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Mobile network sharing trends in developing and developed mobile markets (regulations and market forces): A comparison between selected Latin American markets and Sweden

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**24th European Regional Conference of the International
Telecommunications Society, Florence, Italy, 20 - 23 October 2013**

Juan Pablo Lasso, Ashraf Awadelkarim Widaa Ahmed and Jan Markendahl

**Mobile Network Sharing Trends in Developing and Developed
Mobile Markets (Regulations and Market Forces)**

**A comparison between
Selected Latin American Markets and Sweden**

Abstract

The present document has the objective of analyzing the impact of several factors that are part of mobile telecom markets into the feasibility of sharing resources as a strategy for operators to deploy their networks in a cost-efficient manner and cope with the ever increasing amount of data traffic. These factors include the situation of the operators with their distribution of market shares, the nature of national regulatory authorities, and their lines of action. The study comprises the description and analysis of three markets: Ecuador, Chile, and Sweden, as they pose very different scenarios and are useful to prove the contrast present in two different regions of the world.

The results of this research work show that in order to ease the adoption of network sharing in a market, a state of fair competition must be encouraged, reflected by a good distribution of market shares between operators. This is for the most part a task of the regulators, as they must make sure to award resources to operators in an equitable manner, as well as to identify the right moments to introduce new actors into the market, as it is observed in the cases of Chile and Sweden. Additionally, the regulators must have a liberal approach in their decisions, by permitting both active and passive network sharing, as this study shows that this is not the case in Chile and Ecuador so far.

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Introduction and motivation of work

The cellular mobile communications market has gained an impressive uptake since the early introduction of 2G services, in the last two decades of the 20th century. At early deployment stages, mobile operators around the world have enjoyed high rates of profitable revenue growth that encouraged them to inject the required investments to establish their own mobile networks. The primary objective was to gain a competitive advantage in the market by differentiating themselves in terms of network service coverage, and enhancing network capacity and quality.

Today, the situation is very different for mobile operators in developed and saturated markets; the average revenue per user is decreasing while the total expenditures to expand the business and keep it running, are increasing. Even in emerging markets in Africa, the Middle East and Asia Pacific countries, the mobile revenue growth started declining by 8 to 15% since year 2009 (IBM, 2010). This trend has become present also in the Latin American market, where annual revenue growth declined in 2012 (Wireless Intelligence, April 2013).

Additionally, mobile telecom operators are continuing forced to probe possible network upgrade scenarios such as the adoption of future wide-spectrum mobile broadband technologies, e.g. 3G and 4G, to satisfy the growing subscribers demand for higher speed and capacity. These network upgrades will need more spectrum resources in the access network and high transmission capacity (backhauling) towards the core network which means extra investments. To avoid falling in an unprofitable business situation, especially in highly saturated markets, mobile operators worldwide start to look for new revenue streams as well as possible strategies to optimize costs of deployment. It is here where network sharing comes into the picture. Normally mobile operators perceive network sharing as a means of cost optimization, while regulatory authorities aim to formulate network sharing policies that ensure and intensify the competition, service availability and affordability for end users in the market.

The concept of sharing resources in mobile networks is becoming more complex and encapsulates various possibilities and arrangements from simple collocation agreements to sharing some essential resources and facilities. Thus, National Regulatory Authorities (NRAs) are continuously challenged to catch up and set suitable policies and regulations, as well as to define their level of intervention according to the conditions in the market. In this manner, NRAs must have different perspectives concerning the adoption of network sharing between the competitors in the mobile market of each country.

Research questions

- 1. How is the network sharing between the competitors developed in different regulation environments?*
- 2. How does the number of operators in a country and their market power affect their network sharing strategies?*
- 3. Is the regulatory intervention required or would the market forces effectively shape an optimum network sharing strategy?*

Some related work and methodology

There is a growing body of literatures that study the different aspects of resource sharing in the mobile communications market. In some studies the attention is given to the role of physical infrastructure sharing in reducing the mobile service rollout and operation costs, for example in (Meddour, et al., 2011). Other studies emphasize the various economic and commercial considerations that are forcing and driving the cooperation between the competitors in the mobile markets, along with the possible cooperation and resource sharing models (Markendahl & Mölleryd, November 2012) (Song, et al., June 2012). Also the deployment and operation aspects of resource sharing models, especially in urban areas and how that will affect the fair competition practices in the market have been discussed (Frisanco, et al., 2008).

On the other hand, the study of regulatory and policy aspects affecting resource sharing in different markets has been addressed in some other documents such as (Vlamm & Maitland, 2003) (Lefèvre, March 2008). In (Markendahl & Mölleryd, February 2012), the authors contrast the situation of the markets in India and Sweden, and assess the feasibility of using different network deployment strategies in each country, finding the advantages and challenges for operators in both environments.

Research Methodology, Expected Results and Scenarios to Investigate

This paper aims to have an understanding and insights about the operators' and regulatory bodies' perspectives regarding the adoption of network sharing strategies in different markets, as well as how they perceive future trends.

The adopted methodology in this study will start by collecting data and information about different mobile markets, namely Ecuador, Chile, and Sweden. The interest in this approach is found in that there is a big contrast between the Swedish telecom market, the

Chilean, and the Ecuadorian one. Ecuador has been proven to be one of the countries with the least development in telecommunications in South America, while Chile is nowadays one of the highest developed countries in the region. However, it still falls short to Sweden, which has one of the leading markets in the world.

In the first phase, the focus is to collect data about the mobile markets, in terms of the roles of mobile operators, along with the surrounding regulation environments. In this regard, the annual reports from regulatory bodies and operators are considered as the main sources. Based on the collected data, the research questions will be answered by analyzing and comparing the impact of the market and regulation forces in the adoption of network sharing. In this manner, the following results are expected:

- Similarities and differences in the environments of markets with various economic and regulatory conditions.
- The enablers and barriers that influence operators' willingness and decisions regarding network sharing.

