave links so that the social sector can make informed decisions and see where the nearest infrastructure is available.

The OECD Brazil review reported that Anatel has also been making efforts to improve data collection on backhaul and backbone availability, including from small ISPs, to allow for the mapping of communication infrastructure.[230] It also mentions that the Ministry of Innovation's Department of Digital Inclusion commissioned a detailed study and mapping of broadband networks in Brazil. It assigned the study to the Centre for Strategic Management and Studies (*Centro de Gestão e Estudos Estratégicos*), a non-governmental organisation. By June 2020 the project was set to deliver an interactive and geo-referenced map with granular data (using the same census-level block grid) of transport and first-mile networks in Brazil. Nevertheless, at the moment of writing, we could not obtain any map with such characteristics from the centre.

5.8.1 RECOMMENDATIONS: ANATEL AND MCOM

- Granular at town or village level coverage maps indicating the presence of SMP, SCM, STFC and internet access SLP providers and satellite internet commercial availability
- An important tool for community networks and decision makers is a system that can show actual spectrum occupancy open to potential broadcasters and operators or both collective and restricted interest. When deciding how many community radio licences may be possible in a given locality, it is important that applicants know exactly where the neighbouring stations are and what class of station, power and reach are nearby.
- This also applies to IMT and VHF and UHF bands: transparency of actual occupation of spectrum is essential.
- Map of backhaul infrastructure throughout the country by type of technology.
- Update maps of actual GESAC sites, and future openings in remote and rural areas (Ministry of Communications).
- Coverage and infrastructures' maps in Indigenous territories and quilombos of any telecommunications and broadcasting systems (Anatel, FUNAI and CETIC).
- Gather and publish data regarding existing community networks of any kind across the country. Currently, in Anatel's data

[229] UNESCO. (2019). Op. cit.

[230] OECD. (2020). Op. cit.

panel, it is not possible to learn which registered SLP providers are acting as ISP or any other form of community network. We need to know who and where they are, their coverage and technology.

- Sort all SLP providers into different categories, so that it is possible to know which ones are operating as community networks.

5.9 LEADING COLLABORATIVE WORK WITH OTHER AUTHORITIES: ANATEL

Collaboration and coordination among different stakeholders and public entities, including public universities and state and municipal governments, can also contribute to the realisation of the community networks and universal access agenda. Repeatedly, Doreen Bogdan, Director of the Development Telecommunications Bureau at ITU has emphasised the need for all government levels to work collaboratively and coordinate so that they can together implement effective public policies that act as enablers of education, healthcare, financial inclusion, cultural and political rights, commerce and environmental protection action. Below are some recommendations of collaborative work and partnership initiatives that Anatel could lead and incentivise.

5.9.1 INTERNATIONAL PRACTICE

In Argentina, the organisation AlterMundi has a partnership with Universidad Tecnológica Nacional (UTN) and with Universidad Nacional de Córdoba (UNC), which donate spare bandwidth to community networks. This is then transported through a 53 km PtoP 5 GHz Wi-Fi backhaul they have installed and internet access is then distributed to various networks: QuintanaLibre, LaSerranitaLibre, LaBolsaLibre, AnisacateLibre, Nono libre and ElValleReinicia providing around seven municipalities with mesh technology using LibreMesh and LibreRouter. They offer household connections and hotspots at community centres and schools. Regarding the partnership with the universities, they have an agreement with UTN to connect with a Wi-Fi link and make an internal route between the UTN towers with AlterMundi's equipment. In UNC they reach through the inter-university fibre. They use the university data centre and part of its idle bandwidth and in return they offer academic use of QuintanaLibre's network as a real test bed and knowledge exchange over mesh networks.

Working with municipalities to lower barriers for the deployment of infrastructure is key to the expansion of community networks and other networks. There are model telecom network installation regulations and best practices for municipal governments to facilitate rights of way, access to poles, policies of one-time digging investing in underground polyducts, expedite procedures for the licensing of antennas or tower deployment, infrastructure sharing and effective enforcement of the Antennas Law[231] that initially provided for a default affirmative reply in case local authorities did not reply soon enough. All those initiatives should be implemented and enforced.

