Final Report for Osiptel

Regulation of the telecom market for the next decade

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0 Executive summary

This document constitutes Analysys's final report in its project to support Osiptel in creating a vision for the design and regulation of the telecom market in Peru for the next decade.

Our approach over the course of this project has been to combine desk research with structured workshop discussions with Osiptel staff. Following initial kick-off meetings with Osiptel and industry stakeholders in February 2006, we have conducted workshops with Osiptel in March 2006 and again in April 2006.

During the course of this project we have established three recommended areas of focus for Osiptel. These are, in order of priority:

- the promotion of indirect competition
- the promotion of convergence
- the promotion of direct competition.

Comparing fixed-line penetration in Peru to benchmark countries shows that Peru lags behind its neighbours and is in a difficult position with respect to increasing access. It is not performing as well as other countries with similar deployment costs or whose citizens have similar income levels.

Osiptel is seeking to promote the Peruvian telecom market by defining its regulatory vision and objectives. In revising its regulatory framework, there are a number of useful principles that Osiptel should consider: In order for a telecom sector to develop in an organic and sustainable

way, regulation must be 'technology neutral'. Furthermore regulatory authorities should take care not to impose legacy regulations on new technologies or operators, as meeting these requirements may add unnecessary costs or otherwise delay or deter innovation.

Osiptel's prime regulatory instrument to date has been the implementation of a price cap regime. The analysis undertaken indicates that the price cap regime is serving Osiptel's purpose in terms of lowering prices and making services more affordable for existing users. However, it does not appear to provide sufficient impetus for expanding access. As such additional measures need to be taken if penetration levels in Peru are to be brought into line with levels seen in the benchmark countries.

In order to achieve this, we recommend that Osiptel focus on 'indirect competition', which refers to competition for new customers. This typically occurs in underserved areas where income tends to be lower and as such is of particular relevance to the access issues experienced in Peru.

Indirect competition

Underserved areas with little or no telephone penetration typically find themselves in an 'access gap' because of low income (and therefore reduced demand) or because of high deployment costs (and therefore reduced deployment incentives for operators). These access gaps are defined as follows:

- **Market efficiency gap** between the theoretical reach of a service in an efficient market where all regulatory barriers are removed and what is actually achieved under existing conditions.

- **True access gap** which remains when the market efficiency gap has been filled. It occurs when the cost of providing a service is higher than the affordability of the service.

It is our understanding that that for household/personal connectivity in these areas, the primary need is for basic voice services. This provides critical connectivity for personal and business usage. In particular, prepaid mobile services are a cost-effective option for low-income/low-usage households, and also in the marginal urban areas can be most cost-effective for operators. In terms of deployment, in marginal urban areas the relative population density and proximity to cities should allow for economical coverage by mobile operators.

The two categories of access gap have different implications for market intervention. The market efficiency gap can be addressed by adopting 'light touch' regulation and by reducing artificial barriers to investment, constraints on technology choice, high cost of service and cost of leased lines for backhaul. The true access gap that would face a deployment of fixed networks in marginal urban areas requires market intervention similar in nature to the current FITEL programme in Peru. Other ways to address the true access gap could include asymmetric interconnection for fixed-line telecom, raising price caps on existing fixed-line customers, eliminating wholesale access requirements for newly deployed infrastructure in marginal urban areas and introducing a new universal service fund for marginal urban areas.

Convergence

The current trend for the convergence of services and technology in the telecommunications industry eliminates the traditional 'service vs. infrastructure' division in communications services. It can stimulate the creation of new services and business models and will lead to an increase in competition. This extends to facility-based competition in broadband and service-based competition from voice services over IP (VoIP) because it allows service-based entry without wholesale access to the incumbent's network. We believe that convergence has the potential to generate a significant impact on economic development, in developing as well as developed countries.

VoIP refers to a set of technologies that allow end-users to use the Internet for voice services. It can be offered over a wide variety of technical architectures and commercial business models. VoIP can help meet competition goals as it provides the means for competition at the

service layer without requiring any significant network investment and causes the disintegration of the traditional circuit-switched telephony value chain.

A number of upcoming new technologies might be important in Osiptel's attempt to address current supply-side problems in Peru. However, the potential impact of these technologies also needs to be considered in the context of stimulating competition and entry in the market. Several new technologies can help reduce access gaps, such as WiMAX, powerline communications and next-generation networks, because they lower the cost of deployment for an alternative operator.

In the longer run, promotion of broadband deployment should be an area of focus, for example through increasing of PC penetration, continued consideration of technology neutrality, public-sector demand aggregation and generating cable competition.

Direct competition

'Direct competition' refers to competition for existing customers between entrants and the incumbent operator. In order to compete directly with the incumbent, new entrants typically require some form of wholesale access to the incumbent network, as well as rules regulating retail competition. On balance, we believe that promoting direct competition in Peru should not be a priority for Osiptel. This is because it is very difficult to mandate wholesale access given the reluctance of incumbents to share their networks with competitors. Furthermore, it is unlikely that many companies will invest significantly in duplicating the existing facilities of Telefónica del Perú.

Interconnection is central to any kind of competition and access: in order to provide telephony services, competitors must be able to complete calls to or from all existing subscribers. The regulation of interconnection is much easier than the regulation of wholesale access. While the charges for interconnection may be based on capacity or metered access, the cost of interconnection itself is fundamental to telecom regulation. Indeed the provision of an appropriate interconnection environment with adequate cost-based wholesale rates in a transparent and non-discriminatory manner is crucial to promoting both facility- and service-based competition.

1 Introduction

This document constitutes Analysys's final report in its project to support Osiptel in creating a vision for the design and regulation of the telecom market in Peru for the next decade. The report includes:

- an evaluation of the performance of the telecom sector in the post-reform period
- establishing the priorities and policy goals for the next decade
- reform of the regulatory instruments in a way that is consistent with the priorities and goals that have been identified.

Analysys's approach

Analysys's approach has been to combine two principal methods, desk research and interactive discussions with Osiptel staff conducted during structured workshops.

Following our initial kick-off meetings with Osiptel and relevant industry stakeholders on February 6–8, 2006, we conducted an initial workshop with Osiptel on March 21–22, 2006. The issues discussed during this first workshop included:

- price caps and their consistency with an expansion of access
- additional schemes that may be needed to promote access in marginal urban areas
- the likely impact of new technology on meeting access needs
- comparison between Peru and regional benchmark countries.

Following the submission of our first interim report, a second workshop took place with Osiptel on April 18–19, 2006. The topics and questions discussed during this workshop included:

- what are the feasible schemes for promoting competition in Peru?
- what are the main technological innovations and what are the new services that are emerging?
- what are the key goals should the vision for the future of the industry consider?

A second interim report was submitted following this workshop.

This document constitutes our final report. This final report builds upon our previous analysis and findings and incorporates additional analyses and discussions which Osiptel regards as pertinent for inclusion in this final report. We will also participate in the upcoming international conference organized by Osiptel to deliver the results of this report.

Project areas

During the course of this project three distinct areas of priority were established and explored:

- indirect competition
- convergence
- direct competition.

Indirect competition

Indirect competition refers to the promotion of access to communications services in areas which are currently not being served. This is dealt with in detail in Section 3.

Convergence In this project, we define convergence as the merging of voice, video and data services over Internet-enabled facilities using a variety of devices including mobile phones, personal computers and TV. This is dealt with in detail in Section 4.

Direct competition Direct competition refers to competition for existing customers between entrants and the incumbent operator. The customers targeted this way are typically business customers in relatively dense urban areas. In order to compete directly with the incumbent, new entrants typically require some form of wholesale access to the incumbent network, as well as some rules regulating retail competition. This is dealt with in detail in Section 5.

Exhibit 1.1 summarises the key priorities and policy goals that Osiptel must seek to adopt and implement in order to ensure the successful development of competition in the Peruvian telecom market as explored in this document and in our analysis and the discussions during this project.

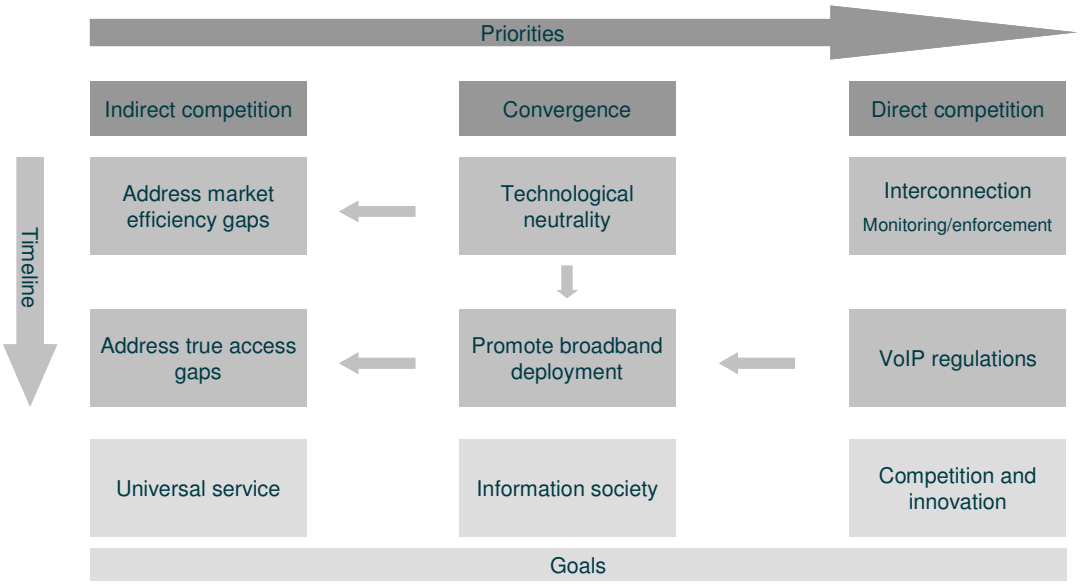

Exhibit 1.1: *Priorities and policy goals for Osiptel [Source: Analysys]*

Setting these regulatory priorities will enable a move towards the following policy goals over the next decade:

- **Universal service provision** through an efficient infrastructure to give Peru's citizens universal access to telecommunications, while accounting for its socio-geographic and socio-economic diversity.

- Promotion of the **information society** and mitigation against the digital divide.

- Fostering of **competition** through technology adoption and service innovation and convergence of markets and industries.

2 Background and context

2.1 Telecom regulation in Peru

Role of telecom in economic development

It has long been recognized that telecommunications can play an important role in economic development, and this role has been magnified by the emergence of Internet-related services.

Telecommunications can help businesses communicate more easily and efficiently with both a wider range of buyers and suppliers, whether it be locally, nationally, or internationally. Indeed, some businesses are built around telecommunications services, from remote call centres to data processing.

Telecommunications can also help governments to deliver better services more effectively, most obviously with Internet-enabled services such as distance learning and telemedicine.

Last, but not least, telecommunications can promote social cohesion, allowing families and friends to remain connected from remote locations.

Regulatory history

In order to maximise the potential benefits and efficiency of telecommunications, many countries around the world have sought to develop competition in telecommunications sectors via a process of liberalization. In the past decade, governments have taken steps such as privatizing the incumbent telecom operator, setting up an independent regulator, and liberalizing some or all different markets. At the same time, recognizing the importance of universal access to telecommunications, many countries have invested in innovative means to employ free-market principles to help address gaps in access to telecommunications services.

Peru was a relatively early adopter of these regulatory reforms, beginning with the promulgation of the Telecommunications Act in 1991, setting up of the regulatory body Osiptel in 1992 and 1993. The incumbent operator Telefónica del Perú (TdP) was privatized in 1994, followed by the termination of a period of limited competition, and ultimately full opening of the market in 1998.

We present here a synopsis of the history of regulations in two areas of particular relevance to our report, namely price regulation and access requirements.

History of access requirements in Peru

The privatization of TdP formalized a series of rights and obligations for the privatized operator. The new operator was offered exclusive rights to supply national and international local and long-distance services for a period of five years in exchange for meeting certain objectives. Market liberalization was subsequently brought forward by almost a year because the objectives of the exclusive right period had already been achieved, including a programme for the rebalancing of tariffs to prepare the market for competition (described below) and for the modernization of the

network on the basis of a series of expansion and quality targets:

- 1994–1998: Cumulative roll-out targets for fixed lines and public telephones.
- 1998–present: No new requirements introduced after previous targets met.
- The universal service fund, FITEL, was established in 1993 to address rural access needs.

History of price regulation in Peru

Osiptel's responsibilities include the design, approval and supervision of the system of tariffs for public telecommunication services in order to create tariff conditions that are compatible with a competitive environment. For local, national and international long-distance telephony Osiptel now sets average weighted capped tariffs. The history of price regulation follows:

- 1994–1998: Rebalancing of tariffs
- 1998–2001: Interim regime with tariff maxima
- 2001–2004: Price cap with an X-factor of 6%
- 2004–2007: Price cap with an X-factor of 10.07% on local calls and 7.80% on long distance and international.

2.2 Economic criteria for evaluation evaluating telecom policies

Regulatory bodies typically seek to increase competition in the market they regulate. Each regulatory body will have individual objectives and criteria that reflect the political social and economic situation in that country. Nonetheless, there are generalized criteria that can be used to assess Peru's past and present regulatory policy, and these include:

- components of social welfare
- equity and efficiency.

Social welfare analysis

Social welfare has three components that should be addressed in assessing regulatory policies.

- Consumers:
  - 'consumer surplus' measures the difference between the price that consumers would be prepared to pay for a service and the price they are actually charged
  - as prices fall, the consumer surplus grows; existing consumers benefit from lower prices and consumers with lower willingness to pay are able to benefit from the service.
- Producers:
  - 'producer surplus' measures the difference between the price that producers receive for a service and the cost of supplying the service
  - falling prices decrease producer surplus but if there was excess capacity then it may result in higher output.
- Government:
  - government may receive revenues via taxation and this can come from both producer and consumer surplus
  - in the case of regulated industries, certain regulatory schemes may impose higher regulatory burdens than others.

Equity versus efficiency

An important component of assessing the welfare considerations of regulatory policies lies in the tension between equity and efficiency.

An efficient outcome is a situation in which all demand for a product or service is met for those consumers whose willingness to pay is at least equal to the cost of production. There are several measures of efficiency:

- **productive efficiency –** when a given level of output is produced at lowest cost
- **allocative efficiency** – when the level of output itself is efficient
- **dynamic efficiency** – when future as well as current outcomes are efficient.

Efficiency is an objective outcome that measures how large the value has become. However, it does not measure whether the outcome is fair.

Equity, on the other hand, measures the 'fairness' of distribution of benefits between producers and consumers and between different consumer segments. There is often a trade-off between efficiency and equity. For instance, taxes to redistribute income to low-income consumers may be considered equitable, but are inefficient because they distort the incentives to work. Equity is a subjective measure of how the value is distributed within society – in this case, some may consider it fair to redistribute taxes to low-income families, while others consider it fair to allow workers to keep their income without paying redistributive taxes.

Economic analysis of price caps

These social welfare concepts are applied to the price cap regime, which is relatively efficient, but questions remain over the equity of the process. Price caps have a number of efficiency benefits:

- promote efficient movement of prices towards costs
- provide incentives for firms to lower costs below levels expected in the productivity (the X-factor)
- allow room for competition to lower prices further below caps.

However, there are still equity considerations:

- Lower prices transfer welfare from operators to consumers (and vice versa). However, if the X-factor is too high or too low this can lead to inefficient transfers from operators to consumers, or vice versa.

- The use of 'service-baskets' can affect the distribution of the surplus between certain sub-groups of consumers, such as residential and low-income users.

Promoting universal access

In most countries, and developing countries in particular, issues surrounding access to telephony services (including the provision of access to telephone lines) represent a very important aspect of social policy. Universal service is a common goal for most developed countries and Peru has been active in promoting this. There are a number of ways of providing universal service/access:

- **Mandatory service obligations, typically via licence agreements**: these can be effective, but may not be very efficient if there is no explicit source of revenue.

- **Implicit subsidies between services provided by the incumbent**: these are not very efficient, as they raise prices on certain services, and are not sustainable when competitors target those above-cost services.

- **Universal service funds similar to FITEL in Peru**: these can be very effective and relatively efficient, depending on how these funds are raised and distributed.

2.3 Impact of the price cap regime in Peru

In the remainder of this section we will review the impact of the implementation of the price cap regime in Peru examining, in particular, whether the price cap regime is serving the purpose of lowering prices and making the services more affordable for the users. We will also investigate whether the price cap regime is consistent with an expansion of access.

Benchmark comparisons

We also make reference to five countries which have been picked for benchmark examination against Peru as a result of discussions with Osiptel. These countries are Argentina, Bolivia, Colombia, El Salvador, and Venezuela. Annex A contains short profiles of the telecom markets in these countries. Annex A also contain profiles and indicators for two additional benchmark countries – Brazil and Chile.

The impact of the price cap regime in Peru is summarized in Exhibit 2.1 and Exhibit 2.2. Rates began to rebalance in 1994, with a notable drop in the cost of connection (Exhibit 2.1) offset by higher monthly subscription rates (Exhibit 2.2).

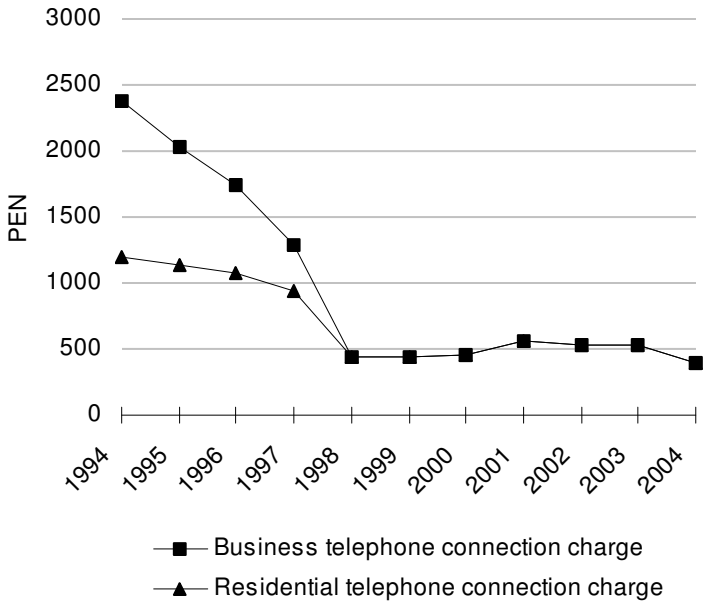

Exhibit 2.1: *Connection charges in Peru [Source: ITU]*

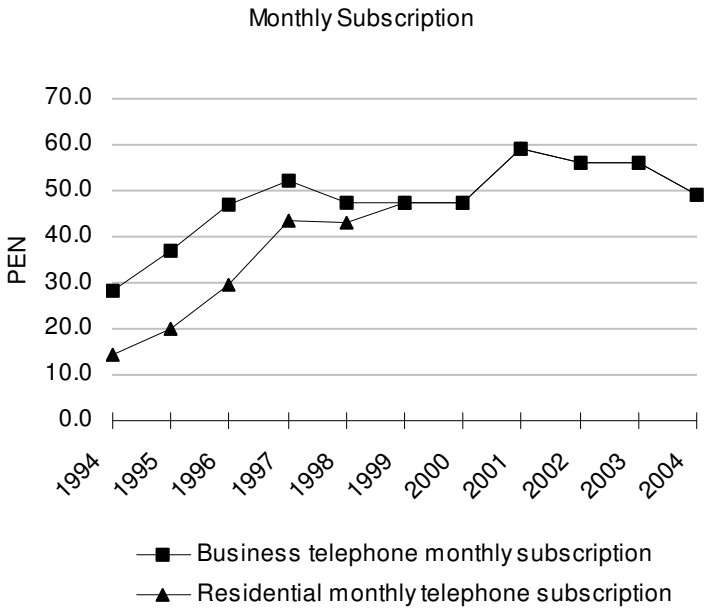

Exhibit 2.2: *Monthly subscription charges in Peru [Source: ITU, Osiptel for residential subscription tariffs for 2002 and 2003]*

There has also been a notable decrease in international call rates (Exhibit 2.4) while local and long distance rates do not appear to have changed markedly (Exhibit 2.3 and Exhibit 2.4).

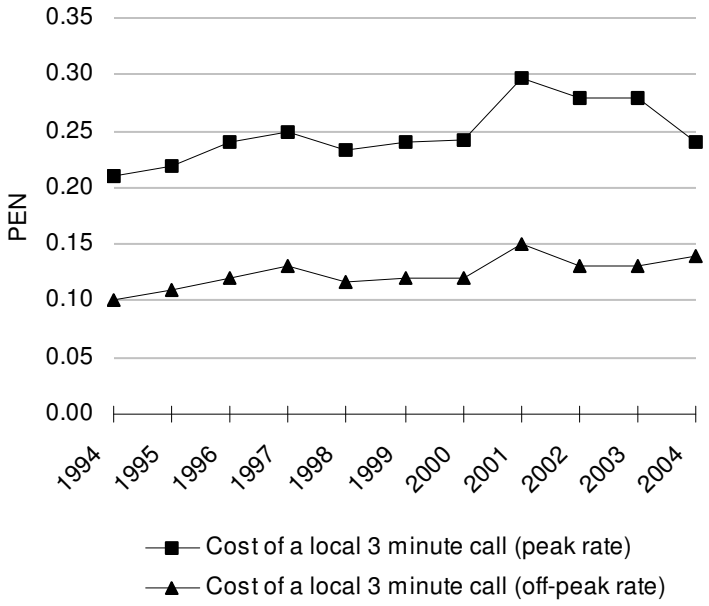

Exhibit 2.3:

Local call rates in Peru [Source: ITU]

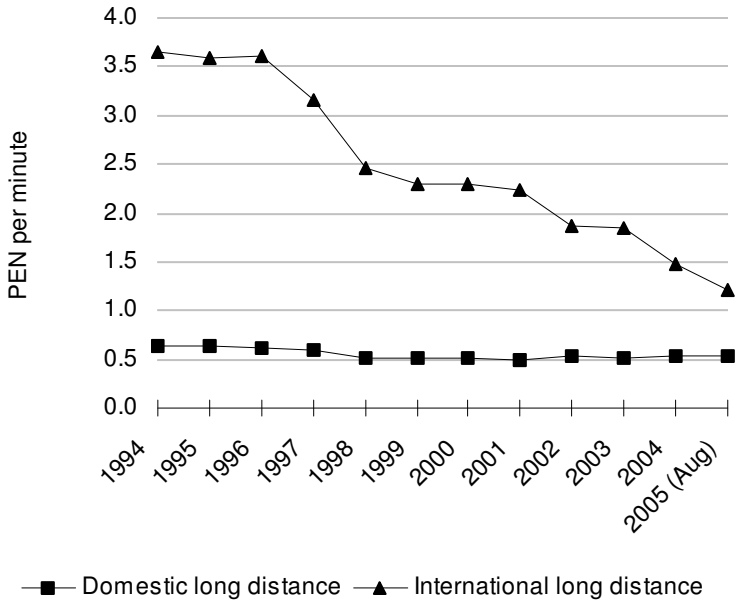

Exhibit 2.4:

Long distance call rates in Peru [Source: TdP's financial reports, Osiptel Web site]

Exhibit 2.5 and Exhibit 2.6 put the falling monthly subscription and local call rates in Peru into context with the benchmark countries and indicate that, in comparison to the benchmark countries monthly subscription in Peru is still relatively high.

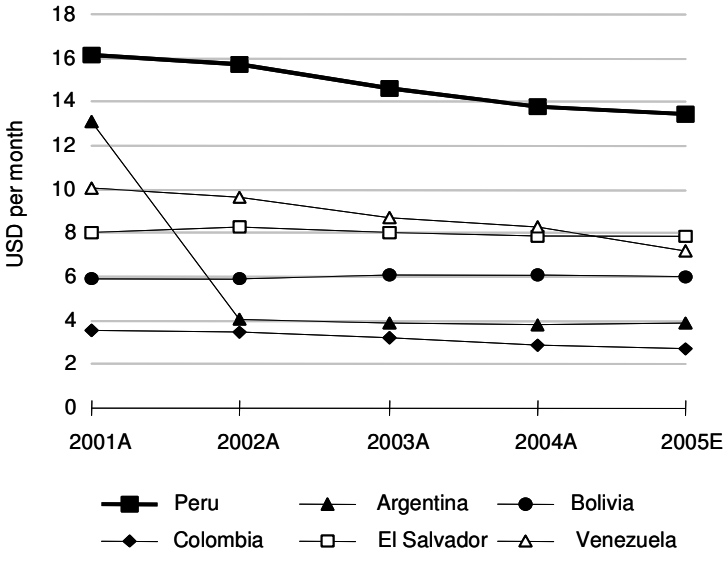

Exhibit 2.5:

Peru fixed monthly subscription[1]

[Source: Pyramid research]

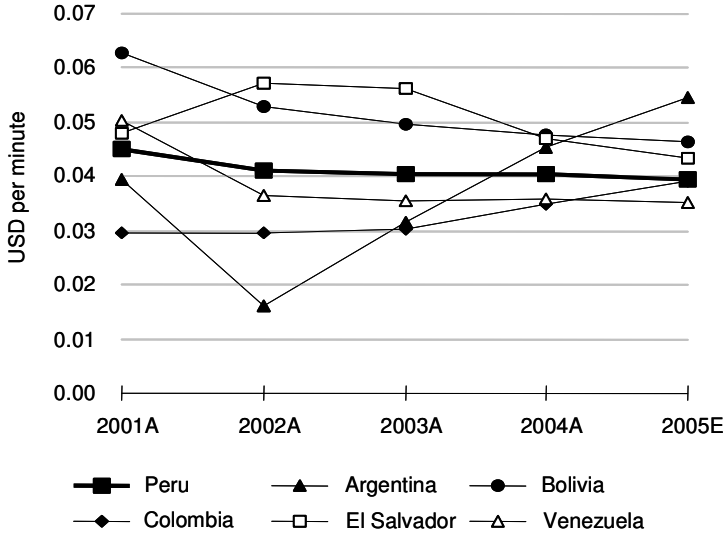

Exhibit 2.6:

Peru local call revenue per minute

[Source: Pyramid Research]

[1] We note that some of the difference in line rental rates may be due to call minutes being bundled into the subscription charge in Peru

Long-distance (Exhibit 2.7) and international call rates (Exhibit 2.8) have also fallen, and continue to be in line with benchmarks of other countries.

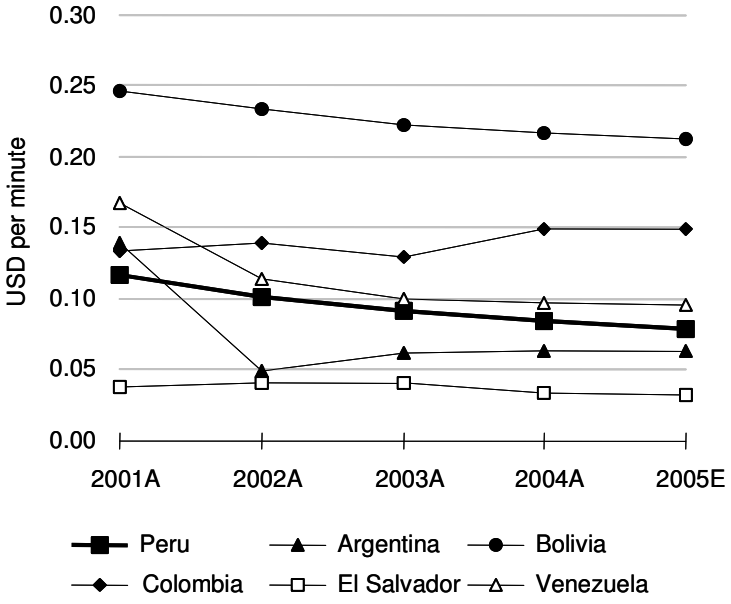

Exhibit 2.7:

Long distance revenue per minute [Source: Pyramid Research]

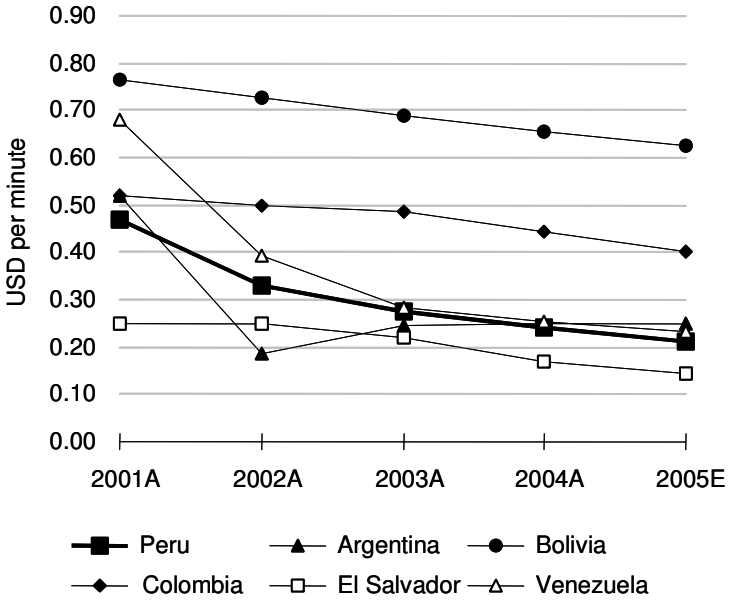

Exhibit 2.8:

International revenue per minute [Source: Pyramid Research]

Overall voice revenues in Peru have fallen. However, as Exhibit 2.9 shows revenues are still relatively high when compared to the voice revenue per line in the benchmark countries.

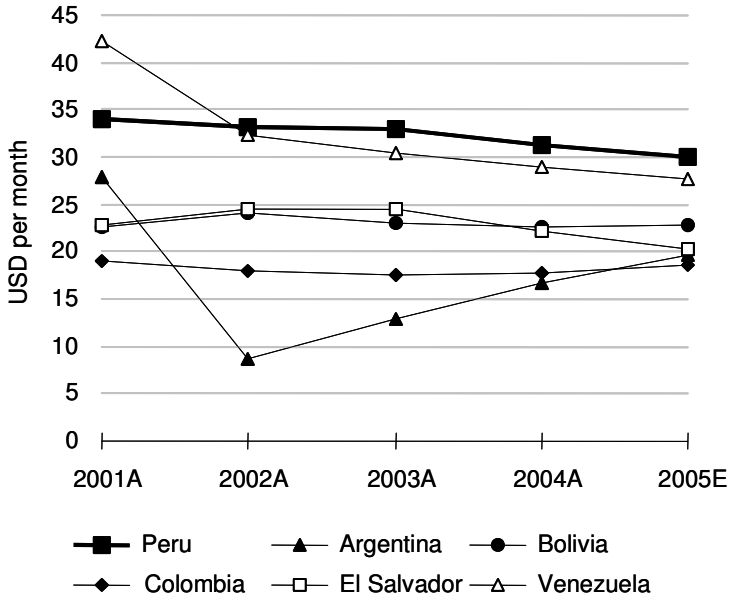

Exhibit 2.9:

Voice revenue per minute per line [Source: Pyramid Research]

Exhibit 2.10 shows how fixed-line penetration in Peru has increased over the past decade. Following the initial readjustment after privatization, there was a dramatic increase in household penetration. Growth in penetration then stagnated at the beginning of the liberalization process. Following the introduction of new price caps in 2001 penetration has slowly begun to rise again. While this correlates with the introduction of price caps, it should be noted that it also correlates with a general upturn in the economy.