Mobile Network Sharing in Different Market Scenarios

This section is devoted to study how the adoption of network sharing as a strategy for mobile network deployment is affected by the different scenarios presented in different countries. Moreover, the analysis is focused into the fact that each country has a different number of operators, with a particular level of fairness in the distribution of market shares (number of subscribers an operator holds) for each case. Additionally, the impact of the regulatory environment is included in the discussion.

In this manner, the study is made in a *country-by-country* basis, where a description of the mobile market is made first, in order to use that information as a tool to assess the advantages and challenges of adopting network sharing between operators. But first, a concise definition of the main types of network sharing strategies that may be adopted is included, to provide clarity in the ideas exposed in the rest of this research work.

Types of Network Sharing

The concept of network sharing implies that two or perhaps more operators split the costs of deploying their networks and divide ownership of the assets involved. Two main different approaches can take place, as explained in the following lines.

- **Passive Sharing:** It refers to sharing only the costs related to network infrastructure, but not capacity. This includes antenna towers, masts, wires, and

other elements related to the build out of base station sites. This approach can be highly beneficial, as it has been proven that construction costs can represent a rather high fraction of total network deployment investments (Markendahl, et al., September 2011).

- **Active Sharing:** In this case, operators share active network equipment. Thus, they can split the costs of buying and implementing it, and they can even benefit from the aggregation of the spectrum each of them has been allocated in order to increase capacity.

Of course, there could be the case where operators decide to cooperate both in construction of base station sites and in the implementation of their actual wireless networks.

Telecom Market in Ecuador

Operators and Market Shares

The mobile market in Ecuador has two private operators that can be considered as incumbent. In 2003, a third operator named Telecsa (with the brand name Alegro) entered the market, with the idea of breaking the duopoly that had been reigning in the country. However, the new operator always failed to make a significant impact, although it did encourage a reduction in prices for voice services. Even today, they remain as a minor force, providing services to a very small segment of mobile subscribers (Carrión, October 2007).

One of the private operators, Otecel, is under the administration of Telefónica, which now commercializes the brand name "Movistar". The other one, Conecel, is a part of the América Móvil empire. In 2011 they changed the name of their brand to "Claro", which they use in most countries in the region. Additionally, Telecsa became part of state owned Telecom company Corporación Nacional de Telecomunicaciones (CNT) in 2010, after it was declared bankrupt. It now operates under the brand name of CNT Móvil. The market shares of each of these operators are depicted in Figure 1. The data corresponds to January 2013.

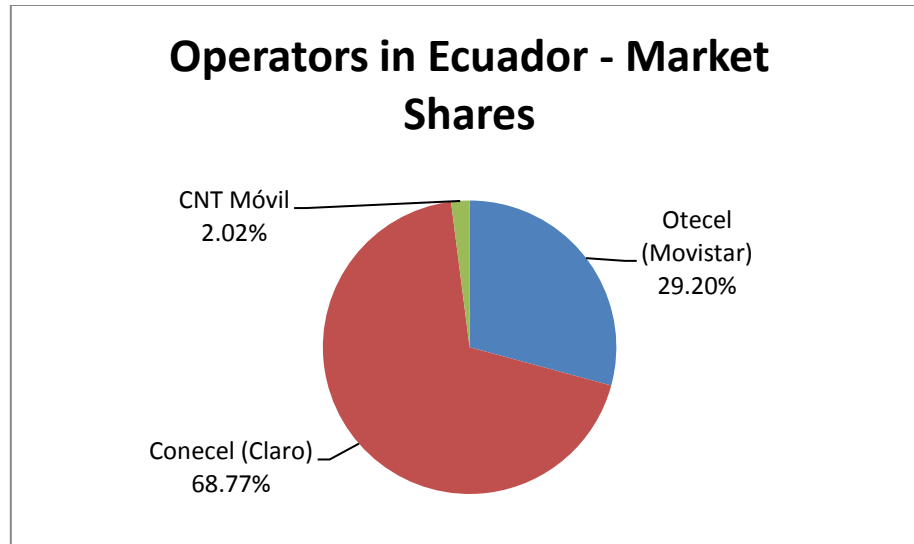


Figure 1. Market Shares for Mobile Operators in Ecuador (CONATEL Ecuador, 2013)

It is clear that Conecel is the dominant operator in the market, while Otecel holds a fair amount of subscribers, leaving CNT Móvil in a very challenging position to survive its competitors. It can be said that the Ecuadorian market holds a state of duopoly by its private operators. The Herfindahl-Hirschman Index measures the level of competitiveness in a market, with a scale of 0 for a status of completely even competition, and 10,000 for no competition at all. The average score for this country is of 5,600 in the recent past (Wireless Intelligence, 2013), which reflects that the market competition is rather unbalanced, like it can be deduced from the figure.

Regulator Structure

Historically, the regulatory body in Ecuador has been marked by a lack of a clear structure and the redundancy of competences between the different national entities that compose it. The current Government decided to revise this structure and set some changes in order to better define the role of each entity and adopt new public policies. However, the structure still remains quite complex. This is a brief description of the public offices in charge of enforcing the law for the telecommunications sector in the country:

- **Ministerio de Telecomunicaciones - MinTel (Ministry of Telecommunications):** It was created in August 2009. It has the power to create and issue regulatory policies. It mainly manages public plans and projects for the development of the telecom sector (Navas, September 2011). It is important to mention that the Minister is also the President of the regulator authority, CONATEL.

