# Infrastructure
*to support*
# the digital economy
*in Chile*

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This article presents a model for dealing systematically with the different matters associated with policies for developing the infrastructure necessary to support a digital economy, identifying the roles of the State and the private sector in this respect. It also describes the main initiatives taken in terms of creating and improving the infrastructure and content in the case of Chile, which illustrates the recent progress made in developing the country's digital economy and the challenges still pending in this field. There is general agreement that Chile must move closer to those countries already incorporated into the information society, and it must do so quickly and promptly. This study helps to identify the main factors for evaluating the policy aimed at promoting access to the digital economy, which is one of the central pillars for designing policies to advance toward the information society.

# I

## Introduction

The origination of a new model in the telecommunications industry, arising from the digitisation of signals and the development of the Internet, has set the stage for a radical transformation of economic and social relations on a more efficient and democratic basis which will improve competitiveness, participation and equality. In particular, the replacement of traditional mechanisms for carrying out transactions, administrative procedures and communications in general with methods that make intensive use of information technologies is giving rise to what has been called the "new digital economy", whose benefits in terms of productivity make it necessary to include the economic agents in this network promptly and massively. At the same time, the externalities and opportunities in terms of human capital associated with access to and use of the new technologies pose various challenges to public policy.

There is a general consensus that a tardy involvement in these information and communications technologies would not only mean missing out on many of the opportunities offered by access to information –larger markets, lower production costs, better training– but also a possible decline in the position achieved by the traditional economy. In this sense, information technology has become a decisive factor in economic growth, and its insufficient development can cause a widening of the gap with respect to countries that enter the digital economy more quickly. At the national level, massive access by the population to the Internet can help to reduce inequalities that limit equitable access to the benefits of economic growth.

Faced with this new phenomenon, it is essential to speed up the expansion of access to and use of the Internet as a tool for information, transactions, administrative procedures and the provision of social services (for example, education and health care) and thus build a non-exclusive pattern of sustained growth that helps to improve the quality of life of all citizens. In order to do this, it is essential to coordinate the efforts of the different actors involved, that is to say, the State, companies, content providers, universities, non-governmental organizations and the community itself.

In the development of information infrastructure, the main task of the State is to create a system of incentives to ensure both appropriate levels of access to the networks and the provision of suitable content. To this end, the authorities should:

— Promote universal access to the Internet.
— Eliminate barriers that interfere with access to and use of the network.
— Establish the necessary conditions to ensure investment in the support infrastructure required by the digital economy and its contents.
— Ensure the development of human resources compatible with the requirements of the new digital economy.
— Become a catalyst in the use of the Internet, by modernizing the public apparatus.
— Coordinate the actions of the public and private sectors and of non-governmental organizations in order to ensure an efficient effort and take advantage of the synergies among these actions.

Chile was the first Latin American country to introduce the Internet: in January 1992, the first connection was made, in the university sphere. In 1998, in view of the general perception that although the country had achieved some important successes in telecommunications, its performance in terms of the Internet was weaker than that of other countries in the region, a Presidential commission was formed to identify actions to advance further in use of the Internet in Chile. Later, the administration that took office in March 2000 assigned high priority in the public policy agenda to the issue of access to information technologies and the Internet. In his annual speech to Parliament in May of that same year,[1] the President of the Republic himself said that "Chile must take the lead among countries using information technologies, especially the Internet, as the engine driving new progress: progress based on companies' flexibility and not their size, on people's intelligence and not geographic proximity, on cooperation and not antagonism". To apply this guideline and give

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[1] For the complete speech, in Spanish, see http://www.presidencia.cl/cuenta/index.htm.

continuity to previously created commissions, the Commission on New Information and Communications Technologies was formed. This multidisciplinary, intergovernmental entity includes representatives of several ministries and public bodies empowered to deal with new information and communications technologies, and its mission is to ensure the development of these new technologies in Chile.

This article analyses the policies for developing the necessary infrastructure for the integration of Chile and all its citizens into the information society and evaluates the progress made in this direction. It is organized in three sections plus the present Introduction. Section II provides a simple model for conceptualizing policies for developing support infrastructure for the digital economy and identifies the basic elements that should be taken into account in them. Section III examines and evaluates the main policy measures recently applied by Chile in this area. Finally, section IV reviews the main challenges to be met in order to continue to develop infrastructure for access to the digital economy and thus help to place the country among those forming part of the information society.

# II

## Support infrastructure for the digital economy

The new information and communication technologies (ICTs) and the development of the Internet are key elements in the transformation that traditional forms and mechanisms for the exchange of information are currently undergoing: a transformation which has expanded to include exchanges of goods and services, giving rise to the terms "digital economy" or "new economy".