5.9.2 RECOMMENDATIONS FOR COLLABORATION

OPEN ACCESS POLICY AND CAPACITY BUILDING

PPPs

- Once Anatel leads the creation of a communication channel or round-table talks with community network advocates, it can also lead or promote collaborative efforts among different

[231] http://www.planalto.gov.br/ccivil_03/_ato2015-2018/2015/lei/L13116.htm

players. One potential collaboration is between such networks and PPPs, who could become backhaul providers while the network serves the first mile. This can benefit both since, most of the time there is no commercial interest for PPPs in providing services for communities that are small and have low incomes. This way PPPs could sell a backhaul service and wholesale internet at affordable prices while the costs of the first mile and distribution of the internet link would be done by the community network, which will not have to worry about reaching the PoP and doing the backhaul themselves.

RNP and universities

- The RNP (Rede Nacional de Ensino e Pesquisa) has PoP in all the 27 federal units of Brazil and provides high speed internet and educational services to public entities, universities and public schools, through a fibre network. A partnership with a community network providing access to their PoP at low cost or even free of charge, would be of great benefit to a network that cannot afford to have dedicated internet connections. The internet bandwidth might vary according to the public use of the services, for example, providing more internet bandwidth on weekends and off commercial hours, where public universities and other institutions tend to use much less bandwidth.
- In addition, regarding partnerships with RNP, their educational assets could help to provide technical courses by the Escola Superior de Redes, especially for the needs of community networks, and provide dedicated spots on their regular network courses for members of such networks, with guaranteed places for women, Indigenous, traditional and Black people from these networks. Public universities can tailor extension courses on community networks and telecom networks and benefit from the community of supporters and technicians which form such networks, for knowledge exchange.

Wi-Fi Brasil/GESAC

- The Wi-Fi Brasil and GESAC programmes play a big role in providing connectivity in Brazil, especially in rural and isolated communities. However, even where there is a GESAC or Wi-Fi Brasil hotspot, the population probably does not live clustered near the hotspot and may need to walk up to 10 km in order to reach it. With that in mind, a partnership to expand their connections as backhaul for community networks would be useful and it can help to address a major problem that these networks have in Brazil; the lack of access to backhaul and dedicated internet links. By doing so, they would continue to provide the community hotspot, but with an increased bandwidth so their internet can be distributed along the community territory by the community network, being able to reach more towns and villages, including households and other community centres located in the same territory. In addition, Wi-Fi Brasil could have a special category of applications to contemplate community networks. We must bear in mind that during the pandemic homes have been the primary gathering place, where connectivity is most needed. We note that a collaboration agreement between the Ministry of Communications/GESAC and different community networks is feasible under the current rules governing the GESAC programme.[232]

[232] https://www.in.gov.br/en/web/dou/-/portaria-mcom-n-2.460-de-23-de-abril-de-2021-315795564

Telebras/SGDC

- Regarding Telebras we consider it has a role in digital inclusion, as a partner that helps shape the state's implementation connectivity programmes where market cannot. With this in mind, government could consider a partnership in which Telebras donates satellite or fibre broadband capacity for community networks in exchange for the first-mile connectivity to be deployed by the network. Specifically, the SGDC satellite could be used for the purpose of providing satellite backhaul in Ka band, since this satellite purpose has always been to serve the parts of the Brazilian population in remote areas.
- Also, the institution could provide courses of satellite backhaul and fibre backhaul and implementation and certificates to community network members to broaden the community technical knowledge, with guaranteed places for women, Indigenous, traditional and Black populations from community networks.