- **Consejo Nacional de Telecomunicaciones - CONATEL (National Telecommunications Council):** It is recognized by the International Telecommunications Union (ITU) as the official regulator authority of the country. Regulations are managed by this entity, including spectrum allocation and policies related to it. This office was merged with the former Consejo Nacional de Radio y Televisión (National Council for Radio and Television), which also gives it competences to regulate frequency allocations for the media broadcasting sector that it did not have before (Navas, September 2011).
- **Secretaría Nacional de Telecomunicaciones - SENATEL (National Secretary of Telecommunications):** It is the entity that actually executes and implements policies and regulations for the sector. It may be said that CONATEL and SENATEL work as one entity.
- **Superintendencia de Telecomunicaciones - SUPERTEL (Superintendence of Telecommunications):** It is in charge to monitor and control the proper use of radio spectrum, as well as the performance of telecommunications service providers. It ensures that the rights of the end-users are protected and it presents reports when sanctions have to be imposed (Navas, September 2011).

It is clear that given the power of the Ministry of Telecommunications, the actual regulatory authority is not completely free to operate. It will always be subject to the supervision of the Ecuadorian Government, which may or may not look after political interests for some regulations and decisions. This is clearly not an ideal situation for the market and its actors.

Concession Licensing and Policies for Operators

The first concession licenses for mobile telephony services in Ecuador were awarded in the year 1993 to private operators Otecel and Conecel. They paid US \$ 2 million and an additional fee of 51 million in 1996. The licenses included 25 MHz (2x12.5 MHz) of spectrum for each operator in the 850 MHz band and the authorization to provide mobile telephony services. In 2006, they were granted an additional allocation of 10 MHz (2x5 MHz) in the 1900 MHz band. In exchange, they paid an amount of 4.4 million dollars. This spectrum was also awarded to Alegro (current CNT Móvil), after they had entered the market with 30 MHz (2x15 MHz), for which they paid 31 million dollars in 2003 (Carrión, October 2007).

When the current Government took office in 2007, it considered that the former operator licenses had been an unfair negotiation, arguing that the mobile telephony

business had generated 7500 million between 1993 and 2008. According to their calculations, the State had lost an estimate of 4477 millions in their concession license negotiations. That is why, for the renewal of licenses, operators were expected to pay 1.200 million dollars (CONATEL Ecuador, s.f.).

In the end the renewal of licenses in 2008 represented a first payment of US \$ 289 million for CONECEL and US \$ 90 million for OTECEL. Additionally, they agreed to pay 3.93% of their annual revenues until 2023. The total amount of money the Ecuadorian State will receive for these concession licenses is estimated to be between 1200 and 1500 million dollars in the 15 years (El Telégrafo, s.f.). This translates in an average 2.10 €/MHz/Pop, which is rather high compared to other countries, as evidenced in later sections of this document.

After being absorbed by CNT and becoming a State-owned operator, CNT Móvil was granted 70 MHz of 4G spectrum in 2012, which CONATEL directly awarded to them. Ecuadorian regulations exonerate public companies from auctions and payments for spectrum in general. The operator was given 30 MHz in the 700 MHz band and 40 MHz in the 1.7/2.1 GHz band (SENATEL Ecuador, 2012). The spectrum allocation given to this operator might be an effort of the Ecuadorian Government to increase their competitive power against the two private operators. Another reason is that it would help the market become more competitive if the third actor became a stronger force in the struggle for market shares.

A spectrum auction for 4G spectrum is expected in the near future, although a precise date has not been established. Several bands have been considered to be set for auction, including bands in the frequencies of 700 MHz, 1700/2100 MHz (AWS band), 1900 MHz, and 2.5-2.6 GHz (Navas, September 2011). There are small possibilities that new actors might bid for this spectrum. Table 1 presents a summary of the spectrum allocated to each operator. It is relevant to mention that the regulator established a spectrum cap of 65 MHz per operator, which still applies at least to Conecel and Otecel.

Operator	700 MHz	850 MHz	1700/2100 MHz	1900 MHz	Total (MHz)
Conecel	0	25	0	10	35
Otecel	0	25	0	10	35
CNT Movil	30	0	40	40	110
Total	30	50	40	60	180

Table 1. Spectrum Allocations per Band and per Operator in Ecuador

In summary, the regulation of the telecommunications market in Ecuador has become vital for the current Government, since they took office in 2007. The priority is to promote the development of the country by making sure a larger percentage of the

population has access to information and communication technologies (ICTs). This, of course, has set challenges for mobile operators, since they have had to cope with more strict regulations and with the fact that some policies on the use of spectrum aim to encourage the success of projects conducted by public entities (Navas, September 2011). From the previous table, it can also be concluded that the amount of spectrum awarded to operators is rather limited, which corroborates the rather restrictive nature of the Ecuadorian regulator.

Analysis of Network Sharing Strategies

On the topic of network sharing, the regulator has created a specific document that defines the guidelines for network infrastructure sharing. It addresses the rights and obligations of the parties involved in this sort of deal, specifying that they are free to mediate the terms of it. It is clearly stated that passive site sharing is discussed, excluding active network equipment or capacity from its scope. Additionally, under request of Otecel and Alegro (CNT Móvil) in 2010, Conecel was declared as Significant Market Power in the market. The regulator established that this operator was obliged to allow the smaller operators to use their network infrastructure by subscribing contracts to rent part of their sites. Otecel has benefitted from this since 2011 (Telefónica, 2011).

It is known that operators Conecel and Otecel have around 2100 and 1300 sites respectively, while CNT Móvil has only 600 of them. On the other hand, the first two operators hold only a total of 35 MHz (2x17.5 MHz) each, while the third has now access to 110 MHz (2x55 MHz), which is excessive for an operator that has only 2% of market shares. Under these conditions, several scenarios for network sharing are proposed in the next paragraphs, trying to explain drivers and barriers for operators in each case.

In a first scenario, if active sharing was permitted, the situation described above could provide a good opportunity, since it remains unclear when the two private operators will be allocated more spectrum. An agreement could be reached, for Conecel and Otecel to share their network sites with CNT Móvil, with the latter sharing their spectrum with them. In this way, all the actors could benefit from an increased capacity in their networks while guaranteeing cost savings in new implementations.

