

## RESEARCH ARTICLE



# The landlocked condition as determinant for development of internet: The Bolivian case

## OPEN ACCESS

**Received:** 31-07-2020

**Accepted:** 05-09-2020

**Published:** 18-09-2020

**Editor:** Dr. Natarajan Gajendran

**Citation:** Davalos Yoshida A, Gil-Herrera RJ (2020) The landlocked condition as determinant for development of internet: The Bolivian case. *Indian Journal of Science and Technology* 13(34): 3521-3537. <https://doi.org/10.17485/IJST/V13i34.1145>

\* **Corresponding author.**

[adolfoarturod@gmail.com](mailto:adolfoarturod@gmail.com)

**Funding:** None

**Competing Interests:** None

**Copyright:** © 2020 Davalos Yoshida & Gil-Herrera. This is an open access article distributed under the terms of the [Creative Commons Attribution License](https://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Published By Indian Society for Education and Environment ([iSee](https://www.isee.org/))

## ISSN

Print: 0974-6846

Electronic: 0974-5645

**A Davalos Yoshida<sup>1\*</sup>, Richard-Jesús Gil-Herrera<sup>2</sup>**

<sup>1</sup> Doctorate Department, Faculty of Social Sciences, American University of Europe (www.unade.mx), ABS Consulting Group (www.abs-cgroup.com), La Paz, Bolivia

<sup>2</sup> Doctorate Department, Faculty of Social Sciences, American University of Europe (www.unade.mx), Cancún, México

## Abstract

**Objectives:** To validate if the condition of Bolivia as a landlocked country is the main reason for the low Internet penetration, or whether there are others relevant factors. Specific objectives: To review the telecommunication infrastructure as an essential facility, as well as to verify if deficient regulation or absence of incentives are other reasons for the low Internet penetration.

**Methods:** Some literature about the role of telecommunications in the economic development, the theory of firm and the non-cooperative behavior, have been analyzed. As part of this research of the theoretical framework and empirical validation, some works about the use of technology, as well as others about performance of Internet markets in landlocked countries around the world have been reviewed. Some South American country cases have been analyzed. Additionally, the regulatory, legal, and economic aspects of Bolivian telecommunications were studied in comparison with the other landlocked South American country. For the empirical validation, a costs model of the firm has been designed. **Findings:** In comparison with other countries in the region, Internet access in Bolivia is among the most expensive ones. The evidence found in this study points out that this is due to absence of appropriate regulation and because the Internet market is highly concentrated, but it is not due to its condition of being a landlocked country. **Novelty:** Contrary to what would be expected using conventional wisdom, the lack of Internet development in Bolivia is not a consequence of its landlocked condition. Conversely, according to the results of the cost model developed for this study, low Internet penetration seems to follow a process of high market concentration as result of insufficient regulation. Hence, it seems necessary that the market of Internet access in Bolivia be economically regulated and to accomplish this, the normative needs to be revised and amended.

**Keywords:** Internet; telecommunications; regulation; competency; landlocked countries; development

## 1 Introduction

Since its inception in the 60s the Internet has been growing rapidly, expanding its scope and dramatically impacting almost every field of human activity in practice. As numerous studies show, for example<sup>(1)</sup>, the Internet is one of the technological advances that has changed not just the way of conducting businesses, but the way of life of the world's entire population as well. This phenomenon is so important, that this period has come to be known as the digital age. Nowadays, the effect that the Internet has on people's lives and on the economies of countries as well is undeniable.

The Internet, viewed from the perspective of its own ability to create value, has been analyzed under the Value Chain approach<sup>(2)</sup> and it is the subject of ongoing studies and monitoring. From this perspective, according to<sup>(3)</sup>, for the Global System for Mobile Communications Association (GSMA) at worldwide level, the Internet value chain has tripled from 1,200 billion dollars in 2008 to almost 3,500 billion dollars in 2015 with an annual growth rate of 16%. This cited behavior is driven mainly by three factors: (a) the increase of Internet access by users, (b) the decrease in cost of mobile devices (c) activity diversification and longer periods of time spent using Internet by the average user.

It is undeniable that today a strategic role as a promoter of integral economic development is assigned to the Internet, not only for the business and economic environment, but for the realization of all the productive activities and services as well. In fact, this is validated in studies developed by international organizations such as the Inter-American Development Bank<sup>(4)(1)</sup>, as it has been observed that countries where Broadband penetration has been incremented by 10% have experienced an increase of 3.19% in GDP and about 2.61% in productivity, and an overall creation of more than 67,000 jobs as well. In addition, another report<sup>(5)</sup> states that small and medium-sized enterprises (SMEs) that make intensive use of the Internet improve their productivity by 10% in terms of sales and cost savings, and SMEs that use the Internet extensively in their business relationships grow twice as fast than those who don't. These analyzes are based on the potential benefits that broadband can bring to improved education and access to capacity building; promotion of equality and inclusion of rural vulnerable communities; support for disaster relief operations; remote medical assistance, increased competition, competitiveness and productivity in addition to cohesion and social interaction; among others<sup>(6)</sup>.

As<sup>(1)</sup> shows, there is enough evidence to assert that the Internet is a powerful tool to promote economic growth and to improve the economic income distribution. With the Internet, not only large companies in urban centers, but also the small artisans and peasant producers, use communications applications based on electronic platforms to increase the visibility of their offers of services and goods, thereby increasing their productivity by avoiding the expense of travel time to conduct their businesses.

Therefore, it is particularly important to carefully observe government's perception of the role of telecommunications in economic development, to adopt proper policies related with Information and Communication Technologies (ICT). Nowadays, all governments in the world are giving connectivity and the Internet more and more importance (to a greater or lesser extent), in their agendas and government plans.

According to<sup>(7)</sup>, the number of users accessing the Internet has grown steeply and steadily. The penetration rate has been increasing to levels whose impact on the world economy is evident.

Studies such as<sup>(8,9)</sup> and<sup>(10)</sup> develop an analysis of the status of Internet in landlocked countries;<sup>(8)</sup> shows that some landlocked countries that have managed to take better advantage of technological tools, are poised for achievement of significant levels of development (i.e. the Switzerland case). On the other hand,<sup>(9)</sup> and<sup>(10)</sup> show the status of the Internet situation in Bolivia and Paraguay in comparison with other South American countries. However, it is not established whether this situation is due to the landlocked condition of both countries, or whether there are other factors such as the absence of a proper official regulation.

As<sup>(11)</sup> shows, the services supported by digital networks and the government-owned Bolivian digital network (i.e. transport networks, access networks and satellite access), are deficient and do not meet the demand or the current needs of the Bolivian population.

Likewise,<sup>(12)</sup> shows that the universalization of Internet services in Bolivia and other South American countries have suffered delays due to political changes and the uncertainty generated by them. The cost of access, coupled with an unfavorable climate for private investment, are probably the main problems that these markets face.

It is expected that this research will allow to establish whether Bolivia has ICT market development indicators that show a disadvantage regarding other countries in the Region with maritime coastline: i) due to its condition as a landlocked country, or by the contrary, ii) whether there are other factors such as lack of public and/or private investment, or the absence of regulatory incentives that could be having an impact on the development of the local Internet market.

## 2 Methodology

This work is carried out to corroborate, through empirical verification for the case of Bolivia and making use of the reference of other landlocked countries, whether the high prices observed in the Bolivian Internet market are mainly due to reasons based on its status as a landlocked country; or by the contrary, whether this phenomenon is due to other factors.

In this sense, the research starts from the general to the specific. To accomplish this, it begins by reviewing and analyzing the situation of the Internet in the world and in other landlocked countries, focusing afterwards on the Internet in South America and finally in Bolivia. To this end, this work has been carried out through the review of previous studies referring to Landlocked Developing Countries (LLDC).

Next, examining the reasons for the current situation of the Internet in the Bolivian case, the paper analyzes the conditions of competition in the local telecommunications market: regulatory laws, number of operators, and market shares. For this analysis, we use instruments and mechanisms provided by economic theory and industrial organization, such as market concentration indexes.

The analysis of the preceding aspects is complemented by the study of the regulatory aspects present in the Bolivian Internet market, taking into account that according to the recommendations of the theory of industrial organization, the Internet is a network industry. The network industries have essential facilities whose replication is difficult and expensive; hence, in accordance with best regulatory practices, they may be subject to technical and economic regulations, whenever the situation so requires.

Finally, an efficient network has been simulated to calculate reference costs. To this effect, the costs of the most important operators in the Bolivian market, gathered through their financial statements, have been applied to this efficient network. From this exercise, the costs of operating a company with a magnitude of traffic equivalent to 50% of the total market have been simulated, based on this modeled company (efficiently sized company).

Then, we analyzed using the financial statements from the last 5 years, the percentual composition of the costs incurred by providers of wholesale Internet access. The objective of this task was to verify the weight of the access costs to submarine fiber from the Bolivian border against the total cost of providing the service. In a theoretical scenario, should Bolivia not be a landlocked country, these costs would not be incurred.

