CRITICAL INFRASTRUCTURE FOR DEVELOPMENT
BASIS FOR SUSTAINABLE CHILE
2016-2025
CRITICAL INFRASTRUCTURE FOR DEVELOPMENT

BASES FOR A SUSTAINABLE CHILE

2016-2025
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The Chilean Chamber of Construction, aware of the contribution made to the social and economic development of the country by public infrastructure, has addressed, since 2002 –through its Studies Management Unit – the task of estimating deficits in areas of infrastructure considered essential. Moreover, with the purpose of further contributing to the design and evaluation of public policies, it has incorporated, since 2012, the support of external specialists, who have helped to supplement the contents of this report, Critical Infrastructure for Development, with their knowledge and expertise.

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Studies Management Unit Chilean Chamber of Construction

GRAPHIC DESIGN
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PRINTED AT
Andros Impresores

Santiago, april 2016
<table>
<thead>
<tr>
<th>Page</th>
<th>Section</th>
<th>Chapters</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>PRESENTATION</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>INTRODUCTION: SCENARIO BY 2025</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>THE INFRASTRUCTURE THAT SUSTAINS US: BASAL</td>
<td>Chapter 1: Water Resources</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chapter 2: Energy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chapter 3: Telecommunications</td>
</tr>
<tr>
<td>39</td>
<td>THE INFRASTRUCTURE THAT CONNECTS US: LOGISTICAL SUPPORT</td>
<td>Chapter 4: Intercity roads</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chapter 5: Airports</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chapter 6: Ports</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chapter 7: Railroads</td>
</tr>
<tr>
<td>53</td>
<td>THE INFRASTRUCTURE THAT INVOLVES US: OF SOCIAL USE</td>
<td>Chapter 8: City roads</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chapter 9: Public spaces</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chapter 10: Education</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chapter 11: Hospitals</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chapter 12: Jails</td>
</tr>
</tbody>
</table>
The report “Critical Infrastructure for Development” (CID) 2016-2025 is a reflection of our trade’s permanent effort to contribute to the discussion of public policies in the area of infrastructure.

For this reason, this document contains a detailed analysis of twelve key sectors for the social and economic progress of the country, grouped into three strategic sectors: infrastructure that sustains us or basal (water, energy and telecommunications), infrastructure that connects us or logistic support (intercity roads, airports, ports and railroads) and infrastructure that involves us or of social use (city roads, public spaces, education, hospitals and jails).

In this group, the addition of three new sectors should be noted –telecommunications, education and public spaces– which not only constitute lacking areas, but also offer the greatest possibility to generate efficiency revenues in the economic activities.

Furthermore, and the same as in the previous edition, renowned specialists in the areas covered contributed to the elaboration of the 2016-2025 CID; using common methodological guidelines, they estimated the future investment needs of the country, considering both a strategic focus as well as a basic scenario of comparison for the next ten years.

The main differences in the results obtained as compared with the previous version of this report are derived from three fundamental elements: (i) the recent changes in the global and political macroeconomic scenario at local level, which has impacted the direction of investments, (ii) the addition of new information at disaggregated level, which allowed a deeper study of de-
ficiencies all over the country, and (iii) the comparison with more demanding standards, in line with the development of the country.

In terms of **water resources**, the needs for future investments are guided by the “water safety” criterion, understood as an appropriate availability of the resource—in terms of quantity and quality—for water supply for people, subsistence uses, the protection of ecosystems and production.

To reach these objectives in the period analyzed, an adequate level of endowment of infrastructure as well as management are required, which implies three challenges in terms of public policies: 1) to understand the development of the infrastructure within a framework of integrated management at the level of basins; 2) to revise the way to finance new investments in urban zones when they can significantly affect price rates, as well as the legal and institutional framework concerning sanitation services in rural areas; and 3) to improve the regulations both concerning the use of land in areas in risk of flooding and landslides and also the changes in basins that imply a general increase of general flows that may affect the drainage systems.

As for **energy**, Chile faces very significant challenges, although their nature is changing quickly because if the slow economic growth continues in the medium term, the power plants under construction at present should be enough to satisfy the investments required for the next ten years.

On the other hand, although Congress is discussing modifications to the regulation of electrical transmission, these modifications will not alter the described scenario, partly because the changes would be applied gradual-
ly and because investments in generation respond to demand and not to the behavior of the transmission system. In this matter, the most relevant investment of the period will be the construction of the SIC-SING interconnection line.