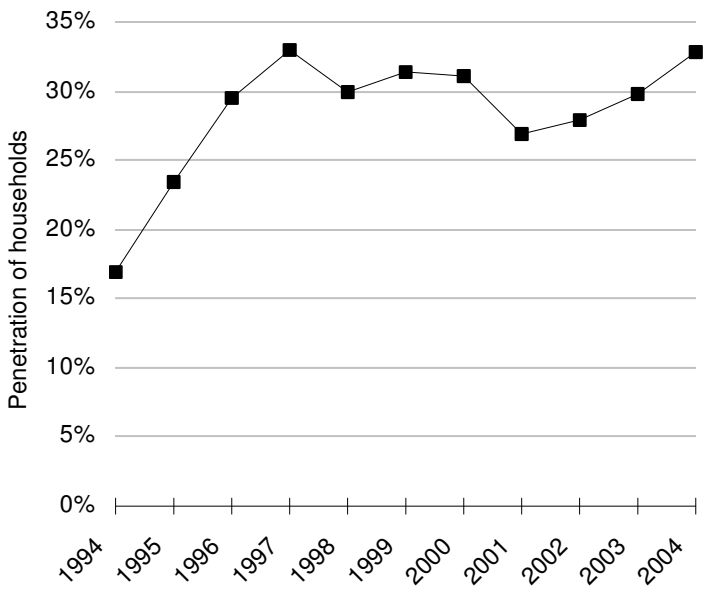

Exhibit 2.10:
Fixed line telephone penetration in Peru [Source: ITU]

While levels of fixed-line penetration in Peru have increased they remain relatively low when compared to the benchmark countries. Exhibit 2.11 shows fixed-line penetration of households in Peru and the benchmark countries while Exhibit 2.12 shows the number of fixed lines as a proportion of overall population in the different countries.

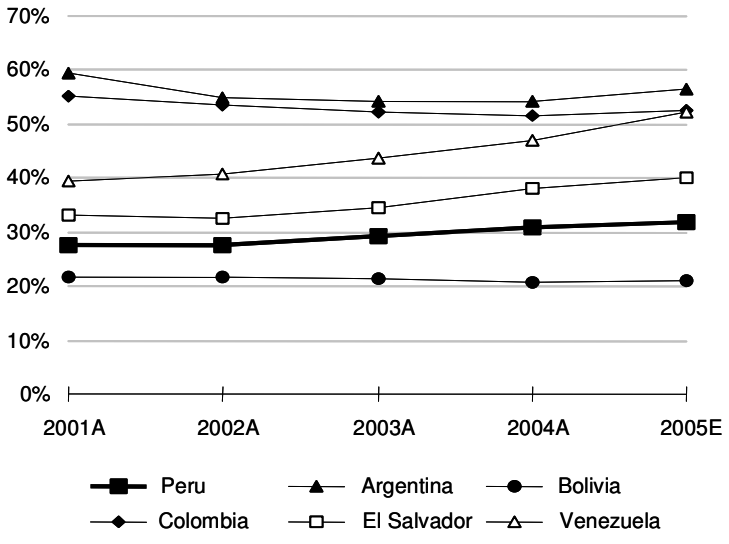

Exhibit 2.11: *Household fixed-line penetration [Source: Pyramid Research]*

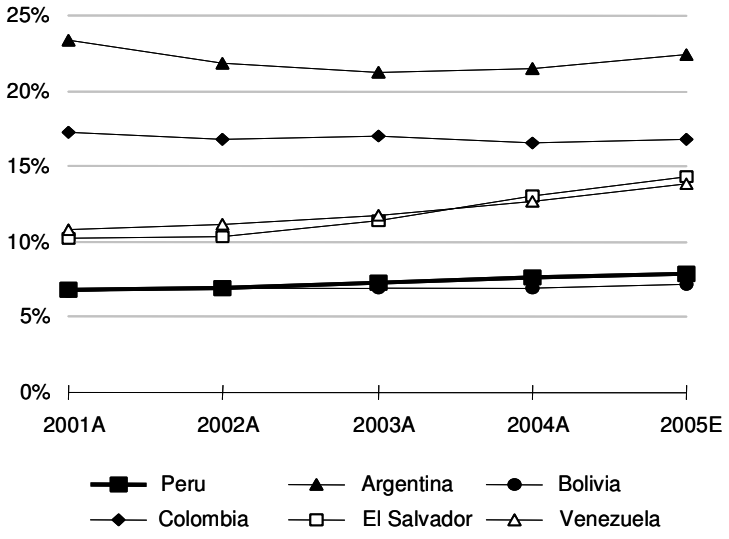

Exhibit 2.12: *Fixed-line penetration of population[2] [Source: Pyramid research]*

[2] Exhibit A.13 shows the fixed and mobile penetration in Peru and the benchmark countries at the time the price cap regime was introduced in the particular country.

As shown in Exhibit 2.13 and Exhibit 2.14, during the same period there were dramatic improvements to the network technology (with digitalization chosen as a proxy) and quality of service (with fault clearance chosen as a proxy) in Peru. Waiting lists for new lines have also significantly reduced over the period (Exhibit 2.15).

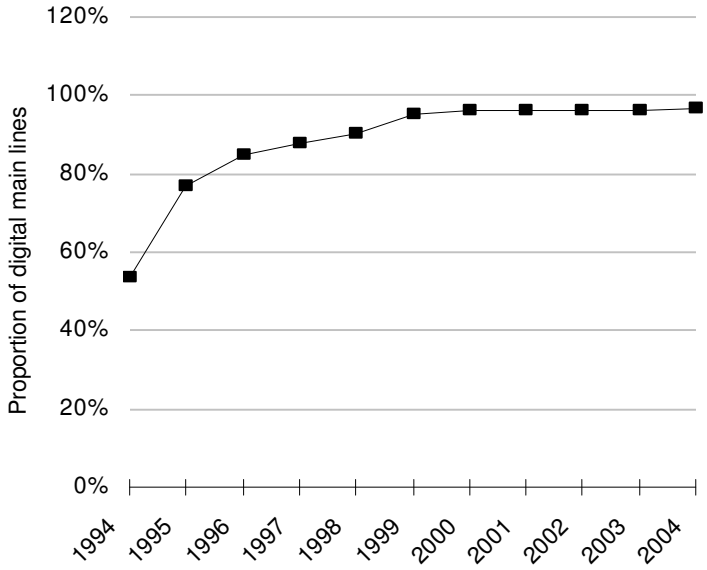

Exhibit 2.13:

Digitalization in Peru [Source: ITU]

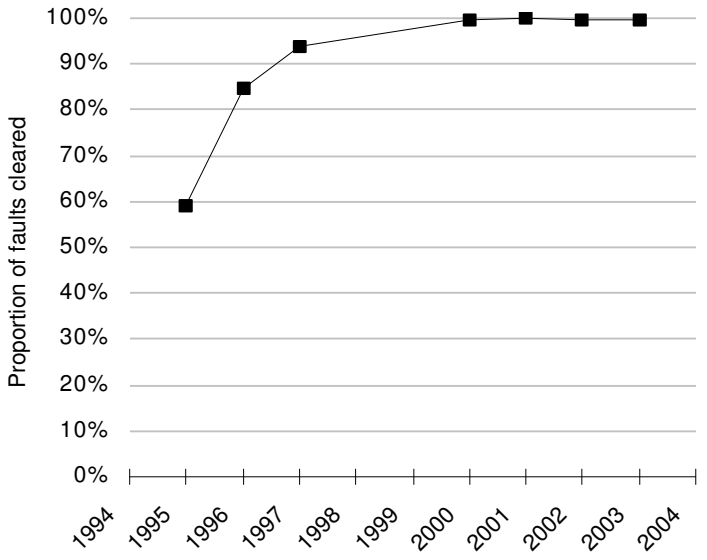

Exhibit 2.14:

Fault clearance in Peru [Source: ITU]

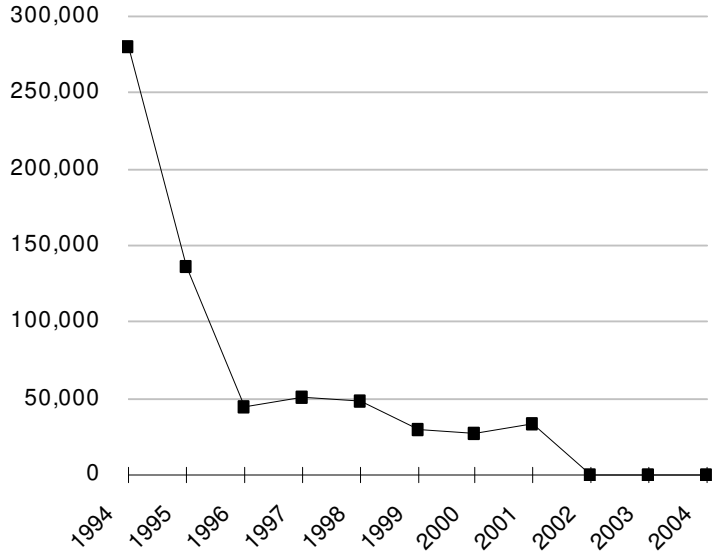

Exhibit 2.15 :

Waiting list for main lines in Peru

[Source: ITU]

However, the annual cost of telephone usage has not changed significantly in nominal terms over the period 1994 to 2005, as illustrated in Exhibit 2.16.

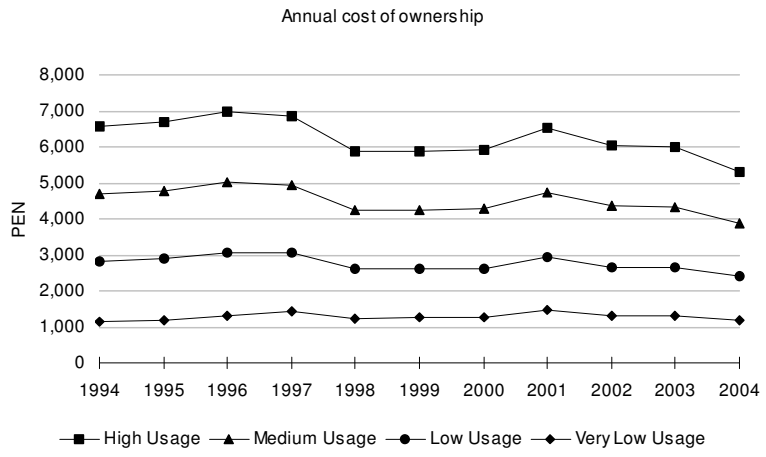

Exhibit 2.16:

Annual cost of ownership in Peru

[Source: Osiptel, TdP, OECD]

Exhibit 2.16 shows the annual costs for different type of users have developed as follows:

- for a high-usage basket from PEN6600 per annum in 1994 to PEN5300 in 2005 (reduction of 19%)
- for a medium-usage basket from PEN4700 per annum in 1994 to PEN3900 in 2005 (reduction of 18%)
- for a low-usage basket from PEN2800 per annum in 1994 to PEN2400 in 2005 (reduction of 15%)
- for a very low-usage basket from PEN1100 per annum in 1994 to PEN1200 in 2005 (increase of 6%)

For these calculations we use a basket of subscription charges, and a certain number of local, long distance and international calls that depend on the usage level. Keeping the number of annual minutes constant over the period analyzed shows how the expenditure for a user of the same set of services changes over time.[3]

To gauge the impact of privatization on the incumbent, Exhibit 2.17 shows the relationship between the number lines and the number of employees, which is a useful measure of organizational efficiency for a fixed telecom operator. It was common for incumbents to be over-staffed prior to privatization and liberalization, and thus an increase in the number of lines per employee demonstrates increased efficiency that would be expected from a private enterprise. TdP has shown significant increase in efficiency since 1995 – while the number of lines has almost doubled, the number of employees numbers has decreased by more than half.[4]

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3 High, medium and low basket calculations are based on OECD basket definitions as of June 2000. High-usage basket = OECD business; Low-usage basket = OECD residential; Medium-usage basket = average of OECD business and residential. The very low-usage basket is based on Osiptel's representation of fixed telecommunications usage in Peru with control and pre-paid plans. Connection charges have been amortized over a period of five years. The calculation uses TdP's price list tariffs as reported by TdP for a certain year and does not consider any commercial one-off temporary discounts.

4 Exhibit A.2 shows benchmark efficiency gains for selected incumbent operators in Latin America in the period 1998-2003. Efficiency gains in this period ranged from 33% for Telefónica Argentina to 140% for CanTV in Venezuela. It is interesting to note that while Peru appears to have had the biggest gain in efficiency over this period, the decrease in prices under the price caps was the lowest.

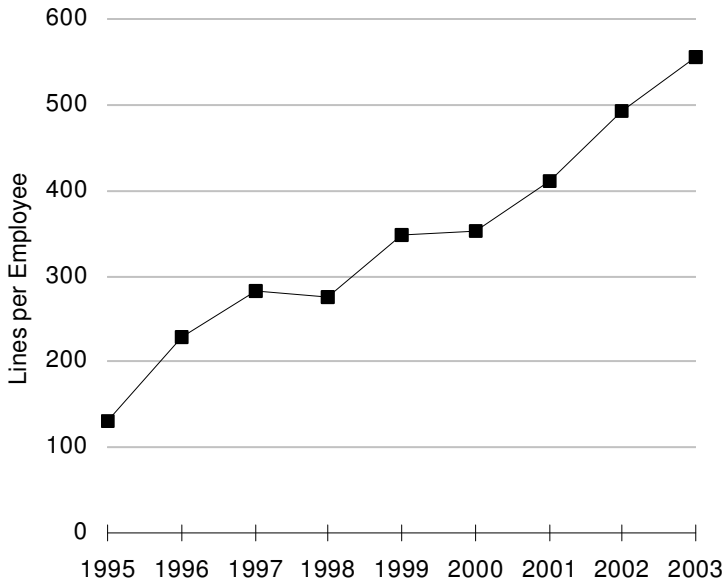

Exhibit 2.17:

Lines per employee in Peru [Source: ITU]

However, efficiency improvements achieved by the incumbent do not seem to have been passed on fully to the end user. The cost of fixed telephony baskets (as per the previous definition) has not fallen at same rate that efficiency has increased. Specifically, while the annual cost of ownership across the usage profile has fallen by 40% in real terms over the period 1995–2003, TdP's efficiency (measured using employees per line serviced) increased by 320% over the same period (Exhibit 2.18). This suggests that the relatively high X-factor applied in Peru is warranted to align consumer prices with productivity gains.

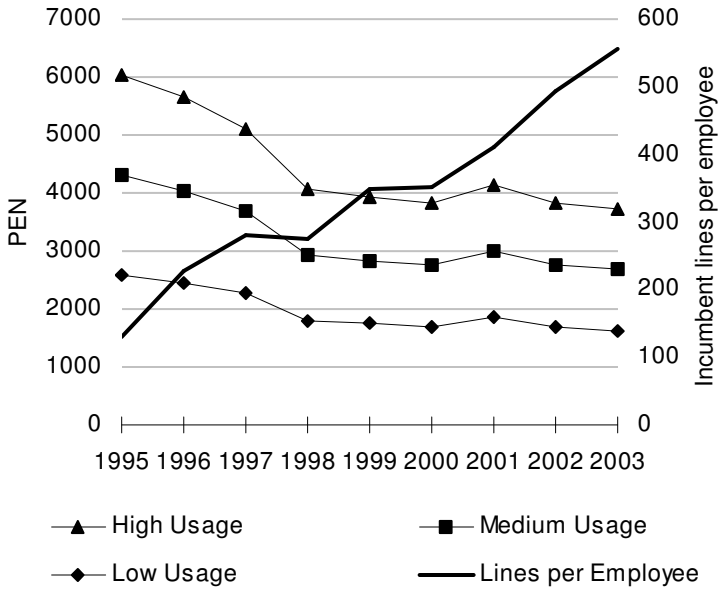

Exhibit 2.18:

Annual cost of ownership (1994 real terms) vs. TdP efficiency [Source: Osiptel, TdP, OECD, EIU]

In conclusion, there are some encouraging developments and the price cap regime appears to be serving the purpose of lowering prices and making the services more affordable for the users. However, it appears that the price cap regime is not sufficient for expanding access and that additional measures need to be taken to align penetration levels in Peru with levels seen in the benchmark countries. These will be examined in the next section.

3 Indirect competition

This chapter examines the causes for and regulatory solutions to the relatively low levels of penetration of access services in Peru, and presents a number of possible remedies for the short term and the longer term. We first demonstrate that the low penetration is not due to lower income levels or higher deployment costs in Peru. After introducing the concept of an access gap, we discuss the impact of price caps on the market in Peru, and conclude that these price caps cannot be the only remedy for the access gap. We argue that the first step to increase access should be to focus on increasing mobile penetration to marginal urban areas, and we make a number of recommendations for actions in the short term that could achieve this without the use of subsidies. Finally, we consider long-term options for increasing access to those customers that would remain uneconomic even in an efficient market.

We use the term 'indirect competition' to refer to competition between entrants and the incumbent operator for *new customers*. This typically occurs in underserved areas where income tends to be lower; it is therefore of particular relevance to the access issues experienced in Peru. From the point of view of regulation, indirect competition simply requires interconnection with the incumbent's network, and possibly wholesale access to leased lines as well.

3.1 Penetration in Peru and its main drivers

In general, there are two main drivers of penetration – *demand for services* and *cost of deployment*. A rough proxy for demand is the average *income* in a country (measured by the

GDP per capita), while a proxy for cost is the degree of *urbanization* (which affects the density, and thus the cost, of deployment). In this section we show that, even allowing for these two factors, Peru lags behind the relevant benchmark countries.

Fixed and mobile penetration combined

Exhibit 3.1 below plots the combined fixed and mobile penetration in Peru and a number of other countries in the region against the GDP per capita in those countries. The exhibit suggests that a difference in overall wealth level is *not* an explanation for the fact that fixed and mobile penetration in Peru is lower than expected.

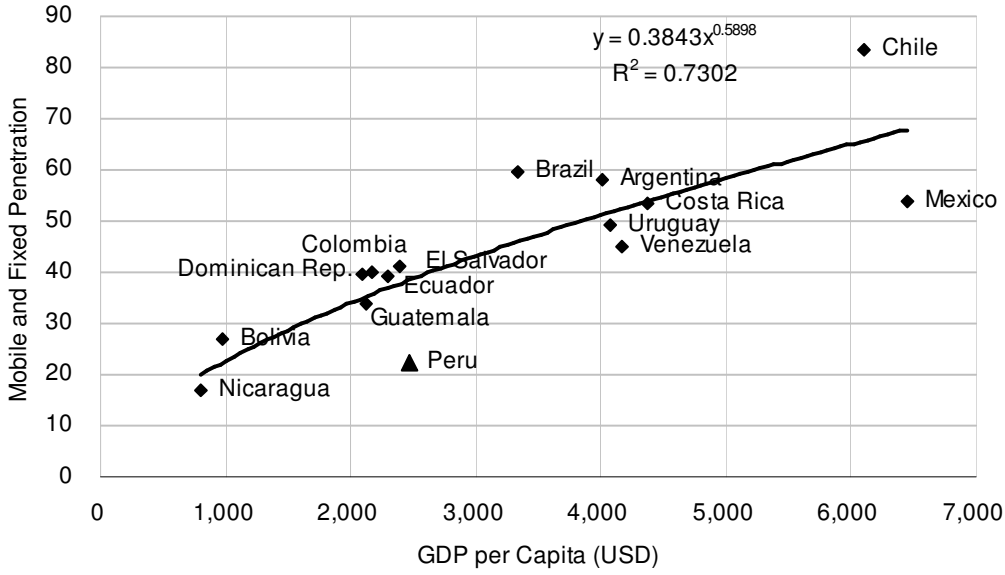

Exhibit 3.1: *Penetration versus GDP per capita in Peru compared with benchmark countries [Source: ITU, EIU]*

In a similar way, Exhibit 3.2 plots the overall fixed and mobile penetration and the same set of countries against the degree of urbanization (percentage of the population living in towns).

This suggests in turn that the lower overall penetration in Peru is not due to a difference in the level of urbanization.

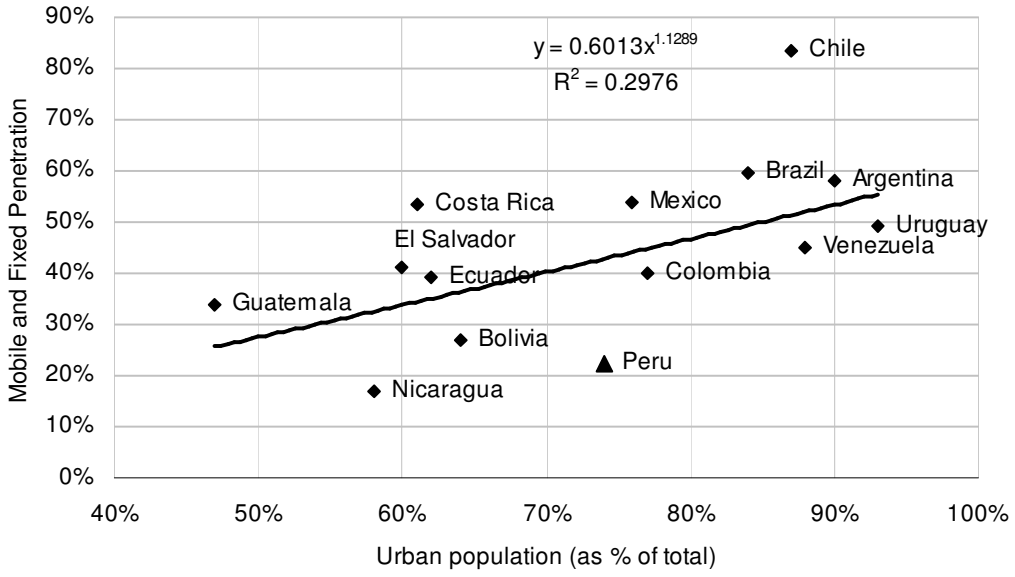

Exhibit 3.2: *Penetration versus degree of urbanization in Peru compared with benchmark countries [Source: ITU, World Bank]*

Mobile penetration

Exhibit 3.3 shows that mobile penetration in Peru has lagged behind other countries in the region, despite the fact that all the countries had almost identical starting points in 1994. This is despite competition between multiple operators in Peru, backed by international owners. Data is not available to benchmark mobile call rates with the other countries, but it is unlikely that the levels of call charges fully explain these differences in penetration.

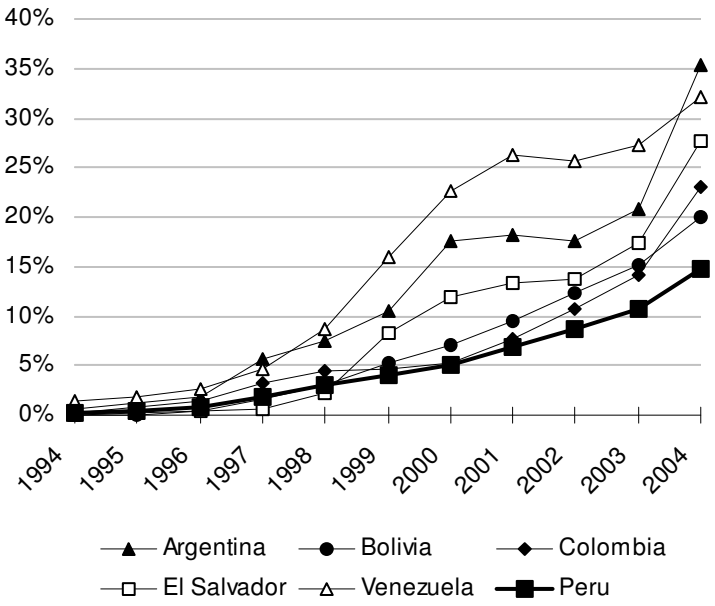

Exhibit 3.3:

Mobile penetration in Peru and benchmark countries [Source: ITU]*

* Compare this with Exhibit A.13 in Annex A, which shows the fixed and mobile penetration in Peru and the benchmark countries at the time when the price cap regime was introduced in the particular country.

The available evidence suggests that these differences in mobile penetration may be, at least partly, due to differences in *coverage*. We will address coverage issues later when we turn to access issues, but we note here that in 2005 the (estimated) population coverage by Telefónica Móviles in Peru was only 60% while in other countries in the region it was as follows:

- Argentina – 90%
- Bolivia – 60%
- Colombia – 66%
- El Salvador – 85%
- Venezuela – 98%.

Fixed penetration

We have already compared *fixed* penetration in Peru with the benchmark countries (see Exhibit 2.11 and Exhibit 2.12). These comparisons again show Peru lagging behind most of the

benchmark countries in fixed-line penetration. It is thus clear that Peru is facing a problem with respect to the provision of access services: it is not doing as well as other countries whose citizens have similar income levels, and it is not doing as well as countries with similar deployment costs.

3.2 The market efficiency gap and the true access gap

The previous section has demonstrated that an access gap exists in Peru. Before discussing what form of market intervention might be appropriate to remedy this situation, it is necessary to distinguish between two categories of gap:

- The *market efficiency gap* is defined as the gap between the theoretical reach of a service in an efficient market in which all regulatory barriers have been removed, and what is actually achieved under existing conditions.

- The true *access gap* is defined as the gap that remains when the market efficiency gap has been filled. It results when the cost of a service is higher than its affordability.

These gaps are caused by two principal factors: low incomes (which reduce demand), and high deployment costs (which reduce the incentives to deploy new infrastructure). This situation is represented graphically in Exhibit 3.4 below.

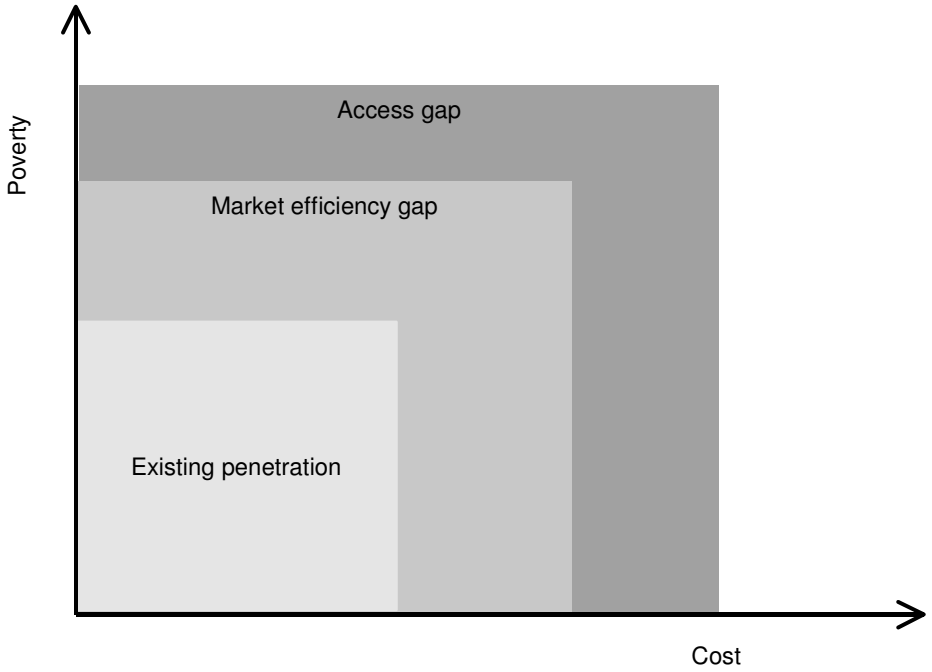

Exhibit 3.4: *Access gaps and market efficiency gaps are both caused by low incomes and high costs [Source: World Bank Discussion Paper 432[5]]*

These two categories of gap have different implications for what market intervention is appropriate. A market efficiency gap arises when as a result of regulatory barriers, services are not made available to customers who could otherwise afford them. This could be because the *actual cost* of providing a service is too high, or because the cost is too high *relative to the price* that operators can charge. Actual costs may be prohibitively high for a number of reasons:

- artificial barriers to investment
- regulatory constraints on technology choice
- high cost of service
- unregulated cost of leased lines for backhaul.

5 Telecommunications & Information Services for the Poor: Towards a Strategy for Universal Access" by A. Dymond, N. Juntunen, J. Navas-Sabater. 2000.

A market efficiency gap does not need to be filled with financial subsidies; it can be addressed by adopting 'light touch' regulation. For example, a solution might be to allow service provision by private companies, as long as the regulator removes barriers to entry and creates a level playing field.

In contrast, a true access gap by definition continues to exist even in an efficient market that no longer has any regulatory barriers to competition. Such a gap cannot be filled without some form of market intervention (such as subsidies).

In the following section we discuss the impact of price caps on the market in Peru. We next ask, in Section 3.4, what types of services are best suited to increasing the penetration levels in Peru. We conclude that the emphasis should be on increasing mobile penetration, and in Section 3.5 we describe the actions that could be taken to reduce the market efficiency gap for such services. This leaves the true access gap, especially for fixed services, and in Section 3.6 we consider possible ways to address this in the longer term.

3.3 The impact of price caps in Peru

Price caps are designed to simulate the impact of competition, thus providing a means to lower prices in accordance with efficiency gains, and thereby providing incentives to operators to seek additional efficiency gains.

It is hard to conclude that the level at which price caps have been set in Peru is inappropriate. It is true that the X-factor is higher than in benchmark countries, where this information is available: for example, it is 5.5% in Argentina, 2.0% in Colombia, and 4.2% in Bolivia. Rates in Peru are thus are set to fall faster. However, as shown above, although price caps have overall been successful in lowering prices in Peru, the monthly subscription remains quite high compared with benchmarks. Further, while per-minute rates appear to be in line with benchmark countries, nonetheless we have shown that Peru has the highest voice revenue per line of any of the benchmark countries. Finally, we have demonstrated that price decreases do

not appear to be proportional to strong efficiency gains for TdP, suggesting that further price cuts would redistribute the efficiency gains to customers.

It can also be noted that there have been a number of encouraging developments in recent years; the performance of TdP, in terms of efficiency and quality of service, has improved: its operations are now comparable to international benchmarks. And in fact penetration has *increased* since price caps were introduced in 2001.

Although price caps may simulate competition in *developed* countries, it is our view that in *developing* countries direct competition is not realistic in any case, and in such markets price caps are not a sufficient tool for creating indirect competition (i.e. promoting access).

In developed countries, penetration is typically high or universal, and competition therefore focuses on high-value customers. In this situation, price caps are an ideal tool for protecting low-income or high-cost customers who might not otherwise benefit from competition, and encouraging these consumers to subscribe to available services.

In contrast, in developing countries penetration is low, and entrants can focus on meeting new demand rather than directly competing with the incumbent. In this situation, price caps may not be sufficient to stimulate new access.

Relaxing the price cap and allowing prices to rise (or fall at a slower rate) may increase incentives to deploy the networks, but make the services less affordable. Additional revenue may not be used to increase deployment to underserved customers, and underserved customers may in any case not be able to afford to pay the higher prices.

On the other hand, lowering the price caps further would make services more affordable but less attractive to deploy by (a) reducing revenues from existing services and thus compromising future expansion, and (b) reducing the incentive to expand, because of the lower revenues from new customers.

In conclusion, based on the evidence, price caps in Peru appear to be serving the purpose of lowering prices in line with international benchmarks and making services more affordable. In addition, price caps have not had a detrimental impact on penetration – indeed since the price caps started in 2001 penetration has increased markedly.

Nonetheless, Peru continues to have among the lowest penetration levels for both mobile and fixed networks among the benchmark countries. We are led to conclude that this may not simply be a demand issue, related to the affordability of services under the price caps, but is also likely to be related to the *deployment of networks*. Other tools appear to be needed in order to stimulate penetration, and these will be discussed in Sections 3.5 and 3.6.

3.4 Primary telecoms needs

Mobile versus fixed-line access services

Before we address the market access gap, we discuss the service we foresee to meet the gap. It is our understanding that that for household/personal connectivity, basic voice penetration is the primary need. This provides critical connectivity for personal and business usage. In marginal urban areas this can be provided via mobile usage.

Prepaid mobile services, in particular, are a cost-effective option for low-income households[6] and are already offered widely in Peru. In the marginal urban areas they can also be the most cost-effective for operators because they require little administrative effort and users are likely to be low-usage customer. Typically prepaid mobile is more attractive for low-income users because services have a low monthly fixed cost associated with them. New low-cost handsets and used handsets can further lower the cost of ownership. In addition to monthly recurring costs being relatively low for prepaid options, users can control their outgoing calls, sign-up does not required credit-checking and need for a bank account which are features well suited

6 Prepaid mobile services is only the more affordable choice for a user making a limited number of calls. Prepaid per-minute tariffs are generally more expensive than postpaid tariffs and mobile call tariffs in general are more expensive than fixed tariffs (especially for local calls as mobile operators generally offer a single averaged tariff nationwide)

for people with no steady or low income. In countries with 'calling party pays' (CPP) regimes such as Peru it is thus economical to use handsets only for incoming calls and useful for small businesses who receive more calls than they make (e.g. restaurants, taxis, etc.). It is also likely that low-income residential subscribers will use the service to a larger extent for receiving than for making calls.

