Institutional redesign to close the residual telecommunications gap in Peru: The third channel of intervention for the emergence of sustainable community networks

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Abstract

The problem of the lack of connectivity in a large part of the world has been further exposed due to the pandemic COVID-19; particularly in Latin America and the Caribbean, including in Peru. We have witnessed the lack of Internet access limits the conditions of development and widens the social and economic gaps among the people connected in urban areas and those who are not connected in rural areas. This problem has a multidimensional nature and arises from several underlying and structural causes that have been widely diagnosed so far. In this regard, this paper is focused on Peru, but it is potentially applicable to Latin America and the Caribbean. The new contribution is the definition of the residual gap of rural telecommunications ("residual gap"), understood as the group of localities that are not either prioritized or to be prioritized by the private sector or the traditional public

interventions in the short and medium term. Likewise, we have analyzed the effectiveness of the current institutional design to deal with the connectivity gap and have proposed the incorporation of a third channel for the whole "residual gap": a model of bottom-up governance for the emergency of sustainable community networks. According to its characteristics, this third channel demands the reconfiguration of the roles in the different social classes and enables the inclusion of territoriality and interculturality approaches in a wide range of geographical spaces. Finally, even though the localities that are part of the residual gap are characterized by a range of adverse conditions for the provision of traditional telecommunication services or others, for the rural Peruvian case, a great residual gap has a huge community network, beyond telecommunications (e.g. rural communities, indigenous populations, water and irrigation associations, etc.). This previous condition is a great advantage for the successful application of the model of community networks proposed in the institutional redesign. Its identification of opportunities is the third contribution of this paper.

Resumen

El problema de falta de conectividad en gran parte del mundo ha sido más expuesto a raíz de la pandemia de la COVID-19; particularmente, en América Latina y el Caribe, así como en el Perú, se ha atestiguado cómo la falta de acceso a Internet limita las condiciones de desarrollo y agranda las brechas sociales y económicas entre los conectados en las áreas urbanas y los no conectados en las rurales. La multidimensionalidad de este problema se encuentra la concurrencia de causas estructurales y profundas que, en el tiempo, han sido ya ampliamente diagnosticadas. En tal sentido, este trabajo, enfocado en Perú, pero potencialmente aplicable a América Latina y el Caribe, propone como nuevo aporte la definición de la brecha residual de telecomunicaciones rurales («brecha residual»), entendida como el conjunto de localidades no priorizadas ni priorizables por el sector privado ni por las intervenciones públicas tradicionales en el corto ni el mediano plazo. Asimismo, se analiza la efectividad del diseño institucional actual con el que se atiende, desde el Estado, a la brecha de conectividad y se propone, para el conjunto de «brecha residual», incorporar una tercera vía: un modelo de gobernanza bottom-up para la emergencia de redes comunitarias sostenibles. Por sus características, esta tercera vía demanda la reconfiguración multiestamental de roles y habilita la inclusión de enfoques de territorialidad e interculturalidad en diversos espacios geográficos. Finalmente, si bien las localidades que integran la brecha residual se caracterizan por una serie de condiciones desfavorables para la provisión tradicional de servicios de telecomunicaciones u otros, para el caso rural peruano, un gran conjunto de la brecha residual cuenta con un vasto tejido social comunitario, ajeno a las telecomunicaciones (v.g. comunidades campesinas, pueblos indígenas, asociaciones de agua y riego, etc.). Esta condición previa se presenta como una gran ventaja para la aplicación exitosa del modelo de redes comunitarias propuesto en el rediseño institucional, su caracterización e identificación de oportunidades es el tercer

aporte de este trabajo.

Resumo

O problema da falta de conectividade em grande parte do mundo ficou mais exposto em decorrência da pandemia de COVID-19. Particularmente na América Latina e no Caribe, assim como no Peru, foi possível constatar como a falta de acesso à internet limita as condições de desenvolvimento e amplia as diferenças sociais e econômicas entre as pessoas conectadas nas áreas urbanas e as não conectadas nas áreas rurais. A multidimensionalidade desse problema está na simultaneidade de causas estruturais e profundas que, ao longo do tempo, já foram amplamente diagnosticadas. Nesse sentido, este trabalho, focado no Peru, mas potencialmente aplicável à América Latina e o Caribe, propõe como uma nova contribuição a definição da lacuna residual de telecomunicações rurais ("lacuna residual"), entendida como o conjunto de localidades não priorizadas nem priorizáveis por parte do setor privado ou pelas intervenções públicas tradicionais no curto ou médio prazo. Da mesma forma, analisa-se a eficácia do sistema institucional atual com o qual o Estado atende a lacuna de conectividade e propõe, para o conjunto da "lacuna residual", incorporar uma terceira via: um modelo de governança bottom-up para o surgimento de redes comunitárias sustentáveis. Pelas suas características, essa terceira via exige a reconfiguração dos múltiplos níveis de incumbências e possibilita a inclusão de abordagens de territorialidade e interculturalidade em diversos espaços geográficos. Finalmente, embora as localidades que compõem a lacuna residual sejam caracterizadas por uma série de condições desfavoráveis para a prestação tradicional de telecomunicações ou outros serviços, no caso rural peruano, grande parte da lacuna residual possui um vasto tecido social comunitário, alheio às telecomunicações (por exemplo, comunidades camponesas, povos indígenas, associações de água e irrigação, etc.). Essa condição prévia se apresenta como uma grande vantagem para o sucesso da aplicação do modelo de redes comunitárias proposto na reformulação institucional. A sua caracterização e identificação de oportunidades é a terceira contribuição deste trabalho.

INTRODUCTION

This essay is about how to connect the unconnected. To do so there are some worthwhile premises that merit to be taken as a basis. The first is that people that have access to telecommunications are in better (development digital) conditions to develop their life projects, to be included in society, and to exercise their rights; this situation is naturally extrapolated to their social economic environment. The second is that people living in the most distant rural areas from urban cities, are less likely to get to these digital conditions of development. This situation is especially present in developing countries and has always been a huge challenge for public policies and for the efforts of the ecosystem of involved parties (i.e. public sector, private sector, social sector, etc.)

Thus, for a long time and with increasing certainty, telecommunications and information

and communication technologies are given an essential role in the personal and economic development of communities, economies and countries: they entail very important improvement on integration, inclusion, employability, innovation, and economic development. As a consequence, connectivity gaps create unfavorable conditions to holistic development in world rural communities, and developing or poor countries are experiencing the biggest gaps.

In this sense, particularly in Peru, though also applicable to most Latin American and Caribbean countries, the gap of coverage and telecommunication/ICT services usage is wide. Remote communities, with less population or a few resources have a limited accessibility to such basic services as online education, telehealth, and teleworking, and also to productive development and potential digital entrepreneurship that come together with digital technologies.