In another area, **telecommunications** have undergone sustained growth for several years, excelling as one of the main agents to boost GDP, with average annual rates of growth over 7% in the last few years. However, compared to the OECD countries, at present Chile presents a gap above 50% in broadband connections. By 2015, the investment deficit in infrastructure was equivalent to almost 2,000 million dollars.

All things considered, the future presents an even bigger challenge. Experts project that the demand for data traffic on the networks will multiply ten times in the next five years; therefore, huge investments will be required to adequately support this traffic. Furthermore, the Digital Agenda 2020 submitted by the government establishes ambitious goals in terms of connectivity to increase the coverage of landline and mobile broadband services in the country, bringing it nearer the rest of the OECD nations.

It is essential to establish a regulation that encourages private sector investments, above all ensuring that business models will not suffer significant changes during most of the assets’ useful life, although public funding will still be required for the development of networks in low population density sectors and/or with lower capacity to pay.

In terms of intercity roads, and despite the progress achieved, international comparison shows that, as a country, it is still necessary to invest heavily in order to improve road infrastructure, either because it has a positive impact on specific areas –like tourism and logistics– or because it makes us more productive or because it benefits competitiveness.

Chile has the instruments and the financial capacity to bring about the required investments. However, this is not enough to activate the infrastructure generation processes. It is necessary to integrate the planning of public roads and the private management taking into account their roles in economy and their relationship with certain productive sectors.

In the same aspect, and taking into account the demand for connectivity all over the country, exploring innovative alternatives of connection be-
tween production and consumption areas becomes relevant. For example, minor detours from main roads may improve coverage and contribute to integration.

As for airports, the sector shows high growth rates of domestic demand (over 10% a year between 2006 and 2013) and an important increase in trips abroad, which shows that air transport has become an accessible alternative for wide segments of the population.

In this respect, although investments so far cover great part of the demand, there is a growing lack of space in the areas assigned for passenger use, particularly at Santiago International Airport.

It is essential to fine tune the projections of demand and costs per terminal, to advance in the social evaluation of the projects, to elaborate public bidding regulations and to schedule in advance the need and use of resources. It is also advisable to widen the areas of planning, adding aspects related to connectivity and accessibility as an integral part of projects for airports, which would allow the setup of medium distance mass public transport systems and in this way expand networks and improve services.

The analysis of the national port infrastructure is closely intertwined with the concepts of logistic efficiency, productivity and competitiveness. So, the needs for infrastructure depend on objectives that are more complex than the transfer capacity of each terminal. At present, relevant elements of the discussion are, for example, measures to improve efficiency and competitiveness in this area, introducing technology and minimizing the impact on indirect costs of the operations, among others.

In this aspect, it is a priority to stick to the investment schedule, especially in ports whose capacity is nearing their limit. This makes it an obligation to prepare the bidding processes in advance, which implies doing research, preparing bases, developing technical studies, anticipating financing and working on the minimum permits needed to grant the physical space to private companies.

However, covering the required investments would allow the achievement of only a part of the objectives of the sector; advancement in modernization of operations, especially regulations and control and inspection mechanisms would still be pending.
In the case of the railroad sector, it should be noted that for several decades its evolution was characterized by a situation of instability, complex administration problems and weakness in the formulation of viable development plans. Nevertheless, the existing master plan, backed up by the three-year plan that assigns the budget, reflects the structural modernization guidelines that the company requires to consolidate its growth with financial strength and high quality of operations and services.

It is essential, though, to incorporate management technology and a strong commercial focus to the sector. Attracting and keeping more than 20 million passengers requires an effort to make contact, understanding of needs, adaptation of offers and users follow-up. Due to the present volumes of transport, EFE has not felt under pressure concerning this task, as it is the case with Merval in Valparaíso, which shows noteworthy harmony with its users.

As for roads and city transport, three deficit areas were identified that have to be addressed to improve the quality and equality of city transport: repair and maintenance of streets and sidewalks, development of decongestion projects and strengthening of public transport with urban trains in the main cities of the country.

It is essential that the design and implementation of a system of public transport at city level be conceived from a multisector point of view, incorporating the need to improve and homogenize the standards of urban transport. Likewise, the projects corresponding to road improvement, maintenance and management must be executed in a coordinated way among the different public entities involved.