DIVERSITY AND CONTENT PRODUCTION

FUNAI and Palmares Foundation

- As pointed out before, there is a great lack of connectivity among indigenous, quilombolas, riversiders, extractivists, traditional and black population in general. FUNAI and Palmares Foundation, have legal powers to collaborate with Anatel by providing qualified data and indicatives of location, topography, population, income, presence of devices, schooling, digital literacy and other socio demographic data that can be helpful for a better understanding of the reality of the population with no or insufficient connectivity. To understand the legal constituencies of these populations and their achieved rights regarding the right to land and to cultural and technological self-determination can be a great asset to a better and more assertive framing of public policies and legislations that are based on their communal way of life and territory specificities. Anatel has the leadership to propose this collaboration to FUNAI and Palmares Foundation.

Ancine

- Another important aspect of community network sustainability and ownership is that communities may learn to create and exchange relevant content. In that sense, Anatel can partner with Ancine to design public calls for content production made by community network and media training and workshops focused on the networks' members to foster this development of local media. Again, affirmative action on in this area for women and Indigenous and other vulnerable groups would be important for equality and pluralism.
- Colombia is implementing a holistic policy for Indigenous media and content creation through partnerships to fund Indigenous producers and creators of the TV series "El Buen Vivir"[233] both online and on community-owned TV channels or community radios. This could be emulated by Ancine, i.e. funding of local, Indigenous and women creators for radio, and online audiovisual content.

[233] CONCIP. (2020, 9 May). El Buen Vivir. *Comisión Nacional de Comunicación de los Pueblos Indígenas.* https://concip.mpcindigena.org/index.php/noticias/actualidad-concip/249-el-buen-vivir-serie-de-tv-a-traves-del-canal-trece

5.10 AFFIRMATIVE ACTIONS FOR GENDER EQUALITY

It is a known fact that ICT and internet access fields hold imbalances that affect men and women differently. These differences are present at various levels such as: availability of access, customs and experiences of use, development of protocols and technologies, design of public policies and the access to decision-making positions that can bring women's perspectives to the field. The asymmetry is even more marked when considering racial and ethnic inequalities. Pointing out where these differences are and being aware of these realities, positions and restrictions is essential to reflect and act on the development of ICT considering gender perspectives and to build a more egalitarian environment of access to the internet and community networks.

5.10.1 INTERNATIONAL PRACTICE

APC's Women's Rights Programme has developed a Gender Evaluation Methodology (GEM).[234] It was first developed in 2002 and was tried and tested by 30 community-based organisations. It is an evaluation methodology that integrates a gender analysis into evaluations of initiatives that use ICTs for social change. This provides a tool for determining whether the ICTs are really improving or worsening women's lives and gender relations, as well as for promoting positive change at the individual, institutional, community and broader social levels. GEM is also available in Portuguese.[235] The Dominican Republic government chose this methodology as a tool to design and evaluate their ICT policies.

In 2015 the United Kingdom Office of Communications (Ofcom), the communications regulatory agency issued and launched its *Diversity and Inclusion Strategy* with specific goals and targets on gender and diversity (age and ethnicity) for 2020. They were able to achieve the goal of equal gender balance in the organisation and had women occupying 40% of senior roles. Ofcom was named by *The Times* as a "Top 50 Employer for Women".

5.10.2 RECOMMENDATIONS

Anatel and MCom

- Include affirmative action policies to increase the number of women in Anatel, especially including senior roles and the board of directors. It is important that racial and ethnic perspectives are also included. At board level this would correspond to the MCom and the executive.
- With reference to the MCom and other executive branch ministries, a public policy on ICT and gender should be implemented across all agencies and ministries. This would certainly help to address barriers, unconscious bias and gaps.
- Such policy should mandate guarantee that women's interests and needs are considered and incorporated in public policies about internet and ICT access, such as Internet Para Todos, GESAC, Wi-Fi Brasil and Telebras policies, with attention to the needs of Indigenous and Black women.
- Anatel could also review and assess its current and future ICT regulatory policies regarding gender inclusion. APC's GEM can be used as a tool to help design and evaluate Anatel ICT

[234] Garcia Ramilo, C., & Cinco, C. (2005). *Gender Evaluation Methodology for Internet and ICTs: A learning tool for change and empowerment*. Association for Progressive Communications. https://www.apc.org/en/node/2835

[235] https://www.apc.org/sites/default/files/GEM_PT.pdf

policies and their effectiveness in including women, Black and Indigenous people and attending to women's and girl's needs on ICTs, with special attention to the needs of Indigenous and Black women.