The concept of the digital economy mainly refers to the replacement of mechanisms for commercial transactions. The way such transactions are carried out has undergone substantial changes over time, each permitting significant reductions in transaction costs. The systems used have progressed from barter to the use of money, and from money in its different forms to exchanges in virtual space through devices connected to the Internet, making it possible to avoid the transaction costs associated with intermediation. The new economy does not involve disappearance of the traditional economy: only the market changes, with suppliers and purchasers meeting in a virtual space to exchange goods and services generated in the traditional economy.

There are two basic requirements for the success of network-based transactions:

i) Infrastructure: There must be an infrastructure to transmit information, making possible an electronic meeting between suppliers and purchasers; an infrastructure providing the necessary means for agreements to be accepted by the parties involved; and an infrastructure for transporting the electronically traded goods from the supplier to the purchaser.

ii) Content: The information needed for suppliers and purchasers to be fully aware of the terms of the transaction must also be available.

The absence of or limitations to one of these two components will inhibit the success of network-based transactions. It is therefore essential to ensure the harmonic development of both.[2]

The concept of the information infrastructure is illustrated in figure 1, which shows the supply of content offered by the public and private sectors, along with the demand for goods, services or information provided by both sectors. For electronic transactions to take place, a support infrastructure is necessary to facilitate interaction between suppliers and purchasers, thus making possible transactions in the digital economy.

The concept of a support infrastructure for the digital economy includes the whole set of elements necessary to guarantee the success of transactions across

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[2] One of the central elements in the diagnosis made in 1998 by the Presidential Commission on New Information and Communications Technologies was the identification of a vicious circle between these two components. The commission found that on the one hand the limited development of infrastructure and lack of interest in operating across networks arose from the lack of content, while on the other hand the lack of content was due to the low penetration of Internet in households and companies. This diagnosis permitted the identification and implementation of significant projects that helped to break this vicious circle, among them, the incorporation of the State itself into the network.

FIGURE 1

**Infrastructure for the digital economy**
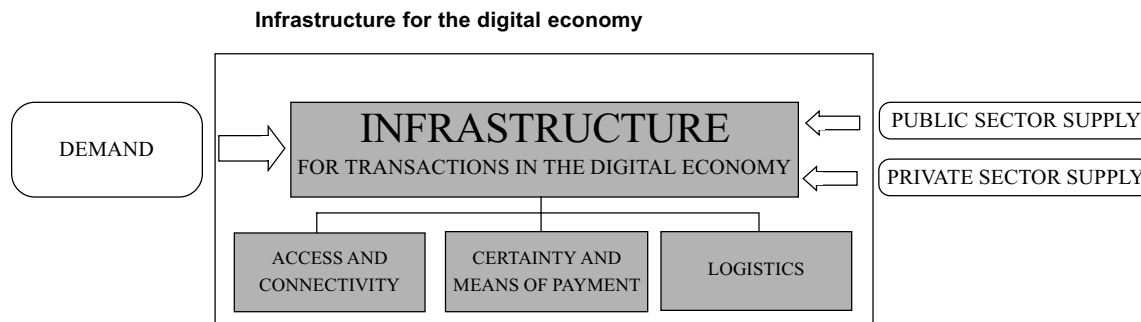


information networks. The three basic elements are: access infrastructure, means of payment and certainty, and distribution infrastructure. With the Internet and the advent of highly competitive, globalized markets, if any of these three elements do not operate promptly and well, opportunities to create added value at the country level can be frustrated. The existence of an adequate supply and demand for goods and services in this virtual market place is also essential, so that a number of measures need to be taken to maximize the potential benefits of these new technologies.

Figure 1 shows how to order policies for encouraging trade through digital media. Several measures can be identified in this respect, involving:

— Strengthening the demand for goods and services traded over the net.
— Developing the access infrastructure.
— Developing the infrastructure designed to provide the means of payment and the corresponding certainty.
— Developing logistical infrastructure.
— Strengthening the supply of goods and services traded on the net.

**1.   Strengthening demand for goods and services traded over the net**

A variety of measures can be applied to develop Internet-related capabilities. They involve not only mastering the devices connected to the Internet, but also strengthening English language skills, since today around 78% of websites and 96% of e-commerce sites use English. Moreover, to make the Internet more attractive than traditional methods for exchanging information, different incentives can be established, such as tax exemptions for electronic commerce[3] or

measures to simplify or expedite administrative procedures.[4]

**2.   Developing the access infrastructure**

The access infrastructure consists of the telecommunications media and other devices needed to gain access to or connect to networks and to transmit information in such a way as to permit two-way electronic communication among the actors generating the information and its users.