In the Peruvian case, this gap is basically territorial (not necessarily demographic): in the fourth 2020 trimester, and according to official sources (Ministerio de Transportes y Comunicaciones – Ministry of Transport and Communications), more than 50% of Peru's rural communities do not have guaranteed coverage of any telecommunication services[1]. A large proportion of these communities suffer from unfavorable situations that do not allow for the emergence of digital conditions of development.

As a consequence, we need to propose and achieve solutions for public policy that go beyond traditional approaches and will eventually solve the wicked problem represented by the connectivity gap in Peruvian rural areas, particularly in those localities that are not either prioritized or to be prioritized by the present institutional design.

1. DESCRIPTION AND CAUSES OF THE PROBLEM

Telecommunications services coverage in Peru, especially landline internet and mobile phone services (mobile internet), have a significant gap if we refer to connected areas in relationship with unconnected ones. This situation results in limited use of these services and an exclusion to public services and possibilities to economic and social development. Thus, the problem has been identified as insufficient connectivity for telecommunication services for people living in rural areas that are not either prioritized or to be prioritized in the short or medium term by the Peruvian public or private sector.

Referring to magnitude, according to official data processing by the Ministry of Transport and Communications (by April 2020), from 96.823 rural communities in Peru, 58.880 do not have either any telecommunication service reported or guaranteed. This means that the coverage gap is 61% of the total rural communities in Peru (and 59% of the entire rural and urban areas). From these rural areas, less than 98% would have less than 500 inhabitants, and 75%, less than 100 inhabitants.

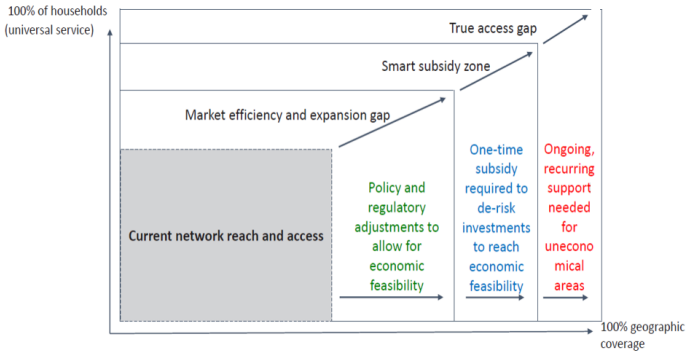
Talking about people having no access to the internet, by April 2020, the Peruvian National Institute of Statistics and Informatics (INEI), estimated that nationally and to a relative extent, the number was 30.2%. However, this gap represented 61.2% of the population in rural areas.

Even though these statistics are not promising, it is important to note that the provision of telecommunication services, as it generally happens with basic services, is limited and underdeveloped, especially in remote rural areas with low population density. This situation partially explains why billions of people are still not connected all over the world (ITU, 2020a).

These unfavorable conditions result in a limited or absent offer for a large percentage of localities in rural areas, an effect that is materialized as a consequence of considerable gaps in infrastructure and connectivity that – in the Peruvian case (although it is common in developing countries) – represent a significant challenge.

It is important to note that there is an inherent constraint to business models and market structures that explains the presence of connectivity gaps manifesting between current situations and desired levels of universal access. The International Telecommunication Union (ITU, 2020b) makes a distinction among a market efficiency and expansion gap, a smart subsidy gap, and a true access gap. Image 1 shows what type of interventions are usually encouraged to address these gaps.

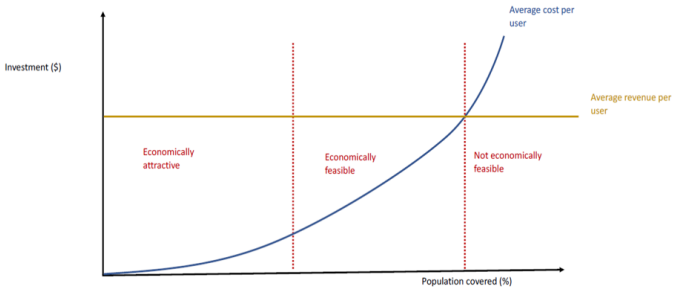
Image 1. Access gaps: distinctions and interventions



Source: ITU (2020)

Following this same idea, Puig (2020) says that necessary investment has three stages to get to a country's population: the first one is the economically attractive one, the second one is the economically feasible one, and the third one is the economically unfeasible one. As is seen in Image 2, in this last stage, average costs per user exceed average revenue per user. We understand that because of this, this remaining one is not considered; this group meets the one located in poor rural areas with less population and more demographic dispersion.

Image 2. Necessary investment ($) to reach the population (%) with terrestrial digital connectivity infrastructure



Source: Puig (2020)

In reference to causes and trying to answer the question of what brings a large proportion of rural communities not to have telecommunication services connectivity, many relationships of causality arise among which we recognize three main causes linked to the public sector, the private sector, and the market demand.

Three main causes are listed:

– Public interventions bridging the connectivity gaps are limited.
– Private inversion is mostly preferred in urban areas.
– Unfavorable conditions for generating demand in rural areas.

Next, we develop the causes and sub-causes.

1.1. Public interventions bridging the connectivity gaps are limited.

Weak presence of institutions in competencies, articulation and planning.

As it is seen, the role of the State bridging the connectivity gaps takes on special relevance in the causal scenario analyzed above. To that effect, as said by Gutiérrez-Hita and Georgantzís (2012), public institutions play a very important role in innovating telecommunication national policies, particularly in remote rural areas.

However, one of the challenges not only in the Communication sector but also in the whole public administration system is articulating common development spaces and public policies designing fully horizontally and vertically. Added to this is the need to have accurate information for decision-making, aligned and joint intersectoral efforts for policies, plans, and strategies that are consistent and coherent with the role of the State and the efficiency of public interventions.

Little flexible regulation

Regulatory frameworks are to ensure an efficient market by addressing its failures. Thus, for those areas with less investment interest, the designing of ambitious broadband policies should have considered the cost, not negligible at all, of connecting people from remote areas located in the jungle, highlands or islands.

Moreover, the Organisation for Economic Co-operation and Development (OECD/IDB, 2016)

claims that the same regulation has to be rethought in order to make network deployment more flexible. In this way, a demanding policy framework and regulation body will contrast with deployment efforts in rural areas.

Focused indirect investment projects of limited scope

As in every public intervention, the scope of rural and social programs and projects begins their planning by, for obvious reasons, prioritizing a subset of communities or social groups with features that will lead to a more significant social impact.

In any case, it should be made clear that we have always understood that to achieve connectivity, telecommunication technology has to be expanded, and public sector support has an important role in promoting investment in remote rural areas (Gutiérrez-Hita and Georgantzís, 2012).