- MCom and its flagship initiatives Internet para Todos, GESAC, Wi-Fi Brasil and others, should include gender perspective policies to ensure more women have affordable access to ICT.
- Invest at least 50% of funds in projects targeting women's access to and use of the internet and projects in communities that are led by women and have special consideration of the needs of Indigenous and Black women.
- To collect gender-relevant data and indicators regarding ICT use and access to be able to identify and tackle gender gaps and create gendered policies that aim to achieve equality. Add a race and ethnicity layer to data collection to obtain even more granulated data.

FUST

- Create affirmative action to have a presence of 50% of women on the FUST council, carrying significant weight regarding decisions.
- Create a quota so that at least 50% of project funds target women's access, communities that are led by women and with special attention paid to Indigenous and Black women. Projects based on women's perspectives, i.e. those designed with gender perspective and with significant involvement from women, of all ethnicities and ages, in decision making and network design, governance, operation and management. The participation of women will help the sustainability of community networks and is essential for equality and inclusion.

ABBREVIATIONS AND ACRONYMS

Ancine	Brazilian Film Agency
Anatel	National Telecommunications Agency
APC	Association for Progressive Communications
CADE	Administrative Council for Economic Defence
Cetic	Regional Centre for Studies on the Development of the Information Society
CGI.br	Brazilian Internet Steering Committee
CNPJ	National Register of Legal Entities
CONAQ	National Coordination for the Articulation of Quilombos
CPF	Registration of Individuals
CREA	Regional Council of Engineering and Agronomy
EIRP	Effective irradiated power
ENACOM	National Telecommunications Entity (Argentina)
FBB	Fixed broadband
FISTEL	Funds for the inspection of telecommunications
FLOSS	Free/libre and open source software
FM	Modulated frequency
FONATEL	Fondo Nacional de Telecomunicaciones (Costa Rica)
FUNAI	National Indigenous Foundation
FUNTTEL	Fund for Technological Development of Telecommunications
FUST	Telecommunications Universal Service Fund
GESAC	Brazilian e-Government Initiative
GEM	Gender Evaluation Methodology
HERMES	High-frequency emergency and rural multimedia exchange system
HF	High frequency
IBGE	Brazilian Institute of Geography and Statistics
ICT	Information and communication technology
IFT	Federal Institute of Telecommunications (Mexico)
IGF	Internet Governance Forum
IMT	International mobile telecommunications
ISP	Internet service provider
ITU	International Telecommunication Union
LGT	General Telecommunications Law
MBB	Mobile broadband
MCTIC	Ministry of Science, Technology, Innovation and Communication
MCom	Ministry of Communications

MNO	Mobile network operator
MVNO	Mobile virtual network operator
NGO	Non-governmental organisation
Ofcom	Office of Communications (UK)
OECD	Organisation for Economic Co-operation and Development
PERT	Structural Plan for Telecommunications Networks
PNBL	National Broadband Plan
PNC	National Connectivity Plan
PtoP	Point-to-point
PtoMP	Point-to-multipoint
PPP	Small-scale internet service provider
RUE	Spectrum use regulation
RNP	National Teaching and Research Network
SCM	Multimedia communication service
SDG	Sustainable development goals
SEI	Electronic information system (Anatel)
SLP	Private limited service
SMP	Personal mobile service
SNOA	Wholesale offers negotiation system
SOIA	Wholesale input supply system
STEL	Telecommunications Service System (Anatel)
STFC	Fixed switched telephone service
TAC	Conduct adjustment term
Telebras	Brazilian Telecommunications Company
TFI	Installation inspection fee
TFF	Operational inspection fee
UN	United Nations
USF	Universal service funds
WTDC	World Telecommunications for Development Conference
VSAT	Very small aperture terminal