The situation in Peru is not typical, however, as TdP's fixed plan 'Línea Social al segundo' is relatively inexpensive compared with prepaid mobile offerings, as shown in Exhibit 3.5. This is a relatively recent development in Peru and fairly unique in developing countries. Nevertheless. the actual connection cost for new fixed access lines is likely to be significantly higher than the tariff charged in TdP's fixed plan, and this service is therefore not likely to be sustainable in marginal urban areas for newly deployed lines.

Costs (PEN)	*TdP**	*Telefónica Móviles***
Start up	25	129
Monthly recurring	25 (30 minutes prepaid, no overage)	20
Per-minute local	0.133 (peak) 0.069 (off-peak) 2.07 (any time, nationwide to fixed)	2.07 (any time, nationwide to fixed) 2.07 (any time, nationwide to fixed)

Exhibit 3.5: *Comparison between TdP's fixed and mobile tariffs [Source: Telefónica Móviles and TdP]*

* Línea Social al segundo with Tarjeta Prepago 147 prepaid card (minimum of PEN3).

** Movistar Prepago Combo Regular (incl. PEN24 calls during first six months); Per minute tariff: todo el día Plan.

As demonstrated in Exhibit 3.6 below, prepaid mobile services in Peru appear to be reasonably competitively priced when compared to benchmark countries.

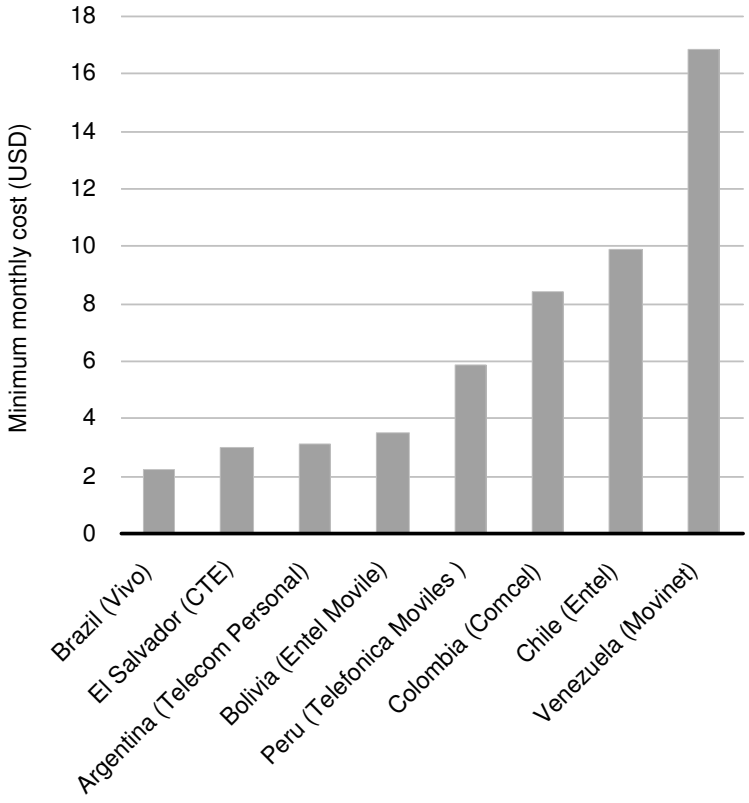

Exhibit 3.6:

Monthly cost of prepaid mobile ownership in Peru and benchmark countries [Source: operator Websites, Tarifica]*

* Monthly recurring costs in order to stay connected; i.e. monthly rental or minimum monthly usage

2G mobile networks can cover most under-served rural and marginal areas more economically and operate more viably commercially because they have different network economics to wireline networks. The cost of establishing a new wireless network are considerably lower than for a wireline network as the costly local loop can be completely bypassed. The base-station and acquiring access to spectrum and backhaul systems represent a single fixed-cost investment and costs per user then decrease continually as more users take-up the service. In

addition, in marginal urban areas the relative population density and proximity to cities should further allow for economical coverage by mobile operators.[7]

Given sufficient spectrum, there is relatively low marginal cost of adding new, in particular low-usage low-administration prepaid, users with a revenue advantage from both user fees and increased marginal termination rates from incoming calls to those subscribers.

Wireline networks have a completely different fixed/variable cost profile compared to wireless networks. Fixed operators face a significant variable cost of extending their networks to reach each additional subscriber by having to deploy 'last-mile' loops. Without subsidies, the connection charge would have to be significant for each new subscriber to the fixed network, as marginal revenues are not likely to be sufficient to cover costs, particularly for low-income callers with low call volumes.

Internet access services

The addressable market for Internet access is limited to those with PCs and because of the cost of a PC, ownership levels are still relatively low in Peru. In particular, it is unlikely that low-income consumers in marginal urban areas own PCs. That said, there is also the possibility of *shared* or *public access* to Internet services, whether in schools and libraries, or Internet cafes open to all. As shown in Exhibit 3.7 below, Internet usage in Peru is already greater than PC ownership, and this is the result of shared or public Internet access. This model may be a more realistic option moving forward, and may even be more critical than household and personal access.

7 The following simplified example provides an illustration of the economics of wireless vs. wireline networks: A wireless base station in a rural environment (assumed cell radius of 10km) covers 260km^2 with five users/km^2. Given costs of USD100 000 for the base station and USD15 000 for backhaul, the investment would be around USD100 per user. The equivalent cost for wireline networks depends heavily on construction requirements, and therefore on the length of the local loop for each user. However the typical average cost of a wireline network is in the region of USD800 per line.

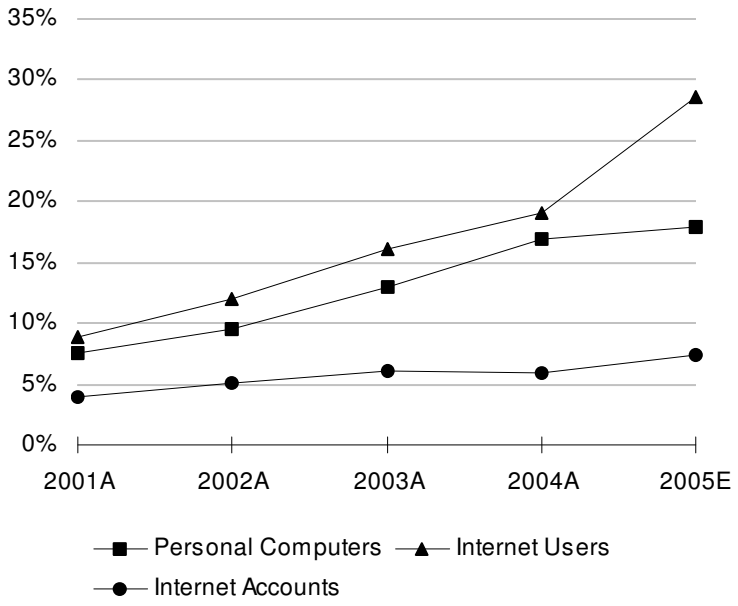

Exhibit 3.7:

Internet and PC usage in Peru [Source: Pyramid Research]

Internet connectivity at present is generally achieved via a fixed-line connection, which as discussed above, is more expensive than mobile in marginal urban areas. With new 2.5G (and beyond) technologies, however, mobile devices can offer Internet access that may be sufficient. In addition, new broadband wireless access (BWA) technologies such as WiMAX may also enable broader Internet access using the same basic infrastructure as the mobile networks.

Mobile service is a widely used deployment model in developing countries. For example, networks based on CDMA450 technology (i.e. CDMA2000 at 450MHz) are already being deployed in Asia and Africa to provide wireless local loop services. CDMA2000 is more spectrally efficient than GSM, enabling a larger number of customers to be supported. In addition, the propagation characteristics of 450MHz spectrum mean that signals travel long distances, reducing the number of base stations needed to cover the same area. To date, these deployments have focused on providing voice rather than broadband services as there is currently little demand for such services in the areas where these networks have been deployed. Examples of commercial service providers include Ethiopia Telecommunications Corporation, Mandara Selular (Indonesia), Cambodia Shinawatra Co, PTCL (Pakistan) and ETC (Vietnam).

The existence of a 'digital divide' with respect to Internet access is, of course, an important issue, particularly for children for whom the Internet is increasingly important for education and later for employment opportunities. The pragmatic solution that has been adopted in many countries, including the US, is to focus on public access to the Internet, such as in schools and libraries. This solution meets the immediate need to provide access to children and others, while recognizing the barrier presented by the cost of personal computers and Internet access to each home.

Another solution, now being addressed by MIT and the World Economic Forum, is to develop low cost computers with wireless Internet access that can be made available to all children. As these computers begin to be made available in the next few years, they will create significant demand for Internet access outside public areas, which will both help to promote private deployments of Internet access as well as to increase the demand for government deployments using universal service funds. Either way, infrastructure built for mobile networks today will greatly facilitate the rollout of mobile data networks tomorrow.

3.5 Reducing the market efficiency gap

As discussed above, we believe that the immediate focus in Peru should be on stimulating mobile deployment in marginal urban areas. Based on our analysis of the Peruvian market, we believe that for mobile services in marginal urban areas there may only be a market efficiency gap and not be a true access gap. We tentatively conclude that addressing these market efficiency gaps may close the overall access gap in marginal urban areas. Therefore, while we understand that the current FITEL program could focus on marginal urban areas if they were labeled by the Ministry as a 'preferred social interest zone', here we focus on ways to eliminate barriers preventing private investment from taking place *without* subsidies. In our view, three ways of removing barriers should at least be considered in the short-run:

- *Lower the cost of deployment* – one approach would be to reduce the cost of backhaul over leased lines. This could be done by allowing infrastructure sharing, for instance with

electrical utilities whose poles could be used for fiber deployment, or imposing obligations on wholesale leased line providers to reduce the price of backhaul services.

- *Increase the return on investment* – one means could be to provide tax credits on telecoms investments in marginal urban areas, or to reduce taxes on revenues from these areas.

- *Lower the cost of services to users* – the CPP system used in Peru, which results in asymmetric mobile call termination rates, already provides a significant subsidy from fixed users to mobile users. However, further reductions in mobile call termination rates could further decrease this subsidy.

3.5.1 Lowering the cost of deployment

Leased lines represent a significant expense for mobile operators moving into new areas where they must rely on existing infrastructure for backhaul transport of the traffic. The cost of leasing an E1 connection in Peru is relatively high: as an example, Exhibit 3.8 shows the retail cost of a national E1 leased line over 300km in Peru and benchmark countries.

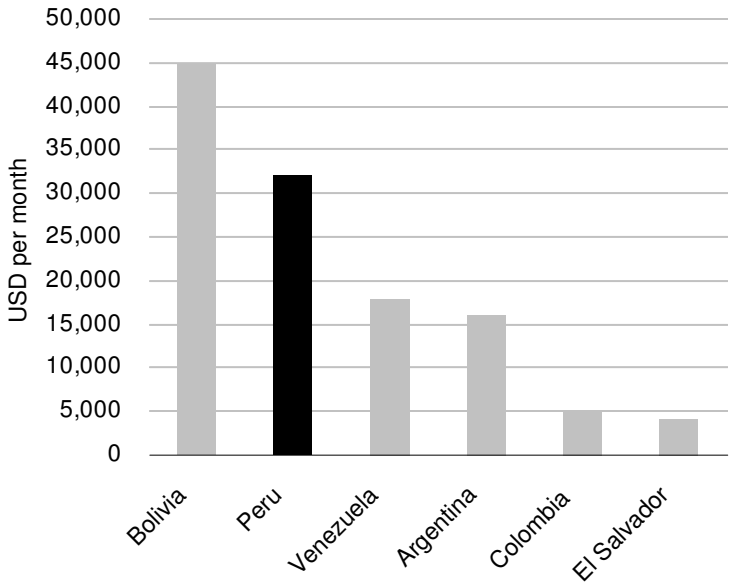

Exhibit 3.8:

Cost of a national E1 leased line over 300km in Peru and benchmark countries [Source: Tarifica]

There are other actions that can be taken to reduce mobile operators' deployment costs. In our experience, the stringent requirements on base station tower siting and radiation monitoring applied in Peru do not exist in most developing countries. The following options might help to lower the cost of towers and base stations.

- reduce the onerous requirements, and the cost, arising from the regulations governing radiation from base transceiver stations (BTSs)[8] to eliminate following obligations:
  - operators must pay and wait for an independent environmental impact assessment for every planned BTS installation
  - they must pay an independent firm to monitor radiation of each BTS every six months; this also causes delays as there are not sufficient qualified staff to carry this out
- reduce any municipal or regional barriers to siting towers
- reduce spectrum fees, if possible
- allow infrastructure sharing for tower sites between different mobile operators, and with electrical utilities.

8 Decreto Supremo No 038-2003-MTC

3.5.2 Increasing the return on investment

In general, regulators should impose light-touch regulation on investment by ensuring technological neutrality for both fixed and wireless investors, to ensure that the most efficient technology can be deployed. Authorities should also refrain from imposing legacy regulations on new technologies or operators. For instance, fixed quality-of-service requirements may not be necessary for these new technologies. In general, it may make more sense to see how the market operates and identify only those legacy regulations that are essential for the new technologies.

3.5.3 Lowering the cost of services to users

The cost of owning and operating a mobile handset in Peru is at the high end of the range of the benchmark countries, as illustrated in Exhibit 3.9 and Exhibit 3.10.

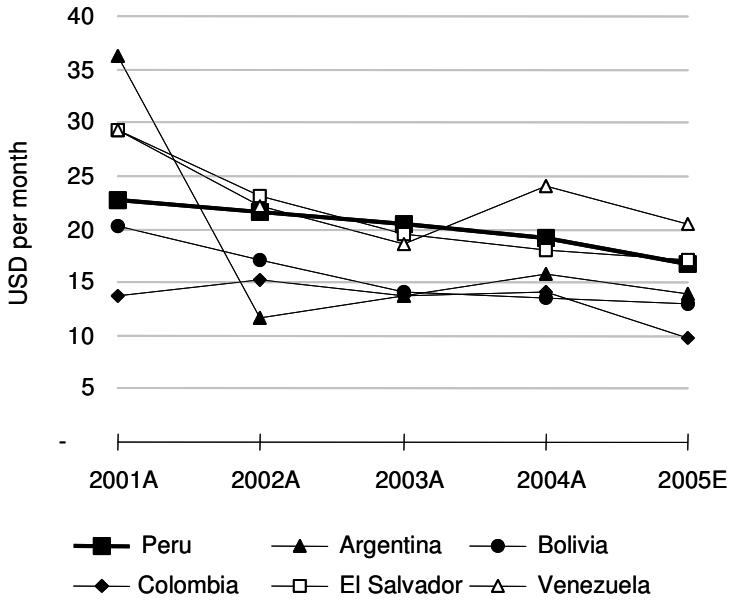

Exhibit 3.9: *Average revenue per subscription in Peru and benchmark countries [Source: Pyramid Research]*

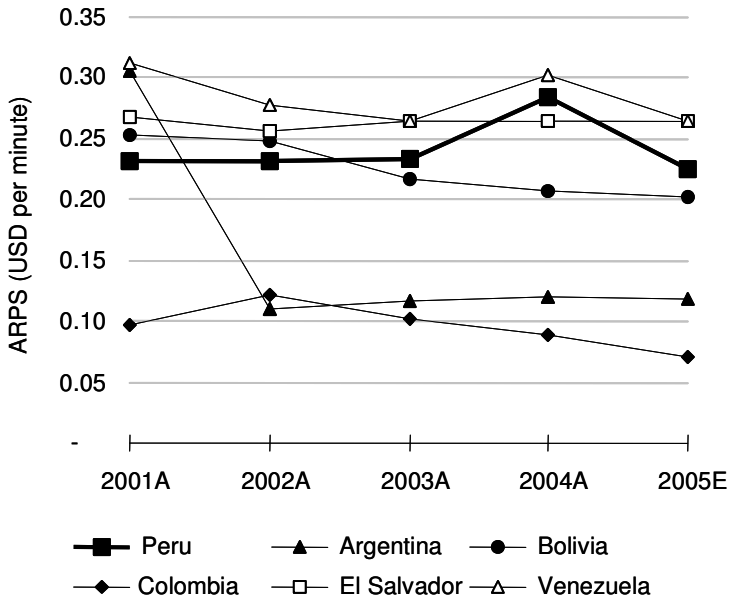

Exhibit 3.10:

Effective revenue per minute per subscriber in Peru and benchmark countries [Source: Pyramid Research]

One way to improve penetration would be to lower the tax on mobile usage. The GSM Association commissioned a study called *Taxes and the Digital Divide* in 2005, which showed that if the government reduced taxes on mobile usage by 1% this could boost the number of mobile users by more than 2% by 2010. The London Business School further noted that the removal of all sales and customs taxes on mobile handsets and services could increase mobile penetration up to 20% in general.[9]

In this respect, Peru has relatively high taxes: taxes account for 29% of the cost of a mobile handset (ranking Peru ninth out of the 50 countries in the GSM Association study), 19% of the cost of the mobile service (ranking Peru 19th) and 20% of the total cost of ownership (ranking Peru 16th).[10]

9 *Tax and the Digital Divide,* GSM Association 2005.

10 *Tax and the Digital Divide,* GSM Association 2005.

Notes on calling party pays

As discussed above, the asymmetric termination rates used in Peru provide some incentive to deploy mobile services. We would advise Osiptel to keep this system for the time being and into the foreseeable future. The CPP system is in use in the vast majority of countries world-wide, both developing and developed. The alternative to CPP is mobile party pays (MPP) in which the mobile termination rate is very low or zero, and the cost of incoming calls is recovered by the subscriber charging the receiving party for the call. Thus, under MPP the mobile subscriber pays for each minute of both outgoing and incoming calls, and from a fixed line it costs the same to call a mobile as it does another fixed line (thus removing the subsidy).

While CPP is the dominant system in both developed and developing countries, MPP is predominantly used in developed countries, notably the USA, Singapore, Hong Kong and Taiwan. As for developing countries, Analysys knows of at least 16 that have switched from MPP to CPP, including Chile (1999), Mexico (beginning 1999), Ecuador (1998), as well as Peru itself in 1996. There are several good reasons behind these switches, namely to shift some of the cost of the mobile network to fixed subscribers and to promote subscription by enabling low cost pre-paid phones that subscribers can use for free incoming calls.

While there are some equally compelling reasons to use MPP in developed countries, no country has yet switched from CPP to MPP. MPP is attractive in high-income countries that already have high penetration because it promotes increased call volume (since the calling party no longer has to effectively pay for both the origination and termination of the calls), so long as the receiving party is willing and able to pay for incoming calls. Consumers used to CPP typically do not like the idea of moving to a system where they must pay for incoming calls, even though mobile operators in MPP countries provide large 'buckets' of minutes at a fixed monthly fee from which incoming (and outgoing calls) are deducted.[11]

[11] Having paid a fixed fee for a certain number of minutes means that the marginal cost of any call within the bucket is effectively zero, as the consumer only pays for calls that go over the bucket. Overtime, subscribers move choose buckets that reduce the chance of using up the bucket minutes, and this prevents consumers from hesitating to accept calls for fear of paying for them.

In spite of some potential attractions of switching to MPP, many CPP countries such as the UK have reached mobile penetration levels approaching 100% but have not attempted, or even contemplated, a switch. Thus, we believe that Peru can build and sustain a healthy mobile network both in urban and rural areas under the current CPP system, and we do not recommend considering a switch in the foreseeable future.

3.6 Reducing the true access gap in the long term

Although providing mobile services to marginal urban areas may be hindered by market efficiency gaps (addressed above), any *fixed* deployment to these is likely to face a true access gap because of the higher costs of deployment. In order to provide access where there are true access gaps, there must be market intervention similar in nature to the current FITEL program in Peru, and we here discuss the options, which we believe are essentially long-term.[12] Possible solutions to reduce the access gap include:

- setting asymmetric interconnection rates for fixed-line services
- raising the price caps on fixed-line services
- introducing a new universal service fund for marginal urban areas
- eliminating wholesale access requirements for infrastructure in marginal urban areas
- increasing the FITEL fund.

3.6.1 Setting asymmetric interconnection rates for fixed-line services

Asymmetric interconnection rates can increase the return on investment in networks in marginal urban areas. In many countries, fixed termination rates are symmetric, reflecting a geographical averaging of costs. In order to provide an incentive for serving higher-cost areas, termination rates could be de-averaged, which would result in a higher cost for subscribers

12 We would note that many of these actions could also address access gaps in rural areas, beyond the support provided by FITEL.

calling certain (higher-cost) areas. This is similar to the situation with mobile phone termination in CPP countries.

Moving termination rates towards costs increases efficiency, and charging higher retail rates to users in urban areas may be more equitable as such callers are more likely to be able to afford these rates. Thus de-averaged termination rates would also increase the incentives to deploy fixed lines in underserved areas, as the return on investment is increased. This is done to various degrees in a number of countries, e.g. Chile, Colombia, the USA and Canada.[13]

Billing systems need to reflect these costs, but this should not be a problem as countries with mobile termination rates such as Peru already require detailed bills and settlement systems. Numbering must also indicate to consumers when they will pay more, based on area codes.

Potential downsides of this option include:

- it makes the interconnection system more complex
- in order to subsidize uneconomic fixed investment, interconnection rates might have to be quite high, making it uneconomical to call the corresponding areas.

3.6.2 Raising the price caps on fixed-line services

As addressed above, price caps could be adjusted upwards to increase either the ability or the incentive to invest in regions that experience an access gap. As also noted, raising the caps on *existing customers* may help raise the capital needed to expand the network, while raising the caps for *new customers* in areas that are targeted for access would increase the potential revenues from serving those customers. We consider the two in turn, noting that it is possible to only raise the caps for one set of customers.

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13 In the USA, for example, the FCC allows the rural operators to charge higher access charges. Verizon, providing fixed-line services mainly in densely populated regions of the east and west coasts charges USD0.0132 per minute for access charges. Iowa Telecom, on the other hand, charges USD0.03.6 per minute in the (more rural) state of Iowa.

Raising the caps on existing customers would increase the ability of operators to invest in new services and, could involve targeting the cap increases at those customers able to afford such increases, such as businesses. Raising these caps must be explicitly tied to investing in access, otherwise it could constitute a windfall profit for the operators.

One could also raise the price caps in marginal areas, to increase the incentive to invest in new services in those areas by raising rates to reflect the higher cost of access. While this would nominally give the operators a greater incentive to invest, it is unlikely to be affordable for the consumers in these high-cost areas.

Thus an increase in the price cap for targeted existing customers (or alternatively, lowering the rate of decrease of prices), could be effective in raising revenues for access expansion, as long as there is a mechanism for ensuring that the increased revenues are used for new deployment. In the following, we consider a more explicit way to achieve the same goal.

3.6.3 Introducing a new universal service fund for marginal urban areas

A new universal service fund could be created to address marginal urban areas, and this could provide money for infrastructure deployment, or to subsidize connections. One source for these funds could be imposing a subscriber line charge on business lines – this would result in a difference in rates for business and residential subscribers, which is common in the region. In fact, Peru is one of the few countries without such a difference in charges, as shown in Exhibit 3.11.

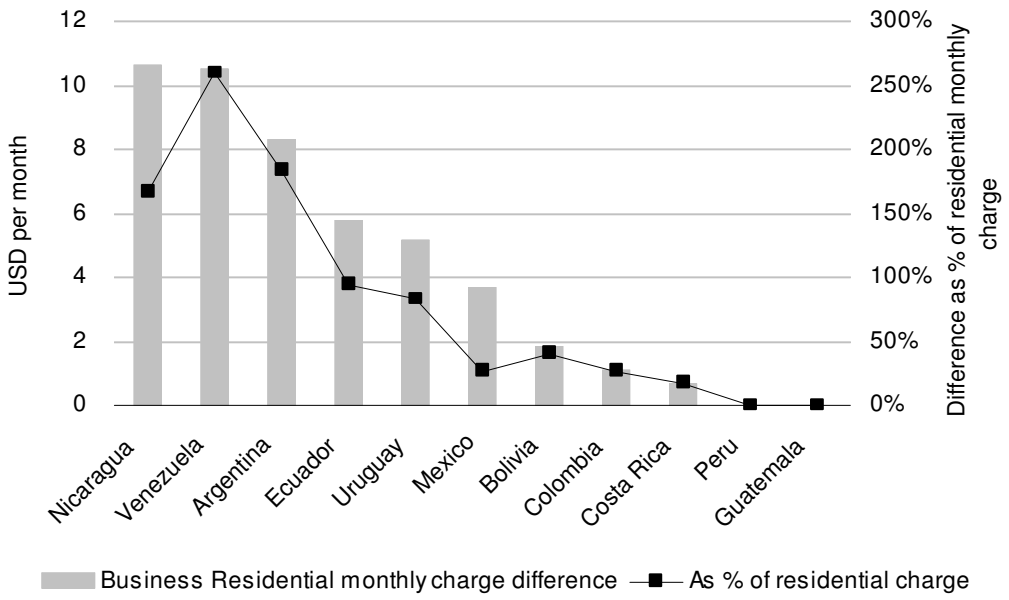

Exhibit 3.11: *Difference between business and residential charges in Peru and benchmark countries [Source: ITU]*

Another, related, approach would be to allow operators to charge more for connection fees in marginal urban areas than in cities. On existing lines the actual cost of connection is relatively low, and we understand that this has been reflected in extremely low connection charges. Conversely, the connection cost when there is no line in place is quite high as it is necessary to deploy a new line to make the connection. Therefore, based on our understanding that operators currently have to charge the same connection charge to all customers, one could allow them to charge a higher fee where they have to build a new line, to reflect the high cost of laying the line.

3.6.4 Eliminating wholesale access requirements for infrastructure in marginal urban areas

Wholesale access requirements have relatively little impact on existing infrastructure, which is a sunk investment for the operator that may have been depreciated already. In this case, having to provide wholesale access to competitors cannot change the existing investments. In contrast,

wholesale access requirements can have a significant impact on *new* investments: the operator has to make a significant sunk investment without a guarantee of return, and there is less incentive to make this investment if a competitor can then use the facilities at cost-based rates.

Waiving wholesale access requirements might increase the expected return on investment in marginal urban areas – for instance, not requiring interconnection for indirect call-by-call access, or not imposing any unbundling or resale requirements. This should be done for a limited time, but long enough to allow the operator to reasonably recoup investment without direct competition from competitors using its network. It would be necessary to determine a simple way to identify new lines, so that operators cannot take advantage of the system.

3.6.5 Increasing the FITEL fund

A final possibility would be to increase the size of the FITEL fund by applying the one percent fee, now imposed only on telecommunications services, to value-added services such as ADSL access and cable service as well.

There are several things to consider before doing this, however. First, in many countries, universal service fees are not levied on services that are not eligible to receive these funds in return, and using this rule, the answer would be not to tax value-added services which are not eligible in return for support. One possible response to this would be to begin to make FITEL funds available for universal access to broadband (which to our knowledge is not the case today).[14] This would help to promote public access to broadband and help to raise funds to pay for it. If Osiptel does not wish to take this step, there is still a pragmatic argument for imposing the fee on value-added services, namely that the current users of such value added services are likely to have relatively high incomes and can thus afford the tax better than other potential sources for the FITEL funds.[15]

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14 In developing countries, it is typical for a universal service/access fund to be established primarily to guarantee basic public voice access. In principle, it is only as a country's telecoms network develops that regulators place greater emphasis on the universal service fund to begin to support roll-out of value-added services. Even then, the emphasis may be on providing shared access to the Internet (e.g. in schools or libraries).

15 South Africa is one example of a universal service funding regime in which the funding of basic access services is partially funded through contributions from value-added services. For a discussion of the characteristics of various universal service funds world-wide, see *Telecommunications Regulation Handbook, Module 6, Universal Service*. The World Bank, 2000.

3.7 Overall considerations

Ultimately, while we label the solutions to the market efficiency gap to be short-term solutions, and the true access gap as long-term solutions, there is no structural reason why one set of solutions must follow the other – they could be pursued simultaneously. We consider, however, that there may be resource constraints limiting the ability to pursue simultaneous solutions (above and beyond the current efforts to increase access). These constraints on new initiatives may result from several sources. There may be constraints in passing any legislation needed, as well as implementing the new regulations. There may also be financial constraints, notably for actions to address the true access gap.

To the extent that these constraints exist, we propose the sequential approach outlined above. By focusing new initiatives on the market efficiency gaps first, this removes any barriers to investments that operators would make on their own, without subsidy or other financial assistance. This will efficiently promote new investment, and also identify those areas that are underserved due to a true access gap.

One of the benefits of indirect competition would be to introduce or strengthen new operators in the market, who can provide innovative solutions to problems and even to begin to compete with the incumbent in targeted areas. The advantage of addressing the market efficiency gaps in the first instance is that this enables a marketplace response to filling the access gap, rather than a mandated response resulting from service obligations or universal service fund allocations. We foresee a variety of operators able to help meet the market efficiency gap. Of course, the relatively capital-intensive effort of building mobile networks will likely be limited to the existing mobile operators and possibly new entrants into the market in order to meet the scale requirements of providing such services. On the other hand, given access to reasonably priced Internet broadband access (via satellite or attached via the mobile networks), as well as allocations of public spectrum, small operators are able to offer public Internet access using new wireless access technologies such as WiFi. Restricting support to the incumbent would simply strengthen the market power of the incumbent at the expense of innovation and variety that could come from the marketplace.

4 Convergence

Convergence is defined as the merging of voice, video and data services over Internet-enabled facilities using a variety of devices, including mobile phones, personal computers and TV. Convergence of services can stimulate the creation of new services and business models that can disrupt established industries. In particular, convergence eliminates the traditional 'service vs. infrastructure' division in communications services, allowing for new sources of service and facility-based competition. Convergence falls into three broad categories:

- convergence of networks
- convergence of services
- convergence of devices.

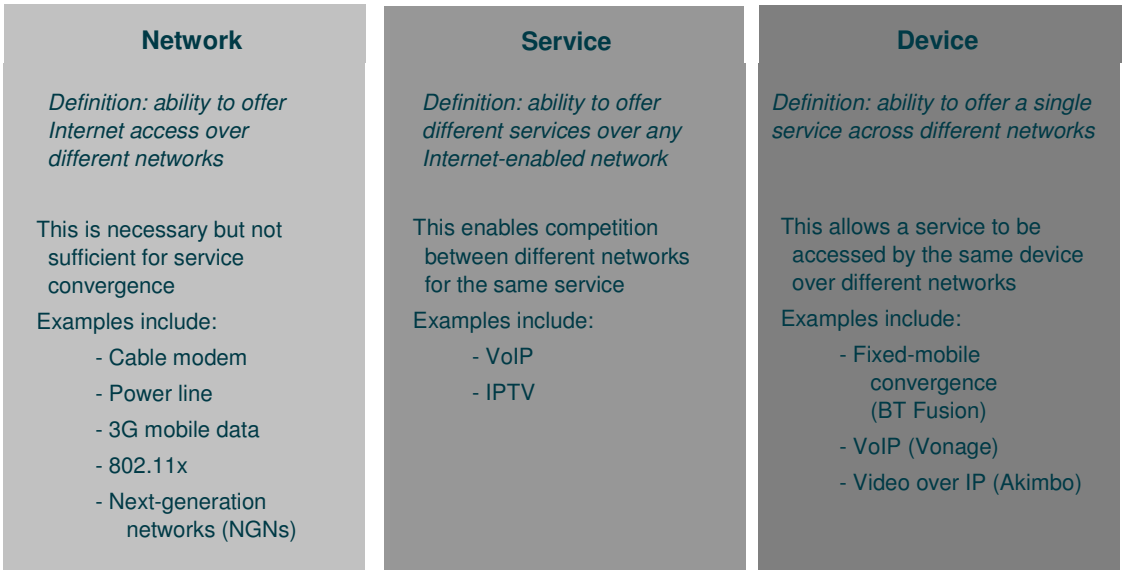

Exhibit 4.1: *Broad categories of convergence [Source: Analysys]*

Drivers of convergence

The convergence of services in the communication industry is being driven by a number of different trends. Key factors include the wide-ranging growth in Internet usage, increasing broadband access, digital content availability, vendor crossover, as well as the emergence of new services and increasing deregulation of the industry. Convergence is not only of relevance for the communications markets in developed countries. Indeed it cannot be ignored in developing countries where it is likely to have a significant impact on all stakeholders.