In the Peruvian case, the criteria for the selection of the National Telecommunications Program (PRONATEL) and the Telecommunications Investment Fund projects, consider some representative features such as:

– Quantity of inhabitants

– Presence of at least one public institution.

– Access to the electric network.

We can infer that it makes sense to find deprioritized subsets outside these programs and projects because the public budget to attend to those efforts is limited and is linked to own public administration demands.

In Peru, the intervention of the centralized National Telecommunications Program to December 2020, reached to 94.926 rural communities (i.e. 95% of the whole Peruvian communities) located in 24 regions and 194 (from 196) provinces in Peru. However, its real intervention range should be that of the gap pertaining to communities without coverage, i.e. 58.880. Nevertheless, ongoing regional broadband projects —the public intervention with the highest historical investment on Peruvian rural connectivity— has intended to connect 5.800 communities since 2015. This goal has been partially achieved by 2021. It is evident that effective scope of these interventions is limited (10% approximately).

Moreover, public interventions can be limited because of the scope, for example, when prioritizing some beneficiary communities, also because of less favorable or flexible regulation framework when deploying infrastructure and providing services, for instance, in generating incentives or through cross-sector collaborative spaces.

1.2. Private inversion is mostly preferred in urban areas.

Highly expensive investment on network deployment
Investment efforts are usually focused more strongly on major cities and the like that

represent big markets for their services because they have more money and population. This set of conditions confirms an urban-focused telecommunications pattern in developing countries (Boateng, 2012).

Peru is not an exception to this condition: investment for deploying telecommunications networks has several limitations and disadvantages in comparison with urban areas. This is part of inherent features to rural areas if considering geography, economic activity and social approach, all these aspects are present in first investments that intend to provide telecommunications services.

Thus, both investment and telecommunications networks operation are comparatively more expensive in rural areas compared with urban areas. Telecommunications networks deployment and maintenance can be affected by geographic challenges that will demand much more expensive infrastructure, and also because there may be other underlying adjacent issues (such as bureaucratic local ones or those related to people against the developments).

First of all, geographical conditions are related to difficulty when starting a project in a rural area. Such conditions are not properly difficulties that are not or cannot be addressed or dealt with diverse technologies (i.e. environmental protection areas find out in satellite solutions, a viable alternative to access to services) but not preferred situations in relation with urban areas.

On the other hand, economic activity, generally limited, in these areas, makes the disposal of hardware materials, for example, a notable issue. In addition, there is not typically skilled labour available (Nandi et al., 2016) for building needs and setting up telecommunication networks. As a consequence, transferring people and materials becomes more expensive for operators.

In recent projects, it is evident that informal land ownership becomes a major problem when complying with commitments and deadlines in regional projects. Such a situation, unregistered informal land ownership, has caused a big delay for these projects to start operating.

What we referred in paragraphs before can be measurable. As for investment, the telecommunications industry is used to state deploying infrastructure in remote areas may be twice as expensive while revenues are even ten times lower, if compared with urban areas: “a combination that deeply affects the business case for MNOs to deploy infrastructure.” (Touchard, 2016; GSMA, 2018).

Expensive network operation and maintenance

Network operation and maintenance in rural areas, similar to initial investment and deployment, generally, has a less convenient cost-benefit scheme in comparison with urban areas. There are also important operating difficulties related to similar conditions to those

of the deployment.

In principle, the cost-benefit scheme is definitively the main problem for operation and maintenance: GSM Association proves that, for example, operating costs in rural areas may triple those in urban areas (Touchard, 2016).

Operating difficulties and remoteness, which are typical features of rural areas (related to an urban locality), pose a set of difficulties for telecommunication infrastructure maintenance and services operation where, for example, addressing failures (troubleshooting) may become difficult as a consequence of a remote monitoring that will demand, in response to warnings, deploying or moving one or more nodes physically.

In addition, electric energy quality in rural areas is significantly lower than that in urban areas. This situation results in, on the one hand, taking more actions for protecting electrical equipment, and, on the other, disposing of a major electrical support.

Operative issues regarding payment for intermediate services and collection have also disadvantages in comparison with urban areas: billing collection is a challenge because payment centres are not near, and digital payment is not frequent as users' habits in rural areas.

1.3. Unfavorable conditions for generating demand in rural areas.

Low purchasing power for hiring services.

The fact that in rural areas, purchasing power is significantly lower than in urban areas, is detrimental for accessing basic services, in general, and for hiring telecommunication services, in particular. In that sense, ITU-D (2017, 7) recognizes that one of the challenges for developing telecommunications/ICT is rural areas characterized by low incomes, lack of income availability and relative poverty in the population.

In Peru, according to INEI (National Institute of Statistics and Informatics), in 2018, poverty levels in rural areas will reach 42.1% of the population, but in urban areas levels may reach 14.4%. Regarding extreme poverty, according to the same statistics, 10% of inhabitants are extremely poor in rural areas compared to 0.4% in urban areas (INEI, n.d.).

To understand this situation, it is important to consider that in 2018, ITU and United Nations Educational, Scientific and Cultural Organization (UNESCO) established the 2025 Targets: "Connecting the Other Half" through the Broadband Commission for Sustainable Development (n.d.). By 2025, basic broadband services "must be easily accessed in developing countries, which represents less than 2% of the gross national monthly income per capita." This goal aims at promoting connectivity inside low-income groups in developing countries such as Peru.

Quasi-homogeneity in telecommunication services plans (mobile services rates are applied nationally, and landline services are provided, especially, in urban areas) is seen as a

restriction to access in those areas where services are covered. Thus, there is social demand, and its limitations are linked to rural areas characterization.

At this point, rural public telephoning precedent in Peru, opposite to what a more accessible service for low-income people would have been, used to be significantly more expensive than in urban areas.

Such situations let us understand that telecommunications services in rural areas represent a luxury service that may be accessed only in one-off emergency cases. In such a sense, as recommended by Katz (2011) social demand can be promoted by specific interventions that will achieve a services fee reduction in less wealthy segments of the population.

Rural inhabitants with limited digital abilities

As a consequence of dispersion and isolation, many inhabitants in rural areas do not have an opportunity to access new technologies and to reach other users in their communities in order to be taught digital skills.

It is evident that digital literacy and abilities are developing concepts that have to be analyzed considering two approaches: basic understanding of digital technology and using digital services and applications.

In particular and according to practical experience, older people are seen as the age group that experiences the most difficulty with understanding technology in such an elementary aspect as how it works.

On the other hand, age groups of younger people take advantage of intuitive designs of programs and applications to adopt the use of digital technologies quickly.

Regarding this same situation, ITU-D (2017, 7) has as a goal for telecommunications/ICT development in rural areas having “high degree of illiteracy in some rural areas” and “great (or total) ignorance about telecommunications benefits in certain rural areas.”