APPENDIX 1
SPECTRUM BANDS OR SUB-BANDS RELEVANT TO COMMUNITY NETWORKS, CURRENTLY DESTINED FOR SLP

Spectrum bands or sub-bands attributed, destined and/or distributed for different SLP services that may be relevant to community networks under the Frequency Ranges Assignment, Destination and Distribution Plan.[236]

Band kHz	Attribution Brazil	Destination	Distribution	Regulation
9-11.3		Limited private service (SLP)		
160-190	Fixed	SLP	160-190	
1605-1705	Broadcast	Broadcast – Onda media		Resolution 116/1999 Resolution 117/1999
1705-1800	Mobile	SLP		Resolution 661/2016
1850-2000	Mobile	SLP	1850-2000	Resolution 697/2018
2000-2065	Fixed	SLP	2000-2065	
2107-2170	Mobile	SLP		Portaría SNC 52/91 June 6 1991
2173.5-2190.5	Mobile (SOS call)	SLP mobile/ aeronautics search and rescue	2173.5-2190.5	Dentel 4/81 ; No. 10/81; No.6/88
2194-2300	Fixed	SLP	2194-2300	Portaria MC 280/79 Dentel 11/81
2300-2495	Broadcast	Broadcast – Onda tropical (120 mts)	Radio broadcast in tropical waves	Portaria SNC 75/90 Anatel Resolution 116/99 Anatel Resolution 117/99
3155-3200	Fixed	SLP		Portaria MC 280/79 (HF & LOW VHF)
3200-3230	Fixed	SLP		Portaria MC 25/83
4000-4063	Fixed	SLP		Portaria MC 280/79
4438-4488	Fixed radio localisation	SLP Limited private – roaming stations		Portaria MC 280/79, Del 11/81;Portaria MC 1207/96
5060-5250 5250-5275	Fixed Mobile	SLP SLP		MC 280/1979 MC 280/1979;Resol Anatel 716/2019
5351.5-5366.5	Mobile	SLP		Portaria MC no. 280/79, Dentel 11/81 Anatel Resolution 697/18, 716/19, Act SOR 9106/2018

→

[236] Elaborated for this brief with the information of the Plano de Atribuição de Faixas no Brasil Resolução nº 716/2019. It does not include frequencies for earth exploration, navigation or aeronautics, although they are also subject to the SLP regime.

Band kHz	Attribution Brazil	Destination	Distribution	Regulation
5366.5-5450	Mobile	SLP		Same regulations
5730-5900	Mobile	SLP		Anatel Resolution 716/19
6765-7000	Mobile	SLP		Portaria MC 1207/96 and Anatel 716/19
8100-8195	Fixed	SLP		Portaria MC 280/79
9040-9400	Fixed	SLP		Same regulations
9900-9995	Fixed	SLP		Same regulations
10100-10150	Fixed	SLP		Same regulations
12100-12230	Fixed	SLP		Same regulations
13360-13450/ 13870-14000	Fixed	SLP		Portaria MC 280/79; Dentel 11/81
15800-16360	Fixed	SLP		Same regulations
Portions of Bandas 16000 to 19000-20000-21000	Fixed	SLP		
22855-23000, 25010-25070, 25210-25550, 26480-26895	Fixed	SLP Radio taxi		
Band MHz	**Attribution Brazil**	**Destination**	**Distribution**	**Regulation**
28-29.7		RADIOAMADOR		Anatel Resolution 697/2018
29.7-30.005; 30.01-37.5; 34.83-37.5	Fixed	SLP		Portaria MC 280/79
38.25-38.31	Fixed	SLP		Same regulations
38.31-38.73	Earth mobile	SLP – radio taxi		Same plus Anatel Resolution 239/2000
39.83-39.986; Portions of 40 to 47	Fixed	SLP		Same regulations
88-108	Broadcast radio	Community radio		Anatel Resolution 716/2019
Several sub-bands in 200 , 363-388	Fixed Mobile	SLE SLP		Portaria MC 623/73 and Anatel 440/2006
Portions of 430-440;	Radio localisation	SLP – Radiolocalisation		Anatel Resolution 681, 697,
451-452; 452-454 456-457; portions of 460-470	Fixed Mobile	SLP, SLP airports		Anatel Resolution 558/10; 628/13; 716/19