Regulatory impact

The regulatory structures that have traditionally separated different services (such as wireline telephony from cable telephony and wireline services from wireless services) will be changed by convergence. This in turn will create opportunities and challenges for regulators. Osiptel's objectives and vision for the industry must make appropriate allowance for the impact of convergence, which is likely to facilitate increased direct and indirect competition in broadband services and to allow service-based competition for voice and video services. With regard to any policy reforms, it is particularly important to adopt a policy of neutrality concerning technology, in order to promote next-generation networks (NGNs) and other new technologies that lower the cost of network deployment, and also to establish clear rules for the provision of voice services over IP (VoIP).

Convergence in the telecommunications industry can stimulate the creation of new services and business models and will lead to an increase in competition. This includes facility-based competition in broadband (cable modem, wireless, powerline) and service-based competition from VoIP (e.g. Skype and Vonage) because it allows service-based entry without wholesale access to the incumbent's network (which is quite difficult to achieve, as described in the next chapter).

However, from a regulatory perspective, the competitive environment may be changed significantly by the convergence of services, leading to conflicts within the sector. Legal and

competitive clashes can be expected between existing and new firms, specifically between new entrants and incumbents and between service-based versus facility-based competitors.

On the other hand, convergence also represents an opportunity for regulators to maximize the benefits resulting from the increased competition and increased incentives to invest.

Economic development

We believe that convergence can have a significant impact on economic development. Convergence encourages new entrants to join the market and consequently increases competition, incentives for new and existing operators to invest in new technology, and also promotes widespread growth in the capacity of national telecom infrastructure. It can facilitate greater integration into the global economy, by helping to increase access to global markets, foreign investment in new services and participation in global standards and policymaking (e.g. WSIS, Internet governance etc.). Finally, it can help to bridge issues relating to the 'digital divide', such as social development (convergence facilitates distance learning, telemedicine and e-government), growth in penetration of information services to the home and promotes education capacity building.[16]

As such, convergence has an impact on all stakeholders, including industry, consumers, government and regulators. While the incumbent and new entrants have differing goals with respect to entry and competition, all operators are interested in offering new value-added services. Consumers are interested in access to services, lower prices of service and service quality. Governments are interested in promoting universal service. Regulators can expect

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16 For further information on this topic, see:

- "Measuring broadband's economic impact", January 2006. (http://cfp.mit.edu/groups/broadband/docs/2005/MeasuringBB_EconImpact.pdf)
- "Africa: The Impact of Mobile Phones", March 2005. (http://www.vodafone.com/assets/files/en/GPP%20SIM%20paper.pdf)
- "Capitalising on convergence" (http://www.intellectuk.org/download.asp?file=58)

further competition gains from liberalisation, although convergence can also lead to complicated regulatory issues.

Voice over Internet Protocol

Of particular note to our purposes here, as a result of convergence, VoIP has emerged as a technology that allows wholesale access to be bypassed: service-based competition can be achieved without unbundled local loops or other regulatory means (which we show to be quite difficult in the next chapter). For example, Vonage and Skype can operate without interacting with a broadband provider. Skype allows users to make calls around the world from their personal computers by uploading its software. Vonage allows users to make calls using their existing telephones by attaching an adaptor to their broadband connection.

The impact of convergence is, however, dependent on the presumption that broadband access must be widely available and on the fulfilment of key criteria to support VoIP services. As discussed in the next section, a number of new and existing technologies are able to provide broadband Internet access, with a number of consequences: lowered cost of deployment to help promote indirect competition, and also help to stimulate direct competition in broadband access between different facilities-based providers.

4.1 Converged technologies and services

The overriding trend of the next decade is convergence. As described above, this has a number of implications in terms of enabling new networks to offer broadband Internet access, and also to enable traditional voice and video services to be offered over these new networks, in competition with existing networks. There are a number of interesting implications from convergence, resulting in the shift from the centralized architecture of the telecoms networks to the more distributed architecture of the Internet.

- Centralized architecture. The PSTN is a centralized architecture, meaning that all of the intelligence is in the core of the network, owned and managed by the operator, while the end-user devices (e.g. telephones and faxes) are 'dumb' devices with relatively little functionality. Thus for instance the operator makes services such as conference calling available, provisions the service, and bills for its usage.

- Distributed architecture. On the other hand, the Internet is distributed, meaning that the intelligence is at the edge of the network, in the devices owned by end-users and service providers connected to the network, while the routers in the core of the network are 'dumb' devices with relatively little functionality beside reading the address of incoming traffic and routing it towards the end-user location. In this architecture, end-users can load their own software, such as Skype, and use that to set-up a conference call without informing (or paying) any operator or service provider.

This difference in architecture impacts a number of areas.

- Equipment. IP routing equipment represents a significant shift from traditional PSTN switches, as the equipment tends to be smaller and less expensive, and to enjoy more of the quantum leap in performance associated with personal computers and other consumer electronics. As a result, there are corresponding changes in vendors, as the traditional switch vendors such as Lucent must compete increasingly with Internet vendors such as Cisco.

- Software. While the PSTN equipment was a closed system with proprietary software, the Internet protocol is an open system based on industry standards, which in turn limits the price of the IP equipment and enable collaborative innovation in the basic system software.

- Applications. The essence of a distributed system is that they are open to innovation, and indeed VoIP itself has been the result of private innovations. Skype was developed at relatively low cost, and once developed could easily be downloaded and installed by anyone with Internet access. This differs radically from the PSTN where all applications are developed and installed by the vendors with little or no interaction with end-users.

- Security. One potential downfall of a distributed system such as the Internet is that it is as accessible to those wishing to harm the system as those wishing to innovate, and security from viruses and hackers is always an issue. Nonetheless, there are no security concerns that we know of with current VoIP applications, and we understand that NGNs will be as secure as the PSTN.

- End-users. By definition, end-users have more control over distributed architectures such as the Internet. For instance, most VoIP services such as Vonage provide Web access that allows users to set up their own call-forwarding, call-prioritization, conference calls, etc., all of which activities would typically be provided over the PSTN (and charged for) by a fixed operator.

A number of upcoming new technologies might become relevant to address current supply-side problems in the context of Peru. However, the implications of these technologies will also need to be considered in the context of stimulating competition and entry in the market.

A regulatory framework that provides a set of rules that are simple, technology neutral and sufficiently flexible to deal with fast changing markets in the communications sector will provide greater clarity in relation to new technologies.

In this section, we review several new technologies that can help reduce access gaps. Each of these provides Internet access, and can also be used for VoIP calls. We briefly describe the following technologies:

- WiMAX
- powerline communications
- NGNs.

We also look briefly at two existing technologies, cable and satellite, both of which are designed to deliver video but can also have an impact on broadband access.

Finally, we will also examine emerging business models arising from VoIP.

4.1.1 Broadband wireless access technologies such as WiMAX

There are a number of BWA technologies that have recently emerged or will emerge in the near future. These include high-speed data capable cellular technologies (such as WCDMA, HSDPA, EV-DO etc.) as well as alternative wide-area technologies (such as WiMAX, IPWireless, Flarion, ArrayComm etc.). Below we look in more detail at WiMAX as one example of these technologies.

Development of WiMAX

The WiFi Alliance was formed as an industry grouping around the IEEE 802.11 standard for wireless local area networks. Subsequently, the WiMAX Forum developed as the industry grouping (including Intel) around the 802.16 set of standards for WiMAX. It defines WiMAX as "a standards-based technology enabling the delivery of last-mile wireless broadband access as an alternative to cable and DSL. WiMAX will provide fixed, nomadic, portable and, eventually, mobile wireless broadband connectivity without the need for direct line-of-sight with a base station".

Just as the 802.11 standard has a number of variants (a, b, n, g etc.), IEEE 802.16 also has variants, notably:

- 802.16 focuses on fixed–broadband access
- 802.16-2004 enhances the standard by providing support for indoor CPE
- 802.16e is planned to be an extension to add mobility.

Prospects of WiMAX

WiMAX has a great deal of industry backing at a time when traditional fixed wireless access (FWA) has not yet managed to achieve the self-reinforcing 'virtuous circle' of high demand and lower costs.

There are a number of reasons for the delay in large-scale deployment of WiMAX, including issues relating to regulations and spectrum, as well as delays in the delivery of WiMAX equipment to the market.

For instance, regulators have to decide whether WiMAX will be provided in licensed or unlicensed spectrum. If licensed, there is the question of which frequencies it should occupy. In some countries, the 3.5GHz spectrum is used for WiMAX, though other spectrum bands are also being considered. Furthermore, certification of WiMAX is of a phased nature: although fixed WiMAX equipment has already been released and certified by the WiMAX forum, some vendors plan to enter the market only after mobile WiMAX certification is complete, further delaying deployment.

Nonetheless, given the industry's backing and the standardisation of the product means that it stands a good chance of success.

- The CPE cost for WiMAX devices was EUR200–400 in 2005. It may decrease to as low as EUR85 in 2008, if sufficient volume can be achieved. Common allocations of spectrum across countries will be key to getting large volumes of devices.

- However, the cost of the BTS ('access points') is not substantially lower than mobile networks. Electronics are cheap, but full deployment still needs towers, power supplies, backhaul links to core network etc. Of course, where mobile networks already exist, the infrastructure can be shared with WiMAX providers.

- Industry opinion is clear that WiMAX chips will be built into PCs. However, since PC manufacture is very competitive and unnecessary costs are stripped out very quickly, this might not be the case if there is no perceived value to having WiMAX-enabled PCs. Also WiMAX-enabled PCs might be optimized for campus or nomadic use, e.g. with lower power or omnidirectional antenna, not wide-area fixed use.

BWA technologies are unlikely to be a true competitor to fixed broadband where it is available

In marginal urban areas that are already covered by mobile networks, WiMAX should have relatively low investment requirements and can be a way to provide broadband. Outside fixed line coverage, coverage from mobile networks should be acceptable and is likely to have a larger footprint than cable modem or FWA.

WiMAX and other BWA technologies (such as UMTS-TDD based IP wireless) are attracting a lot of interest as alternative access technologies, primarily for reaching areas that are not covered by fixed networks. WiMAX and other BWA technologies are not a true competitor to fixed broadband where it is available because of capacity and provisioning cost constraints in comparison to wireline networks; however, it may be viable for completing broadband coverage in areas outside the reach of current broadband technologies, e.g. DSL.[17]

For example, there are a number of alternative operators in Western Europe that are deploying such BWA technologies in rural areas outside DSL-coverage where it is likely that sufficient demand for broadband access exists (e.g. DBD in Germany and Broadband UK). There are, however, also some deployments which also cover urban regions (e.g. Yozan in Japan, Irish Broadband in Ireland and Sentech in South Africa).

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17 WiMAX cell ranges typically vary between just 2 and 6km. At straight-line distances of 2.5km, where the performance of xDSL tails off significantly, WiMAX is still able to offer a high channel capacity, particularly in rural areas with little interference from buildings. Thus WiMAX is able to offer an enhanced service over DSL in rural areas. WiMAX is unlikely to be able to compete with fixed broadband in dense regions, however, as, in practice, WiMAX is unlikely to be able to deliver speeds much in excess of 2Mbit/s for large numbers of customers as the channel capacity is shared between all users. For example, a three-sectored base station with a 25Mbit/s aggregate throughput could be configured four different ways to serve (1) 12 customers with 2Mbit/s dedicated leased lines or (2) 125 SMEs with 2Mbit/s broadband with a contention ratio of 10:1 or (3) 375 customers with 2Mbit/s broadband contended 30:1 or (4) 380 time division multiplexing (TDM) channels at 64kbit/s (e.g. for voice). WiMAX is currently also experiencing indoor coverage penetration problems when deployed in the 3.5MHz spectrum band.

WiMAX deployment in the 2.5GHz spectrum band would result in (modestly) more economic deployment, particularly in rural areas, compared to deployment in the 3.5GHz band as cell radii increase in lower frequency bands. Also the industry hopes that some of the indoor coverage penetration problems currently experienced in the 3.5GHz band will be resolved with deployment in the 2.5GHz band.

Like a cellular mobile base station, a WiMAX base station costs around USD100 000 + USD15 000 for the backhaul (mainly to cover tower, site acquisition and installation and will vary depending on the type of area where it is deployed).

While it is possible that WiMAX deployment could be widespread in rural areas, it is worth bearing in mind that high data rates need small cells, and small cells mean more base stations and therefore more investment required by the operators. As a result, many operators will dimension only for low data rates to save capital expenditure.

Regulatory implications of WiMAX

Regulators should encourage mobile operators to dimension BWA networks for higher data rates, ideally by encouragement rather than threats (e.g. lower license fees in exchange for higher data rate services). Regulators should also encourage reasonable 'all-you-can-eat' or 'big-bundle' pricing for data services. However, such initiatives must remain the operator's choice, especially if the service is provided over full-mobility 3G cellular technologies rather than BWA WiMAX. Amongst other things, operators may wish to protect themselves with a clause to prevent excessive downloading or uploading of data that would congest the network. Similar clauses are already in use in some cable and 3G services in the USA, where many cable providers forbid customers from hosting a server in order to prevent uploading significant amounts of data.

4.1.2 Powerline communications

Powerline communications (PLC), also known in the USA as broadband over powerline or BPL, is a method of supplying a broadband service over a country's existing powerline grid. PLC uses the mains electricity cable into buildings as the last-mile broadband access, instead of a copper pair from the local telephone exchange.

To connect, the end user plugs a special modem into any mains power socket in their building. Their traffic is then transferred to a conventional fiber or DSL line for backhaul at a nearby substation. This means of access has the potential to provide an alternative broadband supply to boost competition, therefore putting pressure on prices to decrease, simultaneously increasing broadband capacity.

Technology constraints and advantages

The 'last mile' (where the signal reaches a step-down power transformer before entering the house) has constrained PLC for many years. Recent attempts to overcome this use wireless technology to route the signal around the transformer.[18]

Previous problems of poor service quality for subscribers, due to interference, also appear to have been largely resolved. However, PLC still causes interference for other people in surrounding areas, which may prompt legal and regulatory challenges. There is also a need for an extensive backhaul network and for data security issues to be ironed out.

However, potential advantages of the technology include:

- large amounts of capacity
- equal upload and download speeds
- signal does not fade with distance allowing access to remote customers more easily
- the infrastructure to support the service already exists, and in many countries is more ubiquitous than the fixed line telecom network.

Therefore, the technology allows for a rapid network roll-out and utility companies already have a service background with existing consumer relationships, which should facilitate services being rolled out quickly.

18 At the distribution transformer, the medium voltage (4000–13 000 volts) is reduced to low voltage (110–220 volts) before entering a building. The transformer is only capable of supporting signals that are transmitted on low frequencies and does not allow the (higher frequency) data signals to pass through. Several possible solutions have been developed to overcome the problem that the transformer creates for PLC, either by avoiding the transformer or finding a way through it. One method of circumventing the transformer is to use wireless technology by routeing the data signal to a wireless transmitter before it reaches the transformer. The signal is then sent to nearby access points and thus any signal disruption by the transformer is avoided.

Trial deployments

Since 2001, there have been over 100 trials in 40 different countries. Such trials are typically run by power distribution companies. Examples during 2005 include Electrica (Romania), Cinergy (Ohio/USA),[19] two municipal power companies in South Africa and EDF (France). The Mexican state power company, CFE, is reported to be preparing to offer PLC services imminently on a wholesale basis to licensed operators – CFE says that it has been testing PLC for more than five years.

Despite this large number of trials and announcements, few examples of actual implementation on a commercial basis exist to date.[20]

4.1.3 Next-generation networks

NGN is a generic term used to describe emerging packet-based networks. According to the ITU's definition, an NGN is able to provide services including Telecommunication Services and to make use of multiple broadband, QoS-enabled transport technologies in which service-related functions are independent from underlying transport-related technologies. It offers unrestricted access by users to different service providers. It supports generalized mobility which will allow consistent and ubiquitous provision of services to users.

Converged IP core networks have been rolled out by many new entrant operators since the late 1990s and many incumbent operators such as BT in the UK plan to migrate to these in the next few years, which will ultimately lead to the switch-off of legacy systems such as the PSTN and the transfer of all voice and data traffic to converged IP networks.

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19 "By one estimate, roughly a quarter million homes in the US already had the opportunity to choose BPL services in 2004" (World Powerline).

20 There is limited geographical commercial availability from Tastel in Australia, Speed-web in Austria, Piper:Net, Vype and Evo-AG in Germany, Goal Technology Solution in South Africa, COMTek and Telkonet in the USA.

Benefits of NGNs

NGNs allow telecom operators to offer a full portfolio of services with the following benefits:

- lower operating costs (e.g. for incumbents, means eliminating maintenance of multiple networks)
- faster and lower cost installation of new services for customers (electronic versus engineer site visits)
- improved reliability and increased flexibility.

NGNs provide cost-effective core network infrastructure for new entrant operators as the deployment of an NGN results in substantially (order of magnitude) lower network investment (e.g. an investment of thousands of USD into softswitches rather than millions of USD for traditional circuit-switched equipment) and operational costs (e.g. efficiency, scalability) over a deployment of traditional circuit-switched networks. For example, many of the new entrant alternative operators in Western Europe have already opted for the exclusive deployment of NGNs for their core network (e.g. Smart Telecom in Ireland and Telefónica Deutschland in Germany).

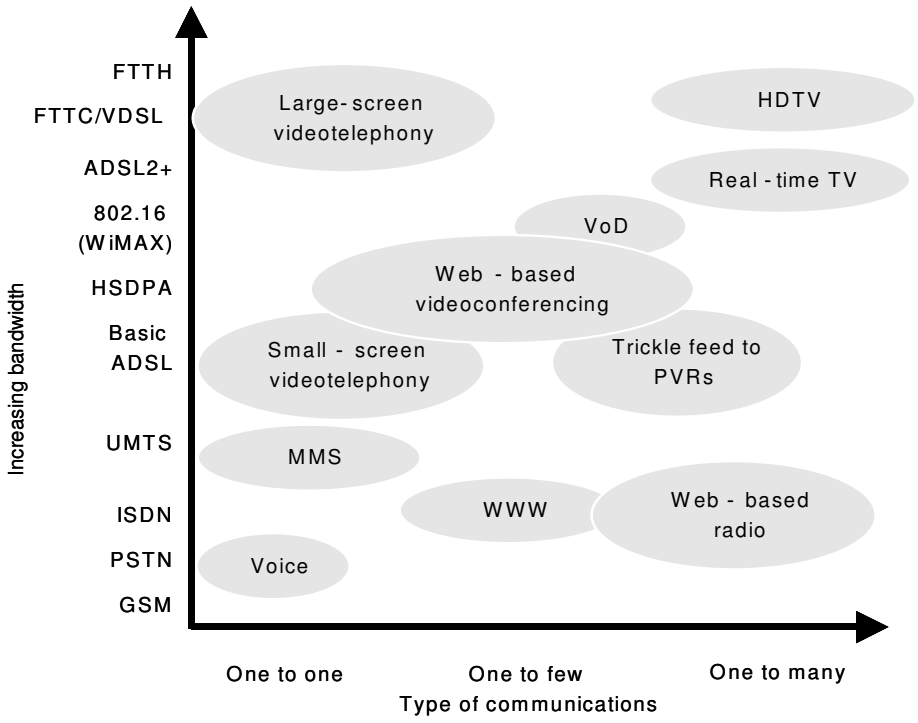

Exhibit 4.2: *Telecom operator's NGN product portfolio [Source: Analysys Research 2005]*

Next-generation voice networks aim mainly to deliver existing services at lower cost

It will be possible to offer new services using NGNs (Exhibit 4.2), although operator business cases are generally predicated on cost benefits rather than any specific new revenue streams. Existing carriers generally envisage that NGNs will be used to support existing basic residential and enterprise services, as detailed in Exhibit 4.3.

Residential services	Enterprise (hosted, managed) services
• Basic call service • Supplementary services • Intelligent network services • Enhanced services	• IP telephony • VoIP VPN • IP centrex • Wireless PBX • Voice telephony with video, collaboration and presence services • Unified communications • Audio/video broadcasting • Multimedia conferencing with presence • Contact centre solutions

Exhibit 4.3: *NGN service portfolios [Source: Analysys]*

4.1.4 Basic characteristics of these new technologies

The basic characteristic of these new technologies is that they provide operators with more efficient methods to either compete with the incumbent operator or to address network gaps that currently exist in Peru (bearing in mind that the viability of PLC still needs to be commercially proven).

- Any alternative operator currently considering deploying a backbone and transmission network is very likely to opt for a converged IP core network rather than an investment in traditional circuit-switched technology because of the savings in deployment and the flexibility it provides going forward.

- BWA networks are commercially more viably to provide broadband access *in areas where wireline networks are not deployed or where broadband wireline access cannot be provided* because of the different network economics associated with wireless compared to the investment into a local loop for each subscriber in a fixed network, as previously pointed out. WiMAX cost drivers generally are very much equal to those of

3G cellular networks and apply equally to wireless broadband network deployment by new entrants as well as the incumbent.

4.1.5 Cable and satellite networks

Importance of existing technologies

In addition to the new technologies described above, existing cable and satellite networks, primarily designed to deliver video services, can have both direct and indirect impacts on the deployment of broadband in Peru.

Cable networks

Cable services can serve two roles in Peru. The cable network provides a very effective way of delivering television services, including domestic and international broadcast and also movies and niche programming. With regard to the fiber upgrades described elsewhere (resulting in hybrid fiber-coax networks), it can also be a very efficient platform for convergence. Modern cable networks can indeed offer the triple play of voice, video, and data services. Furthermore, over the broadband Internet access, other providers can also offer their VoIP services, as described above. Finally, with the advent of IPTV, the fixed telecom operators can potentially offer video and compete in full triple play with the cable operators, and this further stimulates competition. [21]

[21] It is difficult to predict whether IPTV will be offered in Peru. Firstly, there have been are relatively few deployments of IPTV worldwide, and these are in developed countries, so there is little evidence of the success of the technology per se, or the application to developing countries. Second, IPTV is dependent on the length and quality of the copper loops, and often requires expensive deployment of fiber in the network to shorten the length of the copper loops. This can significantly increase the cost of deployment, perhaps prohibitively. Finally, successful commercial deployment of IPTV depends on demand for pay television, which in turn depends on income, number of households with television, availability of programming, etc. We do not have the information to determine whether there will be demand for IPTV in Peru, but would note that it is an interesting technology for leveraging existing telecom networks and will likely be widely deployed over the next five to ten years in general.

Impact of satellite television

Satellite television services, such as Direct TV, are two-way systems that can also play an important role in increasing competition in Peru, both direct and indirect competition. In terms of indirect competition, satellite television can provide video services in remote areas where there is no cable service, and satellite can also provide Internet access (such as e.g. bi-directional broadband services on Hispasat's Amazonas fleet). In terms of direct competition, satellite can also have a significant impact. In particular, the variety and quality of video services that can be provided by satellite could induce cable operators to upgrade their networks to higher capacity, with the side effect that these upgraded networks could also offer cable-modem services. Indeed, it was such satellite video services in the USA which led cable companies to upgrade their networks to be able to offer digital television, and then start offering cable-modem services in order to increase revenues from the upgraded network.

4.1.6 New services

VoIP models

VoIP is a set of technologies that allow end users to use the Internet for voice services. Some, but not all, of these services are very similar to traditional telephony. VoIP offers a wide variety of technical architectures and commercial business models for providing these services.

Broadly speaking, three different types of VoIP can be distinguished (Exhibit 4.4):

- self-provided or outsourced VoIP in company internal networks (e.g. enterprise VoIP)
- VoIP in carrier internal networks
- mass-market retail VoIP services offered to end users.

Enterprise VoIP uses the common IP network with data communications. It is currently widely implemented as a replacement for traditional PBXs or in greenfield sites. However, there remain some concerns about resilience. It is nonetheless increasingly clear that VoIP will

replace PBX as the standard for enterprises, due to lower costs, availability of new services, and easier configuration of the system.

Carrier internal VoIP is effectively the result of an operator moving to an NGN. In this case, the end user is initially unaware of the change. In other words, the end user does not necessarily use an IP device or get access to the Internet. While the 'last mile' remains initially unchanged, the local concentrators and the switches are transformed by the evolution to NGN. As discussed above, NGNs allow operators to offer a full portfolio of services with the benefits of lower operating costs, faster and lower cost installation of new services for customers as well as improved reliability and increased flexibility.

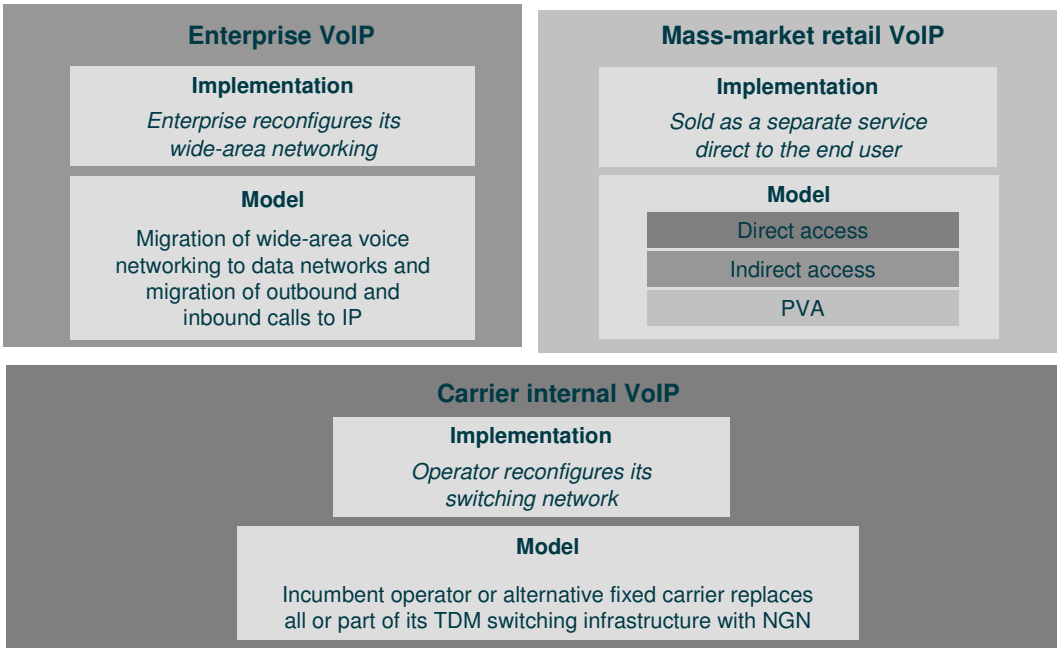

Exhibit 4.4: *Types of VoIP [Source: Analysys]*

Mass-market VoIP

Within mass-market retail VoIP, three main forms can be distinguished (Exhibit 4.5):

- the direct access model
- the indirect access model
- private VoIP applications (PVAs).

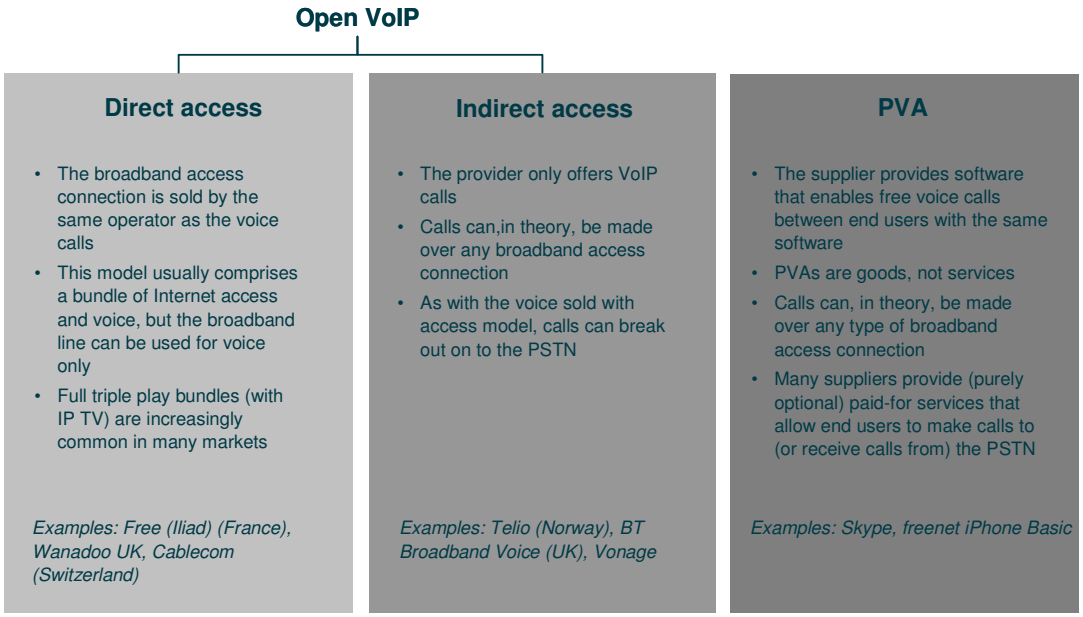

Exhibit 4.5: *Main forms of retail VoIP [Source: Analysys]*

Direct access VoIP

In the direct access model (Exhibit 4.6), if the access network provider and the ISP are the same company, it has greater control over the quality of service. This is the case with incumbent and unbundled services as well as with those offered by network operators using alternative broadband technologies (principally cable modem and fiber).

However, ISPs using a different player's broadband access can also offer retail VoIP in this model. Where a service provider uses another player's access connections, or where it uses shared-line unbundling, the end user will continue to pay a PSTN charge to the incumbent.

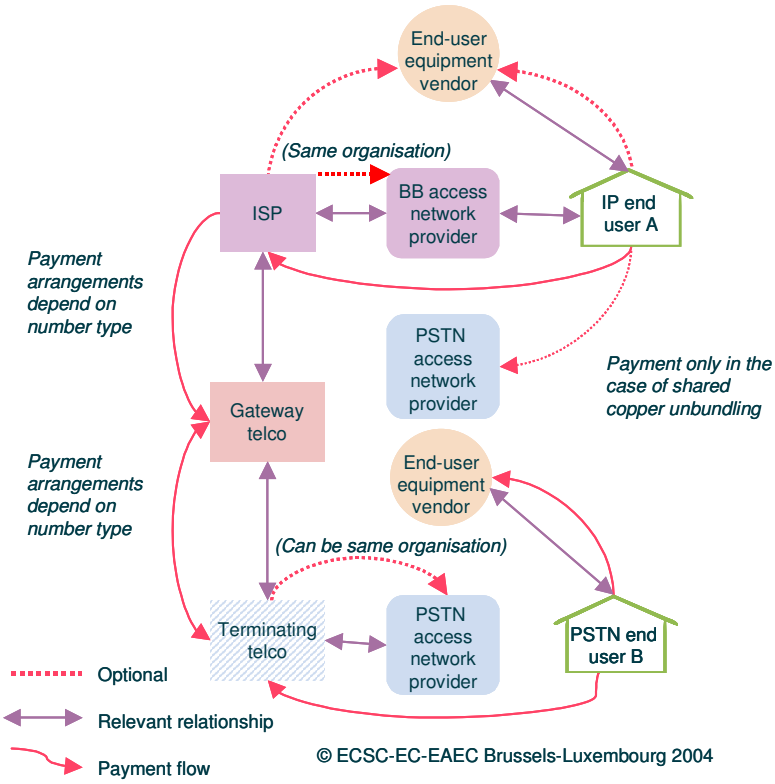

Exhibit 4.6: *Call and payment flow for typical voice sold with access VoIP [Source: Analysys/European Commission, 2004]*

Indirect access VoIP

In the indirect access model (Exhibit 4.7the provider offers calls only, and not broadband access. This service usually provides free on-net calls, and in this respect is little different (at least to the end user) from the private VoIP applications described below. The provider has to pay termination charges to provide calls to the PSTN and the provider's gross margin is made between the retail price of calls and the cost of terminating calls on the PSTN.

If the wholesale access market is competitive and offers cheap calls, the provider's room for manoeuvre in pricing may be limited. Because the provider is not an access provider and little infrastructure is needed, the barriers to entry can appear low. However, without access, the new entrant brand may be weak and customer acquisition costs can be very high.