Finally, this whole analysis allows us to establish whether the landlocked condition of Bolivian is an important factor affecting the Bolivian Internet market (particularly for the observed access costs) or whether there are other factors such as the absence of competition and/or regulatory rules that modify the behavior of market agents, that are more relevant.

## 3 Results

### 3.1 International studies revision

#### 3.1.1 *The internet in landlocked countries*

The Internet Society is a non-profit, non-governmental organization dedicated to the global development of Internet, which since 1991 has focused its efforts and actions on relevant Internet issues. Thus, based on case studies of nine countries<sup>(7)</sup>, it establishes three key areas in which the Internet can help LLDCs to become digitally connected nations:

1. First, networked customs systems have a significant impact on reducing delays and costs of cross-border trade.
2. Second, as well as trade for goods, LLDCs need access to the sea, and they also need access to submarine fiber optic cables.
3. Third, in order to have an equivalent condition in trade of services to countries with access to the sea, the Internet can provide LLDCs a platform of information technology services.

Consistent with<sup>(8)</sup>, the Internet can help to overcome the barriers for landlocked states, through appropriate legal and regulatory environment and good governance. For instance, a national high-capacity fiber optic backbone will be underutilized if it is controlled by a monopoly with high wholesale prices. Another example: Online sales platforms would have very few users if electronic payments were not allowed.

The same study shows how some LLDCs are ahead of many other countries with coastline in commercial efficiency, indicating that the landlocked condition does not have to be a definitive barrier. Similarly, in terms of connectivity to submarine cables, some LLDCs have good capacity and pay lower prices than others with coastline. These LLDCs have largely overcome the barriers of landlock and are exploiting the Internet effectively.

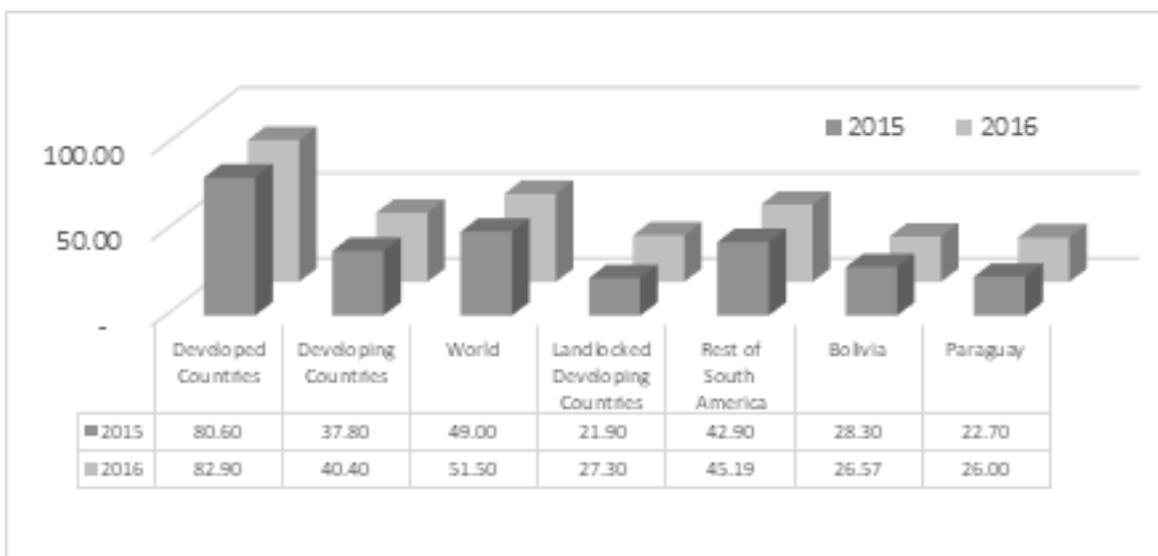
The findings in<sup>(8)</sup> show that only a few LLDCs have a balanced Internet ecosystem and most are lagging in terms of their digital skills. It concludes that the Internet evolution must be more balanced in terms of infrastructure, skills, digital economy, and governance.

Again, according to<sup>(8)</sup>, in some LLDCs proactive policies such as open access and competition among wholesalers have led to the deployment of fiber optic backbones through key border points. Some LLDCs have also established a framework that simplifies Internet-enabled services, although adoption of those politics is generally low, mainly due to the underlying socioeconomic conditions.

### 3.1.2 The internet among LLDCs and the other South American countries

The International Telecommunication Union (ITU)<sup>(10)</sup>, analyzes the connectivity challenges and opportunities for Bolivia and Paraguay (both LLDCs). This study shows that subscriber rates for fixed broadband services in Bolivia and Paraguay are very low (2.6 and 3.4 percent in 2016 respectively) compared to 13 percent in the rest of the South American countries. In comparison, developed countries have an average penetration of more than 30 percent. These low percentages of penetration are mainly explained by the reduced deployment of fixed networks. On the other hand, and regarding the penetration of mobile broadband services, the situation is less dramatic: While the regional average is 61%, Bolivia and Paraguay have a penetration of 57.6% and 41.7% respectively.

According to<sup>(10)</sup>, by 2016 Bolivian households with Internet access reached 26.57%, slightly above than Paraguay (26%), but well below the South American average (45.19%) and even more regarding developed countries (82.9%). The bandwidth in both countries was between 20 and 30 percent below the average of the LLDCs and notably below that of other South American countries, as shown in Figure 1.



**Fig 1.** Comparative analysis of households with internet access  
Source: Adapted from<sup>(10)</sup>.

The ICT Development Index (IDI) is a composite index built by ITU, as a reference measure that allows monitoring and comparison of the evolution of ICT among countries. Figure 2 shows the IDI values of South American countries and the averages of developed countries, South American countries and other developing countries altogether. As can be observed, Bolivia and Paraguay in 2016 are slightly below the rest of South American countries.

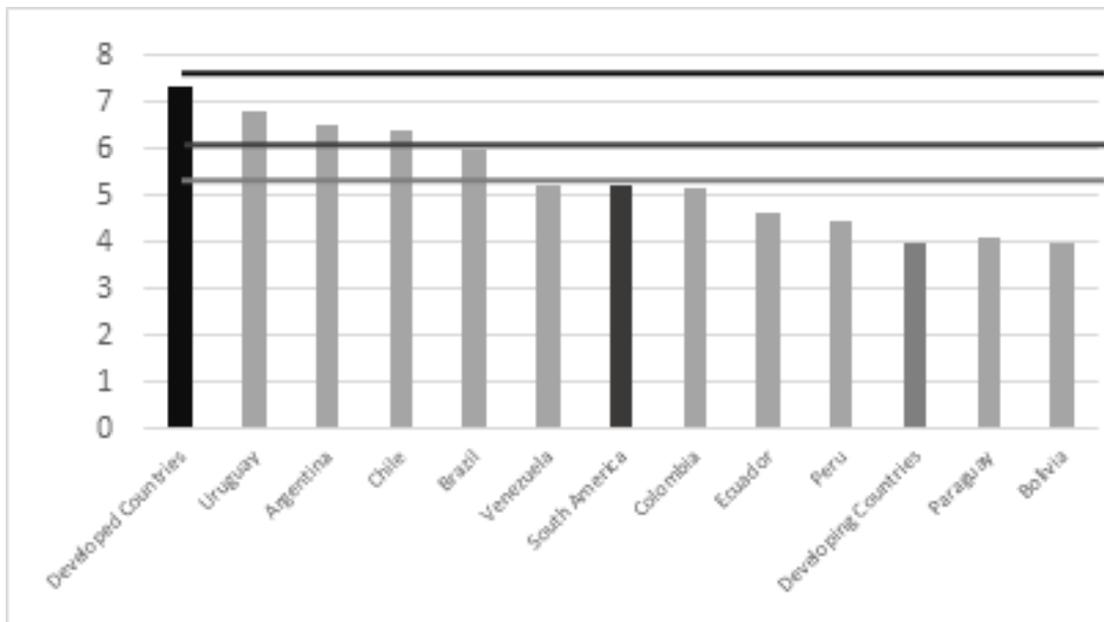


Fig 2. Comparative analysis by 2016 of the IDI in the region  
Source: Adapted from (10)

Prices are certainly one of the most important barriers to accessing services. The comparison made by (10) shows the prices of fixed broadband service in countries in the Region, together with averages of connection speed. Paraguay and Bolivia have the poorest performances in comparison to other South American countries (see Figure 3).