Band MHz	Attribution Brazil	Destination	Distribution	Regulation
703-708; 708-746;758-763	Restricted access	SLP for public safety, national defence		Anatel Resolution 291/02; 407/05; 626/13; 640/14; 688/17
763-806	Fixed Mobile	SLP		Same regulations
806-849;869-890; 900-942	Fixed Mobile	SLP/SLP National security, Radio-chamada		
1710-1930	Fixed Mobile	SLP (1885-1895) 1930-1975 SLP		Anatel Resolution 78/98; 454/06; 716/19
2110-2120; 2450-2483 and other portions of 2600-2700	Mobile Fixed	SLP		Anatel Resolution 497/08
3400-3410; 3410-3450; 3500-3550	Mobile satellite fixed	SLP		Anatel Resolution 78/98; 697/18; 711/19
Band GHz	**Attribution Brazil**	**Destination**	**Distribution**	**Regulation**
11-12.2	Fixed Satellite fixed	All telecom services		Anatel Resolution 288/02; 716/19
14.8-15.35	Fixed	SLP		Anatel Resolution 129/99
17.8-18.1; 18.1-18.4;18.4-18.6	Fixed	All telecom services		Portaria MC 1288/96
18.8-19.3	Mobile	All telecom services		Anatel Resolution 599/12
25 (different segments)	Fixed satellite	SLP		Anatel Resolution 716/19
25.5-27	Mobile	SLP		Anatel Resolution 685/17
27.5-27.9	Fixed satellite	SLP		Anatel Resolution 561/11

APPENDIX 2
SMALL-SCALE OPERATOR ACCESS TO LICENCE-EXEMPT SPECTRUM: COUNTRY COMPARISON[236]

Small Scale Operators		Kenya	Mexico	South Africa	Brazil	Argentina	United Kingdom	United States	New Zealand	Canada	Uganda	Nigeria	Ghana	Tanzania	India
Licence-exempt spectrum (MHz)															
2400 – 2483.5	EIRP	100 mW	2 W in PtoP 1 W in PtoMP	100 mW	4 W	4 W		4 W in PtoMP. PtoP of 1 dBm less in TxPower per 3 dBi increase in antenna gain above 6 dBm	100 mW	4 W in PtoMP and no limit in the Gain in PtoP	100 mW	1 W	100 mW	200 mW	100mW
	Tx Power		500 mW in PtoP 250 mW in PtoMP		1 W	1 W		1 W		1 W					
Registration required?		No	No	No	No	No	No	No	No	No	No	No	No	No	No
5150 – 5250	EIRP	200 mW	200 mW	200 mW	200 mW	200 mW	200 mW	4 W in PtoP 53 dBm in PtoMP	1 W	200 mW indoor only	200 mW	200 mW	200 mW	200 mW	1W
	Tx Power		50mW		10mW/Mhz	50mW		1 W							
5250 – 5350	EIRP	200 mW	1 W	100 mW	200 mW	4 W	200 mW	1 W	1 W	1 W	200 mW		200 mW	200 mW	200mW
	Tx Power		250mW		10mW/MHz	1 W		250 mW		250mW					
5470 – 5650	EIRP	1 W	1 W	1 W	1 W	4 W	1 W	1 W	1 W	1 W	1 W	4 W (Licensed)[238]	1 W	1 W	200mW
	Tx Power	250 mW	250 mW		250 mW	1 W		250 mW		250 mW					

→

[237] Elaborated by Steve Song for the APC and UK DAP Proposal for the Communications Authority of Kenya.