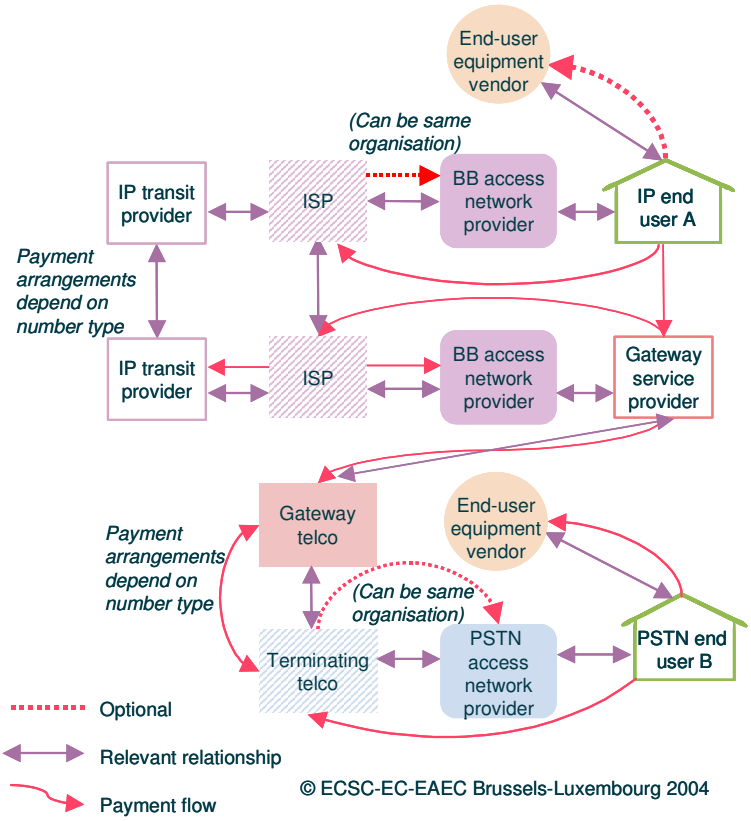

Exhibit 4.7: *Call and payment flow for typical voice sold without access [Source: Analysys/European Commission, 2004]*

Private VoIP applications

PVAs are not services, but software, usually downloaded via the Web. They do not technically require broadband access, but are somewhat impractical without it. Some of these applications have grown out of instant messaging, others have developed from peer-to-peer file-sharing applications.

Internet access charges and equipment costs are usually the only cost for end users. However, nothing in principle prevents a developer from selling the software to end users, or licensing it to a handset vendor or software vendor.

Like the indirect access model, PVAs enable free unlimited calls among islands of on-net users and in theory work on any broadband access network, although use of PVAs may be subject to blocking by private networks, or (in the case of unliberalized markets) by telecom operators.

PVAs do not in themselves enable calls to the PSTN or to mobiles. However, many suppliers do offer this as a service, such as Skype-Out.[22] These suppliers charge per minute for these services, in part to help cover any termination charges. Nonetheless, the rates tend to be very competitive.

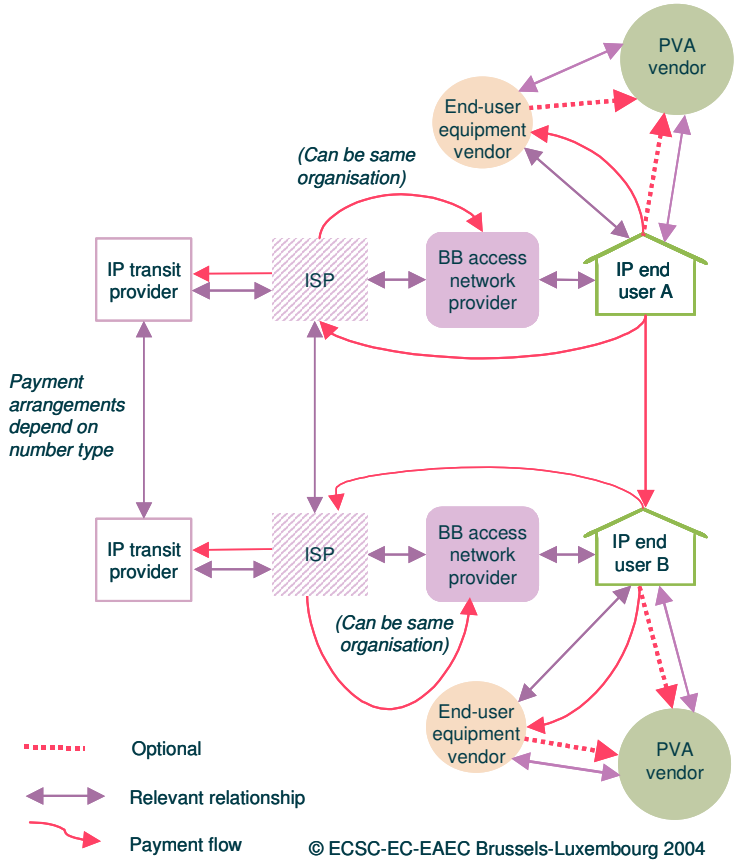

Exhibit 4.8:

Call and payment flow for typical DIY VoIP [Source: Analysys /European Commission, 2004]

22 Skype is classified as a PVA in this report is because it is a software which is loaded onto a computer (unlike e.g. indirect access solutions such as Vonage). Skype can however call out to PSTN connections, and for such usage, some regulators, e.g. in the USA and Austria, are starting to impose emergency access requirements.

Regulatory impact

The indirect access model may have the greatest regulatory impact because the service is very portable, or 'nomadic.' Indirect access VoIP can use a telephone with a standard numbering plan number. To do this, an analogue telephone adaptor (ATA) sits between a broadband connection and the telephone. This box can be taken to any broadband connection while keeping its phone number and 'local' phone plan, allowing, for instance, users in Africa to offer a New York City phone number without the cost of directly calling to or from Africa.

The main regulatory issues arise from the fact that the service is nomadic:

- emergency access – how does the service know who to call when the emergency number is dialled?
- numbering – users in Africa can take 212 numbers to have a New York 'office' and thereby help to deplete the valuable 212 calling range
- network reliability cannot be guaranteed by the VoIP provider as it does not provide the underlying network facilities
- universal service considerations, particularly whether nomadic VoIP services must pay universal service funds and in return whether they are eligible to receive them.

Skype as a typical PVA

However, do-it-yourself services (PVAs) such as Skype can also have a significant impact. Exhibit 4.9 and Exhibit 4.10 illustrate Skype's success in terms of downloads as well as traffic per user.

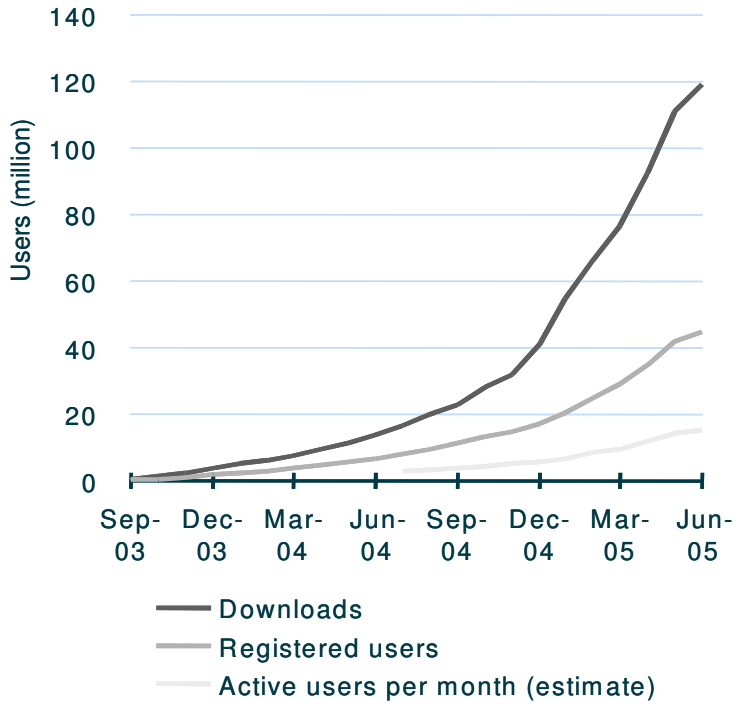

Exhibit 4.9:

Skype downloads, worldwide registered users and estimated active users to June 2005 [Source: Analysys, 2005]

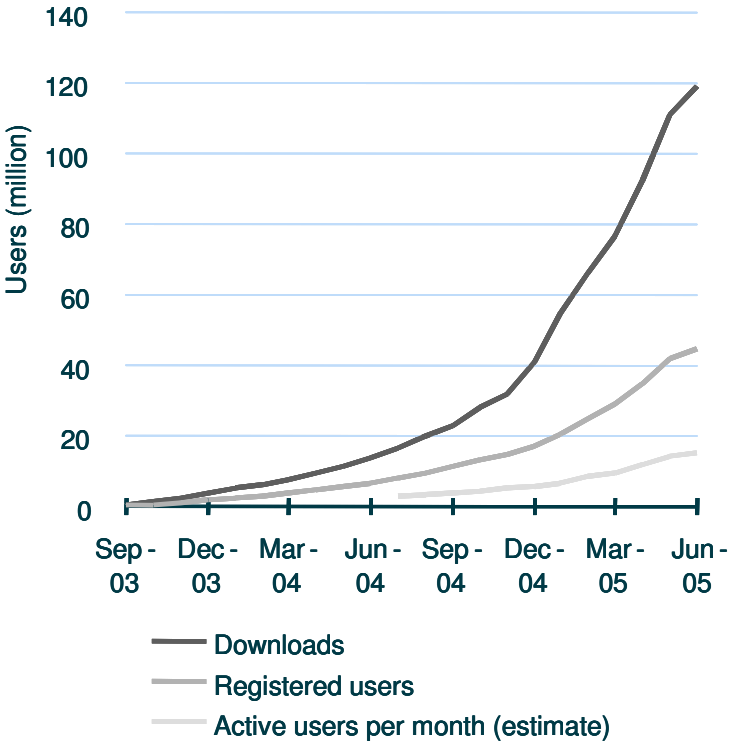

Exhibit 4.10:

Skype minutes of use per registered user and active user, October 2004–June 2005 [Source: Analysys, 2005]

However, it can be noted that Skype's popularity is very different between individual countries as illustrated by the ratio of registered Skype users per broadband subscriber in the different countries.

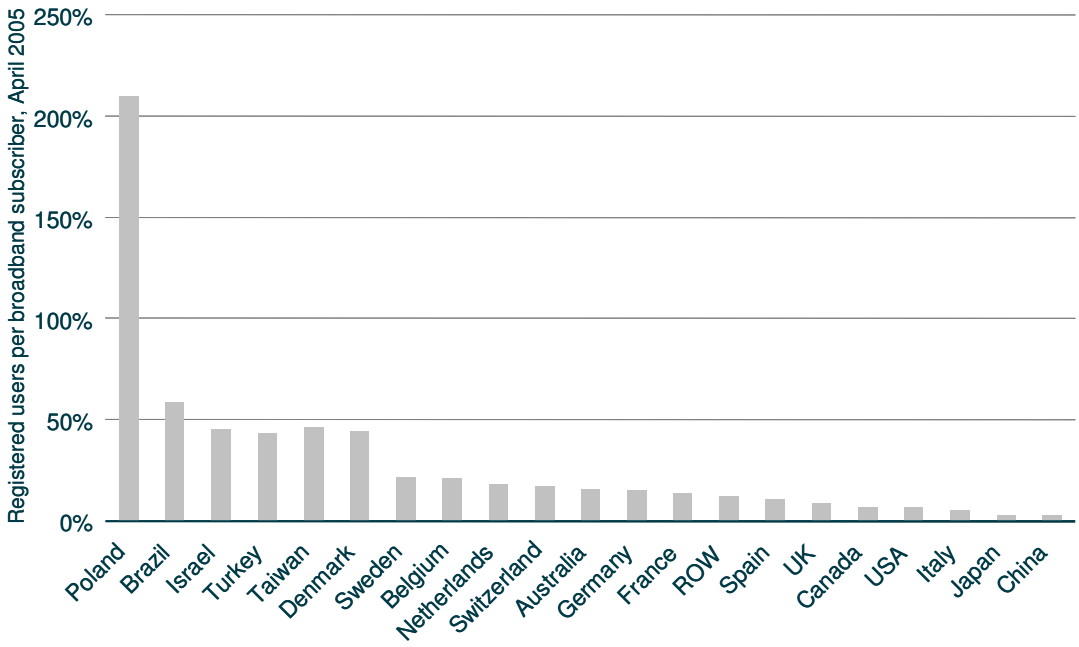

Exhibit 4.11: *Skype penetration as a percentage of broadband subscribers [Source: Analysys, 2005]*

Skype is particularly successful in Poland which is a market with very high call charges but also low broadband penetration (many dial-up users). Countries with a ratio of 50% of broadband users being registered Skype users generally have high telephony call charges and also a moderate broadband penetration.

In Denmark and Taiwan, Skype achieved a successful market penetration of a strong broadband market. In the case of Taiwan, successful partnerships with major ISP and local handset vendors have resulted in significant take-up. In the case of Denmark, the product was exposed very early on.

In a large number of countries, Skype has yet to achieve a substantial penetration, even without any barriers to adoption. For instance, free local calls on the PSTN and relatively low international calling as well as local competition in the telephony market has limited the success of Skype in countries such as the USA.

The main implications of the different VoIP models discussed above on users, service providers and the market in general are summarized in Exhibit 4.12.

Service type	*Impact on user*	*Impact on service provider*	*Impact on market*
PVA model	Option of lower quality, lower price New services Reduced costs	I carry my costs, you carry yours Traffic relies on pre-existing Internet access	Small amount of revenue may disappear from the telecom market
Indirect access model	Additional competition Reduced prices Option of lower quality, lower price New services	Reduced costs New services	Small, but growing Low barrier to entry
Direct access model	Additional competition Reduced prices (free on-net calls and cheap off-net calls) New services	Reduced costs New services	Take-up currently limited in European markets
Enterprise VoIP	Reduced costs New services	(If provided as managed service: Reduced costs New services)	Limited market impact if not managed service
Carrier internal VoIP	International routes – reduced prices National operators – new services Match competitors prices	International routes – reduced cost National operators – reduced cost (one network rather than n networks)	May take years to complete Regulatory costing will change Interconnection could be a cause of disputes

Exhibit 4.12: *Main implications of different VoIP forms [Source: Analysys]*

Impact on the value chain

In terms of general impact, as illustrated in Exhibit 4.13, VoIP causes the disintegration of the traditional circuit-switched telephony value chain which can have a significant impact on competition. Specifically, it allows competition only at the service layer without requiring any significant network investment. Thus VoIP can help meet competition goals but could in turn have a significant impact on the revenues of the incumbent and its traditional competitors. In the case of Peru now is a good time to address these issues as it is less likely that these will be fully anticipated, and thus opposed, by the incumbent.

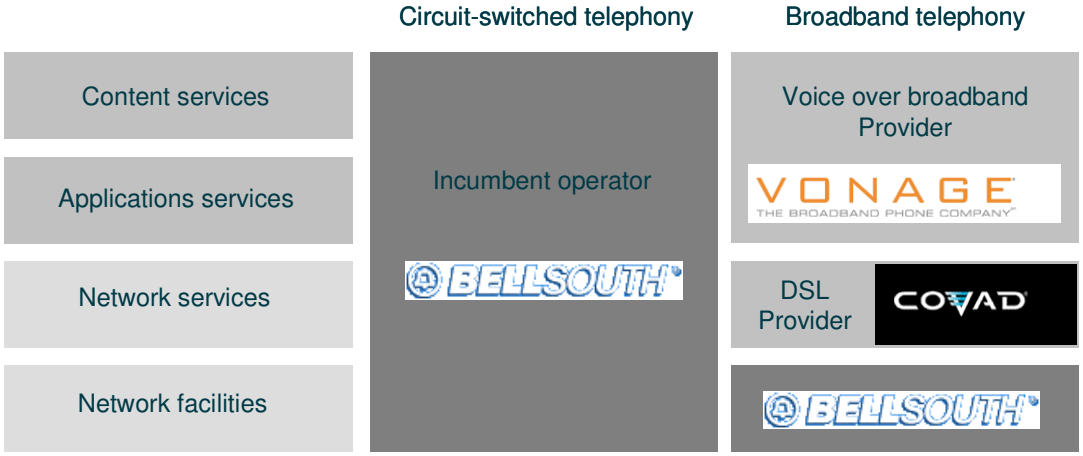

Exhibit 4.13: *Circuit-switched vs. broadband telephony value chain [Source: Analysys]*

Regulatory issues

VoIP also has the ability to help meet social obligations. However, in some countries VoIP can be used to arbitrage remaining universal service obligations. For instance in the USA, VoIP providers can avoid paying above-cost access charges for long distance calls. Also, as described below, providers may also not provide services such as emergency access. For

example, it is possible that in Europe providers do not provide emergency access simply to avoid being classified as telecom operators.[23]

There is also a risk that VoIP might be blocked by the incumbent. While the incumbent does not need to take actions to enable many VoIP services, it could take actions to disable them, such as refusing to port numbers to VoIP services, bundling local access with DSL so that VoIP would effectively double the cost of telephone access, and trying to block or degrade IP traffic that appears to be coming from a VoIP service.[24]

The following policy options are available for regulators to address VoIP:

- ban it altogether
- regulate it like telephony services (licenses, interconnection, USO funding)
- regulate some services in the same way as telephony and regulate other services in a more flexible way, with some possibly being unregulated
- deregulate it completely.

Prohibition

Option 1, prohibition, may not be easy to achieve, and not tenable for 'carrier internal' use. It is therefore likely that it will fail in the long run. Furthermore, stopping architectures that use

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23 This issue has to do a somewhat ambiguous definition of publicly available telephone services (PATS), which is defined by the EU Universal Service Directive as "a service available to the public for originating and receiving national and international calls and access to emergency services". Thus one could conclude that a service that does not provide access to emergency services is not PATS, and is therefore not subject to the obligations of a provider of PATS. Some VoIP providers do not currently provide access to emergency services and can avoid telecoms regulation as a result. For some companies it is also relatively complex and costly to provide emergency services. As such, it may be that some company do not provide emergence access service for economic reasons rather than simply to avoid regulation. In order to clarify these classification issues and provide some certainty, Austria has chosen to designate any VoIP services providing PSTN access as PATS.

24 In March 2006, the FCC in the USA fined Madison River communications for blocking VoIP calls made to its customers, after a complaint made by Vonage. ComReg in Ireland issued draft directions forcing eircom to provide interconnection to VoIP players. The move came after it emerged that not a single operator had been able to activate the 076 number set aside by ComReg for VoIP operators because of lack of connection to the PSTN.

the public Internet to carry the traffic (e.g. Skype and Vonage) is difficult, although it has been tried in a number of countries, including Panama. Most importantly, this option will also mean that the benefits of VoIP are not available.

Enforced convergence

Option 2, enforced convergence, implies regulating all types of VoIP like traditional telephony services. VoIP players would need licenses and would have to abide by existing interconnect and USO funding arrangements. With this option there is a relatively low risk to existing players and market structure, but VoIP would also generate few incremental benefits. It may, however, still be hard to enforce (and, like prohibition, it may help to generate profit for lawbreakers). Certain services such as Skype or voice chat on IM could still be outside regulation, especially if they are free. Vonage and similar models like SkypeIn or SkypeOut would be regulated, however.

Co-existence

Option 3, allowing co-existence, implies regulating certain services like telephony and others in a more flexible way (some possibly unregulated). An intermediate category of service (regulated, but not like telephony) might for example have access to telephone numbers. It brings with it a higher risk to existing players due to increase in competition but is attractive for governments if there are incremental benefits for consumers. However, definitional questions will be difficult to address clearly, e.g. which category each VoIP service is in. Option 3 is how VoIP is currently regulated in Europe.

Deregulation

Option 4, 'free for all', means deregulating VoIP completely. However, consumers may still need protecting and scarce resources, such as telephone numbers, may still need to be managed. Perhaps unsurprisingly, no country has yet taken such a view.

European example

We believe that the European example is a good one. In most European countries, a differentiation has been made between VoIP services that aim to substitute for traditional voice services, from those that will complement traditional voice services. These countries have thus encouraged or imposed full emergency service access and other features of telephony on the former group, while forbearing from imposing obligations on the latter group. This protects consumers seeking a lower-cost replacement for their traditional service, but also allows innovation for new types of services that are not necessarily replacements.

Service categorisation

Whichever option is chosen, there is still the question of how services should be categorized. For this, there are many potential schemes:

- based on business model: Are you licensed (as in China)? Is it free (as in the Philippines)?
- based on architecture: Is it computer to computer (as in Vietnam)? Is it internal to your business (as in Singapore)? Does it rely on the public Internet?
- based on service characteristics: Does it make use of telephone numbers, or provide access to the emergency services (as in the European framework)?
- based on end-user perception: Is it marketed as direct competition with, and as a substitute for, the PSTN (as in the UK)?

Minimum set of VoIP regulations

In order to provide for the minimum regulation regarding VoIP, the management of the national numbering plan as well as consumer protection issues (access to emergency services, consumer education about the different services, unwanted calls, fraud, eavesdropping etc.) need to be addressed. Lawful intercept (e.g. wiretapping), where feasible, might have to be allowed. If taking a liberal view, regulators may also have to intervene to maintain competition, e.g. not allowing dominant players to block access to legitimate VoIP.

Emergency number access

One area where it may be particularly important to protect consumers relates to emergency number access, or more specifically the ability to dial the standard emergency access number (e.g. 911 in the USA) and be connected to the closest emergency response point.

Our recommendation for emergency service access for VoIP is similar to the approach taken in a number of European countries, and is a very pragmatic approach. Under this approach, if the VoIP service in every other way is similar to traditional fixed voice services, most notably if it uses the traditional telephones but is not a nomadic service such as Vonage, then consumers will have a reasonable expectation of the same emergency access as their traditional service, and this should be mandated. On the other hand, to the extent that consumers use services that happen to be nomadic as a replacement for their fixed telephone, they should be able to provide address information that makes emergency number access feasible, and should be given sufficient education and warnings about the implications of not doing so. Finally, we do

not believe that PC-based services such as Skype (which cannot reasonably be deemed to replace traditional phone services) should be subject to emergency service requirements. [25]

4.2 Solutions

The convergence of telecom services and networks has two important ramifications for Peru: A reduction in the cost of providing broadband access and the promotion of voice services over all of these networks. This will help Osiptel meet three goals:

- to promote indirect competition
  - technologies such as WiMAX are cheaper ways to reach underserved consumers
- to promote direct competition
  - VoIP can enable competitors to offer voice services over broadband in competition with TdP without the difficulties of mandating wholesale access
- to promote widespread Internet access and usage.

Short run (Technological neutrality)

Fundamentally, regulators cannot hope to lead converged markets. Regulators will always be slightly behind and some kind of delay in regulation is not necessarily bad. For example, regulating emerging services should not be considered before aspects such as the business model, attractiveness or importance of the service are understood. Beyond this, there are a number of useful principles which can help already in the short run. Regulation has to be

[25] There are several reasons for Skype-Out not to be required to offer emergency access. Firstly, there may not be demand for it. Given that Skype is accessed from a personal computer, Skype is not expected to be a replacement for traditional telecom services that have emergency access. Furthermore, given that Skype users must have Internet access over a wired or wireless connection, they are likely to have telephone service over that same connection, and consequently have alternative access to emergency services. Second, it may be fairly expensive to provide: VoIP is provided as software, and providers are unlikely to have the expertise to provide emergency access. Complications also arise with regard to users' locations: the provider must locate the consumer to determine where the emergency access call should be routed, or customers must themselves enter their new address every time they use Skype. Thus, we feel that the cost will outweigh the benefit to consumers, and could stifle innovation in software-based VoIP services.

technology neutral and an extension of regulation outside the minimum needed is a bad idea. In general, competition law should be preferred to sector-specific ex ante measures as well.[26]

Technology-neutral means that regulation should not refer to the technology used to provide the network or service. Regulation should not incentivize or discriminate between:[27]

- particular architectures – such as the existing hierarchical PSTN, or 'flat' peer-to-peer designs
- certain services – such as nomadic, mobile or fixed
- certain business models – such as pay per minute and per-minute interconnect.

Furthermore, regulation should not assume that a network is used only for a particular service or has a contract with a particular service provider.

Converged regulator

An important element of technological neutrality is also to design a converged regulator. Traditionally, each network only provided one specific service, meaning that a different regulator or division could regulate each service. For example, fixed telephony could easily be regulated separately from cable and mobile could easily be regulated separately from broadcast. With convergence the relationship between service and infrastructure has fundamentally changed. For example, cable can provide telephony, telephone networks can provide television and wireless services can also offer broadband and video. It is therefore

26 In most countries, emerging technologies are not immediately regulated, and thus are initially only subject to competition law rather than any ex ante regulations. In addition to the intrinsic difficulty in regulating each new technology, many of these new technologies can be offered competitively and thus do not require any ex ante regulations, even if they are provided by the incumbent. For instance, many new Internet-based services (IP video, VoIP etc.) face low barriers to entry and thus typically do not require ex ante regulation. Nonetheless, competition law should apply to these technologies as it does to any other product or service, to ensure that the markets stay competitive.

27 It is important to note that secondary effects need to be considered: even if there are no explicit regulatory specifications as to which technology should be used, there may be wider regulatory requirements applying to services that rule out the implementation of a particular technology (e.g. specific signalling requirements for voice telephony).

impractical to spread jurisdiction across different regulators or even different divisions within one regulator. Questions such as who is responsible for voice regulation if it is offered over cable and how PLC would be regulated (if at all) would be difficult to address in the absence of a converged regulator. For this reason, many regulators such as Ofcom in the UK and the MCMC in Malaysia are being designed around technological neutrality.

Use a 'light touch'

In addition to technological neutrality, we believe that authorities should refrain from automatically imposing legacy regulations on new technologies or operators, as meeting these requirements may add unnecessary costs or otherwise delay or deter innovation. This is one version of what is meant by regulating with a 'light touch'.

For instance, quality of service requirements on fixed telephony, typically imposed when there was a regulated monopoly provider of telephony, may have served several important functions: in addition to providing a high-quality and reliable service to end users, these requirements were important to make sure that the regulated monopolist did not neglect network reliability as a result of not having competitive pressure.

After liberalisation, in spite of, or perhaps because of the resulting competition, some incumbent operators argue that the same network reliability requirements should be imposed on competitors, including VoIP providers. This ignores two salient points – firstly, consumers may be willing to trade off lower prices for lower quality, which is certainly the case for free VoIP services such as Skype (although average voice quality is quite good, it can vary), and secondly, one purpose of competition is to allow competitive pressures to determine service features, including quality, rather than regulation. Thus, rather than imposing potentially costly requirements on VoIP providers to prevent potential problems, which could stifle innovation, it may be more beneficial to wait and see whether a market failure emerges that requires regulatory intervention.

Other social regulations, such as imposing emergency access requirements on some forms of VoIP, may nevertheless require regulatory intervention as the cost of market failure may be too high. In the USA, for instance, no such requirements were in place when several accident victims died because their VoIP phones did not have emergency access enabled, forcing the FCC to impose tough regulations. The European approach that we suggest above is a compromise that imposes those regulations only on the services where consumers are most likely to expect emergency access, while relying on consumer education to prevent problems with other services.

Long run (Promote broadband deployment)

In the longer run, promotion of broadband deployment should be an area of focus, for example through:

- increased PC penetration
- continued
- consideration of technology neutrality
- public sector demand aggregation
- allowing for cable competition.

A sufficiently large addressable market for broadband services requires sufficient PC penetration (Exhibit 4.14) as well as a sufficient amount of local digital content (Exhibit 4.15 using the proxy of registered Internet hosts) as precursors.

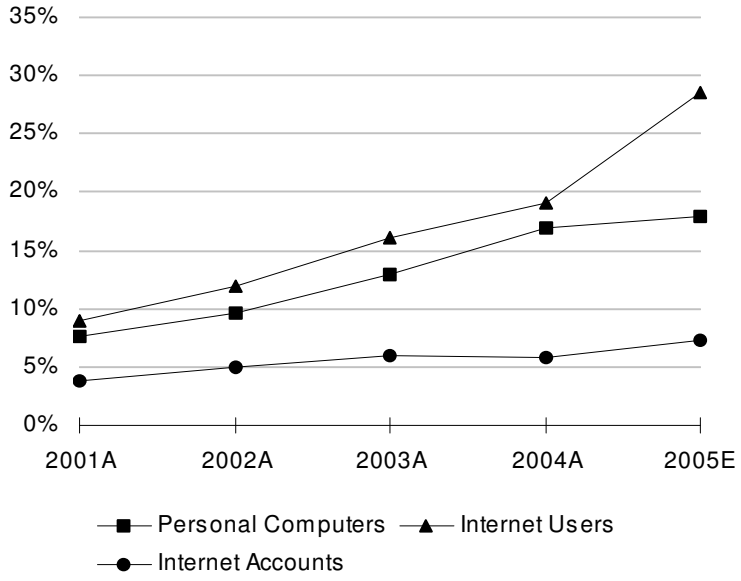

Exhibit 4.14:

Population penetration levels in Peru [Source: Pyramid Research]

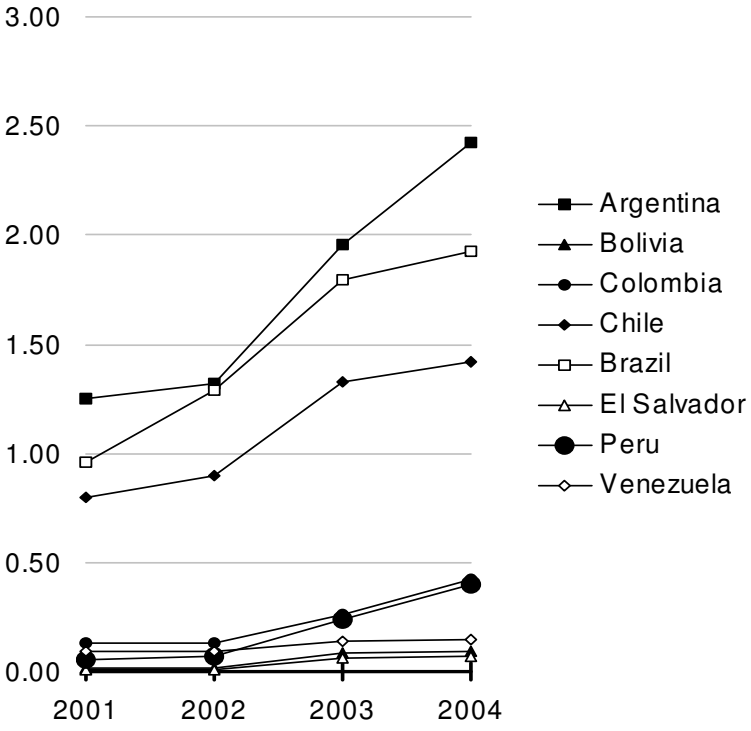

Exhibit 4.15:

Internet hosts per 100 population [Source: ITU]

Also as discussed above, there are a number of technologies available that enable the provision of broadband connectivity in underserved areas. Various advanced wireless technologies provide a platform for high-speed data access and can also be used to expand broadband access. Viable last-mile broadband technologies such as WiFi have already been used extensively to offer broadband access in public places. It is hoped that emerging wireless technologies, such as WiMAX and the continued evolution and enhancement of 3G technologies, will help fill infrastructure gaps in rural and underserved areas. Powerline communications, once commercially proven, could potentially provide an alternative supply over an existing infrastructure.

Demand aggregation

Public-sector broadband demand aggregation can help to drive broadband deployment into rural areas. The public sector can lead demand for broadband connections as the demand for high-speed connectivity from the public sector (particularly educational establishments) is likely to occur before widespread demand from households and SMEs in suburban, rural and remote areas. Public-sector demand aggregation – investment in providing high-speed connections to government institutions (e.g. government departments, schools and universities, libraries, health clinics, Internet community centres) can facilitate network deployment and usage in these areas. Once access (e.g. through fiber) has been deployed to the local government institutes, radio technologies such as 3G, WiMAX and WiFi could be deployed to serve surrounding SMEs and households using the fiber connections.