All policies designed to encourage the development of telecommunications networks and devices to permit non-exclusive, efficient and competitive Internet access and data transmission belong to the area of the access infrastructure. It therefore involves the application of regulatory and policy measures that promote the rapid absorption of new technologies and competition in the telecommunications market, thus making Internet access cheaper, as well as policies for creating infrastructure to serve vulnerable or isolated sectors.

**3.   Developing infrastructure to ensure certainty and security**

An essential element in any transaction is money, that is to say, the means of payment accepted by the parties involved. Basic requirements for this acceptance include the security of the means of payment employed and certification of transactions. Similarly, security regarding the agents involved in a transaction is essential, and this involves their digital identity, along with trust in the inviolability of the private data transmitted across the network.

In this sphere, conditions must be generated that guarantee protection of the digital identity, by providing

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[3] Such as those recently applied in the United States through Law HR 1054.

[4] Such as those applied in Chile and Brazil for tax declarations.

full security for the information moving through networks by means of systems of authentication, certification, privacy and security to deal with any information technology incidents.

**4.   Developing the logistical infrastructure**

This area of infrastructure includes policies to guarantee the timely and efficient delivery of goods or services acquired electronically. Measures to be applied in this respect include the creation of "back office" logistical systems that minimize dispatch times through efficient inventory management and proper organization of the distribution industry to ensure the timely and informed delivery of goods to users.

**5.   Strengthening the supply of goods and services**

The potential benefits of Internet use depend very much on the network content being of interest to users; consequently, the relevant policies must be designed to stimulate this content. The public sector can become a catalyst for the use of the Internet by stimulating access to public services through the Internet.

In this respect, the main challenge facing this sector is to move the State into the virtual arena so as to bring public services closer to people, while for the private sector the challenge is to develop suitable content on the network, especially by aiding small and medium-sized firms, which often find it more difficult to participate in a system based on virtual supply.

# III

# Information infrastructure development
# policies in Chile

This section describes the main policies applied in Chile to stimulate the development of support infrastructure for the digital economy and evaluates the country's status in terms of access and connectivity infrastructure.

The Chilean strategy has been to minimize the regulations applied to the industry, to promote more Internet connections, and to develop close private-public cooperation in the various bodies engaged in the preparation of measures to favour development of the Internet. Right from the start, the Presidential commission on new information and communications technologies began to work closely with the private sector, which was considered to be a leading actor in the country's integration into the information society. Later, in May 2001, the Public-Private Alliance was formed. This body, coordinated by the public sector[5] and made up of companies from the telecommunications and information technology, financial, transportation and postal sectors, was organized to design and establish instruments and projects to encourage the development of infrastructure for access, security and certainty, and distribution.

In this same sense, the government has given high priority to private sector participation in the development of the Internet, by organizing several missions, led by the President of Chile and made up of ministers and leading private sector actors, to establish contacts between Chile and key centres of the technology and information industry. These included, for example, the missions to Silicon Valley and Sweden in 2001. Results from these missions include the creation of the Fundación País Digital (Foundation for a Digital Country), a private sector initiative; the start-up of a project to create a technology park in Valparaíso; and above all, consensus about the importance of a joint effort to position the country in terms of the new technologies.

A description of the main policies applied in the different areas of information infrastructure in Chile follows, with examples from specific programmes.

**1.   Strengthening demand for goods and services traded on the network**

The policies in this field are aimed primarily at training human resources in efficient use of Internet. The demand for information infrastructure is closely tied to the quality and relevance of the contents available

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[5] Specifically, by the Special Information Infrastructure Unit created by the SUBTEL (Department of Telecommunications). See (in Spanish) www.chilefuturo.cl.

on the network. Thus, the experience with community "telecentres" indicates that a key element in their success and sustainability is the creation of local content interesting to local people, whose greater or lesser mastery of the computer is a decisive factor in the use of these telecentres. Training has proved to have a direct impact on boosting demand for Internet navigation hours.

In terms of human resource training, several initiatives to reinforce demand for these technologies have been implemented. In the public sector, a training programme in information technologies has been set up for public employees throughout the country; a technology transfer laboratory has likewise been established; and the modification of the curricula of technical institutes to deal with the new requirements associated with information infrastructure is being studied (these institutes receive 40% of all secondary school students).

Likewise, at the level of small and medium-sized firms, an Internet training programme for companies has been created (www.corfo.cl). This programme seeks to make businessmen see the Internet as a means of improving their competitiveness, expanding markets and making possible new business opportunities. It is designed to train people with different levels of needs for Internet skills, in accordance with the stage reached by the companies concerned in the process of absorption of technologies.