Nevertheless, the significant gaps between the market shares of each operator could pose an obstacle in their willingness to cooperate with each other. Moreover, it is known that Conecel was declared a Significant Market Power and now rents part of their sites to the other operators, as mentioned before. This represents a challenge to network sharing in the sense that the bigger actor may not see the necessity to collaborate with others, since it is already getting financial benefits from the current rental agreements.

A second scenario could take place if Otecel and CNT Móvil partner up to equal the site density that Conecel has already achieved by committing to a passive sharing agreement. This would give both operators the opportunity to become more competitive by gaining some customers if they succeed in increasing the quality of their services, due to better coverage and capacity in their networks. Additionally, this may be a promising option for Otecel, especially if they are not allocated more spectrum in the near future. On the downside, still the gap in market shares they have with CNT Móvil could keep them from considering this possibility.

Another alternative for network sharing could be available if a new private operator entered the market. For instance, a new actor could partner up for passive sharing with CNT Móvil, which currently has the lowest density of sites, or even with Otecel. The case of Conecel getting involved with a newcomer is more complicated, as they probably will not want to jeopardize their leading position in the market.

In this context, both Conecel and Otecel could be interested in active sharing with a new operator if they do not obtain more spectrum soon enough and the traffic in their networks starts to saturate them. The new actor would benefit from cost savings in their own infrastructure while the incumbents would solve their capacity issues. Meanwhile, for CNT Móvil, cooperating with a newcomer would be beneficial only if they wanted to save costs while improving their site density, so passive sharing would be a good option.

One issue that may arise for the feasibility of network sharing in the presented scenarios is that, being a State-owned operator, CNT Móvil has access to a large budget for network investments, and might not be interested in lowering costs, but in ownership of their assets. By adding this fact to the dominant position of Conecel in the market, it can be concluded that perhaps the actor that could be more interested in network sharing strategies is Otecel. As a private operator, they must be more limited than CNT Móvil in their budget, while they can benefit from improving their capacity and coverage to become more competitive with Conecel, as mentioned earlier.

Basically, after looking at the different possible scenarios proposed for network sharing, it is clear that the current situation of the Ecuadorian market poses many difficulties, given the number of operators present, the distribution of their market shares, and the current regulations. In order for this strategy to be feasible, the allocation of spectrum for 4G services to Conecel and Otecel must take place, as it would introduce the necessity of significant network deployments.

Additionally, the sharing of network capacity should be permitted by the regulator, in order to give the opportunity to implement active sharing. The introduction of one or more new actors would provide great opportunities to implement this strategy in the country as well. However, these lines of action may be jeopardized or inconveniently postponed given the nature of the National Regulator Authority, since it was shown that it has a complex structure may be vulnerable to political influences, which can make it difficult to make certain decisions in an effective way.

In this manner, it can be deduced that it is in the best interest of the regulator and operators in Ecuador to follow what has been done in Sweden (which will be described in a later section) and consider network sharing for future network deployments, as increased competition is most likely to drive higher development in the market while the scenarios proposed can improve the opportunities of each operator to improve their business performance, given the reasons exposed in this section.

Telecom Market in Chile

Operators and Market Shares

The Chilean mobile market currently has three private actors that may be classified as incumbent. They are Empresa Nacional de Telecomunicaciones de Chile S.A. (usually referred to as ENTEL Chile), Telefónica Chile (with the brand name Movistar), and Claro (currently owned by América Móvil).

It can be observed in Figure 2 that the three incumbent operators are currently dominating the market, with Movistar and ENTEL in a leading position with similar market shares, while Claro holds almost one quarter of mobile subscriptions, leaving them in a fairly good place as well. Nevertheless, in an interesting turn of events, the regulator decided it would be positive to encourage competition in the market by introducing new actors. Thus, concession licenses were awarded to two new operators, Nextel and VTR Móvil during 2009. Additionally, licenses for Mobile Virtual Network Operators (MVNOs) have been granted in 2011. As a reminder, "*market shares*" refer to the total number of end user subscriptions to the services of each mobile operator.

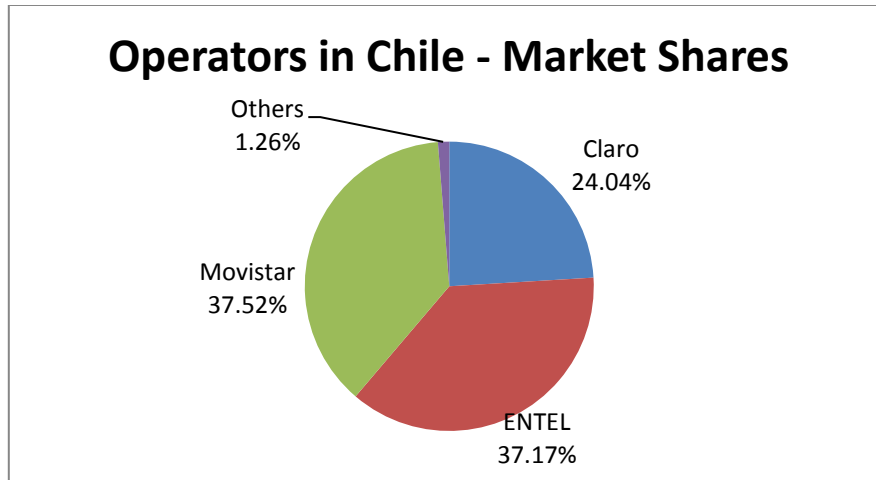


Figure 2. Market Shares for Mobile Operators in Chile (SUBTEL Chile, 2013)

While the figure clearly shows that the incumbent operators are still dominating, it will be interesting to see how the new ones evolve, as they have not yet been around long enough. Up until now, this market has been qualified as a fairly competitive one, having scored an average of little under 3,400 in their Herfindahl-Hirschman rating (Wireless Intelligence, 2013) recently.