Though getting benefit from digital technologies on the basis of developing digital literacy and abilities may potentially improve living standards and users’ productivity, obtaining them, according to research in Asia, will depend on a sociocultural context and value systems in each social structure in rural areas (Abdullah, 2015). However, the Peruvian practical experience shows that social or cultural opposition groups are minor and that there is more of a persistent call to be connected, in general, and accessing connectivity, in particular.

2. THE RESIDUAL GAP OF TELECOMMUNICATIONS, AND WHY IT IS A WICKED PROBLEM

Characterizing the residual gap of telecommunications

The residual gap of telecommunications is a term proposed here and defined as the group of

localities (or inhabited settlements) that are not either prioritized or to be prioritized in a short or medium term. This means that even though these places are identified inside the scope of action of those institutions bridging the rural coverage gap, they do not benefit from traditional public interventions.

Following this idea, the features that form the residual gap are population density, significant levels of monetary poverty, and the lack of public institutions (in the case of Peru). As a consequence, telecommunication services operators do not consider these localities as part of their services expansion plans because this action doesn't fit into a business model that will be lucrative; subsequently public interventions cannot get to them because prioritization criteria in the public sector are limited by established guidelines, sector budget or the ability to demand to the private sector, the expansion of services in rural gap areas.

Estimating the telecommunications residual gap

The estimated value of the residual gap is obtained from the difference between (A) present gap localities (without any guaranteed service) and (B) present gap localities that have been explicitly prioritized by public interventions for the next (five) years or have been part of current interventions. Taking into account this, it is important to note that the residual gap is usually dynamic: in the case of B's value, it depends on such factors as (de)prioritization, delay, stoppage, failure, or reformulation. According to the case study, these situations usually take several months or years to provide a solution.

An example of this situation is the case of broadband regional projects in Cajamarca, Piura, and Tumbes. The corresponding auction was awarded in 2015 to provide coverage services in 1.794 communities, but their contracts were terminated in 2018. In 2021, they are still in an arbitration process.

In this sense for Peru, according to the information from the Ministry of Transport and Communications, the residual gap would be around 50,000 localities (more than 50% of total rural communities). This value is obtained from official sources, and it is calculated as the difference between A (58.880 communities without any guaranteed services), and B (equivalent to 7.960 communities [2] with current interventions or being serviced in a short term in the next five years).

The residual gap as a wicked problem

Having acknowledged, on the one hand, that the multidimensional problem outlined here is common in developing countries and even in highly industrialized countries (e.g., USA, Germany, Spain[3]), and on the other hand, telecommunications services are comparable to elementary services such as electricity or water/sanitation (and consequently suffer from similar problems), there is the question of whether this problem with a focus on the residual gap, can qualify as a wicked problem or, as Gwaka (2018) puts it, represents a wicked challenge (adding, in the case of Zimbabwe, "complex socio-political contexts").

Although this concept is considered as planning theory in the article by Horst Rittel and Melvil Webber (1973), defining itself as a problem that cannot be fully described and for which there is no definitive solution available, it is Jeffrey Conklin who applies it under a public policy approach. In his 2005 article, he establishes premises that we will develop for the residual telecommunications gap (Conklin, 2005).

These premises are listed below. Reasons (in italics) are given to support whether the telecommunications residual gap applies in this regard.

– There is no definitive formulation.- Essentially unique and novel.– *As we have seen, the connectivity gap is multidimensional: it has multiple causes associated with public management itself, incentive policies in non-viable business models, rurality, and poverty. A punctual intervention, proposed as a solution, reveals the complexity, and allows a better understanding of it. Although this problem is not new, it classifies as unique. This is because it is closely linked to an idiosyncratic social context (in each locality of the residual gap), it is served by the scope of a particular institutional design: there is no direct public investment, service delivery is completely different from other basic services (e.g., with wireless access), and it considers the radio spectrum as an essential resource, etc.*

– It has no stopping rule (i.e., a definitive solution).
– Solutions are not right or wrong.
– It has no given alternative solutions.
The answers that have been proposed for almost thirty years have moderately successful results; despite this, many and well-intentioned interventions can be described as wrong. This starts because there are no alternative solutions for the set of localities contained in the residual gap, when there are solutions in particular subsets of this. Consequently, there is no definitive solution or, as Nandi refers. (2016), a one-size-fits-all solution to meet the challenges in bridging the digital gap in rural areas. In the case of Latin America, Galperin (2017) it shares the inference that it is unlikely that a one-size-fits-all approach meets these same challenges for this region. Therefore, the approaches and solutions that come from these must be linked to a particular context and scenario.

– Every solution is a 'one-shot operation.'*This assumption can be considered as each intervention reacts to a social, geographical, and temporal context. For instance, in a global scale, technology-based paradigms that allow an approach to low-cost solutions (e.g., Open RAN or infrastructure/spectrum sharing schemes) are being reconfigured. The Peruvian case currently enjoys demographic bonus and rural urban conditions of rural youth in a constant transition between urban and rural areas (Trivelli & Gil, 2021). Concerning this, the implementation of unidimensional solution schemes (facing a multidimensional problem), which are at the same time quasi-homogeneous, have by itself the potential of causing new issues. In the case of the Peruvian residual gap and connectivity gap, interventions of current institutional design can help to get a better understanding of the situation.*
However, they are very expensive because they have a limited reach, their start-up of operations takes several years, at the end, and they do not become truly effective for the development of the sustainable digital rural goals. This happens because the current intervention methods are under the top-down models, which also limit the implementation of development and intercultural approaches.

In that case, since the residual gap represents a huge number of localities of the connectivity gap, it is important to evaluate whether the current institutional design may or may not deal with them effectively. Furthermore, the wicked problem feature of the residual gap must point out the necessity to apply other prospects in the approach of their solutions.

The complexity of the wicked problems and the approach to their potential solutions require starting from pillars like innovation and adaptability (Brugué et al., 2014) as well as how to recognize the utmost importance of collaborating with societal factors (OCDE, 2016). These conditions are applied to the wicked problem of the residual gap, as will later be developed in this paper.