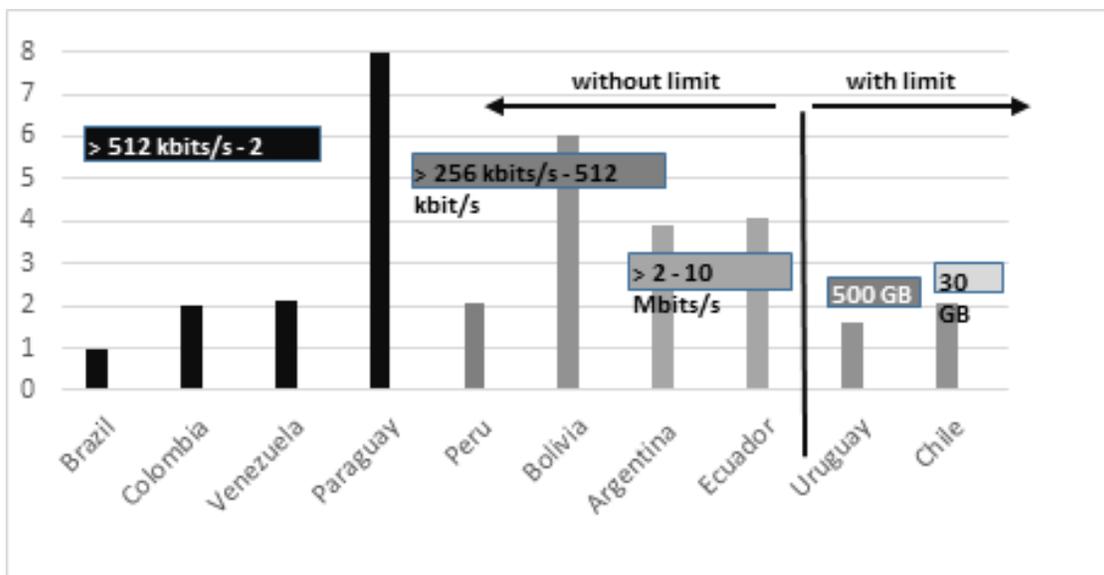


Fig 3. Prices at 2016 of fixed broadband service (% of GNP per capita), speeds and service limitations.  
Source: Adapted from (10)

However, both countries have shown for broadband mobile services an evidently better situation than that of the fixed broadband services (see Figure 4). As indicated by the ITU, Venezuela and Ecuador have more expensive mobile broadband Internet in 2015 than Bolivia and Paraguay.

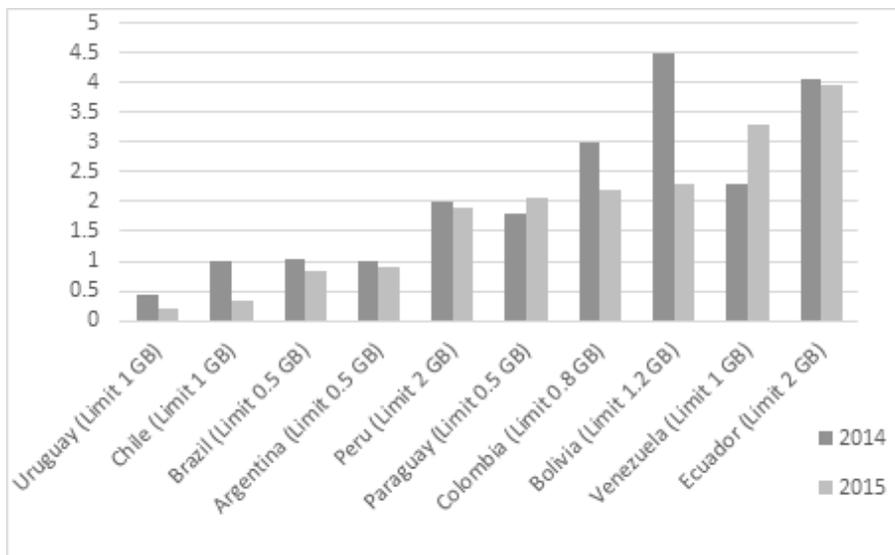


Fig 4. Prices of prepaid broadband mobile service (% of GNP per capita). Source: Adapted from <sup>(10)</sup>.

### 3.2 The current state of broadband in Latin America and Caribbean countries

The Economic Commission for Latin America (ECLAC), in one of its studies related to the Internet market <sup>(13)</sup>, showed that 56% of the inhabitants in Latin America and the Caribbean (LAC) have used the Internet in 2016. This represents an increase of 36 percentage points in one decade. In affordability terms, it was required in 2010 to allocate about 18% of average monthly income to pay for the monthly subscription fees to a fixed broadband service of 1Mbps, while in 2017 that figure was only 1.2%.

Despite these advances, as stated in <sup>(13)</sup>, problems of quality and equity on Internet access remain unresolved. The number of households connected to Internet in the Region grew by 103% between 2010 and 2016. In spite of this, more than half of the households still lack access to the Internet. Bolivia was still lagging in 2016, with less than 30% of households connected to the Internet, a percentage well below the regional average of almost 50%, as shown in Figure 5.

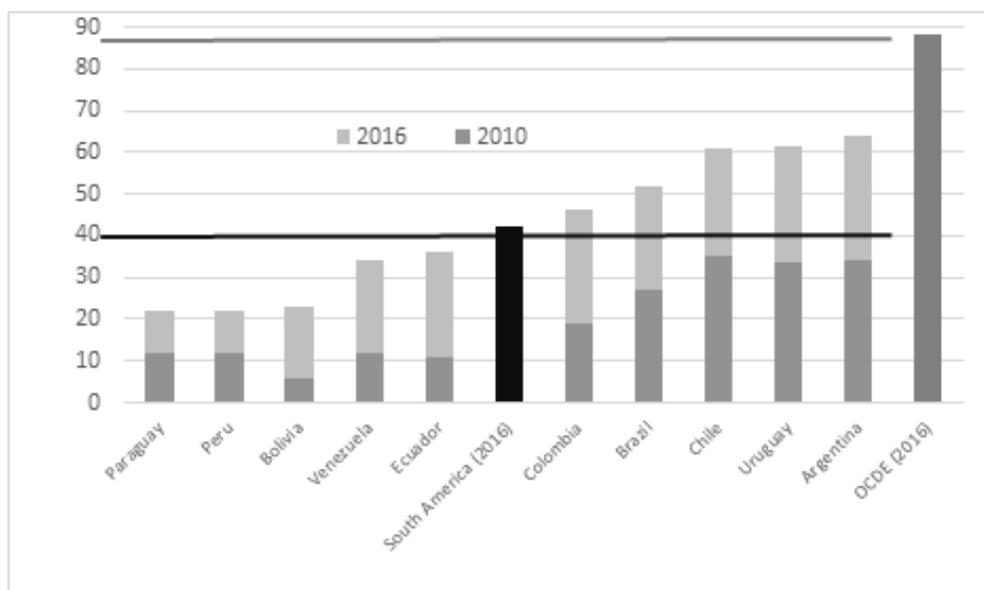


Fig 5. Households with internet by country (%). Source: Adapted from <sup>(13)</sup>.

Concerning the penetration of fixed and mobile broadband,<sup>(13)</sup> shows that Bolivia is below the regional average and, in the case of fixed broadband, the penetration level is the lowest in the Region. This situation is comparable to the low penetration levels of fixed telephony attained by Bolivia.

According to<sup>(13)</sup>, the affordability of fixed broadband services, measured as the average price of 1Mbps as a percentage of GDP per capita, shows that for the case of fixed broadband all countries of the region are below 5%; that is, below the affordability threshold determined by the United Nations International Broadband Commission. In the Bolivian case, this affordability indicator shows a percentage close to 3.3%. However, it is above all other countries in the South American region. On the right side of Figure 6, the cheapest rates of mobile broadband prepaid data plans are shown. In this case, Bolivia has prices that are more competitive in comparison to the other South American countries. Since only Paraguay and Argentina have cheaper data plans than Bolivia, it is important to point out that all South American countries are below the affordability threshold.

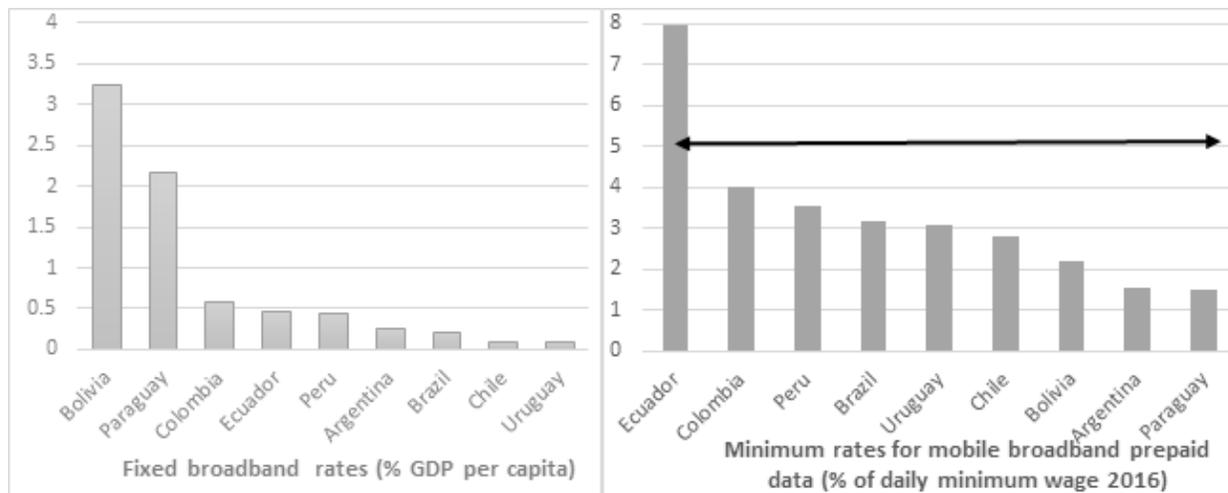


Fig 6. Fixed broadband and mobile broadband rates. Source: Adapted from<sup>(13)</sup>.