Regulatory Body Structure

The official regulator authority in Chile is called Subsecretaría de Telecomunicaciones (Telecommunications Sub-Secretary), often referred to as SUBTEL. It is their duty to create and issue different policies in order to maintain a regime of free competition in the telecom market of the country, while encouraging the constant development of it. They are also in charge of awarding concession licenses for the delivery of telecommunications services and for the use of spectrum. Finally, they are in charge of monitoring the operations of telecom operators, to make sure they comply with national regulations and laws, as well as with the conditions of their licenses.

Even though SUBTEL works as the regulator authority, they are still under the jurisdiction of Ministerio de Transportes y Telecomunicaciones (Ministry of Transport and Telecommunications), because all of the so-called Sub-secretaries in Chile are considered branches of the Ministries in charge of their sector. In this manner, it could be said that SUBTEL does not operate as a completely free entity, and that it may still be subject to political influences coming from the Executive power in the country for some of its decisions.

Additionally, there is another organism in charge of controlling monopoly-like situations in all business sectors. It is called Tribunal de Defensa de la Libre

Competencia, or TDLC (Tribunal for the Defense of Free Competition). In the telecom segment, it has mainly influenced decisions over some of the regulations regarding the prices for different services.

Finally, it is important to mention that SUBTEL has proposed to create a new Superintendence of Telecommunications, which is supposed to assume the duties of monitoring the performance of service providers and controlling their operations. They argue that the market has expanded to levels that make it difficult for only one entity to handle all the responsibilities they are currently taking. However, the creation of this new organism has not been approved yet (MediaTelecom, s.f.).

Concession Licensing and Policies for Operators

Even though concession licenses have been awarded mainly through spectrum auctions, the regulator always considered important for the coverage areas offered by the bidders in their technical proposals to be large enough. Moreover, big efforts have taken place in order to enable a bigger part of the population to access broadband services, resulting in the encouragement made to operators to deploy base stations in remote areas that historically have not enjoyed connectivity. This is why in the latest auctions the focus has been to reach compromises from operators, rather than to raise high amounts of money from their bids.

Another important fact to mention about the way the regulator has awarded spectrum in Chile is that they have shown support for new actors to enter the market, in order to increase competition. This was reflected especially in the process conducted to assign spectrum in the 1700/2100 MHz band in 2009, when SUBTEL focused on bringing Nextel and VTR Móvil in the market, while applying spectrum caps to the three incumbent actors. Another example is the fact that in the latest 4G spectrum allocation, the winners compromised to offer roaming agreements for the entry of MVNOs in the market (SUBTEL Chile, s.f.).

The amount of spectrum allocated to operators in Chile in the past few years places them in a privileged position in the Latin American region, even reaching the levels of some more developed countries. A summary of the current spectrum allocations per operator is shown in Table 2. It is important to mention that the regulator has announced an auction in the near future for the 700 MHz digital dividend band.

Operator	800 MHz	1900 MHz	1700/2100 MHz	2.6 GHz	Total (MHz)
Movistar (Telefónica)	25	30	0	40	95
ENTEL	0	60	0	40	100
Claro (Amér. Móvil)	25	30	0	40	95
Nextel	0	0	60	0	60
VTR Móvil	0	0	30	0	30
Total (MHz)	50	120	90	120	380

Table 2. Spectrum Allocations per Band and per Operator in Chile

In summary, the approach to spectrum allocation taken by the Chilean regulator is to promote hybrid beauty contests/auctions with fairly small fees for operators, compared to other countries, with an average of 0.014 €/MHz/Pop. For instance, in 2012 only US \$ 11.8 million were raised for the licensing process for 4G services in the 2.6 GHz band. This is important, as it allows operators to focus their investments in deploying their networks in the best way possible, yielding the possibility to offer better quality services to end users. It is also noted that the distribution of spectrum is rather fair, although the new operators have complained that they need to be awarded spectrum in lower bands, in order to be more competitive and to achieve lower base station deployment costs in the future.

Analysis of Network Sharing Strategies

For a long time, some part of the Chilean population has been concerned about being exposed to high amounts of radiation coming from mobile base stations and other sources. This is why, after long debate, a new bill to regulate the installation of antennas and towers was approved in the beginning of 2012. One of the main objectives is to ensure that transmitting powers are compliant to the suggestions made by the World Health Organization, in order to preserve the environment and to protect citizens from an excess of exposure to radiation (ENTEL Chile, 2011).

Besides, the rules regarding the deployment of antennas and towers will be more strict, limiting the size and amount of them that may be installed in each area, in order to preserve the ornament of public spaces. This also looks to encourage network infrastructure sharing between mobile operators, an initiative the regulator is promoting after looking at the success experienced by actors in developed countries that have reached this sort of agreement. The idea is to complete 4G network deployments faster than expected, reaching larger coverage areas with smaller investments (SUBTEL Chile, s.f.). The introduction of network infrastructure (i.e., antenna towers) providers in the market as a consequence of this regulation, also seeks to encourage site sharing.

From the information gathered above and in previous sections, it can be observed that, despite having still certain political influences, the Chilean Regulator Authority still has

managed to have a progressive mindset. This has established their Telecom market as one of the leaders in the Latin American region. Moreover, the fact that they have taken serious action to allocate spectrum to mobile operators, to introduce new actors in the market, and to promote the introduction of infrastructure provider companies in their ecosystem, gives a positive idea of what the future decisions might be in general, but also in the matter of network sharing.

One fact that can be taken as an advantage in general, but that may be a drawback for network sharing, is the fact that operators have paid small fees for their spectrum allocation, as seen in the previous section. This allows them to have bigger budgets for their network deployments, and it could be the reason why so far, operators have still been reluctant to shared costs for those implementations. However, it would be interesting for them to see that this sharing strategy could pose benefits to them, in the way the Regulator has already done.