## 2. Development of a non-exclusive access infrastructure

The access infrastructure is that which provides users with access both to the devices necessary to establish communication and to the networks giving access to the basic connectivity infrastructure for data transmission.

a)  *Access to devices for digital information exchange*
Universal access to information technologies is a priority policy objective for reducing the so-called digital divide. According to information up to November 2000, in that year 16.9% of Chilean households had a computer and 8.3% were connected to the Internet. In terms of numbers of people, the figures were better: 29.6% and 15.9% of the population, respectively, thus indicating that people have access to computers and the Internet in places other than their homes, as well as through some specific community programmes.

The relatively low rate of household access to the Internet largely reflects the fact that the main medium used is the personal computer, whose high cost constitutes a significant entry barrier. While technological development will introduce new means for accessing the Internet at higher speeds, such as digital television and third generation mobile services, it is necessary to improve access to terminals through specific support programmes.

In late 2001, the private sector started to install public telephones especially designed to send e-mails and messages to cellular telephones at prices accessible to users, which will contribute significantly to more widespread use of the Internet. Similarly, the market is generating solutions that permit Internet access through infocentres.

For its part, the public sector has implemented several measures to promote access to computers, which may be divided into measures of an individual nature and those at the community level.

Among the possible measures to promote **individual access** to Internet connection devices are subsidies for the purchase of equipment and targeted credit policies. Chile has opted for the second alternative, establishing a programme of soft loans for groups of users with common interests, in this case school teachers and small and medium-sized firms. Unlike other countries, no moves have been made to establish special programmes for improving Internet access by providing lower-cost equipment.

The national Production Development Corporation (CORFO) and the state-owned bank BancoEstado have opened lines of credit to allow micro- and small firms to purchase computer equipment and receive training in Internet use.

To this end, BancoEstado (*www.bancoestado.cl*) offers two lines of credit to small and medium-sized firms: one called Easy PC Credit, to finance the purchase of a computer, aimed at micro- or small businesses which are formally established and have been in existence for at least one year; and a PC Internet credit scheme to finance the purchase of computer equipment for all kinds of educational establishments, whether State-subsidized or private schools, to help them to set up computer classrooms and obtain equipment for carrying out the school's administrative tasks.

Similarly, in 2001 CORFO set up a programme to provide 10,000 computer sets (equipment and services) for small businesses and teachers, with preferential financing. This programme was repeated at the end of that year, providing the same number of computer solutions.

The policy for **community access** to telecommunications services has mainly focused on strengthening infrastructure for vulnerable or isolated sectors, through a subsidy for investment in this respect. Thanks to the universal access policy applied in Chile since 1995, basic telecommunications infrastructure –wired, wireless and satellite networks– has been developed throughout the country, particularly in rural areas, thus providing extensive coverage,[6] and it is hoped to expand it to include infrastructure providing universal access to the Internet.

Several other initiatives have also been taken to promote community access to information technologies and are already under way.

*"Enlaces" Network.* In the context of the educational reform programme, in 1993 an experimental project in the field of computers and digital networks was begun in Chile's State-subsidized schools. It is known as the *Enlaces* (Links) *Network,* and its purpose is to integrate information technology into the educational system as a resource for teaching and learning, training teachers, and developing relevant content. By 2000, 90% of Chile's students were in schools with a computer room connected to the Internet (100% coverage of secondary schools and 50% of primary schools). In 2001, an educational portal (*www.educarchile.cl*) was inaugurated to help the community advance in terms of educational content relevant to the formation of human capital.

*National Community Infocentre Programme.* This programme is a means for the coordination and generation of inter-institutional alliances. It operates through a governmental working group that coordinates public initiatives in this area, creates alliances and designs policies to promote universal community access, in close coordination with non-governmental initiatives. A national list of infocentres has been prepared (*www.gobiernodechile.cl* and *www.mapas.moptt.cl*), which so far lists 184 such centres; this includes 18 infocentres for small and medium-sized firms, which will soon rise to 60. Similarly, in 2002 the government department responsible for libraries, archives and museums (*Dirección de Bibliotecas, Archivos y Museos*) was due to set up around 366 infocentres in its premises in

municipalities all over the country: this initiative is being carried out jointly with the Gates Foundation. Among the measures for developing these infocentres throughout the country are projects for the recycling of computers and the establishment of community telecentres.