The commonly referred variable to measure the quality of service is the connection speed; Figure 7 shows the evolution of average fixed and mobile broadband connection speeds, where Paraguay, Venezuela and Bolivia hold the last positions in the Region in terms of connection speeds.

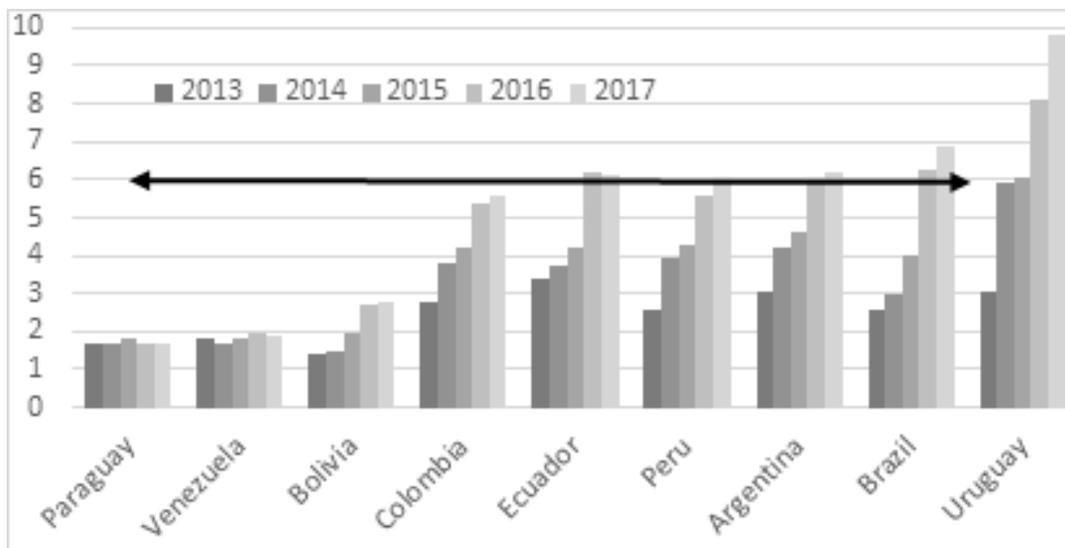


Fig 7. Evolution on the effective average speeds of connections by fixed broadband. Source: Adapted from<sup>(13)</sup>.

According to<sup>(13)</sup>, the region still has a heavy dependence on international Internet traffic, mainly from the United States, not just because that country is the main content provider, but also because many of the contents generated in the region are stored there. In this regard and according to this study, quality of access is highly conditioned by international telecommunications infrastructure. In this matter, both Bolivia and Paraguay have a disadvantage due to their landlocked condition.

### 3.2.1 The digital gap in Latin America region

Dialogue on the Information Society (DIRSI) is a regional organization whose network of professionals and institutions specialize in ICT policy and research in Latin America. It conducts research; publishes and disseminates articles and reports; and it also supports dialogue on aspects of ICT policy, regulation and governance in Latin America.

A study commissioned by the International Development Research Center and the Canadian International Development Agency<sup>(14)</sup> had as an objective to gather the situation of 19 Latin American countries in terms of prices, speeds and affordability of the broadband, using data obtained from a survey carried out by DIRSI of the plans offered in the region. This work concludes that the Region shows improvements in terms of access quality (speeds offered), although the results related to prices are less optimistic. At the same time, disparities between countries are very important; while some countries show important advances, others appear lagging behind in a high percentage of the indicators.

Another important indicator is the analysis of the cost of fixed broadband.<sup>(14)</sup> studies the price of the cheapest plan, adjusted by the purchasing power parity (PPP) prices. This indicator approximates the minimum expenditure that a household needs to incur to access fixed broadband services. Figure 8 on the left shows the cheapest broadband plan for a minimum of 1GB for each country, where Bolivia has the second highest price in South America, only lower than Argentina. An interesting indicator presented in this study is the median price of broadband plans. The median is the data at the center of the plans arranged from lowest to highest for each country and it can be interpreted as the "typical plan" for this country. Regarding this, in the right side of Figure 8, Bolivia has the highest price for the entire region, followed by Paraguay.

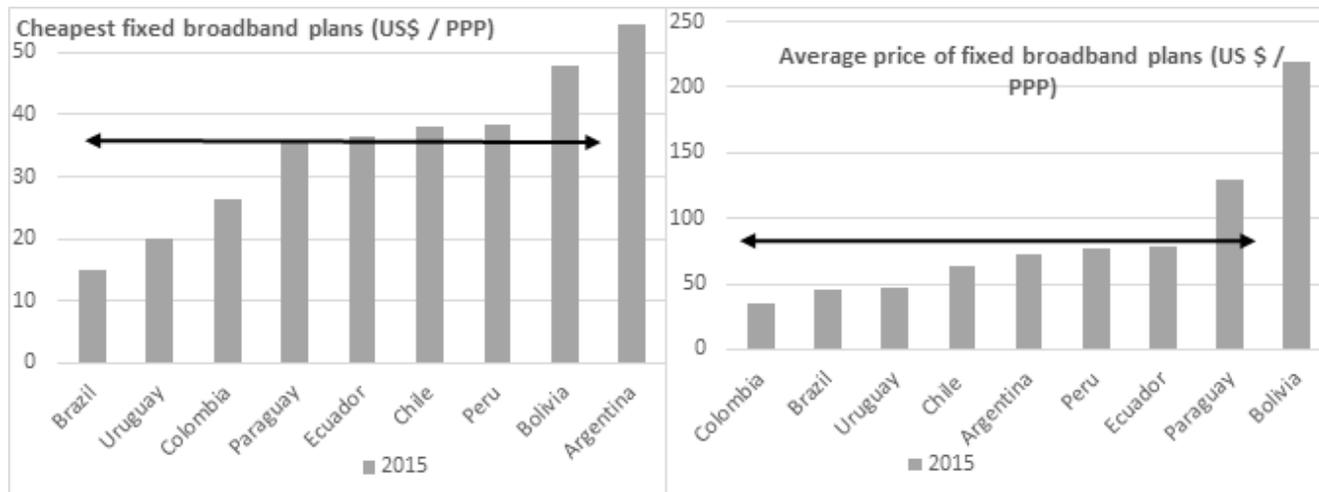


Fig 8. Comparison or fixed broadband prices. Source: Adapted from<sup>(14)</sup>.

As mentioned before, the fixed broadband speed is a typical indicator of supply quality and development. In<sup>(14)</sup> the profile of speeds offered in broadband plans is shown in terms of the median speed for each country. Certainly, it can be considered the "typical speed" for each country. The left side of Figure 9 shows that Bolivia and Paraguay hold the last positions in South America regarding this indicator. Also, analyzing the prices and speeds altogether, the right side of the same figure shows the median price per Mbps of download for each country and there we can see that by far, Bolivia has the highest median price in the Region and Paraguay the second most expensive.

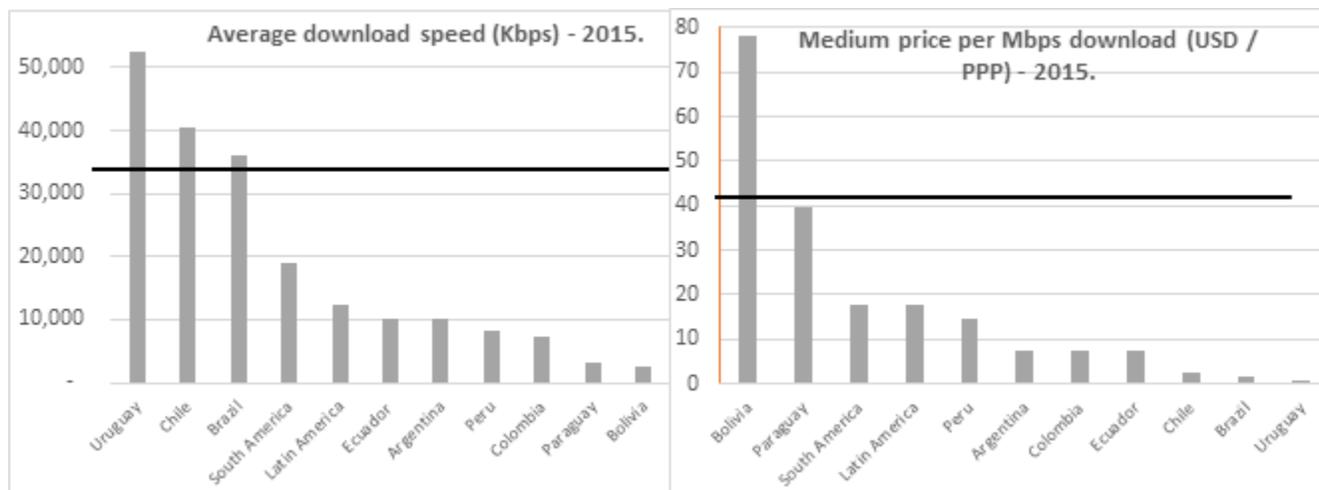


Fig 9. Comparative analysis of download speeds and prices. Source: Adapted from (14).