For instance, 4G deployments have already started, with Claro launching their own network in mid-2013. The other two incumbent operators, ENTEL and Movistar, are also in the process of deploying their 4G networks, which will be operative in the near future. However, these deployments are aiming to provide coverage mainly in urban areas for the moment. The fact that they have agreed (according to the stipulations of their concession licenses) to cover also a list of 543 rural communities that have been hard to access in the past due to the geographical setup of the country, opens a great opportunity to think of network sharing as a good solution to optimize the costs of implementing base stations in those areas.

Another driver for the three incumbent operators to consider cooperation strategies is that they have a rather balanced distribution of market shares and spectrum, as they would not be jeopardizing their positions in the market, while gaining benefits from more cost-effective network deployments. On the other hand, one limitation if a venture of this nature were to happen, is that the Regulator might be concerned about the state of competition, given that this could be dangerous for the growth of the new actors they encouraged to enter the market, as it could give even further advantages to incumbent actors.

As mentioned in the previous section, a new spectrum allocation process is being prepared by SUBTEL for the 700 MHz band. It is very likely that the new operators, Nextel and VTR will be benefitted once this contest takes place, given their position of disadvantage in front of the other three operators as far as the amount of spectrum they have been allocated is concerned. Also, they have claimed to be in need of being awarded some frequencies in lower bands. This scenario, combined with the fact that the two

greenfield actors have had significant investments in the recent past in order to deploy their 3G networks, opens even more opportunities for cooperation agreements. But, of course, the possible scenarios depend on how this new spectrum band is handled by the Regulator.

In this context, the first scenario proposed contemplates that spectrum in the 700 MHz is awarded only to Nextel and VTR, the new operators. This situation unfolds two possibilities:

- The first one would be for these new actors to perform either passive or active sharing, through which it would be easy for them to bear the costs of building a new network, after the investments they have already made in their 3G networks in the past couple of years. Moreover, it must be mentioned that both companies still hold roaming agreements with ENTEL and Movistar, respectively, until 2016, to provide coverage in certain areas of the country. A joint venture would help them even with the build-out of what is left of their 3G networks, especially as far as site construction is concerned. As an advantage for this option, passive sharing is already allowed and encouraged by the Regulator, as it was mentioned before. However, the legal limitation for active sharing is still an issue in case they opt for that strategy.
- The second option would be feasible only once active sharing becomes legally permitted. If that is the case, the incumbent operators would see the need to access spectrum in the 700 MHz band while the new actors would benefit from the utilization of the sites their peers have already built during all the years they have been operating. Perhaps the most suitable incumbent operator for this sort of deal could be Claro, since they are still in disadvantage to their counterparts of Movistar and ENTEL as far as the amount of customers is concerned, and 4G services in an additional spectrum band could determine an added value to acquire a bigger portion of the market.

A second scenario for the 700 MHz band would be for it to be split between the 5 mobile network operators in the country. In this case, the perspectives for network sharing become slightly more complicated, especially if the second option proposed above is to be considered, as greenfield operators would have nothing to offer to incumbents. Of course, the way in which spectrum in this band is distributed could open new opportunities in the long run, once 4G services have been widely introduced in the country and the network traffic starts to saturate them. In this case, agreements for spectrum sharing in the form of aggregation could be reached. But, still, this is subject to whether the Regulator decides to allow active sharing or not.

On the other hand, under this second scenario, the first possibility described before is still feasible, as it still provides a means for the new operators Nextel and VTR to save costs, while enhancing their network and giving them the opportunity of providing better coverage and quality in their services. All the factors would translate into better chances for them to compete with incumbent operators in better conditions.

To summarize the situation in the Chilean market, it can be said that the conditions set in the market are rather encouraging for network sharing. The way spectrum has been distributed, the fact that there is a plan to make a new band available for 4G services, and the state of a rather fair distribution of market shares among operators provides a wide variety of options to consider collaboration as a good strategy for operators in their future network deployments, as it has been evidenced in this section.

On the regulator side, perhaps its main influence in the future would be to establish the rules that will maintain a good level of competition in the market once operators start cooperating with each other, to prevent abuses and uneven market powers. There could be the danger of incumbent operators being reluctant to network sharing, since they may fear that they might be exposed to losing market power by cooperating with their new competitors. As an example, it is worth mentioning at this point that Movistar, ENTEL and Claro have already been penalized in the past, as they were accused of blocking the introduction of new actors in the market.

Additionally, SUBTEL should look to take action and allow the possibility for operators to perform active sharing as soon as possible, since complete cooperation has shown to be successful in more developed markets, as it will be evidenced in a later section by describing network sharing in the Swedish market. Finally, it must be said that the decision to regulate the amount of antennas deployed and the introduction of infrastructure companies is positive, as it allows operators to perform passive sharing even through these entities as third parties in their agreements.

Telecom Market in Sweden

Operators and Market Shares

The mobile market in Sweden has a total of four operators that have been introduced at different stages. Their names are Telia, Tele2, Telenor, and Hi3G. They are all part of companies present in other countries around Europe and Asia. The distribution of market shares they held by mid-2012 are presented in Figure 3. Additionally, a significant

number of MVNOs run operations through agreements to use capacity from the networks of the main MNOs.