Competition with cable-modem service

Competition is also very important to promote broadband deployment and adoption. In countries with widespread cable service there is often vigorous competition between DSL and cable modem. For instance, in the USA there are still more broadband subscribers using cable modem than DSL. It is therefore very important to try to create competition between TdP and Telefónica Cable. The most effective way to create competition would be to force Telefónica to divest the cable company. If that is not possible, there are other tools available.

It may be anti-competitive for Telefónica Cable not to offer cable-modem service that otherwise would have been offered but for the merger. In the USA and in Singapore large mergers involving cable operators were only allowed on the condition that the cable operators provide cable open access. Cable open access allows independent ISPs to resell the cable-modem service of the cable operator, but we recognize that there are few areas in Peru that have cable networks capable of providing cable-modem service today. Realistically, only an independent company would have the incentive to upgrade the cable networks and begin to provide cable-modem service.

Competition between facilities-based offerings is impossible when both the cable and fixed line operator are owned by the same parent company: the company would have little incentive either to upgrade its networks to offer triple play, or to allow the two subsidiary companies to compete in price for any individual component of triple play. There are very few examples of such integration outside Peru, owing largely to the potential impact on competition for overlapping services.[28]

The optimal policies for a better market performance in Peru are relatively limited, largely by the fact that the TdP cable operator has not upgraded its network to offer cable-modem service. Thus, while at least Singapore and the USA have compelled cable operators to provide cable open access, it would be difficult to first compel the cable operator to upgrade its network, and then make it available to competitors. Furthermore, the cable open access conditions were imposed as conditions for allowing mergers to take place, at a time when it is relatively easy to impose such conditions on companies seeking merger approval.

Although we are not familiar with the details of Peruvian competition law, typically it is much harder to impose competition policy conditions on companies that are not seeking a merger, because of the need to show the anti-competitive harm that is already occurring and necessitates such action. If cable open access were feasible, it would still receive significant resistance from TdP despite the fact that it is arguably easier to impose than more complicated forms of wholesale access such as unbundled local loops. In both the USA and Singapore,

[28] The leading cable TV operator in Portugal, TV Cabo Portugal SA, is still owned by Portugal Telecom through the holding company PT Multimedia.

mandated cable open access has not been very successful because of resistance by the operator and the difficulty of making a viable business case.[29]

In conclusion, divestiture is the only approach that would enable the cable company to compete fully in broadband access with TdP.[30] The success of such divestiture would ultimately depend on the willingness and ability of the purchaser to make relevant investments in the cable network, but identifying a suitable purchaser could be a condition of the divestiture.[31]

Promote deployment of cable networks

Analysys knows of only two ways to promote entrance or expansion of independent cable operators, which could provide cable-modem service, among other services. These relate directly to the discussion of the market efficiency gap versus the true access gap from above.

- **Market efficiency gap** – if there was a simple market efficiency gap for cable deployment, then Osiptel should find and remove barriers to deployment, which could range from high costs of accessing municipal rights-of-way to lay the network,[32] high costs for the satellite

29 In Singapore, the wholesale rate for cable open access was not regulated, and thus it was set too high to be viable for any independent ISP. In the USA, on the other hand, each cable open access deal had to be approved by the regulator, and thus the cable operator may have had more incentive to negotiate a viable deal with the independent ISPs. Nonetheless, it has been difficult for these ISPs to make competitive offerings, partly because they do not offer the video services that the cable operator can bundle with the cable modem service.

30 The divesture of only the data transmission capability of the cable network, with Telefónica Multimedia retaining the control of the cable television service would not be an appropriate alternative for two reasons: Firstly, the data transmission takes place over the same physical network as the television, and thus it would not be possible to divest only the data transmission portion of the network. Second, the network is shared among users, so any independent provider of data transmission would have to share the network with other providers, including the incumbent, which would limit the broadband speeds and services that could be offered. Cable open access would accomplish the same goal as divestiture of the data transmission capability. Cable open access would work best if Telefónica Multimedia was not allowed to offer its own competing service, but it is still likely that Osiptel would need to ensure that the wholesale price was reasonable.

31 International cable companies that might be interested in opening an international branch in Peru could include the large Mexican triple-play cable operators (e.g. Megacable, Cablemas), NET Serviços from Brazil or Liberty Global which has a number of operations in Latin America.

32 In the USA, for example, municipalities also have significant influence over the rights of way. However, a significant number of states have been very successful in passing laws that impose limits on the municipalities' franchising of operators moving into cable

time needed to send the video streams, and also high cost of accessing content, potentially due to exclusive deals with existing cable companies in Peru.[33] Other barriers could include excessive taxes on televisions, making ownership prohibitive for many users. Removing these barriers will stimulate private investment. It is worth noting that some of these barriers may also exist for upgrading existing networks to be able to provide two-way services such as cable-modem service.[34]

- **True access gaps** – if on the other hand, the efficient costs of network deployment (with all barriers discussed above eliminated) outweighed the potential revenues, then there would be a true access gap. We know of no country that has included cable television deployment in universal service funds, likely because television is viewed as more of a luxury than a necessity, but of course the advent of cable-modem service, and the possibility to offer VoIP using that service, make cable television networks more attractive for meeting public policy goals. In order to increase deployment, in the USA a number of rural municipalities, worried about not receiving broadband Internet access from commercial operators, have deployed cable networks using the rights of way and other facilities owned by the electric utility (which in many rural municipalities, is owned by the municipality itself). These deployments have been relatively successful and have often stimulated the incumbent private operators to offer their own broadband services.

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33 It may be difficult to overcome exclusive content deals, as it is relatively standard that content providers, be they networks, movie studios, or sports teams, make their content available exclusively to increase the return. Although entrants can also bid for exclusive access to the content, they may not have the customer base to be able to bid competitively for the content. If the content provider is part of the same company as the incumbent cable provider, then there can be requirements that content be made available to other providers in order to prevent leveraging of market power – this was done in the USA following cable companies' purchase of networks. For instance, Time Warner owns CNN, and must make CNN available to other cable networks (as well as providing access to competing news channels over the Time Warner network).

34 Traditional coaxial networks cannot provide cable-modem service because of their limited capacity. In order to provide interactive services, cable operators must lay fiber rings close to the neighborhoods so that each 'node' of households served by the coaxial network is no greater than about 1200 households. The resulting network is referred to as a hybrid fiber-coax network (HFC). Barriers to the deployment of fiber in the network could delay or deter such upgrades.

5 Direct competition

We use the term 'direct competition' to refer to competition for existing customers between entrants and the incumbent operator. A large proportion of the customers targeted this way are typically business customers in relatively dense urban areas. The services offered are generally those that combine a low cost of entry with high value to users. In order to compete directly with the incumbent, new entrants typically require some form of wholesale access to the incumbent network, as well as some rules regulating retail competition.

5.1 Direct competition through wholesale access

Direct competition can be divided into two distinct groups, according to whether the alternative operators' entry or competition in the market is based on services or facilities.

As illustrated in Exhibit 5.1, retail competition may come from service-based providers using wholesale access to the incumbent's network (to sell Product B). Retail competition can also come from facility-based providers with alternative networks (to sell Product C). Facility-based competition can also create wholesale competition, with the different facilities competing to sell wholesale services to a service-based provide (to sell Product B).

From the perspective of connection to the incumbent network, facility-based competition simply requires network interconnection, whereas service-based competition requires access to the incumbent's network via unbundled local loops or a resale offer.

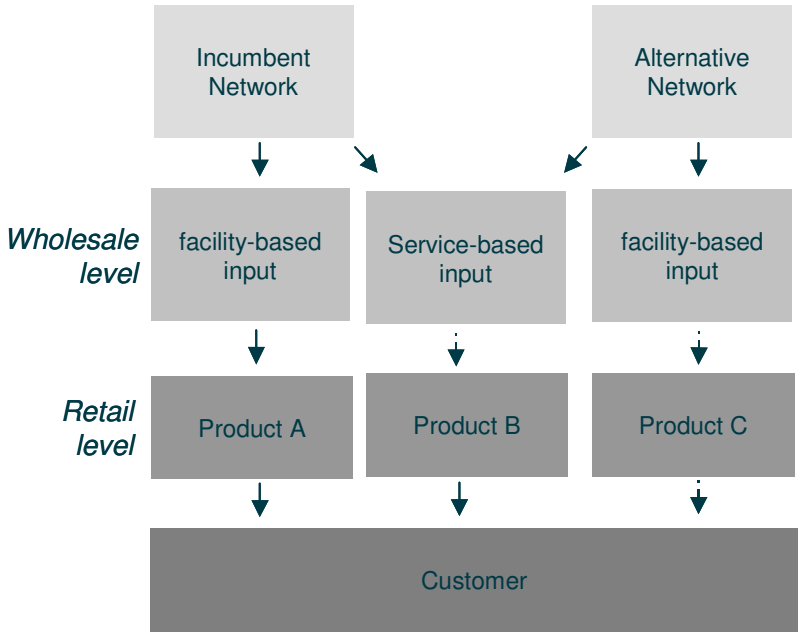

Exhibit 5.1:

Service-based vs. facility-based competition

[Source: Analysys]

Facility-based competition

Facility-based competition can take place between different infrastructures (e.g. wireless vs. wireline). Although some entrants have tried to create facility-based competition by replicating the incumbent's network, this is very expensive and largely an inefficient use of resources. This inefficiency is particularly relevant in developing countries where penetration is typically low and the resources could be better used elsewhere.

The advantage of facility-based entry is that it relies only on interconnection with the incumbent. This allows greater differentiation and innovation in the services offered, and as such can lead to more vigorous competition because competitors can provide their own unique services over their own facilities.

Service-based competition

In comparison to facility-based entry/competition, service-based entry has lower investment requirements for entrants. The key to promoting service-based entry is to set a favourable access price, as entrants' business plans will rely heavily on their access to the incumbent's network. While service-based entry can have a relatively low cost, entrants may struggle to differentiate their services from those of the incumbent, since they are using the same infrastructure.

The impact of service-based entry has been called into question for a number of reasons. First, there are invariably difficulties due to resistance from the incumbent operator, given the latter's reluctance to share its network with competitors. Incumbents also generally argue that cost-based access to existing infrastructure eliminates investment incentives. In contrast to the arguments of incumbents, entrants contend that they need to build up a customer base before investing in facilities.

Ultimately, the incentive to invest – and consequently the level of competition in the market – depends principally on access costs and the ability to innovate.

Wholesale access

The promotion of direct competition in the retail market via service-based competitors requires regulatory attention to both wholesale and retail issues. On the wholesale side, regulators must determine three things: what wholesale access needs to be provided; what is the cost of the access; and what are the procedures for such access.

Regulators must identify what form of wholesale access is required along with other wholesale services in order to promote competition. Exhibit 5.2 illustrates the multiple access points at which service-based competition can take place.

Each of these access points corresponds to a different level of investment required by the entrant with a trade-off between fixed and variable costs: the more of the incumbent's network that is used by the entrant, the lower the up-front investment that the entrant must make, but the higher the wholesale access cost. For instance, with local loop unbundling the total wholesale cost is relatively low, but the entrant must buy its own switches; at the other extreme, with second tandem interconnection the entrant must pay for relatively little infrastructure up-front, but in turn must pay the incumbent more in wholesale charges for the use of the incumbent's infrastructure.

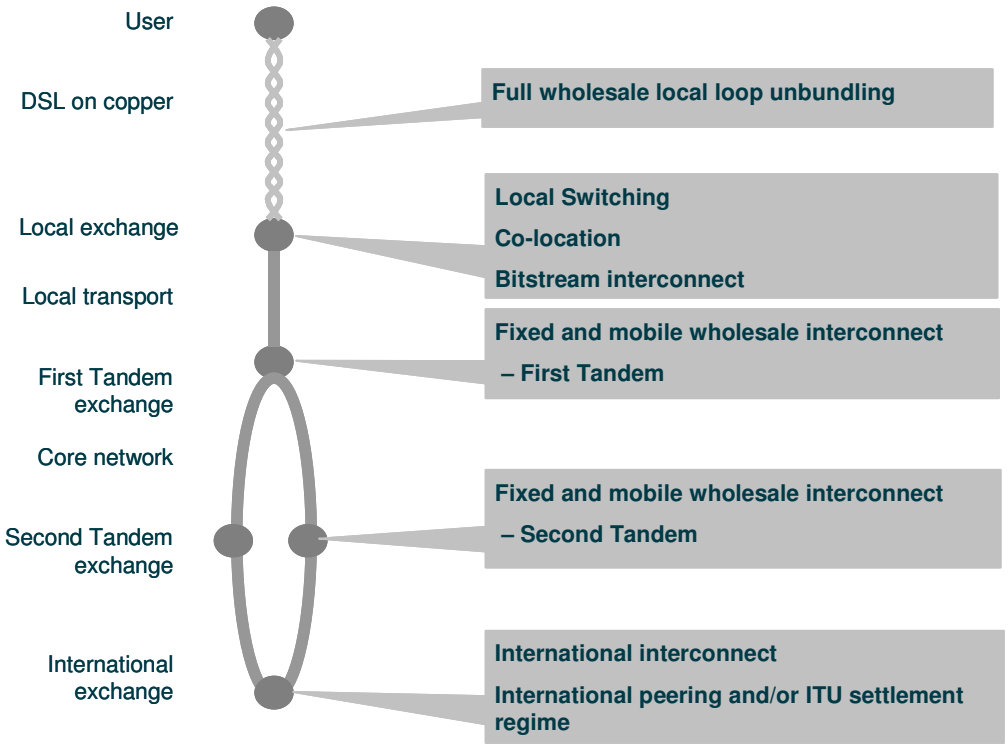

Exhibit 5.2: *Points of access to the incumbent's network for service-based competition [Source: Analysys]*

Wholesale access rates

Having determined the wholesale services available, the next step is to set the wholesale access rates. For all wholesale services, the success of wholesale access is critically dependent upon the cost-basis (e.g. retail-minus or cost-plus) for establishing the incumbent's charges. The impact of this decision is so important because of because of the signal it gives out to competitors and the economic impact on the incumbent. If the cost is set too low, then inefficient entry will occur and the incumbent will effectively be subsidising its own competitors. On the other hand, if the cost is set too high, competitors that would otherwise be very competitive will have little incentive to enter the market.

The accepted best practice in developed countries is for the cost of wholesale access to approximate the cost incurred by an efficient operator to build the network using the latest technology. This is considered to offer fair compensation to the incumbent for use of the network and sends a signal that entrants should only build their own network if they can do so in a way that is more efficient than the incumbent (for instance using a new technology). The preferred methodology for this is long-run incremental costing (LRIC).

LRIC allows the cost of wholesale access to be established, though regulators must decide the best approach for imposing these charges. Often the preferred choice is to pursue a gradual transition from retail-minus/benchmarked wholesale rates through to LRIC (Exhibit 5.3). In Europe this evolution has typically taken a minimum of six months per stage.

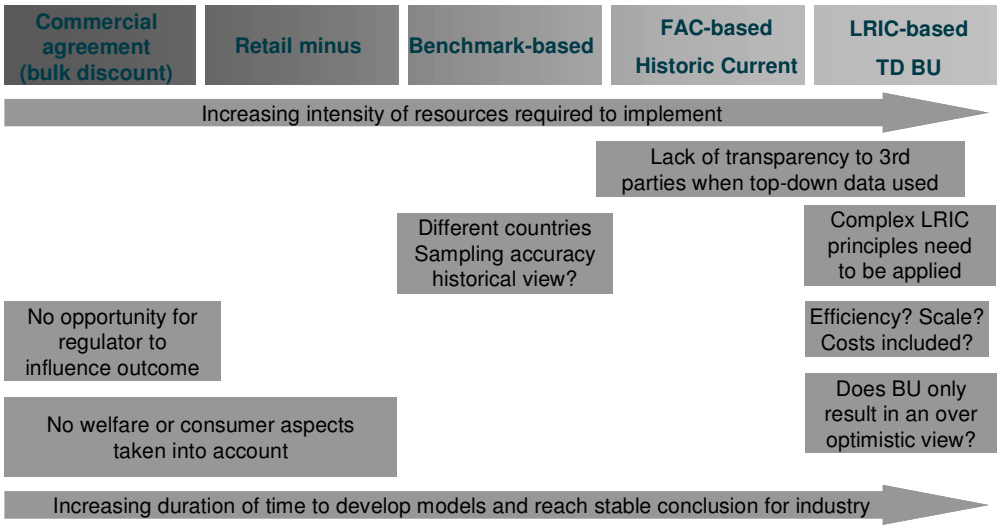

Exhibit 5.3: *Leading the incumbent towards LRIC [Source: Analysys]*

However, LRIC pricing may not always be the best choice, especially in developing countries. LRIC pricing is used to best effect in developed countries where the cost of the incumbent's network was made and amortized during the period of its monopoly. In developing countries, LRIC pricing may not allow sufficient incentive for investment where the network is still expanding. In particular, the incumbent would not be interested in building new infrastructure that would immediately be made available to entrants at cost – the incumbent bases its investment decision on the ability to sell higher-margin retail services to end-users. Finally, even if the regulator decided to use historical cost rather than forward-looking cost to avoid some of these problems, it may be more difficult to determine historical costs in some developing countries.[35]

35 For a critical discussion of the LRIC methodology see "Competition in Telecommunications", Laffont & Tirole, MIT Press, 2000.

Access procedures

The final step is to ensure transparent procedures for accessing wholesale services. In many countries, the incumbent is required to issue a reference interconnection offer (RIO) that provides transparent terms and conditions for entrants' access and/or interconnection with the incumbent's network. Because these terms and conditions must be made available to all qualified entrants, reference offers can reduce the time for negotiating relevant access or interconnection and provides certainty as to the terms and conditions, which is particularly important for entrants trying to raise the capital needed to enter the market. Reference offers can be used for all wholesale services (indirect access, direct access, leased lines and interconnection).

As summarized in Exhibit 5.4, wholesale access is still rather limited in the benchmark countries used in this project. It has to be noted that where such offers exist it is difficult to monitor their success to date because of limited availability of data.

	ULL offer?	*Bitstream offer?*	*General comments*
Argentina	No	No	Telecom Argentina and Telefónica have access to the last mile. An LLU decree from 2000 still has not been completed
Bolivia	Yes	No	
Brazil	Yes	Yes	Line sharing and full LLU are available but have not proved effective in promoting competition
Chile	No	No	After extensive consultation in 2004, the NRA will soon publish a decree on LLU
Colombia	No	No	
El Salvador	No	No	
Peru	No	No	
Venezuela	Yes	No	LLU is still underdeveloped (CANTV still controlling 85% of lines in service)

Exhibit 5.4: *Wholesale access offers in benchmark countries and Peru [Source: GlobalComms, Analysys, Pyramid Research]*

Transition to facility-based competition

Promoting service-based entry in the short run may also promote facility-based competition in the long run. Initially, regulation can encourage entry into markets where significant market power (SMP) is found by setting low access prices for those assets that are costly to replicate. Over time, once entrants build up a customer base and start to earn positive rents, regulators could proceed to increase access prices, starting for those parts of the network that are easiest to replicate. What starts as service-based competition could develop into self-sustaining infrastructure-based competition, as entrants respond to increased access prices by investing in their own networks. However, this is 'investment-ladder' theory is based on the following assumptions:

- Regulators have the necessary information, competence and inclination to 'micromanage' the evolution of competition in the market.

- The fragmented form of competition that access-based entry will promote can be sustained in the long run without the support of perpetual regulation.

Investment ladder

Exhibit 5.5 illustrates the ladder of investment for an entrant offering broadband data services. The investment ladder can be similar for telephony but typically revenue is insufficient (other than for large business customers) without the additional revenues from broadband to move up the ladder to providing one's own infrastructure to the building.

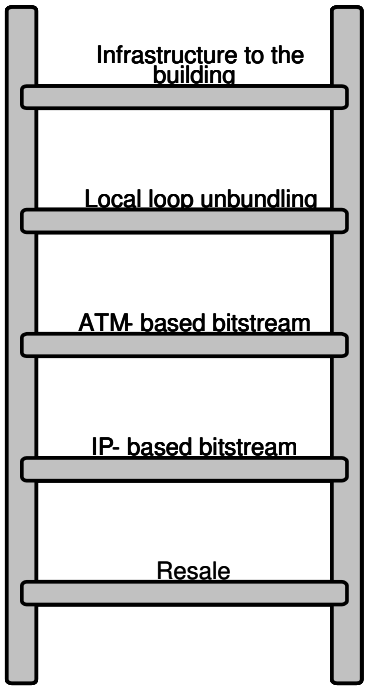

Exhibit 5.5:

Ladder of investment for broadband services [Source: Analysys]

For a new-entrant broadband provider, investment decisions depend primarily on the price of wholesale alternatives. The first step is investment in billing systems for simple resale. The operator uses increasing scale and certainty in revenues from existing customers to move gradually into supply via:

- IP-based bitstream
- ATM-based bitstream
- local loop unbundling
- complete infrastructure to the building.

Sufficient margins must exist between each step to provide the necessary investment incentives for the entrant and, provided that retail prices remain above cost, there will always be scope for a vertically integrated entrant to compete with the incumbent.

5.2 Retail competition regulations

While wholesale access to the incumbent's network is a prerequisite for competition in the market, competitors must also be able to win over the incumbent's customers. To fully promote competition, regulatory attention should thus also be paid to establishing rules governing the incumbent with respect to retail competition. Attention to retail issues is very important if entrants are to compete with incumbents for customers on a 'level playing-field'. While the retail price regime, other retail issues that require regulatory attention include:

- number portability
- restrictions on the incumbent's ability to 'bundle' services
- contractual transparency and fairness
- restrictions on the incumbent's ability to specifically target valuable departing customers.

Number portability

Number portability refers to the ability of end-users to retain their telephone number when they switch operators at a fixed location. Many users are very reluctant to switch providers if that means changing telephone numbers. Number portability is critical for sustained retail competition and is a feature of all countries with healthy competition.

Restriction of bundling

In markets that are already competitive, bundling of services can be an appropriate competitive tool for operators with potential benefits for consumers.

However, an operator with SMP in one market can use bundles comprising various services as a means of exploiting that power in other, otherwise competitive, markets. For instance, an incumbent provider can make an exclusive offer that bundles together local access and long-

distance service. This can have negative impacts on competition in the otherwise more competitive long-distance market, and thus harm consumers in the long run.

There are two clear options for the regulation of bundling by operators with SMP:

- allow bundles to be offered, but only subject to ex-post regulatory supervision
- an ex-ante ban on bundling.

Contractual transparency

Contractual transparency and fairness is important for the promotion of competition as customers must be able to switch providers easily in order to try the services of entrants. There should be transparency in contracts so that customers know the terms and conditions under which they can switch providers. SMP operators should also not be allowed to set cancellation penalties above the cost of non-recoverable investments made to serve a customer.

Preventing targeted 'win-backs'

Finally, if unregulated, the incumbent may be able to exploit its data resources to target specific customers and win back the most valuable subscribers. Incumbents possess significant amounts of data on their customers and competitors and they know which customers are valuable from prior spending patterns. Incumbents also know which customers are about to switch providers when they get requests from competitors for wholesale access to provide service to their customers. They can use this information to gain an unfair advantage in preventing valuable customers from switching or to win them back after they have switched. Unchecked, this scenario makes retail competition very difficult, although regulators can mitigate this by laying down clear rules governing 'win-backs'. Such rules may include forbidding incumbents from making offers to ex-customers for a certain period of time.

5.3 Pitfalls in establishing direct competition

Imposing wholesale access and retail competition is extremely difficult, not least because of the complexity of setting up the system and determining the correct wholesale costs and procedures. It is made substantially more complicated by incumbents' often vigorous opposition the creation of competition in a market that they control. This opposition can be very effective, because entrants, via wholesale obligations, rely on the incumbent's network for access. Furthermore direct competitors must also take retail customers away from incumbent, despite the incumbent's advantage of greater knowledge about its network and its customer than the competitors or the regulator. Incumbent operators will usually try to exploit this information asymmetry to its maximum advantage.

Although incumbents' attempts to thwart competition are by definition anti-competitive, competition policy cannot be relied upon to promote direct competition until the markets can be judged to be fully competitive. There are several reasons for this.

First, while the incumbent still holds market power, ex ante regulations are necessary both to create competition (via wholesale access and interconnection) and to sustain it (via retail competition regulations and enforcement).

Secondly, ex post competition policy would be unlikely to provide a timely means of creating or protecting competition, given the time that it takes to make an affirmative determination that there has been a violation of competition policies. The company suffering from anti-competitive actions may not survive long enough to benefit from any remedy, and other companies would be less likely to enter the market if they had to rely on competition policy to protect them from anti-competitive harm.

Thus, rather than relying on competition policy to protect competition, it is better to draft comprehensive ex ante regulations and vigorously enforce them, as described below. This is difficult to do in practice, however, and that is one reason that we recommend a focus on promoting indirect competition rather than trying to impose direct competition via wholesale access regulations.

Looking at the experience of regulators in markets around the world, a number of developing countries around the world have imposed wholesale access obligations in the last few years. In addition to the few regional benchmark countries outlined in Exhibit 5.4 above, Pakistan, Malaysia and Egypt have all taken this step, although none of these countries has yet seen significant take-up of these wholesale access services by alternative operators.

On balance, we believe that promoting direct competition in Peru should not be a priority for Osiptel. This is because it is very difficult to mandate wholesale access given the reluctance of incumbents to share their networks with competitors. Furthermore, it is unlikely that many companies will invest significantly in duplicating the existing facilities of TdP.

We believe that Osiptel's focus should be on indirect competition: the most immediate issue in Peru appears to be access, and the emphasis should therefore be on ensuring that it is attractive to enter markets that are not yet covered by other operators. In addition, the promotion of convergence should be an important aspect for Osiptel as new converged technologies have lower costs than existing technologies and also promote Internet access. As outlined above, VoIP allows service-based direct competition without having to regulate wholesale access as described here.

5.4 Interconnection

Interconnection is fundamental to any kind of competition and access, including the indirect competition that we stress above, as well as VoIP competition that we stress below. In order to provide telephony services, competitors must be able to complete calls to or from all existing subscribers:

- using any type of technology, including fixed or mobile, PSTN or VoIP
- via direct or indirect competition
- in the short run as competition is introduced
- in the long run even if competition is effective.

It is easier to regulate interconnection than it is to regulate wholesale access. Whereas the incumbent has market power over wholesale access, control over interconnection is not held entirely by the incumbent: entrants must carry voice calls to the customers of the incumbent, and the incumbent must also carry voice calls to the customers of competitors. The overall traffic flow is often balanced even if the size of the networks are not balanced. The charges for carrying traffic from another network can be calculated in a number of different ways, though the different approaches are considered to fall into on of three distinct types:

- time-based interconnection
- capacity-based interconnection
- bill-and-keep.

Best practice has emerged in the industry in developed countries to establish fair compensation for the incumbent for the interconnection cost per minute, which is reflects the cost incurred by an efficient operator building the network based on latest technology. Generally, the methodology used for this is LRIC. But as outlined earlier, LRIC costing may not always be optimal for developing countries because it may be difficult to establish the historical cost of the incumbent and the cost of the incumbent network might not have been amortized since the monopoly. Also the incumbent's network might currently still be expanding and LRIC may not give sufficient incentive to expand.

Time-based interconnection

Most narrowband voice interconnection schemes are based on metered time units. This allows relatively easy identification of whether a margin could be made, given that retail prices are also expressed on a metered basis. Entrants are able to use these characteristics in a way that approximates a form of insurance.

Capacity-based interconnection

Capacity-based interconnection offers certain benefits to both the incumbent and alternative operators. Capacity-based charges are not calculated according to the minutes of usage, but rather are based on the capacity of the interconnection port. The price is generally set so as to cover the total costs of the infrastructure needed to connect users to this port and is paid for in totality by the alternative operator. The alternative operator purchases PSTN capacity to reach the point of interconnection from the incumbent and has the burden of managing it efficiently.

Capacity-based interconnection is a different way of paying for interconnection, but it does not require any specific technical changes to the network. From an incumbent's perspective, costs are always driven by peak-time capacity needs regardless of the notional transfer prices that are used.

Capacity-based interconnection entails advantages and disadvantages for both the incumbent and alternative operators. While it gives alternative operators increased flexibility in retail product development, minimum capacity commitments increase risks. For the incumbent, despite initial inexperience with the scheme, it makes network capacity and revenue planning easier.

Colombia is currently the only country in Latin America with a capacity-based regime for narrowband voice interconnection. The Colombian regulator CRT introduced the *Regimen Unificado de Interconexión* (RUDI) in 2002 in an attempt to reduce interconnection costs and to facilitate interconnection negotiations and stimulate convergence and efficient use of existing infrastructure with as little intervention as possible. RUDI introduced capacity-based interconnection charges, according to which the alternative operator pays a flat charge based on its anticipated peak traffic, which is measured in terms of capacity (numbers of E-1 circuits). The charges are calculated on the premise that the interconnection provider recovers its costs of operation, network maintenance, plus sufficient profit, independently of the traffic volume. The alternative operator that purchases capacity assumes the risks associated with traffic fluctuations.

The stated purpose of the change to capacity-based interconnection in Colombia was to reduce retail tariffs for voice and data (flat-rate tariffing) as well as promote Internet take-up. But as indicated by Exhibit 5.6 and Exhibit 5.7, it is difficult to identify an immediate positive impact of this scheme for the Colombian end-user because neither a significant reduction in end-user voice calling charges nor a significant increase in dial-up Internet penetration has yet been seen.

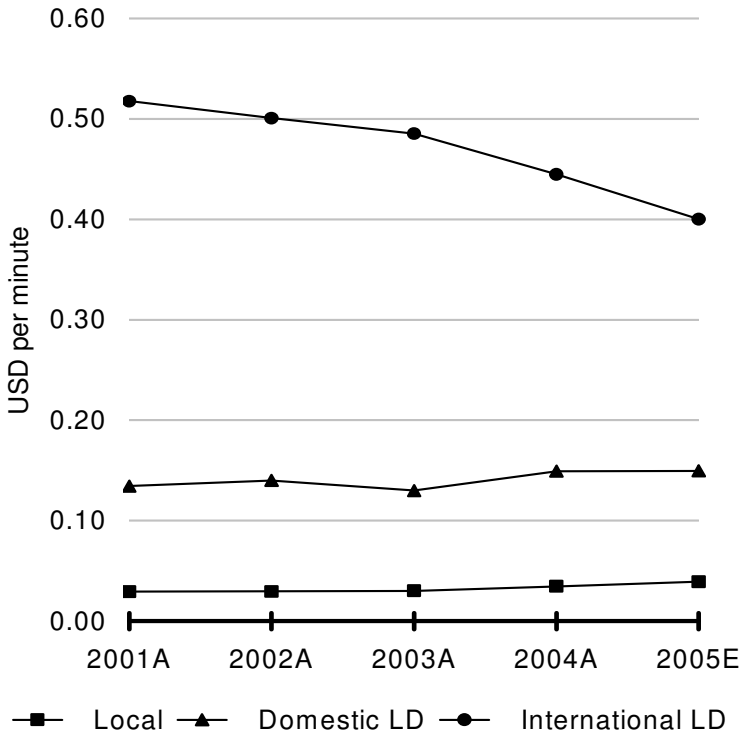

Exhibit 5.6:

Fixed voice revenue per minute in Colombia [Source: Pyramid Research]

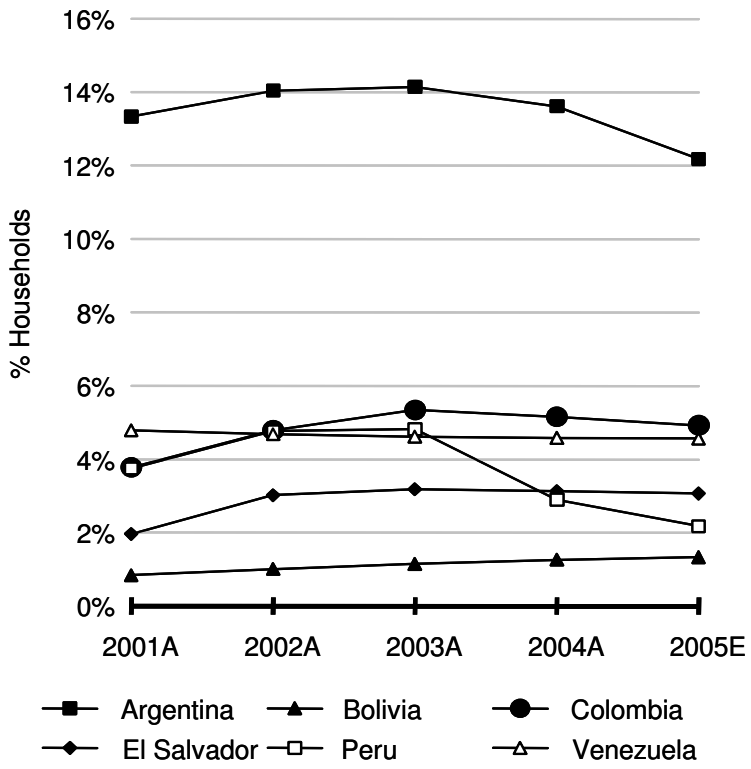

Exhibit 5.7: *penetration of narrowband Internet in Colombia and benchmark countries [Source: Pyramid Research]*

In Europe, capacity-based interconnection was discussed mainly in the context of interconnection for dial-up Internet traffic. In 2000 the UK regulator obliged BT to provide a capacity-based call origination product called flat-rate Internet access call origination (FRIACO). FRIACO, the world's first interconnection rate based on capacity pricing, is a wholesale product purely for dial-up Internet access.