As indicated before, affordability is measured as the cost to access broadband in relation to the level of income. In (14) it is used as an indicator that measures the cheapest plan as a percentage of GDP per capita. As shown on the left side of Figure 10, Bolivia has the lowest affordability in South America for fixed broadband Internet with slightly more than 8.2% cost with respect to GDP per capita, well above the 5% threshold. On the right side of Figure 10, the same indicator for mobile broadband is shown. The indicator shows that mobile broadband is more affordable than fixed broadband; all South American countries have a percentage lower than 5%; however, Bolivia is still the country with the lowest affordability in the region.

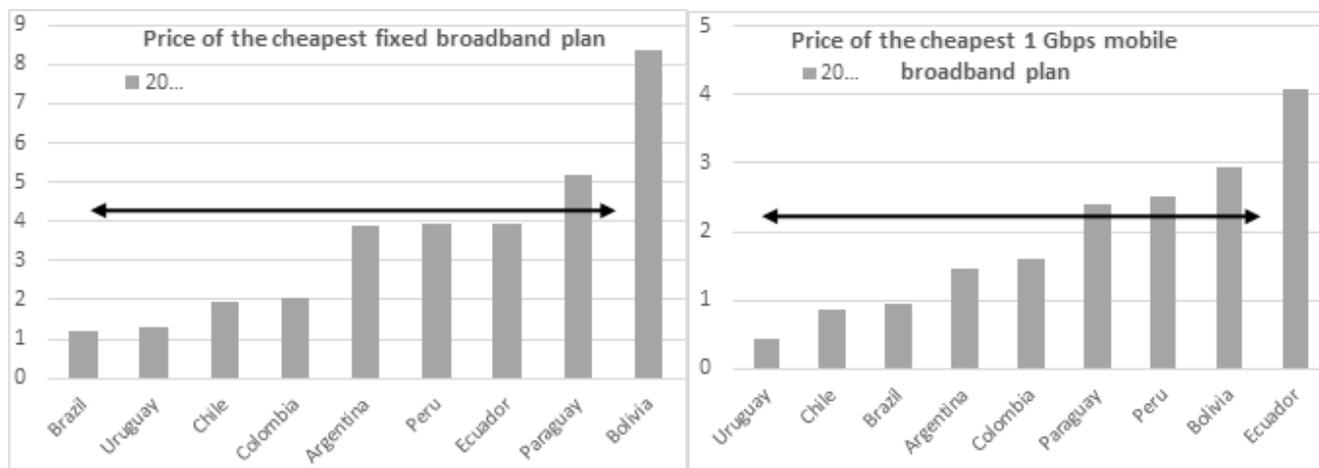


Fig 10. Price of the cheapest broadband plans, as percentage of GDP per capita. Source: Adapted from (14).

This research has also considered the work of (9) that refers to the challenges and opportunities in terms of connectivity in Paraguay. The author concludes that ICT policies and regulations related to connectivity should aim at accelerating the development of broadband, in both fixed and mobile networks, to guarantee the necessary economic growth. Hence, it is recommended to include broadband services in the definition of basic telecommunications services. The author also recommends the inclusion of broadband access in the universal service definition to ensure that the population can access all corresponding technologies and services.

Likewise, (9) concludes that in developed countries, the implementation of fixed broadband networks has given access to broadband services to almost the entire population. But in the LLDCs of South America nowadays, most of the population accesses broadband services through mobile networks, as seen in the review of the different studies already analyzed. In order

to offer broadband, mobile networks need a national backbone fiber network. As it was pointed out, the construction of fixed broadband access networks has a high cost and it is not realistic to encourage competition in such networks; therefore, it would be convenient for all operators and service providers and for the sake of competition, to have open access to fiber optic networks already deployed.

### 3.3 The Bolivian internet market

#### 3.3.1 Internet chain of access

Before describing the Bolivian market, it is important to conceptually define the Internet access chain on which the analysis is performed. For that purpose, Figure 11 shows the connectivity value chain in the lower layers of the OSI model being considered.

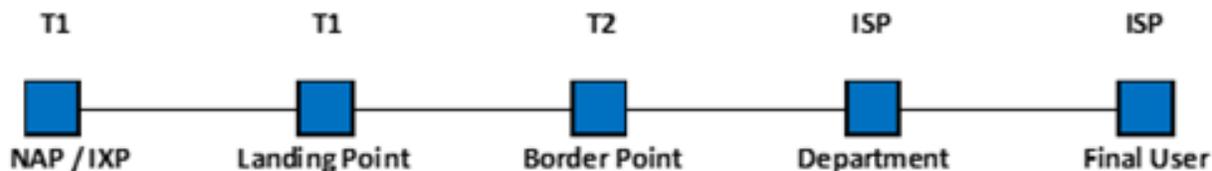


Fig 11. The value chain of access to internet for the Bolivian case.

Source: Own elaboration.

One of the characteristics of the Internet access in Bolivian market is the existence of two types of companies among the Internet access providers. A group made up by companies that have access to the international fiber optic network, which are those operators with transport infrastructure from the Departmental Distribution Node (DDN) to the border point. And a second group, made by companies that only have infrastructure to get from the DDN to the end user, which means that they have to pay for the flow (IP transit) to the companies of the first group. The first group can be characterized as a wholesale market and the second as a retail market.

#### 3.3.2 Bolivian market

The State Political Constitution, the Government National Agenda and the laws of the sector, give to telecommunications a fundamental role in economic development but above all, for the search for greater equity and fairness for Bolivian society.

Article 43rd of the Telecommunications Law<sup>(15)</sup> establishes the Tariff Policy for the telecommunications sector. The Telecommunications and Transport Regulatory and Control Authority (ATT) regulates the general regime of tariffs and prices for telecommunications services. The rates and prices provided to the public shall: i) reflect the costs demanded by the efficient provision of each service; ii) comply with the principles of solidarity and affordability, so as to include tariff options for lower-income users; iii) promote the efficient use of services and not include anti-competitive aspects; iv) avoid cross-subsidies; v) be equitable for users who are in similar circumstances. For the case of Internet, Article 50th establishes that Internet providers shall necessarily establish and provide interconnections within national territory.

In accordance with Article 61st, suppliers have certain prohibitions whose observance the ATT oversees, of which the following are highlighted:

1. Anti-competitive practices such as the joint, direct or indirect fixing of prices, the establishment of limitations, control or distribution of the market, and others.
2. Unfair practices such as the performance of any kind of commercial acts or dissemination of false, incomplete or misleading information.
3. Operations of economic concentration, whose purpose is to limit, restrict, suppress or distort the exercise of competition or that seek control or exclusivity in the provision of telecommunications services.

The regulation of Telecommunications Law 164<sup>(16)</sup>, establishes the tariff regulation for public telecommunication services; however, the Internet access service is not defined as a public service and this regulation would not be applicable to this market. This regulation establishes certain conditions for tariff fixing by operators. The ATT will declare as dominant operator in a relevant market of telecommunications services to a provider: (a) with average market share of 40% of total market sales, but only if (b) the difference in market share with the second competitor is equal or greater than ten percentage points.

In consequence, the Internet market is currently governed by competition rules and is not subject to tariff regulation. For Government to fix the price of Internet access, a previous verification that there is a company with a dominant position in the market is required.

According to<sup>(17)</sup>, there are up to seven wholesale Internet access service providers in Bolivia. All of them are also performing as operators in the retail market because the current regulation allows vertical integration in this market. Hence, it is not possible to identify an Internet access market and neither to separate wholesale nor retail markets.

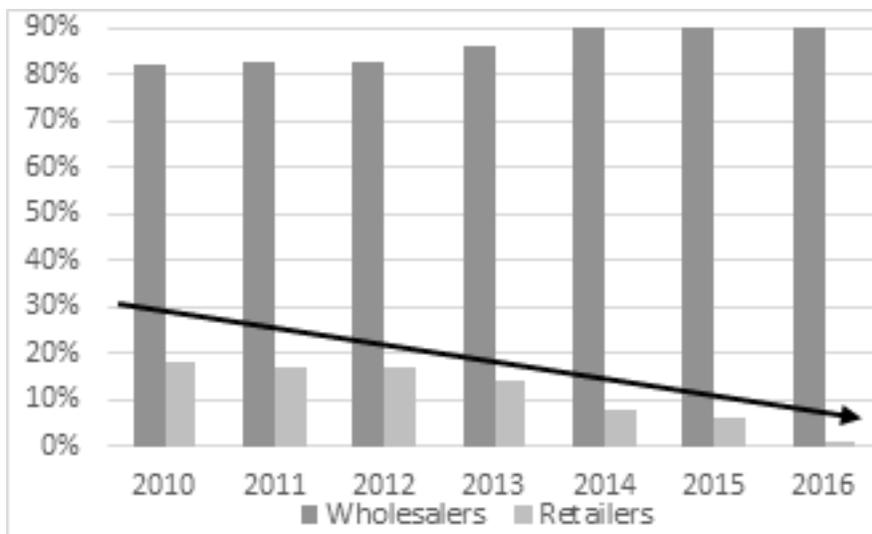
Of the seven wholesale Internet access providers, one is also a fixed telephony and mobile services provider nationwide; two others are mobile service providers; and two are local service providers of fixed telephony. Table 1 shows the participation of 6 wholesale operators in the wholesale and retail markets.