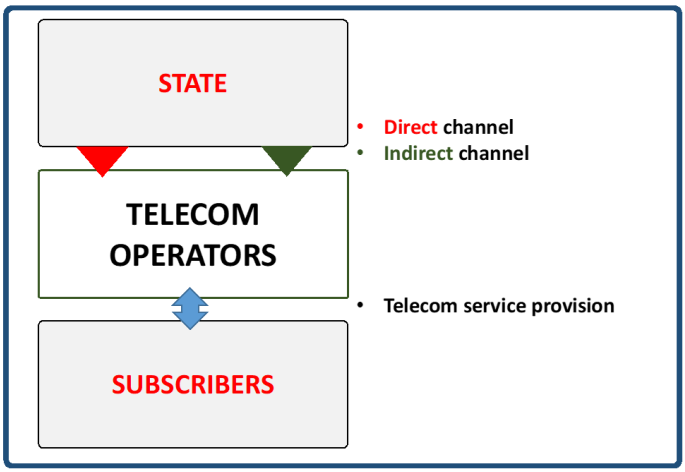
3. INSTITUTIONAL (RE)DESIGN. THE THIRD CHANNEL OF INTERVENTION FOR THE RESIDUAL GAP

Current institutional design for rural connectivity

The current institutional design has resulted in important achievements in closing the connectivity gap, although not enough. Currently, the Peruvian State promotes access to telecommunications services in rural areas that do not have commercial priority for operating companies. This institutional construct is based on rules such as the subsidiary role of the State and can be classified according to the intervention mechanism applied for the delivery of the service: direct investment and indirect investment. Image 3 shows the dynamics of actors in the current institutional design.

Image 3. Peru: stakeholder dynamics of the current institutional design for addressing the

telecommunication gap.



Source: Own elaboration

Firstly, we refer to direct investment intervention ("direct channel") when the Peruvian State manages and finances connectivity projects through public tenders that turn into a Project of a networking company. (e.g., mainly via supply subsidies schemes), which acquires all the commitments specified therein.

As seen, this dynamic happens, generally, through the Telecommunications National Program and Telecommunications Investment Fund with the involvement of the Ministry of Transport and Communications, the Ministry of Economy and Finances, and the Private Investment Promotion Agency (PROINVERSIÓN).

The following are some examples of the "direct channel" of rural telecommunication:

– The National Backbone of Fiber Optic (Red Dorsal Nacional de Fibra Óptica).

– The Broadband Installation Project of Integral Connectivity and Social Development of the Regions (Broadband Regional Project for 21 regions).

– The Loreto – San Martin Amazonian Integration Project to the terrestrial network of Telecommunications (regions Loreto and San Martin).

Secondly, the indirect investment intervention ("indirect channel") consists of regulatory schemes that promote, on its application, the deployment and growth of telecommunication services offered in the country. This occurs because of the liabilities that the networking companies are subjected to the concession obtained and the resources used (e.g., radio spectrum) or as part of the incentives that the networking companies opt for.

The following are examples of the "indirect channel" of rural telecommunications:

– The coverage expansion plan (of networking companies).

– Covering liabilities as part of the public tenders for the radio spectrum.

– Compensation against fee payment for using the radio spectrum (through the infrastructure expansion factor).

– Goals of using the radio spectrum (qualitative methodology with territorial approach).

The Peruvian State has established an institutional design for the connectivity in rural areas in these two lines or channels. In every scenario, the networking company, which is private, channels the main service to the potential users.

Effectiveness of the current institutional design

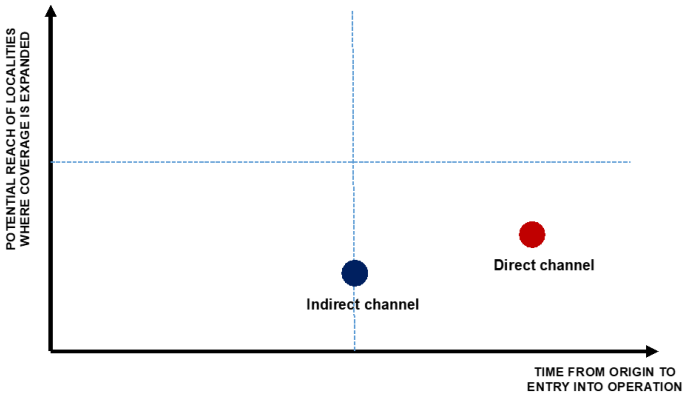
Referring to effectiveness, recent experience in Peru shows that direct intervention channels have not accomplished the desired goals in given time. For instance, in relation to the national backbone, the World Bank (2019) says, “it is very expensive and notably underused.” In relation to the Regional Project for 21 regions, this organization adds, “they have not been implemented with swiftness nor with expected efficiency.” (In January 2021, 3 out of 21 projects are under reformulation with the contract avoided, and only four contracts, signed in 2015, are in operation).

The fact that direct intervention channel projects are used to operating with delays classifies this institutional design channel in a quadrant, where the time from its origin until its operation entry is high and its range is low or medium (e.g., best-case scenario, until 7.000 localities for the 21 regional projects).

If we refer to the indirect intervention channel, it is important to consider that the Peruvian State, apart from the coverage obligations requested to the networking companies, develops incentive schemes that, if attractive to these companies, will turn into specific covering projects in rural areas. In terms of scope, these are relatively limited. For instance, in return for awarding spectrum blocks in 2.3 GHz and AWS-3 bands, it was expected to expand the coverage up to 5,600 localities in 2020 (Ministry of Transport and Communications, 2019). This amount was subsequently adjusted from 5,600 to 1,561 in 2021 (Ministry of Transport and Communications, 2021)[4] to be attended to within a two-year range since the awarding of the tender (keep in mind that the residual gap is about 50,000 localities). Thus, in relation to the time from its origins until its operation entry, indirect interventions channel tend to be less than those of the direct channel.

Image 4 presents a visual representation of these two characteristics of the direct and indirect channels (i.e. the scope and the time of entry into operation).

Image 4. Direct and indirect channels of interventions are shown in the scope-time quadrant.



Source: Own elaboration

In addition to that, projects of the current institutional design generally have training components for the potential user population. These contractual obligations are a complementary measure as part of a use approach. In spite of this, the characteristics of the projects generate, according to experts, perverse incentives in their development: operator companies tend to opt for the lowest cost solution instead of, for example, the one that aligns most closely with the interests and aspirations of the potential users of telecommunications services and digital platforms. This situation results in training or capacity-building interventions having a very low impact.

Another aspect, also important in relation to the intervention channels and which adds to the limitations of (quasi)homogeneous, vertical and capacity building models, is that demand is not usually subsidized to potential users (at least partially to public establishments or indirectly with the provision of tablets to educational institutions). Given that landline internet coverage in rural areas is minimal, users must generally contract mobile services whose tariffs apply, without distinction, throughout the Peruvian territory.

Finally, from a human rights perspective, the model can be improved: the community is not the focus of interventions; therefore, its participation and commitment are subordinated to the fulfillment of specific obligations and events, and its citizen action in its own public spaces is not demanded. Besides, intercultural approaches would require an understanding of the inherent characteristics of the community (linguistic and cultural communities) in the construction of more appropriate service delivery models.