[238] https://www.ncc.gov.ng/accessible/documents/936-5-4ghz-spectrum-assignments/file

Small Scale Operators		Kenya	Mexico	South Africa	Brazil	Argentina	United Kingdom	United States	New Zealand	Canada	Uganda	Nigeria	Ghana	Tanzania	India
5650 – 5725	EIRP	1 W	1 W	1 W	1 W	4 W	1W	1 W	1 W	1 W	1 W	4W (Licensed)[239]	1 W	1 W	2 00mW
	Tx Power	250 mW	250 mW		250 mW	1 W		250 mW		250 mW					
5725 – 5850	EIRP	1 W	4 W	4 W (PtoP 200 W)	4 W	4 W (200W for PtoP links up to 5.825 GHz)	4 W light licence (fee and registration)	4 W in PtoMP and no limit in the Antenna gain in PtoP	200 W for PtoP	4W in PtoMP and no limit in the gain in PtoP	4 W in PtoMP PtoP of 1 dB less in TxPower per 3 dB increase in antenna gain above 6 dBi	4 W (no limit in gain for PtoP)	4 W	1 W	1W
	Tx Power		1 W	1 W	1 W	1 W		1 W		1 W		1 W			
Registration required?		Yes	No	No		No	No except 5725-5850	No	No	No		No	No		
17GHz				100 mW											
24.15 – 24.25 GHz	EIRP			100 mW			100 mW		1 W						
V-Band (60GHz)				55dBm			85dBm (light licensed)	82dBm						10 W	
E-Band (70/80 GHz)							85dBm (light licensed)		Licensed						
Dynamic Spectrum (TVWS or other)															
Regulatory Status (2021)		Nearly complete		Operational	Consultation underway	None	Operational	Operational	Operational	Awaiting database provider	Consultation underway	Nearly complete	Consultation started, possibly stalled?	none	none
International Mobile Telecommunications (IMT) Spectrum															
Alternative access to IMT spectrum			Set-aside of GSM spectrum for CNs	None	None	None	Local Access and Shared Access License	CBRS	Managed spectrum park	None	USF project	None	None	rural spectrum license	none
Use it or Share It license provisions			Yes	No	No	No	Yes	Yes	No	No	No	No	No	No	No

[239] Ibid.

APPENDIX 3
TELEVISION WHITE SPACES REGULATION AROUND THE WORLD[240]

Country	Regulation status	Channel Size (MHz)	Freq Start (MHz)	Freq End (MHz)	WSDB Update Freq (hrs)	EIRP Rural (dBm)	EIRP Urban (dBm)	EIRP Nomadic (dBm)	Adjacent Channel Leakage Ratio (ACLR)	Max Antenna Height (m)
Colombia	Published	6	470	698	24	46,15	46,15	Fixed only		50
Ghana	Draft	8	470	694	24	40	36	20	ETSI	30
Kenya	Draft	8	470	694	24	40	?	?	ETSI	?
Mozambique	Draft	8	470	694	48/24	41.2	36		ETSI	40
New Zealand	Published	8	510	686	N/A	40			ETSI	
Nigeria	Draft	8	470	694	24	40	36			60
Singapore	Active	8	470	806	6	36	20	20		30
South Africa	Published	8	470	694	12	41.2	30	20	ETSI	30
South Korea	Published		470	698						
Trinidad and Tobago	Published	6	470	698	24	36		Fixed only	See regulation	
Uganda	Published	8	470	694	?	36	36	20	ETSI	50
United Kingdom	Active	8	470	790	0.25	36				30
United States	Active	6	470	694	0.3	36				

[240] Research and elaboration by Steve Song for APC, for the executive report on spectrum sharing and a licensing framework for the Communications Authority of Kenya.

POLICY BRIEF AND RECOMMENDATIONS FOR AN ENABLING ENVIRONMENT FOR COMMUNITY NETWORKS IN BRAZIL

presented to the
Agência Nacional de Telecomunicações

by
Association for Progressive Communications (APC)

supported by the
United Kingdom Digital Access Programme

November 2021