**Table 1.** Participation on the final user internet market as percentage of revenues.

Operators	Years						
	2010	2011	2012	2013	2014	2015	2016
1	18%	18%	17%	13%	8%	6%	5%
2	15%	13%	11%	10%	6%	5%	4%
3	7%	8%	13%	17%	18%	18%	19%
4	22%	15%	18%	20%	39%	34%	29%
5	0%	0%	0%	0%	0%	0%	4%
6	20%	29%	24%	26%	21%	31%	38%
<b>Retailers</b>	18%	17%	17%	14%	8%	6%	1%
<b>Total</b>	<b>100%</b>						

Source: Own Elaboration Based on<sup>(17)</sup>

The evolution of wholesale and retail sales by providers shows the possible existence of anticompetitive practices, applied by owners of essential facilities in the retail market. As Figure 12 shows, operators that only intervened in the end-user market reduced its participation to marginal levels over time (1% participation of the entire group for 2016).



**Fig 12.** Evolution of internet market participations (% sales).  
Source: Own elaboration based on<sup>(17)</sup>

The concentration of the Internet market in the hands of wholesale operators, particularly two of them, is more evident as shown in Figure 13. The two operators with the highest market shares account for 67% of revenues and the three main operators add up to 86%.

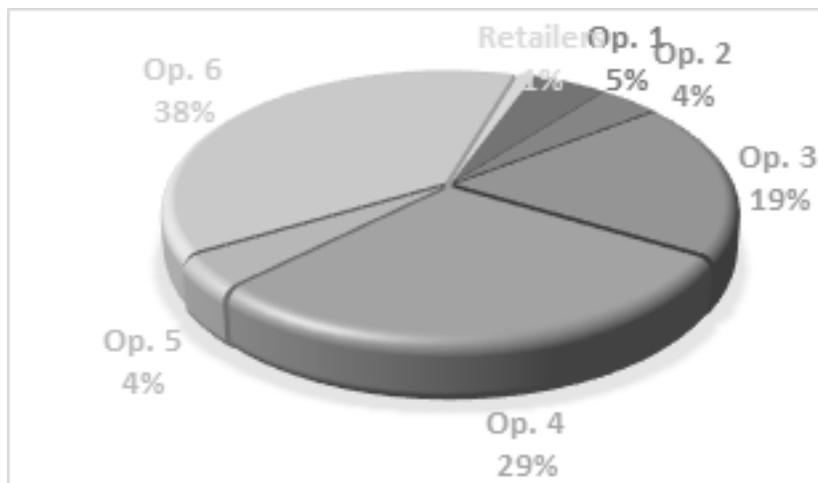


Fig 13. Internet market participation (2016) Source: Own elaboration based on<sup>(17)</sup>

Figure 14 shows the evolution of the concentration of Internet end users’ market, measured by the Herfindahl-Hirschman Index (HHI) for the two and the three operators with the highest market shares. In both cases, the tendency towards greater concentration is growing; although when considering the three operators with the highest market share, the HHI reached 2,646 in 2016, a value that shows a high level of market concentration.

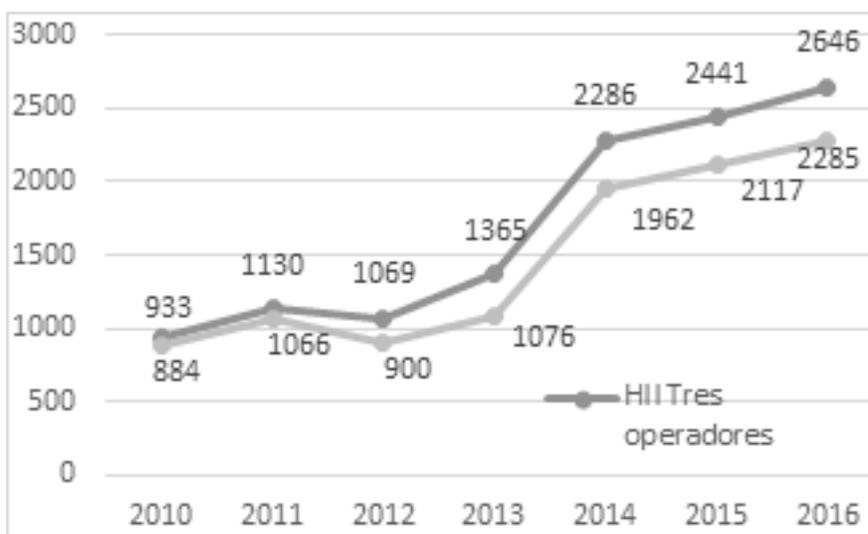


Fig 14. Evolution of Herfindahl-Hirschman index on the internet market Source: Own elaboration based on<sup>(17)</sup>

In the case of a network industry (and Internet access is one of them), it is important to verify whether there are essential facilities that their owners could be using to take advantage in detriment of their competitors. If this is true, that could be the explanation for the levels of the observed increasing market concentration. In this regard,<sup>(18)</sup> establishes that “The conditions governing a monopolistic bottleneck are met when: (1) a facility is necessary for reaching customers (i.e. if no second or third alternate option exists); in other words, if there is no active substitute. This is the case when due to economies of scale and scope, a natural monopoly exists and a single provider is able to make the facility available more cheaply than several providers; (2) at the same time, the facility cannot reasonably be duplicated as a way of controlling the active provider; in other words, when there is no potential substitute. This is the case when the costs of the facility are irreversible”.

According to this, the wholesale Internet access market has clearly essential facilities that, notably for the case of Bolivia, are in the hands of companies whose presence in the market has been steadily growing until reaching the concentration levels

measured with the HHI index.

In relation to the importance for competition of essential facilities in the telecommunication sector,<sup>(19)</sup> concludes that the “Recognition of the essential facilities doctrine provides invaluable transition rules and criteria in the ordered deregulation of the telecommunications industry. Infusing essential facilities principles within section 251 of the 1996 Act creates investment incentives and ensures a competitive marketplace by mandating interconnectivity, resale, and unbundling at competitive rates only when a monopolist denies access to a facility essential to competition in the local telecommunications market that cannot be practicably duplicated by a competitor. The essential facilities doctrine thus provides an incentive for facilities-based competition necessary to achieve the congressional goal that “all Americans, regardless of where they may work, live, or visit, ultimately have comparable access to the full benefits of competitive communications markets”.

Regarding<sup>(20)</sup>, the ownership of the essential facilities allows the buildup of barriers to entry for competitors that can't duplicate such facilities in an economically feasible manner. Using this mechanism, the operator that owns the essential facility (wholesale market) begins to acquire monopoly power in the retail market.

### 3.3.3 Cost of international transit connection

The studies carried out in relation to the problems that landlocked countries face have ambiguous conclusions. Some of them conclude that the fact of being landlocked generates costs that make the vigorous development of their Internet markets impossible and as a consequence, they can't take advantage of all the benefits that the use of ICTs generates. For the Bolivian case, government authorities and experts attribute important economic costs as the result of its poor development of Internet use. The CEPAL study<sup>(13)</sup> seems to support these arguments.

Other regional studies such as those developed by<sup>(10)</sup> and<sup>(14)</sup>, even though they show that the indicators of the telecommunications sector place Bolivia among the least developed in South America, they also show that mobile telephony and mobile Internet indicators are close to the regional average. However, and coincident with other studies, when the latter are analyzed in terms of quality, Bolivia drops to the last regional position.

On the other hand, it has been observed that the Bolivian market is highly concentrated and vertically integrated, which could be generating monopolistic behaviors resulting in high access costs and therefore, market development levels lower than those that could be observed in a competitive market. About the results shown in section 4.2, the wholesale suppliers could possibly be using their advantage of owning essential facilities in their respective networks to obtain unfair competitive advantages in the retail market, reducing the participation of those companies that only intervene in the latter. This behavior is a reason for discussing the need for economic regulation and measures such as vertical divestiture.

Along those lines, it is pertinent to analyze whether the low levels found in the indicators of market behavior are explained by the costs imposed by the landlocked condition of the country or are solely the result of the absence of efficient and/or proper regulatory mechanisms.

To validate this, a hypothetical business model for a wholesale Internet access service provider in the Bolivian market has been developed for testing purposes. For the modeling of this hypothetical company, the costs reported by the main wholesale Internet service providers have been considered. The modeled costs, albeit being based on the reported costs of all companies, were adjusted considering a company that operates efficiently in the wholesale market. For example, a company that provides wholesale services does not require large amounts of money to be spent on marketing plans, due to the low number of retail Internet service providers (ISP).

Likewise, for the definition of the cost of capital, a backbone network that covers from the international cross-border point to the departmental distribution nodes (DDNs) and some important intermediate cities has been designed. For dimensioning the 2018 network's capacity, observed maximum traffic has been modeled from a hypothetical operator that would have 50% of the market.