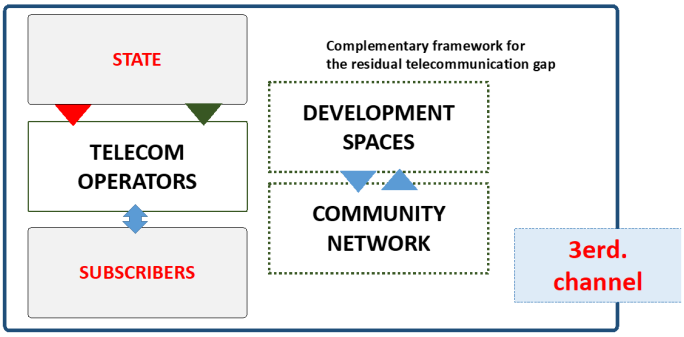
Although the current institutional design has proven effective in increasing coverage over the years, its limitations could lead, far from shortening distances, to deepen social gaps by not promoting an adequate use of its potential and cause a privileged group with exclusive access to telecommunication services. This situation was highlighted by Calcina & Hidalgo (2014) when referring to an analysis of rural interventions in the Peruvian rural Amazon.

Institutional redesign proposal. The third channel

Given the fact that the different measures that make up the two intervention channels for

investment in rural telecommunications in the current institutional design are insufficient for the areas belonging to the residual gap, we propose to incorporate a third channel into the current institutional design. It is a bottom-up governance model for the emergence of sustainable community networks, i.e. networks that are self-managed by the community social sector. Graphically, Image 5 shows the dynamics of the new actors in the institutional redesign proposed in this paper.

Image 5. Peru: dynamics of (new) actors in the institutional redesign proposed to address the telecommunications gap.



Source: Own elaboration

According to this, it should be noted that the presence of community networks in the world occurs precisely where the limitations of the public sector and the private sector (in this case, for the residual gap) concur. Community networks have as specific antecedents in Africa (Gwaka, 2018; Rey-Moreno & Graaf, 2016) and Catalonia (Baig et al., 2015), and such experiences of recent years in Latin America as in Argentina, Colombia, Brazil, and Mexico (Baca et al., 2018). They have been established as a trend for last-mile connectivity solutions for rural and remote areas (ITU-D, 2021) and their scope is even posted as disruptive; for instance, in the case of wireless community networks, the Internet can be referred to as a common good (De Filippi & Tréguer, 2014).

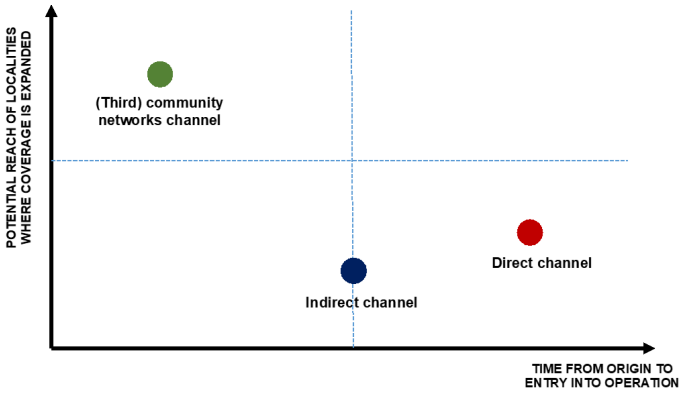
Despite this, in Latin American countries, the promotion of community networks as part of institutional interventions (i.e. institutional design) or public agenda, has not been established consistently or formally. It is following this approach that the main proposal of this paper is given.

It is important to consider that the new proposal for a third channel of community networks in Peru does not involve public or private investment projects. In spite of this, it has a potentially much wider scope, especially if a specific regulatory framework for the residual gap was to be developed for this purpose. In any case, its scope is potentially higher, given that the residual gap is estimated at 50,000 rural localities and there is a significant set of rural and formal community organizations (also around tens of thousands) with which a third intervention channel is highly likely, especially if the right conditions are promoted.

Additionally, international experience shows that, since they are specific projects tailored to

the interest and conditions of the community organization, the time from the origin to the implementation of a community network can be significantly low (less than a year or a few months). A relative comparison of the other two intervention channels can be seen in Image 6.

Image 6. Direct and indirect channels of interventions and the third channel of community networks are displayed on the scope-time quadrant.



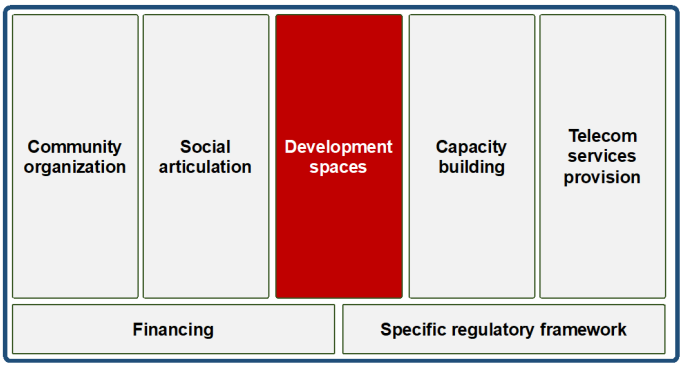
Source: Own elaboration

Equally important is to note that a governance model with bottom-up community networks makes it possible to make up for those shortcomings that may be present in traditional intervention channels, such as, personalization, an intercultural approach and having primary and updated information among other factors.

Third-channel governance model

The following is a description of the pieces of this new institutional design scheme that, according to the analysis, are essential for the generation of “development spaces” or public policy spaces from which community networks emerge (Image 7).

Image 7. Parts of the third channel governance model of community networks



Source: Own elaboration

Development spaces

Development spaces can be seen as decision-making arenas or public policies focused on rural development. They are a consequence, in this sense, of the establishment of certain conditions identified as essential. These conditions go from a differentiated regulation and are oriented to address the residual gap in the provision of services without profit.

Multi-stakeholder articulation

The multi-stakeholder articulation is established with the presence and influence that one or more actors have settled in one or more rural communities. These actors are exogenous to the community organization, but they may be the ones who promote their generation or coordinate intensely with it.

As examples, we have the following:

– Non-governmental organizations.

– Academy.

– Educational or cultural associations.

– Companies with a local presence.

Capacity building

Development of abilities is a joint effort to develop and increase digital literacy, digital skills and technological appropriation. It also promotes elementary understanding in the use of technology.