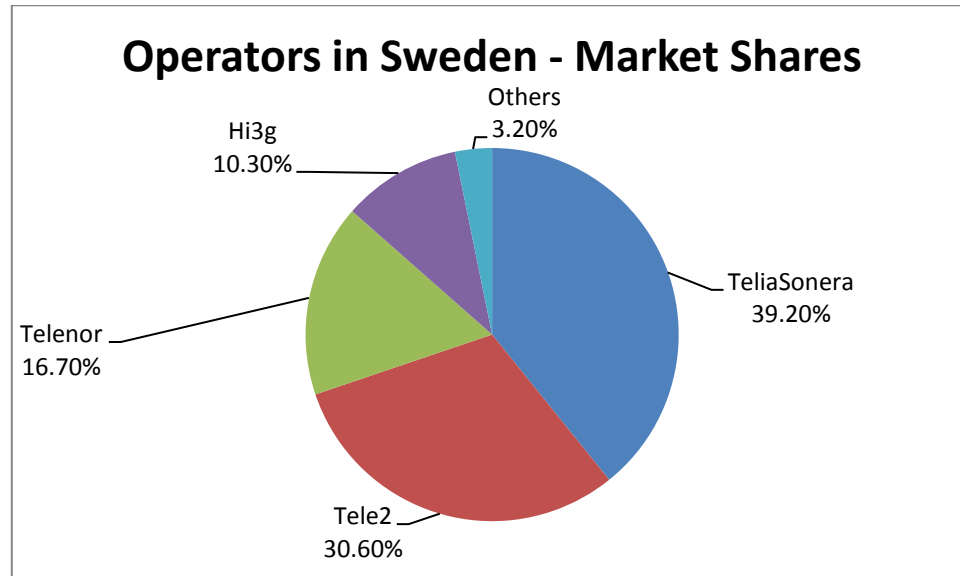


Figure 3. Market Shares for Mobile Operators in Sweden (PTS Sweden, 2012)

It can be seen that Telia dominates the market, closely followed by Tele2. These operators are considered incumbent actors, as they were among the first three operators to start services in 1992. Although the proportion of market shares held by each operator has remained almost at the same levels in the past few years, Hi3G has managed to increase their market shares and double them since 2007 (PTS Sweden, 2012). This has seen the number of customers of the other operators decrease. Given the distribution presented, the mobile market in Sweden has been rated at scores of a bit over 3,000 in recent evaluations for the Herfindahl-Hirschman Index (Wireless Intelligence, 2013), which reflects a market with good levels of competition.

Regulator Structure

The legal structure for telecommunications in Sweden is quite simple. There is only one entity that acts as the regulatory authority. It is named Svenska Post- och Telestyrelsen (Swedish Post and Telecom Authority, or PTS).

PTS is responsible, according to its website, of *"the electronic communications and postal services in Sweden. The term 'electronic communications' includes telephony, the Internet and radio"*. Also, it is mentioned that the main focus of their work is to ensure that the interests of the consumers are preserved and protected, to maintain fair

competition in the market, to promote secure communications, and to maximize the use of limited resources (i.e., spectrum) (PTS Sweden, s.f.).

In this manner, PTS is in charge of awarding licenses both for the use of spectrum and for the delivery of telecommunications services, as well as issuing regulations and monitoring the operations of the actors in the market. It acts as a completely independent public agency, meaning that the Swedish Government has no influence on its decisions and actions.

Concession Licensing and Policies for Operators

The regulatory body in Sweden has followed a very liberal approach, by allocating enough spectrum to operators and giving them more and more freedom to deliver their services as time went by. Ultimately, they came up with the idea of setting "service free" and "technology free" licenses in the latest concessions they conducted. Service free licenses refer to the fact that operators can choose to offer voice and/or data services in a band as they please, contrary to the traditional licenses that aimed to only one type of service per band. In the same manner, technology free licenses allow to deploy 2G, 3G or 4G networks freely within a band.

The means adopted for these concessions has been to perform spectrum auctions where operators bid for different bands of spectrum. Of course, in every case, frequencies are allocated to the highest bidder. Another important fact is that the fees imposed for spectrum are not too high, nor too low, with an average of 0.40 €/MHz/Pop. This allows both the Swedish State and the mobile operators to benefit, since the former can raise funds to further develop Telecommunications in the country, and the latter are left with enough capital to invest in their network infrastructure. Table 3 presents the total amount of spectrum allocated to operators in different bands.

Operator	800 MHz	900 MHz	1800 MHz	2100 MHz	2.6 GHz	Total (MHz)
Telia	20	20	70	0	40	150
Tele2	0	25	0	0	0	25
Telenor	0	15	0	40	0	55
Hi3G	20	10	0	40	70 (50 TDD)	140
SUNAB (Tele2 + Telia)	0	0	0	40	0	40
Net4Mobility (Tele2 + Telenor)	20	0	70	0	80	170
3GIS (Telenor + Hi3G)	0	0	0	0	0	0
Total (MHz)	60	70	140	120	190	580

Table 3. Spectrum Allocations per Band and per Operator in Sweden

From the table, it can be confirmed that operators have been allocated a high amount of spectrum in different bands. The distribution of resources is rather fair, with all operators being able to access more than 100 MHz each, either alone or through the joint ventures they have established with their peers. These ventures will be further discussed in the following section.

Analysis of Network Sharing Strategies

Sweden has one of the leading Telecom markets in the world and when it comes to network sharing, they are one of the pioneer countries in adopting this kind of strategy for mobile network deployment, with it being adopted first in the early 2000s by operators in order to implement their 3G networks. After Telia failed to acquire a license to offer UMTS technology in 2001, they entered into a network sharing agreement with operator Tele2, which was named Svenska UMTS-Nät AB (SUNAB). Currently, they both keep 50% ownership of this joint venture (TeliaSonera, 2013). Additionally, Telenor got involved in another joint venture called 3GIS with operator Hi3G, which was meant to be used for the deployment of their 3G networks in the 2100 MHz band (Telenor, 2013).

In addition to their joint venture with Telia, Tele2 has established another one in 2009. It is called Net4Mobility and it is shared with Telenor, at 50% ownership each. Their goal was to roll-out 2G and 4G networks together. In this sense, they now own the first multiple operator core network in 2G in the world, having launched it in 2012. They also plan to roll-out their 4G network in the 800 MHz frequency during 2013. Both operators act as MVNOs getting capacity from the network of Net4Mobility (Tele2, 2012). Figure 4 summarizes the existing cooperation agreements between Swedish mobile operators.