The product has generally proved popular with ISPs and led to a wave of product development, including the availability of unmetered and partially unmetered dial-up Internet offerings. FRIACO was seen as a vital remedy to put independent ISPs on a level playing field with the vertically integrated ISP of the incumbent, BT.

For dial-up access (which was the most common method for Internet access at that time), capacity-based pricing is seen as a more efficient way of pricing interconnection because of the particular call characteristics of dial-up Internet calls (long call durations, maximum usage generally occurring in off-peak hours).

Following FRIACO, the CaBIS capacity-based interconnection product was introduced in Spain in 2002 also with a view to promoting flat-rate dial-up Internet offerings. Alternative operators lobbied for the introduction mainly to be able to offer flat-rate dial-up Internet services. Capacity-based interconnection in Spain is offered for any switched traffic (voice and dial-up). As with FRIACO in the UK, the main justifications for this product were to provide:

- incentives to optimise use of capacity
- more flexibility for design of ISP retail services
- possibilities for alternative operators to offer the same retail services as Telefónica de España.

Telefónica de España continues to offer both interconnection models: metered and capacity-based. This is required in order to mitigate against higher risk for the alternative operators if only the capacity model was available. The selection of the interconnection scheme in Spain is based on interests and characteristics of the alternative operator and also depends on areas where traffic volume is low and where it would not be profitable to use the capacity model.

The introduction of the capacity-based interconnection regime in Spain required revision of the costing methodology applied to interconnection charges. Spanish capacity-based interconnection rates are priced according to the point of interconnection (local, metropolitan, single and double transit) as well as the capacity purchased (64kbit/s, 2Mbit/s, n × 2Mbit/s). The charges are based on cost and were initially orientated on previous metered voice tariffs. However, it required the introduction of new criteria for cost allocation/drivers as well as review and new approval of cost attribution methodology and calculation of costs for product groups (also known as activity centres).

There are pros and cons to capacity-based interconnection for both incumbents and alternative operators. For incumbents, capacity-based interconnection enables easier capacity planning, easier resource allocation as well as planning of interconnection revenues independent from business evolution of alternative operators. On the other hand, incumbents are inexperienced with this scheme and different traffic patterns by dial-up Internet access users may adversely affect network dimensioning.

For alternative operators capacity-based interconnection will increase the flexibility of service design as well as allow better allocation of costs to the resources actually used and costs will independent of time of day and in inverse proportional to volume. However, requirement of minimum usage and long-term commitment increase risks and required higher precision of demand forecasting and planning.

The use of capacity-based interconnection is expected to grow as VoIP traffic increases with peering principles being applied to underlying IP networks. Today, backbone operators typically manage interconnection through a combination of peering and transit arrangements. Peering is a bilateral arrangement between two similarly-sized backbone operators to exchange traffic originating from, and terminating with, their own customers, with no settlements exchanged.

The alternative to peering is transit, typically the type of arrangement that smaller IP operators enter into with a larger IP operator. This sets out payments for use of the capacity of the connection between the backbones, rather than the actual amount of traffic exchanged through the transit connection.

IP interconnection arrangements could be relevant because VoIP could be pulled towards capacity-based rather than per-minute interconnection charging, which would tend to lead to flat-rate retail pricing. Also new core IP networks may adopt peering, thereby eliminating interconnection payments and facilitating the migration to bundled retail rates without the risk of high outflows of termination payments. Furthermore, if interconnection fees were incorporated into NGNs to the extent that they were cost-based, they would be likely to be relatively small compared to current PSTN interconnection costs (indeed the lower cost of NGNs per unit traffic is a key motivator for operators now rolling out NGNs).

Bill-and-keep

Bill-and-keep is a system where neither side pays the other for termination of traffic. One immediate impact is that this saves money on billing systems and services. It can be very effective under the right circumstances, in particular, when:

- The amount of traffic flowing between networks is roughly equal.

- The interconnection service provided is the same for both operators (for instance, if both operators provide each other with local termination). However, if one operator provides transit to the other operator this must be paid as it would otherwise not be an equivalent exchange of services.

There are numerous examples of bill-and-keep. Peering between backbone operators is a form of bill-and-keep; mobile operators in Singapore do not charge each other for terminating calls; in the USA the FCC allows operators to negotiate bill-and-keep for local call termination.

Benchmarks

Most regulators in this project's benchmark countries have implemented cost-based models to calculate interconnection rates as summarized in Exhibit 5.8.

	Interconnection regime	*Pricing methodology*	*Comments*
Argentina	Commercial agreement	LRIC	Regulator is currently developing a LRIC model with the operators
Bolivia	Imposed by the NRA + commercial agreement	Price cap	A LRIC model is currently being reviewed by operators
Brazil	Imposed by the NRA	-	A tariff calculation model (based on LRIC) will be available for the period 2006-2008
Chile	Imposed by the NRA	Cost orientation [1]	Model is based on an efficient operation, with incentives for the incumbent operator to move to new technologies
Colombia	Imposed by the NRA	LRIC	Introduction of capacity-based interconnection in 2002
El Salvador	Commercial agreement	LRIC	
Peru	Imposed by the NRA	LRIC	Switch to capacity-based interconnection charges currently considered
Venezuela	Commercial agreement	Cost orientation [1]	NRA is not authorized to intervene unless and until the parties have failed to reach an agreement

[1] No information on the actual methodology

Exhibit 5.8: *Basis for interconnection charging in Peru and the benchmark countries [Source: ITU, World Bank, Analysys]*

Broadly speaking, the current metered interconnection rate in Peru is well within the range of the benchmark countries (Exhibit 5.9). However, reaching a meaningful comparison of interconnection rates is not straightforward because the costs of interconnection will be influenced by different network and country topographies and the levels of interconnection (local, single tandem, double tandem) might be defined differently. A high-level assessment of local interconnection tariffs from the incumbent operators in the benchmark countries indicates that cost of interconnection is particularly high in Bolivia, where those rates are not cost-based.

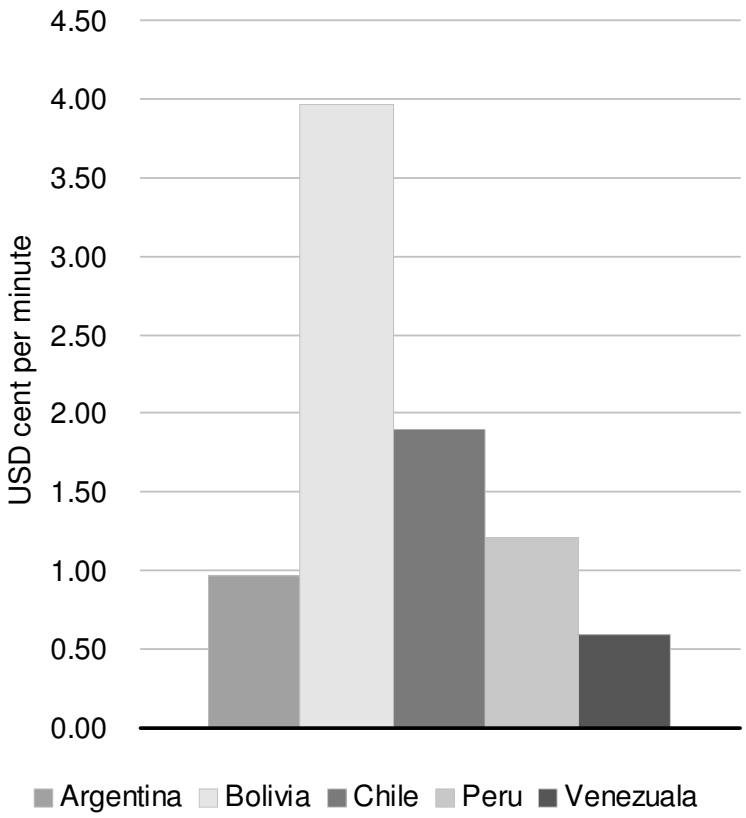

Exhibit 5.9: *Local interconnection tariffs (2005) [Source: Regulators' Websites]*

There are certain advantages to charging for interconnection on the basis of the capacity utilized. The benefits are derived mainly from the simplification of billing and planning and the fact that flat-rate dial-up Internet access can also be offered by alternative ISPs.

However, even with capacity-based interconnection there remain some challenges. In particular, the cost of interconnection must be determined, whether for capacity or metered access and the incumbent can still leverage SMP over interconnection terms and conditions as well as identifying the points of interconnection.

Bill-and-keep can be considered a long-term option as it reduces many costs of billing and negotiating interconnection and allows for a transition to IP-based systems (voice and data). It is, however, unlikely to be accepted in the short-run given the SMP of TdP.

Regardless of the chosen form of interconnection charging it is important to have in place procedures for monitoring interconnection agreements and enforcing the regulations, which will be discussed in the next section.

5.5 Solutions for establishing direct competition

Short-run solutions

Interconnection and monitoring and enforcement of these rules

Provisioning of an adequate interconnection environment at adequate cost-based wholesale rates in a transparent and non-discriminatory manner, by means of publishing a reference interconnection offer, is crucial to facilitate facilities- and service-based competition.

It is also crucial to be able to rapidly detect anticompetitive actions and to impose sufficient penalties, with a view to preventing such problems from occurring in the first place and acting to terminate such problems when they do arise. For example, in the USA incumbents took advantage of paper-based LLU requests to delay switching customers to competitors' networks.

Role of monitoring and enforcement

Monitoring and enforcement are therefore a vital element of all regulation. Monitoring is essential for promoting competition and preventing anti-competitive actions. Rules to monitor the incumbent to detect anti-competitive actions on the wholesale level should cover access requests, access provisioning, quality of access as well as imputed cost of self-provided services. The quality of the wholesale service and cost of interconnection services must also be

monitored. On the retail level, monitoring must cover tariffed services and their quality of service.

In order to monitor the incumbent's behaviour the incumbent must provide information about access requests, provisioning and about the quality of access on an ongoing basis on the wholesale level as well as information about imputed cost of self-provided services. On the retail level, the incumbent must provided information regarding tariffed services and proof that the actual prices fit within tariffs. Furthermore, information about quality of retail services provided, such as provisioning times, down times and response times.

Monitoring

Monitoring provides information to both the regulator and competitors regarding the actions of the incumbent. It provides the evidence to determine whether there has been discrimination, and competitors can also compare this information with their own experiences to determine whether they are being treated fairly. Monitoring issues can be included in the terms of relevant reference offers.

A central access database to process and report on all relevant information regarding competitors' access requests and the incumbents' responses could be helpful. This could be operated by a neutral third-party the way that the US FCC assigned NeuStar to administer local number portability and wireless number portability. A central monitoring system could have information about the reference offer (type of access is available, where it is available, the cost of access at each point and service level agreements), about the rules (time allowed for responding to each type of request, rules regarding discrimination between the incumbent and competitors), about access requests by competitors (all requests for access service and maintenance of existing access for all subsidiaries of the incumbent as well as the competitors) and the incumbent's responses to these requests (when it will provide the requested service or provide justification for denying service). The system should also include reports on when the parameters in the reference offer or the rules have been violated which can be made publicly available via the Internet.

Enforcement

Enforcement of competition rules is vital to punish and deter anti-competitive actions. On the wholesale level this covers the prevention of discrimination (quality, wholesale tariffs), arbitration of access disputes as well as penalties to deter recurrence of anti-competitive behaviour (discrimination and not complying with access rules). In order to cater for efficient arbitration of access disputes, procedures and timeframes for access disputes need to be defined.

On the retail level, attention must be paid to the prevention of abuse of SMP (quality levels and retail tariffs), formal complaints by competitors and informal complaints by end-users as well as appropriate penalties. If SMP is abused or for other valid complaints, penalties must be imposed.

Prevention of discrimination

It is important that the incumbent does not discriminate either in its own favour versus an entrant, or in favour of one entrant over another. There are a number of tests available to determine when there is discrimination. These include:

- margin squeeze (imputation) test
- test for non-discrimination in quality
- test for non-discrimination in delays for provisioning access.

A margin squeeze occurs when a vertically integrated company such as an incumbent charges its competitors more for wholesale services than it charges end-users for retail services. The regulator should construct a test to ensure that sufficient margin exists between retail and wholesale services such that an efficient entrant can make a reasonable return on investment.

The regulator should also compare service quality for wholesale services with that for the incumbent's retail services where the same facilities are used. Remedies should be imposed

when the incumbent's retail services have consistently better service quality than those of competitors using wholesale services.

Where services are comparable, the regulator should also ensure that wholesale services are provisioned at the same speed as the incumbent's retail services. For instance, retail customers of the incumbent should not consistently receive DSL service faster than wholesale customers receive access to wholesale line rental with DSL service.

The enforcement rules should then be very clear. Parties need to be informed when rules have been violated. For many violations (e.g. failure of incumbent to meet access deadlines) enforcement should be automatic. For violations that require arbitration, there should be firm deadlines regarding the timing. All parties (entrants, incumbents, end-users and the regulator) should have the ability to request arbitration or other forms of enforcement. Deadlines for each step of enforcement should be explicit and reasonably short.

Penalties

If a complaint is upheld, penalties must be imposed. Penalties are implemented to have two effects: to compensate the complainant for damages and to deter the infringing side from engaging in such actions in the future. For instance, the penalties could equal the lost revenues caused by the actions to compensate the complainant plus remedies for damage to the reputation of the entrants. In addition, repeated sanctions against the same party should result in escalating penalties to add deterrence value. Asymmetric treatment of providers with SMP can be used to prevent abuse of SMP from causing irreversible harm to entrants. SMP operators should not be able to use the arbitration procedure to unreasonably withhold funds from entrants in order to weaken their market position. Penalties for operators with SMP can be trebled to prevent repeated abuse and a company without SMP that loses an arbitration case that they initiated should only have to pay minimal costs for the arbitration.

In its latest report on domestic enforcement of telecommunication law[36], the ITU discusses enforcement, amongst other examples, in the markets of Burkina Faso, Egypt, Kenya, Morocco, Tanzania, Uganda, Bolivia, Brazil and China. It concludes with, amongst others, the following guidelines encouraging national regulatory authorities (NRAs) to:

- consider the severity of the harm, the risk sensitivity of the offender, and the cost of enforcement
- establish and employ sanctions that are reasonable and effective
- consider imposing a fine that exceeds the benefit the offender received from committing the offence
- considering the cost of enforcement, seek effective alternatives to fines
- decrease the penalties when there are other deterrents that encourage compliance
- consider employing specific guidelines for determining the severity of a sanction
- consider setting a fine that represents a percentage of the offender's revenues as it may permit regulators to discipline market players without seriously undermining small operators.

Long-run solutions

Regulators can promote VoIP by ensuring that DSL is unbundled from voice access so that consumers can take a Vonage-type VoIP service on top of their DSL without also having to pay for any voice service bundled with their DSL. Without this standalone DSL it is almost impossible for an entrant to sell VoIP services as a replacement for traditional fixed voice services.

Number portability is important for creating retail competition, by ensuring that consumers are willing to give up their existing voice service in favor of VoIP without losing their number.

36 Report on domestic enforcement of telecommunication laws: Guidelines for the international community. ITU-D Study Group 1, 3rd Study Period (2002-2006)

This is feasible in the USA, and the leading independent VoIP provider, Vonage, already has 1.5 million customers.

In order to protect their voice revenues, incumbents may block VoIP services or degrade the quality of service. One small ISP in the USA, Madison River Communications, has already been caught blocking the service of Vonage, and was quickly forced to stop by the FCC. In addition, there are companies that sell equipment specifically designed to block Skype calls, again to protect the voice revenues of the incumbents. Without imposing rules, commonly referred to as net neutrality, then entrants cannot offer viable VoIP services if the incumbent chooses to block them.

International trends

There is one final direct competition trend to consider, and that is the trend in ownership of operators in Latin America. There has been a slow realignment of ownership of mobile and fixed operators in Latin America, as the US (and most European) operators sell their stakes and Telmex and Telefónica expand and consolidate their positions across the region. Over the past few years, AT&T, MCI, BellSouth and most recently Verizon have sold their stakes in mobile and fixed operators around Latin America, and from Europe TIM (Telecom Italia) and France Telecom have limited stakes, while the other large carriers aside from Telefónica have no operations in Latin America.

Telmex and Telefónica are now the largest multinational players in the region: as of December 2005, Telmex and Telefónica had 28.5 million and 21.6 million fixed lines (representing 45% of fixed lines in Latin America) and their mobile divisions had 94.8 million and 70.5 million lines respectively (representing over 70% of the mobile lines in Latin America). In Peru, Telefónica owns the incumbent fixed and mobile operator, and Telmex owns the second largest mobile operator as well as a fixed-line competitor.

Although there are other international operators in Latin America in general, and Peru in particular, the trends point towards consolidation of the Telmex/Telefónica ownership and

away from other international operators entering the market with significant investment. There are two interesting trends occurring simultaneously that are of potential interest to Osiptel:

- The first trend is that each of the main operators in Peru operates in a number of different countries around the region.

- The second is that both of these operators compete against each other in most of those markets, in fixed and/or mobile markets, with the incumbent operator or an entrant.

We examine the potential impact of each trend in turn.

The ownership of operators in Peru by companies with ownership stakes in similar companies around the region likely provides significant benefits in Peru. First of all, these companies can leverage their experience with similar investments in terms of increasing the efficiency of the company, upgrading the technology, providing new services, and even improving their marketing approach. Indeed, we have discussed the improvements in TdP under the ownership of Telefónica. Second, there may be economies of scale derived from these ownerships, in terms of negotiating volume discounts on equipment and handset purchases, which could be passed on to consumers in lower prices. Finally, multinational companies with headquarters or subsidiaries in Peru may benefit from purchasing international network services from a single company with subsidiaries in the region, although we have not analyzed whether such demand (or supply) exists today.

The fact that the two largest operators in Peru also compete against one another in a number of other countries may not be so beneficial in the long run. There is a large economic literature about duopoly interactions between companies, stemming from advances in game theory, and this literature would suggest that it is easier to sustain collusion in one market if there is multi-

market interaction between the companies.[37] In other words, either of the companies in Peru may fear that if they begin a price war in Peru, the other company will not just retaliate in Peru, but also in the other markets in which they jointly operate. On the other hand, related theory would suggest that such behavior is unlikely in growing markets, where the companies are seeking to build up market share by attracting new customers, but rather in saturated markets, where the only means to grow market share is to win customers from competitors. Thus, given the significant growth rates across the region in mobile services, as well as fixed, it is unlikely that Peru will see any downside from the joint presence of Telefónica and Telmex in the near future.

37 For relevant economic literature on the competitive behaviour of multi-market firms, see, for example:

- "Multimarket Contact and Collusive Behavior," Bernheim, B. Douglas, and Michael D. Whinston, RAND Journal of Economics, 21, 1, 1-26.(1990).
- "Collusive Conduct in Duopolies: Multimarket Contact and Cross-Ownership in the Mobile Telephone Industry," Parker P. M. and L. Roller, Rand Journal of Economics, 28, 304-322 (1997).

The latter paper is particularly instructive, as the authors study multi-market contact between cellular providers in the early days of the mobile industry in the USA. At this time, the licenses were all regional and there were only two licenses available in each region, and the authors show that prices were non-competitive partly as a result of this multi-market contact.

6 Conclusion

In order to ensure the successful long-term development of competition in the Peruvian telecom market, Osiptel must seek to adopt and implement a number of key priorities and policy goals using a number of regulatory and competition policy instruments. Exhibit 6.1 summarises these priorities and instruments, as explored over the course of this project. We also provide some indication about relevant timelines and interdependency between the recommendations. Annex B contains a fixed and mobile market forecast simulating the impact of the policies outlined in this report.

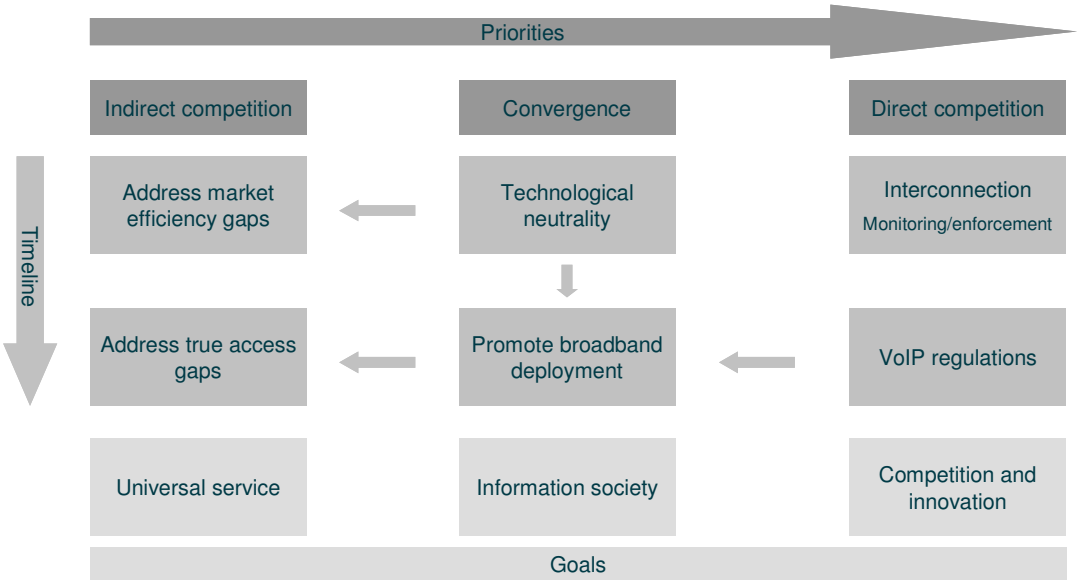

Exhibit 6.1: *Resulting priorities and policy goals for Osiptel [Source: Analysys]*

We recommend that Osiptel's primary focus should be on stimulating indirect competition in order to increase access to telecommunications services. In order to promote indirect competition Osiptel should concentrate on eliminating the inefficiencies that have lead to the development and perpetuation of the existing market access gap, and on promoting efficient interconnection. It is also important to ensure that necessary monitoring and enforcement of interconnection regulations are in place. To promote widespread deployment of broadband, Osiptel should first implement a policy of 'technological neutrality', and then directly promote broadband deployment.

Direct competition (whether based on facilities or services) does not currently represent an efficient area for Osiptel's attention, given that it can be expensive and difficult to regulate, and requires significant resources to set access terms and conditions and involves constant monitoring and enforcement. As new technologies become available direct competition will develop in the long run, both as a result of new broadband networks and also the availability of VoIP services over broadband connections.

6.1 Short-run policy objectives

Primary priority: indirect competition

The most immediate priority should be to address the market efficiency gaps. Promotion of mobile deployment and usage will provide an impetus for closing the market efficiency gap in marginal urban areas. Three steps in particular have been identified as possibly helpful to close the market efficiency gap:

- Lower the cost of backhaul using wholesale leased-line obligations or allowing infrastructure sharing.
- Reduce the cost of deploying networks by reducing barriers to tower siting.
- Lower the cost of access by reducing or eliminating taxes on mobile handsets.

In terms of timing, these issues should be addressed as soon as possible, given the stated importance of promoting access in Peru. There are two levels of success for these efforts, which are likely to take many years. The first measure is to achieve parity with penetration in other (economically similar) countries in the region, as described above. The second measure then is to meet the long-term goals for universal access or service in Peru. The details of the long-term objectives that Osiptel sets should be defined in line with its political social and economic priorities, but could be as ambitious as mandating the provision of a telephone in each household and business in Peru.

We would not recommend focusing new initiatives on the true access gaps until at least the first measure (parity with benchmark countries) has been achieved, on the basis that the priority should be to close those gaps first.

Secondary priority: convergence

A second-order short-term priority should be to ensure technological neutrality in preparation for convergence and to promote the deployment and usage of converged networks and services. Three steps can be taken in this regard:

- Eliminate any discrimination between different types of networks (such as NGN, mobile, wireless and powerline infrastructure).
- Eliminate any differences in treatment of voice or Internet services regardless of the type of network.
- Ensure that there is clear jurisdiction over the converged services and networks.

We would recommend that the first step would be to review relevant regulations and consult with the industry to identify, and then address, relevant barriers to convergence as described above. These goals will be met as new broadband networks, followed by VoIP services, are introduced.

In terms of timing, these tasks are not as immediately relevant as closing the market efficiency gaps, but on the other hand, may be easily achievable as they may not require significant expenditure of efforts.

This process will be most effective if a 'light touch' is used: convergence can be expected to increase competition in the wider market, which will allow regulations on existing technology to be relaxed rather than imposing existing regulations on new technology.

Tertiary priority: direct competition

As a third-order short-term priority, it is important to have interconnection regulations (and appropriate monitoring and enforcement regimes in place) in order to prepare for the direct competition that is expected to develop in the market. Monitoring ensures that there is no discrimination against competitors in negotiating interconnection or in the ongoing interconnection agreement. Enforcement compensates competitors for any discrimination and provides a deterrent preventing any such discrimination. Interconnection regulations are critical for all types of competition and it is important to have cost-based interconnection charges (metered or capacity) or consider moving to bill-and-keep. There must also be procedures such as a reference interconnection offer (RIO) to allow easier negotiation of interconnection arrangements.

In terms of timing, we would recommend that Osiptel first address interconnection issues, including the costing of interconnection as well as interconnection procedures, and then address the monitoring and enforcement of those procedures. These goals will be met when interconnection guidelines are in place that enable entrants to interconnect to the incumbent with minimal regulatory intervention, using standard procedures.

6.2 Long-run policy objectives

Primary priority: indirect competition

In the medium term, addressing true access gaps in providing fixed services in marginal urban areas should be highest priority for Osiptel.[38] We have identified three existing and proposed means to address this gap:

- FITEL provides for universal access
- steps taken to eliminate the market efficiency gaps will also help to address true access gaps.
- promoting convergence with a "light touch" application of technological neutrality will lower the cost of deployment in all areas, including marginal urban areas.

There are also other steps that could help to further fill true access gaps:

- de-average termination rates to increase returns from networks in high-cost areas
- eliminate any wholesale access requirements on new investments to promote investment

38 We would note that many of these actions will also help to address access gaps in rural areas, beyond the FITEL program.

- Increase funding for universal service/access by introducing a subscriber line charge for business subscribers.

In terms of timing, if there are resource constraints, this activity should only commence when Peru has at least caught up with neighbouring countries by addressing market efficiency gaps. As discussed above, objectives should be formulated in terms of the level of penetration that would be considered to be sufficient, and then these efforts should be undertaken to meet those objectives.

Secondary priority: convergence

Promoting convergence by promoting broadband deployment will help in the medium term to meet market gaps and create an information society. Promoting broadband deployment will help to facilitate VoIP services and create both direct and indirect competition. A number of steps can be taken to promote broadband deployment and usage:

- steps taken to promote technological neutrality will help to promote broadband services
- increase PC penetration with low-cost PCs (e.g. MIT Media Lab computer) or public access to computers
- public-sector demand can help to promote broadband and also promote demand
- it is also important to create competition with existing cable network via divestiture or cable open access.

Osiptel should first focus on increasing public Internet access, and then on promoting private access using a combination of low-cost PCs and leveraging the infrastructure deployed through meeting the access gaps described above. Bridging the 'digital divide' is likely to take a number of years, and success can be measured by first ensuring that all residents have some public access to computers,

whether through schools or for-profit access points.

Tertiary priority: direct competition

Direct competition will be promoted by regulation to support VoIP services, which will help to increase competition and access in Peru. The development of broadband infrastructure and access will create a market for VoIP, which in turn will help to create service-based competition to TdP. There are several steps that can be taken to promote VoIP usage and consequently direct competition:

- require the incumbent to offer stand-alone DSL
- allow number portability between PSTN and VoIP users
- impose net neutrality rules to prevent companies from blocking VoIP traffic
- clarify rules regarding numbering, emergency access, consumer privacy etc.

While VoIP is not likely to be a significant issue until broadband deployment is relatively widespread, it would be important to identify the necessary changes to make at an earlier stage in order to begin implementing the regulations before the incumbent has concrete reasons to object to them, and also to not stifle innovation at an early stage. Success will come when VoIP services are available over different Internet platforms and consumers begin to substitute VoIP for their traditional voice services.

Introduce a consultation process

We recommend that Osiptel begin a system of public consultation to help to implement the recommendations made in this report as well as assist with the formulation and implementation of other regulations. There are two main reasons for using public consultations. First, during these consultations valuable information can be learned about relevant issues at hand from those in the industry most impacted by the issues. For instance, we could foresee that a

consultation about addressing the market efficiency gaps in marginal urban areas could help to both identify and prioritize those barriers facing the operators who would consider deploying in those areas. Second, the consultations increase the transparency of the regulatory process and help operators to understand what decisions are being made and how they are being made.

Public consultations are very common in countries with independent regulatory agencies, and in those countries typically consultations can be initiated in two ways: first, the regulator itself can initiate a proceeding to change or create regulations, and second, operators themselves can trigger consultations either by seeking changes in regulations or as a result of any pre-defined action such as merging with another operator. For guidance, below is the procedure followed by the FCC.

The FCC can initiate two types of consultations:

- Notice of Inquiry. This is a document that seeks information about a particular area of concern, but where the FCC has not yet decided whether a new regulation (known as a rulemaking in the USA) is necessary.

- Notice of Proposed Rulemaking. Here the FCC has decided that a new rulemaking is necessary (possibly based on the results of a Notice of Inquiry) and proposes this rule in order to get comments from the industry about the potential impact of those rules. These comments help to shape the final Rulemaking released by the FCC.

The industry can also trigger consultations in at least two ways.

- Request for rulemaking. This is where an operator is unclear about the application of existing rulemakings to new situations, or feels that a rulemaking is required for a new situation. These have been quite common with regards to VoIP services, for instance, where operators seek to determine how existing rules will apply to this new technology.

- Merger. Operators must submit applications to merge, including a competitive impact assessment, that are put out for comments by other parties potentially impacted by the

merger. Typically it is not just other operators who provide comments in these cases, but also consumer groups discussing the impact of the merger on end-users, and often labor unions discussing the impact on the employees of the merging companies.

In all cases, the FCC solicits comments from interested parties, and then all comments are made public for review. At this point, the FCC solicits reply comments, where all parties can then reply to the arguments made in the first round of comments. Again, these reply comments are made public. Interested parties can also meet directly with the FCC staff to present their views. In the final rulemakings, the FCC will address these comments and discuss why they did or did not change the final rulemaking based on the comments.

Annexes to Final Report for Osiptel

Regulation of the telecom market for the next decade

July 28, 2006

Our ref: 289-313

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Regulation of the telecom market for the next decade

Annexes to Final Report for Osiptel

Contents

Annex A: International benchmarks

A.1 Country profiles

The benchmark countries chosen in discussion with Osiptel provide reasonable benchmarks for Peru on a number of economic and geographical dimensions. Key indicators are summarized in Exhibit A.1. We also profile each country in turn.