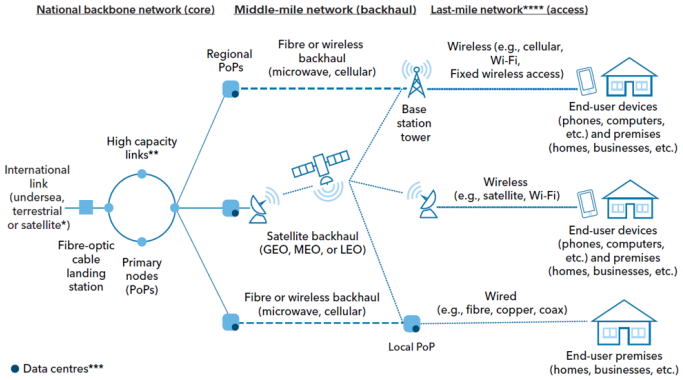
Therefore, the development of capacities becomes an essential condition in the emergence of collective wills to access and use telecommunications services.

Provision of telecommunications services

The provision of telecommunications services is a necessary condition for the access and use of the services. Therefore, it is the result of the confluence of the different parts described here and is made up of infrastructure (both passive and active) and service management over time.

It should be noted that the technological approach for the delivery of the service in its different stages (international connection, transport networks and access networks) is varied and, generally, the product of a combination of technologies (see Image 8). In particular, there are some access technologies, such as Wi-Fi and LTE (ITU, 2020b; Espinoza & Reed, 2018; Prieto Egido et al., 2020), identified as ideal for these rural spaces (Nandi et al., 2016).

Image 8. Network components for last-mile interventions in developing countries



Source: ITU (2020)

Specific regulatory framework

A specific law framework should be understood as a set of rules that make a difference between urban areas from rural areas of interest (i.e. those of the residual gap).

In this sense, the specificity sought here would materialize with a policy and regulatory agility framework (i.e. procedures and obtaining licenses), the use of elementary resources (e.g. radio spectrum, numbering, interconnection to other operators), and the payment for the right typified as commercial telecommunications activity (e.g. canon).

In this regard, considering the reviewed international experiences and the current sectoral legal framework, we propose to have a public policy for community networks whose purpose is, among others, the regulatory differentiation for the provision of telecommunications services through an operator of community networks with a focus on the residual gap. Among the main aspects to consider, the following are evaluated (but not limited to these):

– Formalize the third channel of telecommunications for the residual gap of telecommunications.

– Incorporate the definition of the scheme of community networks and community operators.

– Establish an innovative social license with transparent and simplified processing.

– Develop new public, private or other financing schemes.

– Establish mechanisms for assigning the radio electric spectrum (dynamic use, secondary, unlicensed spectrum, among others).

– Exempt payment for the right to use the radio spectrum or other resources that are basic for operating.

Financing and economic sustainability

Any model of delivery of telecommunications services in rural areas (or residual gap) finds economic sustainability as one of the main challenges. This occurs not only due to the geographical conditions of rural areas and the comparatively low demand of their inhabitants, but also due to conditions inherent to access to services or products necessary for this operation (from the availability of commercial electricity to access to a hardware store).

In this sense, the model of governance through community networks suppresses, for the traditional operators, the interest in making profitable the provision of the final service and, likewise, expands the possibilities of financing sources and economic sustainability schemes that the current institutional design does not consider.

Thus, although the operation of a community network is essentially autonomous and one of its goals is its economic sustainability, new actors/sectors can participate in its financing. The table below shows who these new actors are and their relationship with the three channels of institutional design (i.e. the two channels identified in the current institutional design plus the one proposed in this paper).

Table 1. Sources of financing in current institutional design and potential financing in new community networks

n°	Funding sources	Current institutional design		Third channel
		Direct channel	Indirect channel	Governance in community networks
1	Public sector / Universal Service Funds (USF)	Yes	No*	Yes
2	Self-financing / Internally generated resources	No	No	Yes
3	Private sector	No	No	Yes
4	Civil society [5]	No	No	Yes
5	International cooperation / multilateral bank**	Yes	No	Yes
6	Other public sectors or subnational governments	No	No	Yes
7	Academy	No	No	Yes
8	Others	No	No	Yes

* Incentives or obligations

** IADB, CAF, World Bank

Source: Own elaboration

From a sustainability and financing approach, the specific regulatory framework for the promotion of governance in community networks in Peru must make it explicit that, by

eliminating the restrictions on access to financing, a range of financing sources opens up at local, national and even international levels.

Community organization

It is the main piece of the model and represents the organization of people who carry out activities of common interest or live in a shared geographic area. It is usually made up of an inherent organizational structuring, a formal legal status, the provision of its own infrastructures (e.g. community premises), and decision-making mechanisms. The scope of their presence can be local, provincial, or regional.

The success of the emergence of a sustainable community network depends on the confluence and articulation of the pieces of this model and one that effectively serves the needs of the population that self-manages it. In addition to this, it is important to explore what other characteristics of the residual gap can become an advantage for the development of community networks.

4. OPPORTUNITIES FOR THE THIRD CHANNEL IN THE WIDE RURAL COMMUNITY FABRIC

The residual gap in Peru also has other characteristics that can represent significant advantages. We refer to the vast social fabric in the Peruvian rural sector that represents a favorable condition for the development of the governance model in community networks.

The already established legal status and the already articulated social structure are the main attributes that exist in this vast community fabric, which mainly focuses on agricultural development or the provision of drinking water and sanitation services, among others. Examples include the following:

Table 2.

Community-based organization:	**Estimated volume**
Indigenous or native peoples (in localities)	38,438
Administrative Associations for Aqueducts and Sewers (Water Boards, according to the Ministry of Housing, Construction and Sanitation-MVCS)	24,546
Associated producers forming agricultural cooperatives	40,000
Peasant communities	6,682
Núcleos ejecutores / Implementing cores (National Water Authority)	527
Water Management Authorities Local Water Administrations	71 14
Community broadcasters	63
Agricultural cooperatives	n.d.
Peasant patrols	n.d.
Religious organizations	n.d.

Source: National Water Authority (ANA), Ministry of Culture, Ministry of Agrarian Development (MIDAGRI), Ministry of Development and Social Inclusion (MIDIS), Ministry of Energy and Mining (MINEM), Ministry of Housing, Construction and Sanitation (MVCS), Ministry of Transport and Communications- MTC (4^{th} quarter 2020)

As can be observed, community-based organizations with the largest volume are (i) rural communities and indigenous or native peoples, (ii) Administrative Associations for Aqueducts and Sewers, and (iii) the coffee cooperatives.

Indigenous or native peoples

According to official information, in the fourth quarter of 2020, there are more than 8,000 indigenous or native peoples (IP) in Peru present in more than 38,000 localities (or population centres). Their national legal framework is broad and goes from the Political

Constitution of Peru up to a set of laws and specific regulations under the jurisdiction of the Ministry of Culture. Thus, of the 38,438 communities of the native peoples registered, 37,335 (i.e., 97%) belong to rural areas. From those, communities without mobile services are within the range of 26,000. As for IP communities without mobile services, they represent 70% of the total number of rural communities and 67% of all IP communities in Peru.