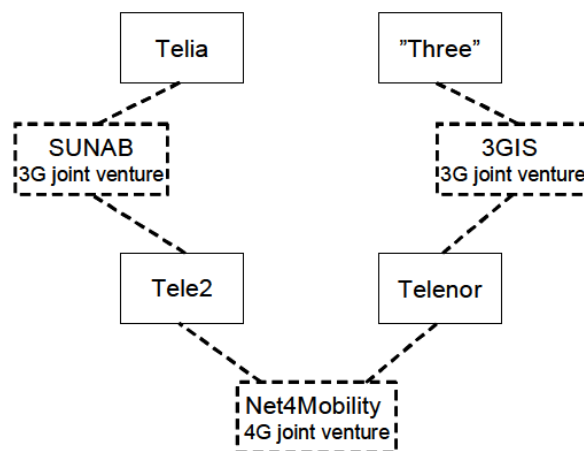


Figure 4. Joint Ventures for Shared Network Deployment between Swedish Mobile Operators (Markendahl & Mölleryd, November 2012)

At this point, it is important to mention the nature of the agreements established by Swedish operators. In all cases, they have taken advantage of the fact that the regulator has not restricted any sort of sharing, which enables them to share sites, non-telecom and radio equipment, as well as radio spectrum. This ability to make full utilization of this strategy has led to high cost efficiency in network implementations, with operators still being able to maintain a competitive market by focusing also on developing their own product solutions and marketing campaigns to acquire customers (Markendahl & Mölleryd, November 2012).

In this sense, the case of this country has proven that network sharing can be successful in a market where the amount of mobile operators is appropriate, with their market shares being fairly distributed in a market where competition levels are good, as its Herfindahl-Hirschman Index reflects in a previous section. This is caused in part by the fact that operators are used to having fierce competitors that will challenge them to maintain their business in good shape, and see sharing resources as a means to improve their business performance. This, in contrast to the situation seen in Ecuador, for instance, where two of the operators have so much power that they are very likely to refuse cooperation, not to jeopardize their position. Or, the situation in Chile, where incumbent operators have already shown signs of being reluctant to the entry of new actors in the market.

Network sharing also helped to overcome limitations in the situations of operators at one point or the other, like when Telia was not able to acquire 3G spectrum and formed an alliance with Tele2 to deploy a common network, for instance. This did not only aid operators individually. It also helped preserve competition in the market by allowing all the actors to have fairly equal conditions when implementing their networks for new services.

Another strong point for the success of network sharing is the fact that the regulator has a very liberal nature. They have managed to stay free of political influences and make decisions that are in the best interest of the development of the market and of the end users. In this context, they have managed to allocate enough spectrum to all operators, and to encourage competition by introducing new actors in the market and giving sufficient freedom for operators to run their businesses in the country. The fact that passive and active sharing were permitted at such an early stage compared to other regions of the world was key in order for operators to roll-out their base stations and offer coverage even in rural areas, as the deployment of 3G networks became more cost-effective and easier to bear for operators. Without this turning point, perhaps Swedish

operators would have struggled more to provide quality 3G, and now 4G services in their country.

Summary and Conclusions

After looking at the current situation in the three markets analyzed, it can be observed that they stand at very different positions when it comes to network sharing between mobile operators. It is also confirmed that the factors that were proposed for this study affect the feasibility to resort to this strategy as a network deployment solution.

The first conclusion to be drawn is that the number of operators and the way their market power is distributed is an important factor to determine the feasibility of using network sharing in a market. It was observed that in the case of Ecuador, the existence of only three operators, with two of them holding a state of “duopoly”, make it very likely to find reluctance from them to cooperate with their weaker counterpart, of even with a hypothetical new operator.

This can be corroborated by the case of Chile, where two new MNOs were recently introduced in the market, not without an initial attempt from the three incumbents to stop them. However, now that this addition is effective, this study shows that competitiveness has been enhanced and it has opened a wide range of opportunities for operators to consider sharing resources. Having mentioned this, it can be suggested that a new actor would be beneficial in the Ecuadorian market, not only as far as network sharing is concerned, but also to encourage more development and fair competition in it.

In this context, the case of Sweden has shown that a market with an enough number of mobile operators and good levels of competition, reflected by an even distribution of market shares, is a healthy environment for operators to build networks together and not to jeopardize their positions in the market, but to benefit their business instead. Network sharing was possible in the beginning between operators with rather similar market power, in the cases of the joint ventures of SUNAB (Telia and Tele2) and 3GIS (Telenor and Hi3G), followed by the more recent Net4Mobility. One of the keys has been the ability from operators to differentiate their products and customer acquisition strategies in spite of sharing their network implementations.

From the regulatory point of view, it could be observed that the ideal condition to encourage network sharing is for regulators to be as independent as possible and have a “liberal” mindset, distributing enough radio spectrum to operators and allowing them to make use of both passive and active network sharing. In this manner, it could be observed that in Sweden, due to the fact that the regulator acted within this line of thinking,

operators established their joint ventures without restrictions, leading to cost-effective roll-outs of their networks that led to great development in their mobile market.

On the contrary, it was seen that the regulators in Chile and Ecuador still have not permitted active network sharing, which limits the options they have to cooperate with each other. Even though there are many possible scenarios for this, some of them are not feasible until the regulators make this possibility legally available. However, it is necessary to highlight the fact that the regulators in both countries have taken steps forward into allowing passive infrastructure sharing, which is now exploited at least in the form of site rental from bigger operators to smaller ones. In Chile, it is positive that even the establishment of tower companies is encouraged.

Given the scenarios set for the three countries, it can be said that the main intervention required from regulatory into network sharing is to provide operators with the liberty to cooperate both through active and passive resources, to award them spectrum in sufficient quantities that reflect even distributions, and to encourage fair competition in the market, which may lead to rather even market powers. In this way, operators are able to see this deployment strategy as a driver, and not a threat to the success of their business. This last line of action should be a major concern for regulators in Chile and Ecuador, given the reluctance of incumbent operators to compete (and hypothetically cooperate) with new actors, as it was mentioned before.

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