	2004 GDP/capita (USD PPP)	*Urbanization (percentage)*	*2004 population (thousands)*	*Population density (per km^2)*	*Local liberalization date*	*Price cap regime (Yes/no)*
Argentina	13 070	89	38 660	14	2000	Yes
Bolivia	3729	60	9010	8	2001	Yes
Colombia	7131	83	45 325	44	1994	Yes
El Salvador	3540	60	6760	319	1998	Yes
Peru	5543	74	27 547	22	1998	Yes
Venezuela	6020	88	26 000	30	2000	Yes
Source:	*Pyramid*	*Pyramid*	*Pyramid*	*ITU*	*Global Comms*	*Nera*

Exhibit A.1: *International benchmark summary comparison*

Argentina

- Third largest economy in Latin America, behind Mexico and Brazil
- Local, long-distance and international telephony all fully liberalized in November 2000
- Main wireline players: Telefónica (incumbent), Telecom Argentina (incumbent), Telmex Argentina
- Main wireless players: Movistar, CTI Movil, Nextel Argentina, Telecom Personal
- Selected notable events:
  - government froze telecom tariffs in local currency values (Jan 2002)
  - updated telecom bill and incumbents charges being renegotiated (Q4 2005 to present).

Bolivia

- One of the smallest economies and lowest GDP per capita in Latin America
- Local, long-distance and international telephony all fully liberalized in November 2001
- Main wireline players: Entel (LD incumbent), Nuevatel, Boliviatel, 15 regional telecom cooperatives (incumbents for local calls)
- Main wireless players: Entel Movil, Telecel, Nuevatel
- Selected notable events:
  - Sittel (regulator) given control over setting ceiling on telecom tariffs by amendment to Telecom Law in April 2002.

Brazil

- Largest economy in Latin America in 2005.
- Local, long distance and international telephony all fully liberalized in January 2002
- Main wireline players: Vésper (Embratel now owned by Telmex), Telefónica Brasil, Telemar Norte Leste, Brasil Telecom.
- Main wireless players: Brasilcel (Vivo), TIM Brasil, Telecom Américas (Claro)
- Selected notable events:

  - government signed new 20-year contracts with main operators in December 2005. Among measures introduced are per-minute rather than pulse billing and new per-minute local call rates.

Chile

- Among the fastest growing Latin American economies, especially in the mid nineties.
- Local telephony liberalized in 1992. Long distance and international telephony liberalized in 1994.
- Main wireline players: Telefónica CTC Chile (incumbent), Telmex Chile, VTR-Metrópolis
- Main wireless players: Movistar, Entel PCS, Smartcom
- Selected notable events:
  - Subtel sets local rates and access fees for incumbent CTC every five years. Last review in May 2004.
  - Subtel approves CTC tariff rebalancing in February 2005. Local call charges drop by 14% while monthly subscription increases by 7%.

Colombia

- Fifth largest economy in the Latin American region
- Local telephony liberalized in 1994. Long-distance and international telephony liberalized in January 1998
- Main wireline players: Colombia Telecom (incumbent, now owned by Telefónica), Empresa de Telecomunicaciones de Bogotá (ETB), Empresas Públicas de Medellín (EPM)
- Main wireless players: Colombia Móvil (Ola), Comunicación Celular (Comcel), Movistar
- Selected notable events:
  - monthly fixed charges abolished and per-minute billing introduced (June 2005)
  - end-user charges in low-income areas capped to rate of inflation (June 2005).

El Salvador

- Most densely populated and industrialized country in Central America
- Local, long-distance and international telephony liberalized in July 1998
- Main wireline players: CTE Telecom (incumbent), Telefónica Multiservicios
- Main wireless players: CTE Telecom, Digicel, Movistar, Telemóvil
- Selected notable events:
  - developing cost-based price model for local tariffs in tandem with mobile operators (2005 to present).

Venezuela

- Economic success closely tied to earnings from oil and global fluctuations in oil price. One of the larger Latin American economies after Brazil, Mexico and Argentina
- Local, long-distance and international telephony all liberalized in November 2000
- Main wireline players: CANTV(incumbent, now partly owned by Telmex), Movistar (WLL), Digicel, Entel, Intercable
- Main wireless players: Digicel, Infonet, Movinet, Movistar
- Selected notable events:
  - tender for subsidized concession to provide communications to ten rural areas launched by Conatel (December 2005).

A.2 Further international benchmarking charts

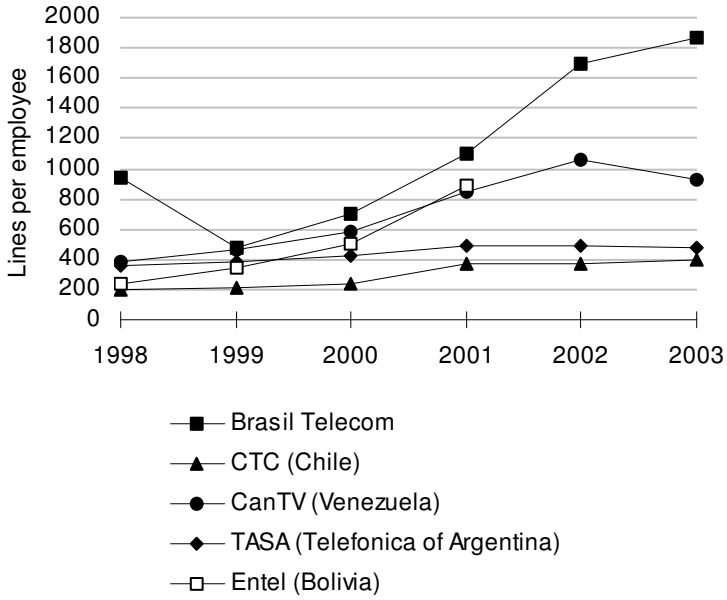

Exhibit A.2:

Efficiency gains of selected incumbent operators in Latin America in the period 1998-2003. [Source: Operator Websites]

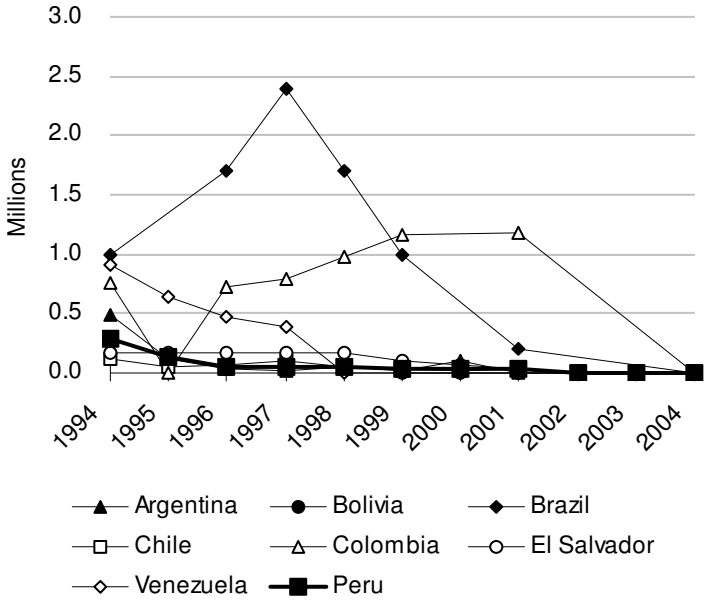

Exhibit A.3:

Waiting list for main lines [Source: ITU]

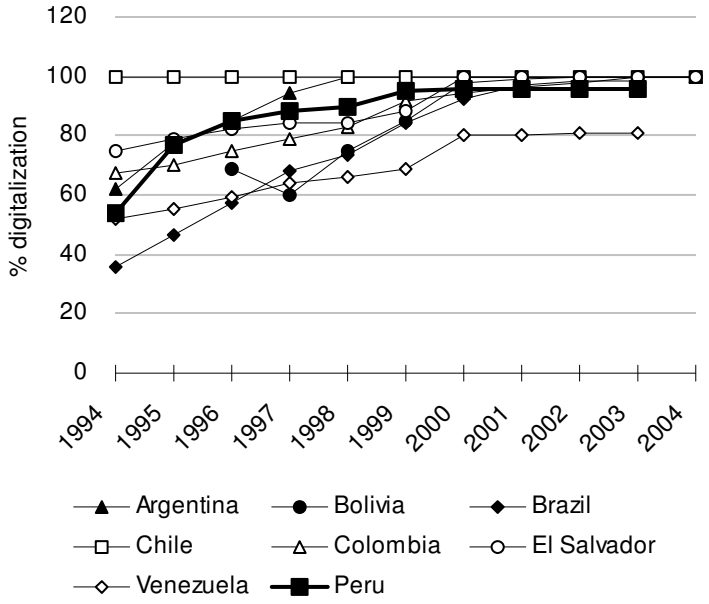

Exhibit A.4:

Digitalization

[Source: ITU]

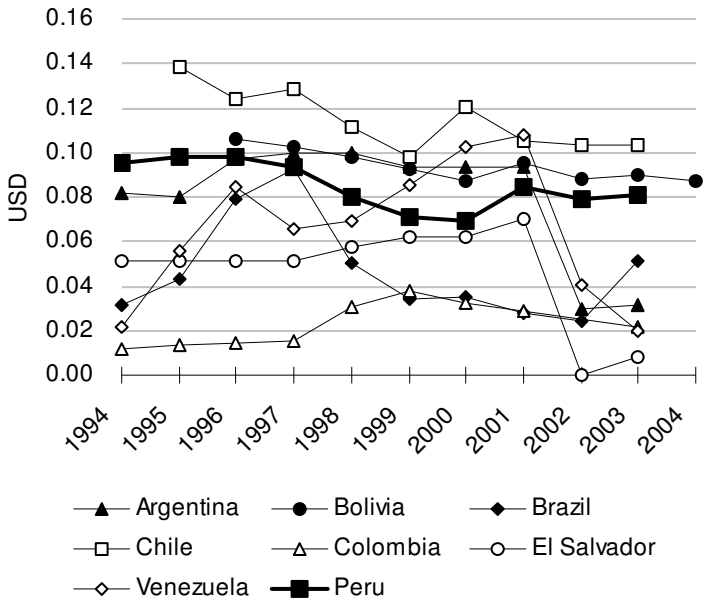

Exhibit A.5:

Cost of a 3 minute local peak call

[Source: ITU]

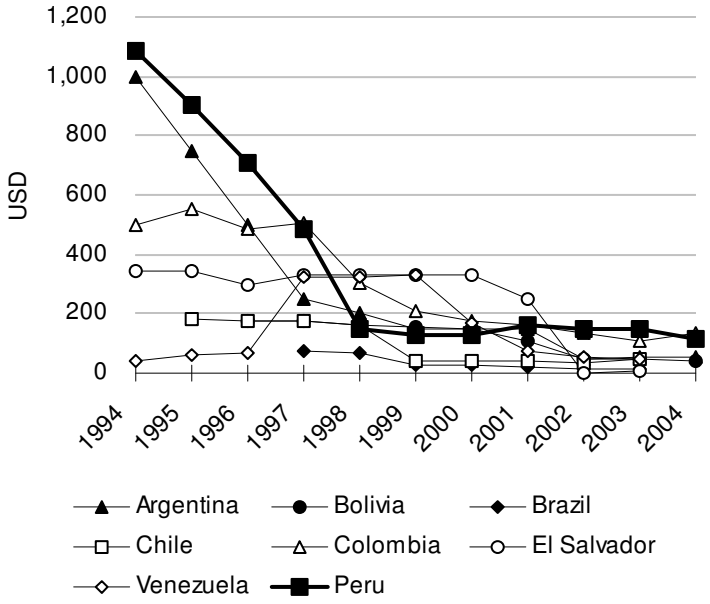

Exhibit A.6:

Business line connection charge

[Source: ITU]

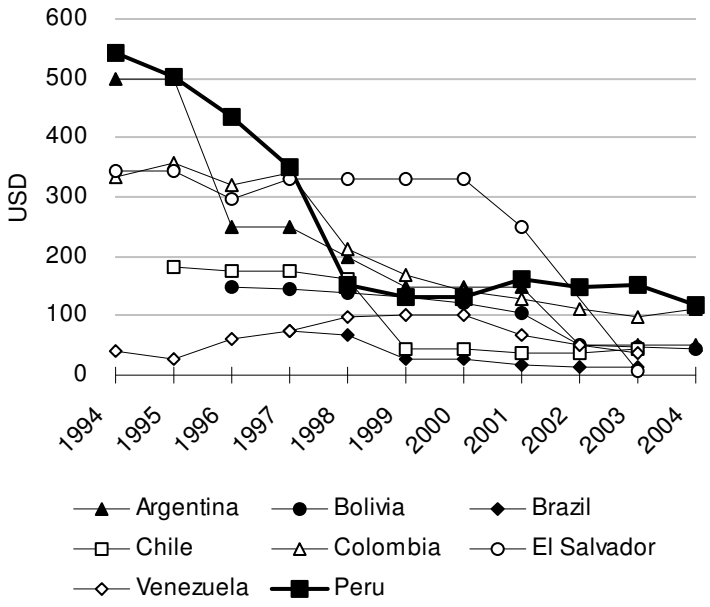

Exhibit A.7:

Residential line connection charge

[Source: ITU]

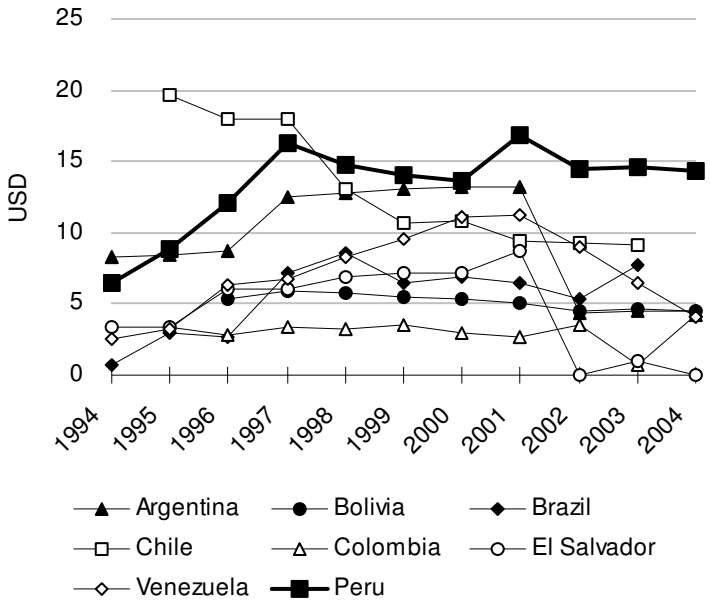

Exhibit A.8:

Residential monthly subscription charge [Source: ITU]

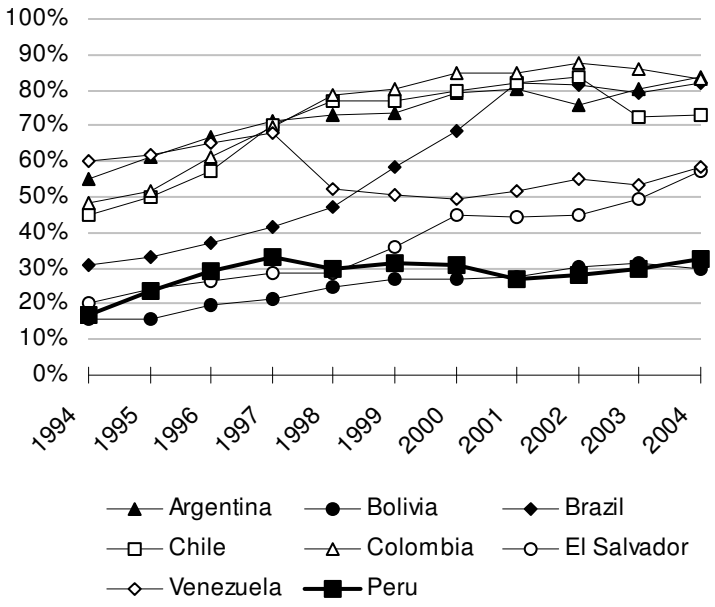

Exhibit A.9:

Household penetration of fixed lines [Source: ITU]

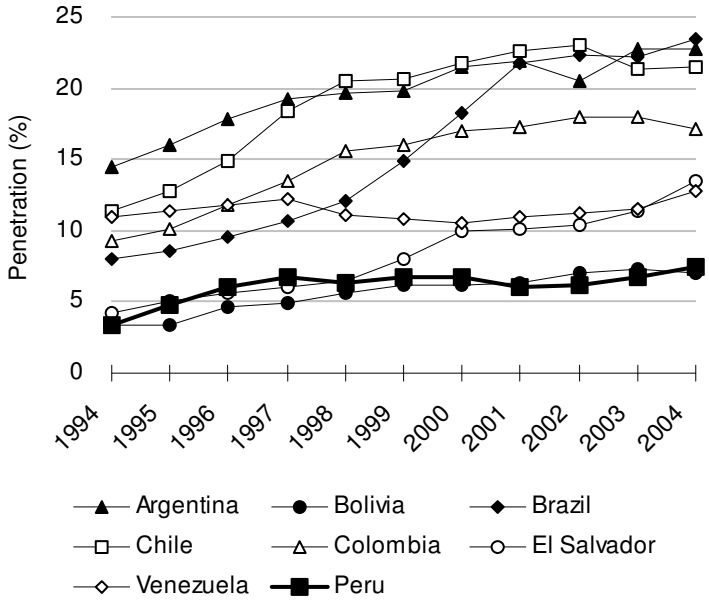

Exhibit A.10:

Fixed line penetration of population [Source: ITU]

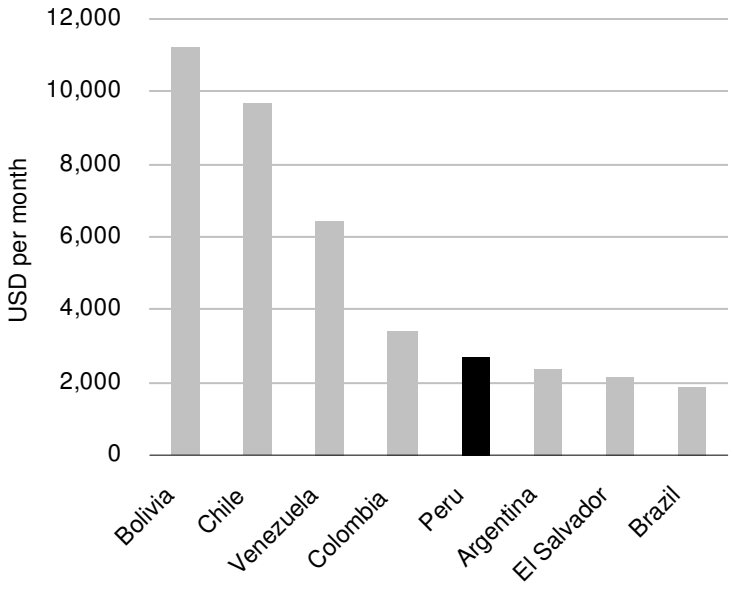

Exhibit A.11:

Cost of 5km E1 leased line [Source: Tarifica]

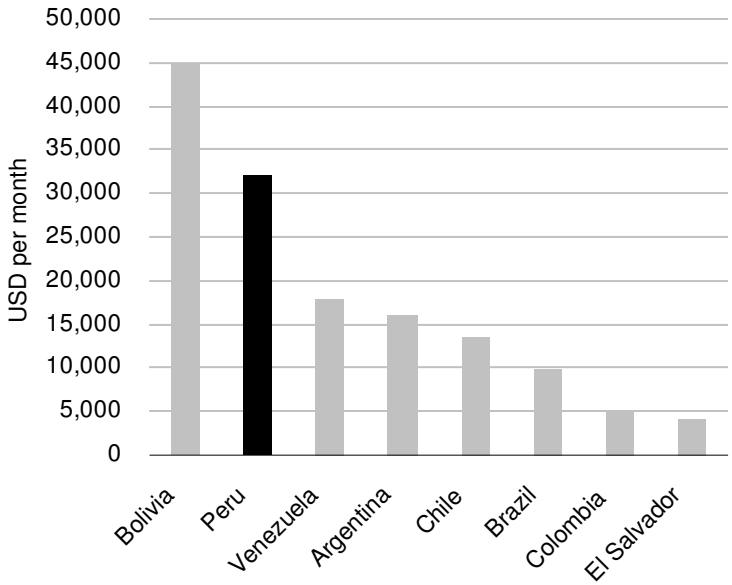

Exhibit A.12: *Cost of 300km National E1 leased line [Source: Tarifica]*

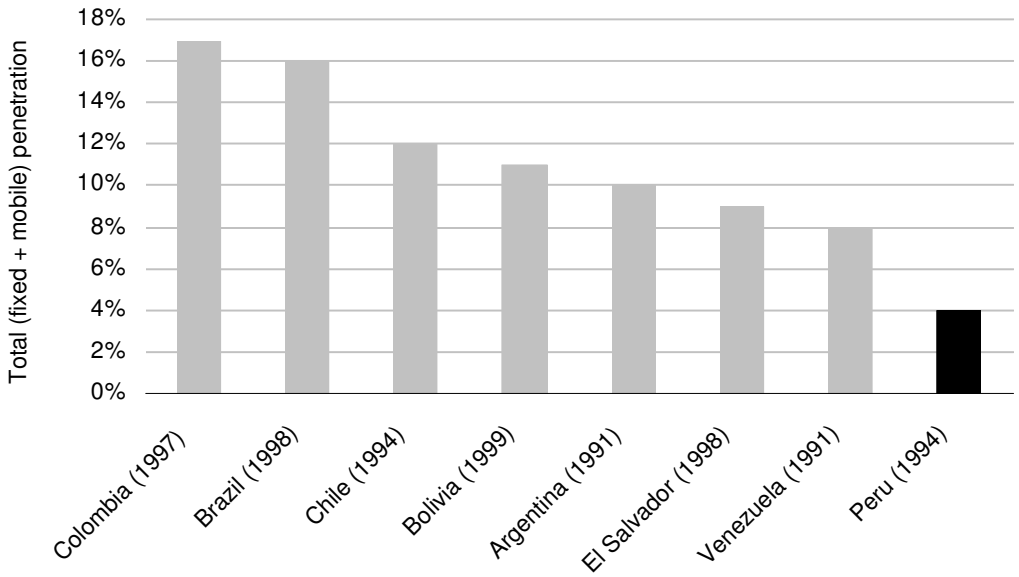

Exhibit A.13: *Penetration at introduction of price caps [Source: ITU, NERA]*

Annex B: Market simulation

As discussed previously in the main body of this report and indicated in Exhibit B.1, Peru lags behind the benchmarks in terms of fixed and mobile penetration.

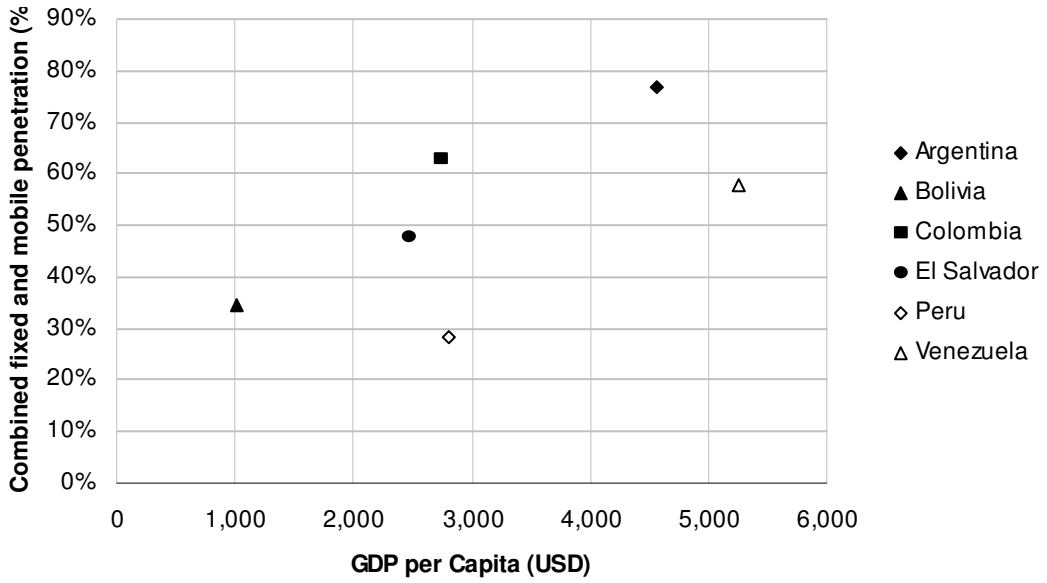

Exhibit B.1: *Fixed and mobile penetration against GDP per Capita in 2005 [Source: Pyramid]*

The fixed and mobile market forecast for Peru from Pyramid Research is assuming significant growth in particular in the mobile sector over the next 5 years as summarized in Exhibit B.2. The growth in mobile subscriptions will help to reduce the market efficiency gap and should be

supported by Osiptel by adopting 'light touch' regulation and by reducing artificial barriers to investment and the other means outlined in this report. At an average capital expenditure of USD200-250 per mobile subscriber, this will require investments of USD2 billion to USD2.5 billion from the private sector.

Peru Market Forecast		*2001A*	*2002A*	*2003A*	*2004A*	*2005E*	*2006E*	*2007E*	*2008E*	*2009E*	*2010E*
Population	000	26,347	26,748	27,148	27,547	27,950	28,360	28,780	29,210	29,650	30,050
% Urban Population	%	73%	74%	74%	74%	75%	75%	75%	76%	76%	77%
Nominal GDP/Capita	USD	2,038	2,114	2,240	2,492	2,800	2,980	3,160	3,390	3,600	3,760
PPP Adjusted GDP/Capita	USD	4,795	5,039	5,256	5,543	5,840	6,160	6,510	6,860	7,210	7,583
Narrowband Subscriber Lines	000	1,785	1,840	1,963	2,103	2,207	2,314	2,409	2,498	2,570	2,643
penetration	%	7%	7%	7%	8%	8%	8%	8%	9%	9%	9%
Broadband Subscriber Lines	000	10	39	86	219	353	416	448	470	486	501
penetration	%	0%	0%	0%	1%	1%	1%	2%	2%	2%	2%
Personal Computers	000	876	1,093	1,286	1,650	1,758	1,912	2,039	2,139	2,198	2,616
penetration	%	3%	4%	5%	6%	6%	7%	7%	7%	7%	9%
Internet Users	000	94	137	218	313	390	426	447	457	459	461
penetration	%	0%	1%	1%	1%	1%	2%	2%	2%	2%	2%
Mobile Subscriptions	000	1,742	2,315	2,920	4,093	5,730	8,224	10,304	11,974	13,304	14,525
Prepaid	000	1,297	1,715	2,233	3,200	4,704	6,942	8,857	10,357	11,571	12,700
Postpaid	000	445	600	687	893	1,026	1,282	1,448	1,618	1,733	1,824
penetration	%	7%	9%	11%	15%	21%	29%	36%	41%	45%	48%

Exhibit B.2: *Telecoms market forecast for Peru [Source: Pyramid]*

At an overall CAGR of 15% for fixed (4% CAGR) and mobile subscriptions (20% CAGR) from 2005 to 2010, the Peruvian market is expected to grow fastest compared to all benchmark countries which will help to reduce the market efficiency gap that Peru is currently experiencing (Exhibit B.3).

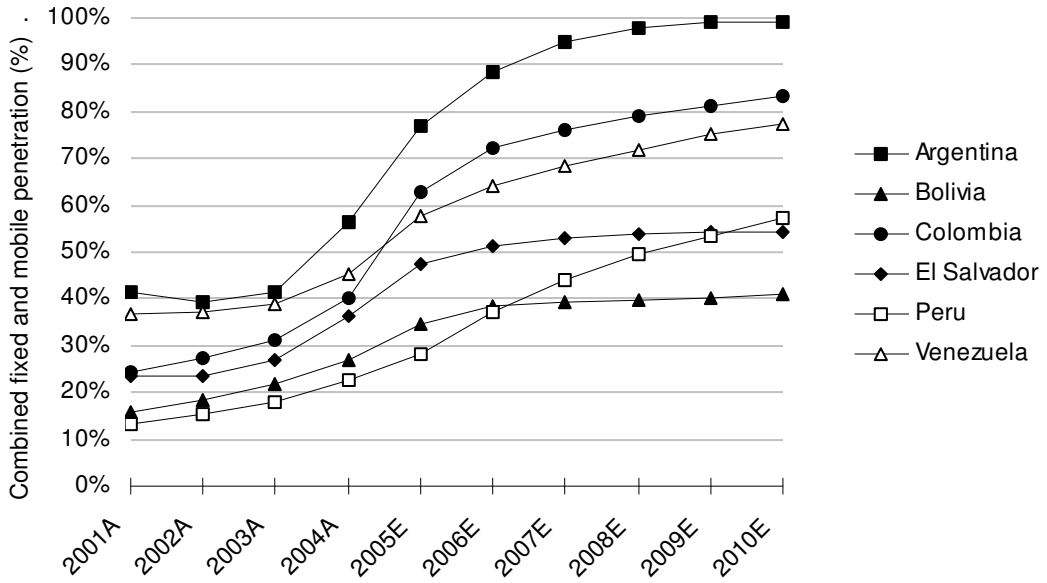

Exhibit B.3: *Combined mobile and fixed penetration forecast [Source: Pyramid]*

However, at a combined penetration of 57% of population in 2010 Peru will still be lagging the more developed markets of Argentina (overall: 99%. fixed: 24% and mobile 75% of population), Colombia (overall: 83%. fixed: 17% and mobile 66% of population) and Venezuela (overall: 77%. fixed: 15% and mobile: 62%).

While the annual growth required to reach the penetration levels of these more advanced markets will be difficult to achieve in the short term, they are a valid goal to set in the medium term over the next ten years. Reaching overall penetration levels of 80% by 2015 would require a CAGR of 11% in overall fixed and mobile subscription levels from 2005 to 2015 as illustrated in Exhibit B.4.

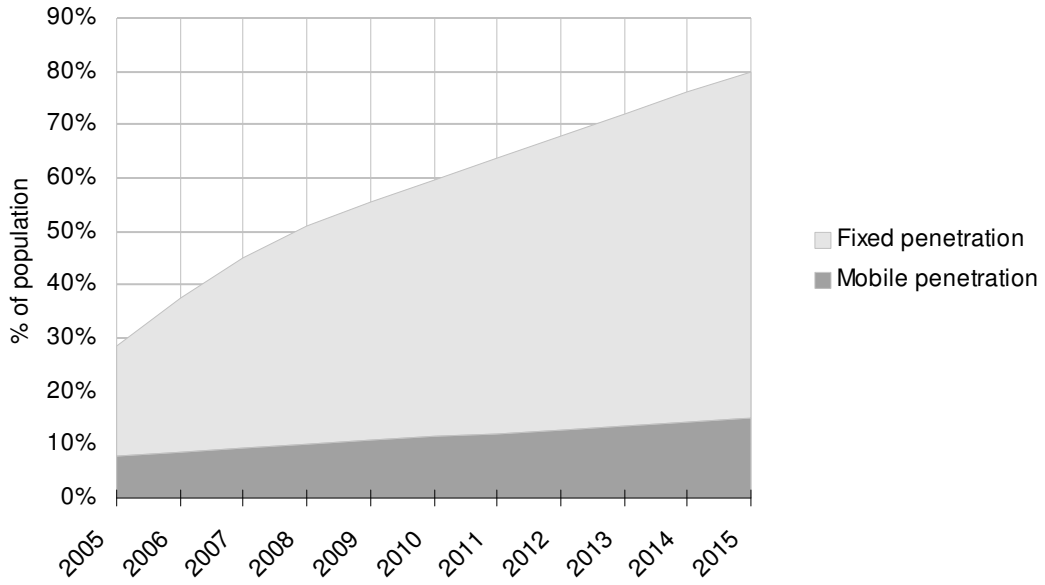

Exhibit B.4: *Longer-term penetration levels illustration [Source: Analysys]*

A significant part of the additional penetration to be achieved over the longer term is likely to be complicated by the reasons for the true access gap previously discussed (affordability and cost of deployment) and is likely to require market intervention similar in nature to the current FITEL program as outlined in this report. Assuming a long term penetration of 15% of population for fixed lines and 65% for mobile subscribers and assuming a capital expenditure of USD1000 per fixed line and USD200 per mobile subscriber, the additional investment to reach 80% in the medium term would result in investment requirements of USD3.5 billion.