Through this modeling approach, the assets required for the operation of that network have been identified and through them, the feasible investment required. Likewise, through the WACC methodology<sup>3</sup>, the profitability rate to be used for determination of the cost of capital has been calculated. Table 2 shows the values determined with the combination of values for the cost of debt of 4% and an unlevered beta of 1.28.

**Table 2.** Values of WACC (Estimated with  $RD = 4.0\%$ ,  $\beta = 1.28$ ).

	Ke	Relation Debt/Patrimony	WACC
Scenarios	18.17%	0.8	11.43%
	17.56%	0.7	11.57%
	16.95%	0.6	11.72%
	16.34%	0.5	11.89%

Source: Own Elaboration

Using the rate of 11.43, it was possible to obtain an estimated composition of costs. The results are shown in Table 3.

**Table 3.** Costs composition of providing wholesale internet (%).

Concept	Participation in Total Cost (%)
Capital Cost	36.69%
Administration Costs	13.01%
O&M Costs	26.01%
T1 and T2 Costs	4.32%
Depreciation	14.80%
Taxes	3.00%
legal obligations	2.17%
<b>Total</b>	<b>100.00%</b>

Source: Own elaboration

Along with the results shown in Table 3, the costs attributable to T1 and T2; that is, to the traffic in the sections from the international cross-border node to the Landing point (T2, according to Figure 13) and from the Landing Point to the NAP / IXP (T1, according to Figure 12), amount to just 4.32% of the total costs. Of these costs, more than 50% correspond to T1, resulting in the costs attributable to T2 (i.e. the payment for traffic that exists only because it is a landlocked country) reaching a maximum of 2% of the total costs. That is, no more than 2% of Internet access prices could be explained by the condition of Bolivia as a landlocked country.

## 4 Discussion and Regulatory Policy Implications

Regarding the review of literature, there is a lot of evidence that ICT and the Internet are important to strengthen the growth capacity of the states. Many studies show that the use of ICTs can help in an important way to boost the growth of countries. As an example, the results achieved by<sup>(1)</sup> and the reports<sup>(21)</sup> and<sup>(6)</sup> are indicated.

On other hand, as the Internet Society demonstrates in<sup>(8)</sup>, the Internet can help LLDCs to reduce delays and costs of cross-border trade, through access to submarine fiber optic cables and provision of a platform of information technology services.

For the Internet to help overcoming the barriers for landlocked states, they need to have an appropriate legal and regulatory environment and good governance. For instance, a national high-capacity fiber optic backbone will be underutilized when it is controlled by a monopoly with high wholesale prices. In addition, online sales platforms would have very few users if electronic payments are not allowed.<sup>(8)</sup> show that LLDC countries that have been able to take full advantage of the Internet have largely overcome the barriers of access to sea. But only a few LLDCs have a balanced Internet ecosystem and are lagging in terms of their digital skills.

Finally,<sup>(8)</sup> concludes that the Internet evolution needs to be more balanced in terms of infrastructure, skills, digital economy and governance. This way, proactive policies such as open access and competition among wholesalers have led to the deployment of fiber optic backbones reaching key cross-border points.

Investigation studies such as<sup>(7)</sup> or<sup>(10)</sup> show that for the South American case, Bolivia and Paraguay are quite behind in relation to their fixed connectivity relative to the rest of South American countries. This gap has been bridged through mobile Internet, but this technology is more expensive and less advantageous than fixed broadband Internet.

International studies show that Bolivia stands at the last positions in terms of indicators of coverage, price, and quality of broadband Internet. For example,<sup>(13)</sup> shows that Bolivia is below the regional average in penetration of fixed and mobile broadband. A priori, as many politicians and policy-makers justify<sup>(22,23)</sup>, these results would be due to the costs imposed by its status of landlocked country. In the present work and to validate this, the Bolivian market has been analyzed, both in the normative legal aspects for its operation as well as in the institutional organization and market share of the operators. The

analysis tries to validate whether the results in telecommunications market behavior, particularly the Internet, are due to the landlocked condition of the country or, conversely, due to perverse incentives related to the absence of competence and/or problems with the regulatory framework.

Regarding the legal analysis, the Internet market of Bolivia is not subject to regulation. On the other hand, wholesale operators on the Internet access market are not prevented from participating in the retail market without restraints, because the legal framework does not establish such restrictions. Analyzing the market historic concentration levels, it has been verified that in parallel with the increase of importance of Internet use, there has been a growing market concentration in hands of Internet access wholesale operators. Likewise, using the Herfindahl-Hirschman concentration index, it has been established that the wholesale market is very highly concentrated. According to other legislations, such as the North American one, this value of HHI would imply taking regulatory actions. In this regard, as stated by<sup>(15)</sup>, it should involve the economic regulation of the wholesale market. But in the Bolivian case, this matter does not occur, at least until now.

On the other hand, through the simulation model of an efficient company, the capacity costs of a hypothetical operator with a 50% of participation in the Bolivian wholesale market has been estimated. Taking this into account, the modeling results show that the costs of payments to access providers from the international cross-border point to the NAP/IXP are less than 5%, of which only a fraction (less than 50%) would correspond to the operator that provides traffic service across the Bolivian border and the NAP/IXP.

In addition, given the values of broadband access in the Bolivian case, the differences in relation to other Latin-American countries are more than the cost of traffic from the border point to the NAP/IXP. Hence, it not reasonable to state that the main problem for the development of the Internet market in Bolivia is its landlocked condition. To the contrary, in this study it is ascertained that the Internet Bolivian market suffers from several problems regarding: i) a process of excessive concentration of essential facilities and the sale of wholesale and retail Internet access; ii) legal gaps in relation to the regulation of access prices, therefore freedom to fix them; iii) integration of wholesale and retail markets and, as a consequence of the latter; iv) inability of the regulator to carry out an efficient regulatory task to avoid anti-competitive behavior.

As it is demonstrated in the literature, the wholesale Internet access is clearly a market where bottlenecks (essential facilities) are present. In this context and with high probability, the Internet access market in Bolivia shows the presence of anticompetitive behavior. This could be the result of absence of specific regulations that modulate the behavior of agents and information that allows the regulator to differentiate markets: on one hand, those that can produce substantial competition (retail market); and on the other, those for which replication of essential facilities represent too high a cost (wholesale market).

From the preceding analysis:

1. It is not possible to confirm that lack of development of the Bolivian Internet market is mainly due to its status of a landlocked country, since the relative weight in the total costs of Internet access provisioning is less than 2%, while the differences in relation to observed prices in other regional countries are higher than this percentage. On the contrary, the evidence seems to show that these are due to negative incentives that wholesale operators have. The lack of proper regulations produces incentives for vertical integration and market monopolization.
2. The low development level of fixed telecommunication networks has in turn conditioned its use for development of fixed broadband Internet. Mobile technology had to make-up for the absence of suitable fixed networks at substantially higher costs. The quality and average use, measured by capacity, speed and cost, are quite limited and not sufficient to constitute an alternate solution to allow the development of the Internet at levels like those observed in developed countries.
3. In this regard, the regulatory framework needs to be updated to allow for the differentiation and separation of wholesale and retail Internet access markets. This market separation would allow that, abiding to the existing Bolivian regulation, a tariff regulation be imposed if a condition of dominance in the market persists.

Considering everything reviewed in this study and the theory of essential facilities, the importance of taking regulatory measures for this market is paramount.

## 5 Conclusions

1. There is plenty of evidence that ICT and the Internet are important to strengthen the growth capacity of the countries. For the Internet to help overcoming the barriers for landlocked states, appropriate legal and regulatory environment and good governance are needed. The Internet evolution must be more balanced in terms of infrastructure, skills, digital economy, and governance.
2. Bolivia holds the last places in Latin America in terms of indicators of coverage, price, and quality of broadband Internet. According to the legal analysis, the Bolivian Internet market is not subject to regulation. On the other hand, nothing

prevents wholesale operators on the Internet access to also participate in the retail markets unrestrained. Thus, the wholesale market tends to become highly concentrated.

3. On the other hand, payments to access providers from the international cross-border point to the NAP/IXP are less than 5% of the total costs, and less than 50% would correspond to the operator that provides traffic service across the Bolivian border and the NAP/IXP. Hence, it not possible to affirm that the main problem for the development of the Internet market is its landlocked condition. To the contrary, the Internet Bolivian market suffers from severe problems of concentration and vertical integration, probably due to legal and regulatory gaps.

As the literature widely demonstrates, the Internet access market has essential facilities that need to be regulated.