*Computer recycling project for Infocentres.* This initiative, begun in 2001 as part of the Public-Private Alliance, aims to create infocentres run by non-governmental and community organizations, with equipment and services provided by private firms. The State's role is mainly that of management, targeting and selection of the institutions responsible for running the infocentres, along with coordination among the companies and civilian organizations involved. By late 2001, ten infocentres were up and running, and by the end of 2002 another 100 were due to be established, using recycled elements.

*Community Telecentres.* This programme, in association with the Telecommunications Development Fund (see www.subtel.cl), seeks to provide local communities with an integrated community solution in terms of telecommunications services, including the Internet. The implementation of this programme, involving competitive grants to subsidize the development of community telecentres, is designed to generate community telecommunications and Internet infrastructure in isolated locations. The subsidy is financed from the general State revenues, so it has no distorting effect on the industry. The allocation of funds is efficient, in that those projects offering the most social benefits compete among themselves and the subsidies go to those applicants who meet the basic requirements but request the lowest amounts. To date, five community telecentres are up and functioning, as part of a pilot project that should develop further in 2002.

b) *Basic connectivity infrastructure to access the digital economy*

Chilean telecommunications policy has stimulated a rapid increase in the telecommunications infrastructure, which is of a high standard compared to other countries with similar per capita income. Because of the early market liberalization,[7] privatization of the main fixed telephone and long-distance companies in the late 1980s, and the application of a regulatory framework that encourages investment, market competitiveness and universal access, investment in

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[6] The Telecommunications Development Fund programme, which started in March 1995, helped to improve the coverage of public telephones to virtually the whole country within five years. Only 3.2% of households now lack access to telephone service, that is, do not even have access to public telephones.

[7] In the early 1980s.

telecommunications has risen steadily and with it the importance of this sector to the country's economy.

Internet access in Chile has grown strongly since mid-1999, because of the reduction in the price of dial-up connections, technological progress that permits higher-speed Internet access –at prices that residential and small business users can afford– and a minimal regulatory framework in a competitive market.[8] To date, the penetration rate for Internet access is over 20%, thanks to the leap in the number of new broadband connections that became available as from 2001.

Although the basic connectivity infrastructure, understood as the basic Internet access infrastructure, which consists mainly of the public fixed telephone network, has performed well by regional standards, the country still displays a significant deficit compared with developed countries (table 1).

In terms of the organization of the industry, although there have been some substantial advances towards the entry of new operators and the development of new services, the market structure of the sector still shows a significant degree of concentration, particularly with regard to access to the "last mile", where the dominant operator still controls about 80% of the market. In other services, such as mobile telephone service, long distance and the Internet, although there are many operators (4, 13 and 42 respectively) the market still tends to be controlled primarily by two or three firms, whose business is vertically integrated at every level.

Access to the digital economy requires access and connectivity infrastructure at three levels:

i) *International connectivity*. For the country to be fully integrated into global communications systems it needs an infrastructure connected to systems abroad via international links to form part, ultimately, of the global network of networks, thus placing the opportunities that exist elsewhere in the world within the grasp of Chilean individuals and companies.

TABLE 1

**International comparison of telecommunications service coverage, 2000**
*(Telephone lines, subscribers and users per 100 inhabitants)*

|  | Fixed telephones | Mobile telephones | Internet users |
|---|---|---|---|
| Argentina | 21.3 | 16.3 | 6.8 |
| Brazil | 18.2 | 13.6 | 2.9 |
| Colombia | 16.9 | 5.3 | 2.1 |
| Chile | 22.1 | 22.2 | 16.6 |
| Mexico | 12.5 | 14.2 | 2.7 |
| Peru | 6.4 | 4.8 | 9.7 |
| Uruguay | 27.8 | 13.2 | 11.1 |
| Venezuela | 10.8 | 21.7 | 3.9 |
| United States | 70.0 | 39.8 | 34.7 |
| Spain | 42.1 | 60.9 | 13.3 |
| Finland | 55.0 | 72.0 | 37.2 |
| England | 58.8 | 72.7 | 25.8 |
| Italy | 47.4 | 73.7 | 23.0 |
| Sweden | 68.2 | 71.7 | 45.6 |

*Source*: International Telecommunication Union (ITU) and SUBTEL.

significant barrier to the development of information technologies in Chile.

ii) *National connectivity (backbone)*. Networks are needed to connect communities at the local and national levels, at speeds that satisfy the demands of the country's economic and social development. These networks constitute the system's backbone.

In terms of national connectivity, the Internet access infrastructure can be seen as a trunk network fed by multiple access networks, with the public telephone network being the most used today. The trunk network consists primarily of fibre optic networks that provide connectivity at the national and international levels and meet capacity needs without restrictions.

In Chile, the region between Arica and Puerto Montt has three fibre optic networks at the national