Administrative Associations for Aqueducts and Sewers

User associations, committees and water boards in general are organizations essentially linked to the provision of a service that demands, due to the conditions of the population centres in which they are located, a multi-stakeholder articulation and community management.

According to official information, there are 24,546 of these organizations throughout Peru. Of these ones, it is estimated that 13,245 (i.e., 54%) are in communities that do not have telecommunications services.

Coffee cooperatives

On the other hand, another type of organization present in the areas of interest are coffee cooperatives. Coffee is grown in approximately 449 districts and its organization has four main groups in relation to producers: grouped in cooperatives and associations, federations, commercially articulated to companies, and groups that are neither articulated nor organized (Díaz Vargas & Willems, 2017:18).

Even though the latter group is the largest, it is those grouped in cooperatives and associations (and, to some extent, federations) that have better organizational conditions, according to the United Nations Development Program (Díaz & Willems, 2017:18). This group is characterized by the fact that their technical teams tend to apply better criteria and are better supported by national and sub-national public programs, as well as by international cooperation.

Having said that, referring to the problems identified in the coffee sector, one stems from the rural nature of the areas in which this activity is carried out, aside from the poverty and extreme poverty of coffee producers. This situation is related to the problem raised in this study, since in most of the areas where coffee production takes place, there are no quality connectivity services (weak) or, where they do exist, they are costly. The United Nations Development Program (UNDP) also states that, for communications, this problem is because service operators do not prioritize infrastructure deployment (Díaz Vargas & Willems, 2017:51).

Rural communities

Rural communities are also another type of structured organization with formal recognition by the State. There are, at least, 6,682 ones in Peru, with the regions of Puno, Cusco,

Ayacucho and Huancavelica containing more than 55% of the total (INEI, 2018, 281). In terms of population, the total number of rural communities covered by the census encompasses more than three million people.

CONCLUSIONS

As can be seen, there is a vast community fabric present in rural areas in Peru (around tens of thousands). A large part of them (also inside around tens of thousands) does not have telecommunications services coverage, i.e., they belong to (and are part of) the residual telecommunications gap.

The fact that these organizations exist and maintain an already established organizational structure, that they have the use of infrastructure or goods, and have a formal legal status represents a great opportunity to accelerate the process of the third channel of intervention with community networks (somehow, “they skip the most complex steps”).

Based on what we exposed above, we have come to the following conclusions:

– In Peru, the current institutional design which addresses the rural connectivity gap, has two top-down intervention channels or lines: The “direct channel”, when the State manages and finances connectivity projects through public tenders that result in projects executed by an operator; and the “indirect channel”, when the State designs and sets regulatory frameworks that promote, in their application, the deployment and growth of the services offer as obligations or as incentives that these operator companies can or cannot choose.

– The implementation of these top-down interventions in the current institutional design for closing rural connectivity gaps results in a large group of rural localities, under the scope of public intervention, neither currently prioritized nor able to be prioritized in the short or medium term. In this paper, this subgroup is known as the “residual gap” of rural telecommunications.

– The estimated value of the residual gap can be obtained from the difference between (A) the current gap’s localities (i.e., without any guaranteed service) minus (B) the current gap’s localities that public interventions have explicitly prioritized for the next five years or are part of ongoing interventions. For Peru, we estimated a residual gap of 50,000 localities (approximately 50% in relative terms) throughout the Peruvian territory.

– Due to its complexity, multidimensionality and dynamism, the problem associated with the residual gap can be ranked as a wicked problem. Hence, it is necessary to resort to innovation and collaboration proposals to establish new perspectives to address this problem.

– The proposal of a bottom-up governance model for community telecommunications networks, incorporated as the third intervention channel in the current institutional design, reconfigures the role and functions of the involved actors; in this model, the organized community makes decisions on how to build and operate its own network in a collective

action. Moreover, compared to the generally homogeneous and vertical schemes of the other two intervention channels, development and intercultural approaches can be applied more effectively.

– The materialization of this third intervention channel model is achieved through the generation of differentiated public policy space for (and focused on) localities in the residual telecommunications gap. This space provides an opportunity for the generation of synergies and shared efforts, not only from the governing body of the communications sector but from public sectors and subnational governments (regional or local), as well as through the potential involvement of international cooperation, academia, non-governmental organizations, and civil society in general (through crowdfunding or other schemes).This new third intervention channel proposal for community networks does not involve public or private investment projects. Despite this, it has a potentially much greater outreach.

– For Peru, since the residual gap is estimated at 50,000 rural localities and there is a significant set of rural and formal community organizations (also estimated in the tens of thousands), the third intervention channel is highly probable, especially if the right conditions are promoted.

– International experience in community networks shows that, since they are specific projects adapted to the interest and conditions of the community organization, the period from the origin to the implementation of a community network can be very low (less than a year or estimated at a few months). In addition, much more information is available than in the quasi-homogeneous schemes of the other two intervention channels.

– In Peru, the vast rural organizational fabric existing in the residual gap areas constitutes an important advantage in the materialization of interventions with community networks because they have an already established legal status, have infrastructure and goods and, in particular, have an already articulated social structure.

– Adapting the current institutional design to address the not currently prioritized nor not able to be prioritized residual gap, and establishing a public policy for it, would allow a significant number of inhabitants from rural areas to connect to the Internet, to access public services in a digital format, and to be included in the digital society despite their unfavorable development conditions. In that sense, Internet access can be the catalyst to change their status and therefore lead to the social and economic development of rural areas in Peru.

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***Article translated by** Johanna Reyes on November-December, 2022. Translation provided by the authors.

Notas

[1] Information based upon statistics about mobile services coverage and landline internet coverage in populated places by the 4Q2020, Ministry of Transport and Communications of Peru.

[2] B's value is, in turn, the sum of direct intervention channel localities (6,399 in PRONATEL projects) and indirect intervention channel ones (1,561 in AWS-3 and 2.3 GHz current bands biddings).

[3] Similar recent documented examples are shown in statements, reports, or documentaries by Joe Biden (2021), El País (2020), and by DW documentary (2020). In this latter case, the communal movement Freifunk is significant.

[4] Basis for the contest (2021) are available at: https://www.investinperu.pe/RepositorioAPS0/0/2/jer/ST_BANDA_ESPECTRO_AWS3/Bases_LPE_Bandas_AWS-3_y_2_3_GHz_06May21_R_.pdf

[5] By April 2021, a current example is the "open call for grants to support community networks in the global South" of APC. Here the amount that organizations or projects may be able to ask for to develop in a country is between 15,000 and 20,000 US dollars. https://www.apc.org/es/news/convocatoria-abierta-para-solicitar-subsidios-de-apoyo-las-redes-comunitarias-del-sur-global?s=08