## References

- 1) García-Zaballos A, López-Rivas R. Socio-economic impact of broadband in LAC countries. IADB Technical Note No. IDB-TN-471, 2012. Available from: <https://publications.iadb.org/publications/english/document/Socioeconomic-Impact-of-Broadband-in-Latin-American-and-Caribbean-Countries.pdf>.
- 2) Porter EM. Competitive Strategy: Techniques for Analyzing Industries and Competitors. New York. Free Press. 1980. Available from: [https://www.academia.edu/11498170/COMPETITIVE\\_STRATEGY\\_Techniques\\_for\\_Analyzing\\_Industries\\_and\\_Competers](https://www.academia.edu/11498170/COMPETITIVE_STRATEGY_Techniques_for_Analyzing_Industries_and_Competers).
- 3) Page M, Firth C, Rand C. The Internet Value Chain: A study on the economics of the Internet, GSMA. 2016. Available from: [https://www.gsma.com/publicpolicy/wp-content/uploads/2016/09/GSMA2016\\_Report\\_TheInternetValueChain.pdf](https://www.gsma.com/publicpolicy/wp-content/uploads/2016/09/GSMA2016_Report_TheInternetValueChain.pdf).
- 4) IABD. Bridging Gaps, Building Opportunity: Broadband as a catalyst for economic and social development in the countries of Latin America and the Caribbean. Inter-American Development Bank. 2012. Available from: <https://publications.iadb.org/en/publication/11729/bridging-gaps-building-opportunity-broadband-catalyst-economic-growth-and-social>.
- 5) McKinsey & Company. McKinsey & Company, (2011) “Internet Matters: The Net’s Sweeping Impact on Growth, Jobs and Prosperity.” Briefing Note, McKinsey Global Institute, McKinsey & Company. 2011. Available from: [https://www.mckinsey.com/~media/McKinsey/Industries/Technology%20Media%20and%20Telecommunications/High%20Tech/Our%20Insights/Internet%20matters/MGI\\_Internet\\_matters\\_exec\\_summary.pdf](https://www.mckinsey.com/~media/McKinsey/Industries/Technology%20Media%20and%20Telecommunications/High%20Tech/Our%20Insights/Internet%20matters/MGI_Internet_matters_exec_summary.pdf).
- 6) Rodríguez El, Cano L, Zevallos AG. Annual Report of the Broadband Development Index in Latin America and the Caribbean: IDBA 2014, Discussion Paper N° IDB-DP-404. Inter-American Development Bank. 2015. Available from: <http://dx.doi.org/10.18235/0001882>.
- 7) UIT (2013) Study on International Internet Connectivity: Focus on Internet connectivity in Latin America and Caribbean, ITU Telecommunications Development Sector. 2013. Available from: <https://www.itu.int/en/ITU-D/Regulatory-Market/Documents/International%20Internet%20Connectivity%20in%20Latin%20America%20and%20the%20Caribbean.pdf>.
- 8) Internet crossing borders: Promotion of the Internet in landlocked developing countries. *Internet Society*. 2017. Available from: [https://www.Internetsociety.org/wp-content/uploads/2017/10/LLDC\\_ExecSummary\\_20171013-ES.pdf](https://www.Internetsociety.org/wp-content/uploads/2017/10/LLDC_ExecSummary_20171013-ES.pdf).
- 9) Salvat J. Landlocked Developing Countries (LLDCs) of America - Challenges and Opportunities in Connectivity Matters Paraguay. 2017. Available from: [https://www.itu.int/dms\\_pub/itu-d/opb/ldc/D-LDC-LLDC\\_AM.02-2018-PDF-E.pdf](https://www.itu.int/dms_pub/itu-d/opb/ldc/D-LDC-LLDC_AM.02-2018-PDF-E.pdf).
- 10) Salvat J. Connectivity Challenges and opportunities - Bolivia: Landlocked Developing Countries (LLDCs) of the Americas region, International Telecommunications Union (UIT). 2018. Available from: <https://www.itu.int/en/ITU-D/LDCs/Documents/2018/Publication/D012A0000DE3301PDFE.pdf>.
- 11) Campero. Telecommunications and ICT infrastructure in Bolivia, Vice Presidency of the Plurinational State of Bolivia, United Nations Development Program. 2016. Available from: <https://Internetbolivia.org/wp-content/uploads/2017/05/Campero-merged.pdf>.
- 12) Davalos A. Comparative Analysis of the Electricity and Telecommunications Markets: Performance of Countries in an Environment with Uncertainty and Structural Changes. In: XXI CLAD International Congress on State Reform and Public Administration. 2016. Available from: [http://www2.congreso.gob.pe/sicr/cendocbib/con4\\_uibd.nsf/5390048AAAF607723052580D7007A4E1C/?protect=char%0024relaxFILE/davalado.pdf](http://www2.congreso.gob.pe/sicr/cendocbib/con4_uibd.nsf/5390048AAAF607723052580D7007A4E1C/?protect=char%0024relaxFILE/davalado.pdf).
- 13) Rojas E, Poveda L. State of broadband in Latin America and the Caribbean, Economic Commission for Latin America and the Caribbean (ECLAC). 2018. Available from: <https://www.cepal.org/es/publicaciones/43365-estado-la-banda-ancha-america-latina-caribe-2017>.
- 14) Vicens M, Callorda F. The digital gap in Latin America: price, quality and affordability of broadband in the region, Regional Dialogue on the Information Society, (DIRSI). 2016. Available from: [http://dirsi.net/web/web\\_files/download/publicaciones/descargas/Digital-divide-in-LATAM\\_broadband-price-quality-and-affordability-in-the-region-pdf-259.pdf](http://dirsi.net/web/web_files/download/publicaciones/descargas/Digital-divide-in-LATAM_broadband-price-quality-and-affordability-in-the-region-pdf-259.pdf).
- 15) Law 164, General Law on Telecommunications, Information and Communication Technologies of Bolivia, Law No. 164 on August 8, 2011, Official Gazette of Bolivia. 2011. Available from: [https://www.minedu.gob.bo/files/documentos-normativos/leyes/ley\\_164\\_\\_\\_ley\\_general\\_de\\_telecomunicaciones\\_tecnologias\\_de\\_informacin\\_y\\_comunicacion.pdf](https://www.minedu.gob.bo/files/documentos-normativos/leyes/ley_164___ley_general_de_telecomunicaciones_tecnologias_de_informacin_y_comunicacion.pdf).
- 16) General Regulation to Law No. 164, Supreme Decree No. 1391 of October 24, 2012. Official Gazette of Bolivia. 2012. Available from: [http://www.pit.bo/documentos/Anexo\\_al\\_Decreto\\_Supremo\\_1391.pdf](http://www.pit.bo/documentos/Anexo_al_Decreto_Supremo_1391.pdf).
- 17) Institutional Memory of 2014 to 2017 of Telecommunications and Transport Regulation and Control Authority. . Available from: <https://att.gob.bo/content/memoria-institucional>.
- 18) Knieps G. The three criteria tests, the essential facilities doctrine and the theory of monopolistic bottlenecks, Discussion Paper Institut für Verkehrswissenschaft und Regionalpolitik No. 132. 2010. Available from: [https://www.researchgate.net/publication/254458927\\_The\\_three\\_criteria\\_test\\_the\\_essential\\_facilitiesDoctrine\\_and\\_the\\_theory\\_of\\_monopolistic\\_bottlenecks](https://www.researchgate.net/publication/254458927_The_three_criteria_test_the_essential_facilitiesDoctrine_and_the_theory_of_monopolistic_bottlenecks).
- 19) Somat JT, David A, Jumpst BP. The Essential Facilities Doctrine in the Deregulated Telecommunications Industry. *Berkeley Technology Law Journal*. 1998;13:565–614. Available from: [https://btjl.org/data/articles2015/vol13/13\\_2/13-berkeley-tech-l-j-0565-0614.pdf](https://btjl.org/data/articles2015/vol13/13_2/13-berkeley-tech-l-j-0565-0614.pdf).
- 20) Baumol JW, and WMT. Deregulatory Takings Breach of the Regulatory Contract, and the Telecommunications Act of 1996, Columbia Law School. 1997. Available from: [https://scholarship.law.columbia.edu/faculty\\_scholarship/408](https://scholarship.law.columbia.edu/faculty_scholarship/408).
- 21) McKinsey & Company, (2011) “Internet Matters: The Net’s Sweeping Impact on Growth, Jobs and Prosperity” Briefing Note, McKinsey Global Institute, McKinsey & Company. 2011. Available from: [https://www.mckinsey.com/~media/McKinsey/Industries/Technology%20Media%20and%20Telecommunications/High%20Tech/Our%20Insights/Internet%20matters/MGI\\_Internet\\_matters\\_exec\\_summary.pdf](https://www.mckinsey.com/~media/McKinsey/Industries/Technology%20Media%20and%20Telecommunications/High%20Tech/Our%20Insights/Internet%20matters/MGI_Internet_matters_exec_summary.pdf).
- 22) Finance and Banking in Bolivia. 2018. Available from: <http://finanzasbanca.blogspot.com/2018/11/ramos-falta-de-acceso-al-mar-retrasa-el.html>.

- 23) Los Tiempos Digital. Bolivia is more connected but still claims quality Internet and better cost. 2018. Available from: [www.lostiempos.com/especial-multimedia/20180517/bolivia-esta-mas-conectada-pero-aun-se-reclama-Internet-calidad-mejor](http://www.lostiempos.com/especial-multimedia/20180517/bolivia-esta-mas-conectada-pero-aun-se-reclama-Internet-calidad-mejor).