Besides, linked to the growing process of urbanization in the countries, there has been strong pressure exerted on goods and services of common use available in cities, highlighting the importance of public spaces to satisfy the collective needs inherent to city life, such as sport, recreation and culture, among others.

At present, Chile lacks an integrated regulatory and institutional framework that allows the adequate provision of public spaces to satisfy the needs of access (coverage) and capacity for all the population, which generates inequality sources in areas that have fewer resources for development and management. To solve this situation, regulations are required that define explicit standards for the provision of public goods and services at local scale, both
in terms of coverage and of capacity, as well as an institutional framework, policies and strategic objectives for their implementation.

On the other hand, the present scenario in education is characterized by its uncertainty, mainly as a product of the high costs associated with projects of educational infrastructure and the present restructuring of the state system at country level.

In spite of this, the need to improve and innovate in the present educational spaces is evident, so that they contribute to strengthen state education and foster learning. Educational establishments must have the infrastructure that allows them to incorporate innovation in the configuration and use of spaces, so that they can come near the OECD standards associated with modern educational systems, having a critical impact on Chilean students. To materialize such improvements, the authorities must prioritize the investment areas in a first stage and select the establishments to be strengthened in the first place.

Data shows that the schools that have coverage of educational services for all the cycles are the ones that should be intervened in the first place. Among these, the most vulnerable schools would be the focal groups.

In the hospital sector, the country will continue undergoing an aging process of its population, which will mainly affect the public health service.

To respond to this demand, the present system has more than 2 million square meters built area of hospitals, of which nearly 60% is in regular or poor conditions.

At national level, there is consensus on the need to improve this situation, so the State has allocated a growing amount of resources to the investment program. However, recent history shows that it is not enough to only count with resources but it is also essential to have the capacity of institutional management that allows their efficient and timely use.

In this respect, a key element is to have an institutional organization that operates under a long term view, independent of the current conditions, to ensure the materialization of the works.

The main effort in the next decade should be to continue to reposition of the existing establishments, the strengthening of primary health care and to
start identifying the actions necessary to develop a network of health care associated with the rapid aging the country is undergoing. All of this requires a transversal political agreement that supports development through the concession model, similar to what was required when the Public Works Law of Concessions was passed, to prevent changes of government affecting investment plans.

In the prison sector, it emerges that, as from the Reform of Criminal Justice there has been a growing demand for closed correctional facilities, with a noticeable annual growth of prison population imprisoned in premises of this type. This situation produced both an increase in the overcrowding rates as well as concern at political and government levels about the effectiveness of the reform from the point of view of rehabilitation, motivating a meaningful analysis of it.

In this area, today it is possible to observe that the execution of new projects of closed infrastructure has come to a standstill since the beginning of this decade, in spite of the programs announced by successive governments.

In practice, the level of implementation of the budgets assigned to the Undersecretary of Justice has been low, which has implied that the concretion of most of the major sized projects has been delayed in the last five years. In this respect, a general initial recommendation is to decentralize the investment processes and distribute them to all the regions of the country, in collaboration with the Chilean Prison Service. The second recommendation has to do with resuming the model of prison concessions, which in the last decade showed the capacity to design, build and operate efficient prisons with better standards, which led to improve the capacity for reintegration and safety in the whole of the sector.

JORGE MAS FIGUEROA
PRESIDENT
CHILEAN CHAMBER OF CONSTRUCTION
Summary of investment requirements
Millions of dollars

<table>
<thead>
<tr>
<th>Strategic axis</th>
<th>Sector</th>
<th>2016-2020</th>
<th>2016-2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infrastructure that sustains us: Basal</td>
<td>Water resources</td>
<td>6,270</td>
<td>12,540</td>
</tr>
<tr>
<td></td>
<td>Energy</td>
<td>3,351</td>
<td>11,566</td>
</tr>
<tr>
<td></td>
<td>Telecommunications</td>
<td>12,697</td>
<td>26,346</td>
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<tr>
<td>Infrastructure that connects us: Logistic support</td>
<td>Intercity roads</td>
<td>10,633</td>
<td>20,198</td>
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<td></td>
<td>Airports</td>
<td>1,011</td>
<td>1,729</td>
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<td>Ports</td>
<td>1,725</td>
<td>4,390</td>
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<td></td>
<td>Railroads</td>
<td>992</td>
<td>4,036</td>
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<tr>
<td>Infrastructure that involves us: Of social use</td>
<td>Roads and city transport</td>
<td>34,486</td>
<td>54,020</td>
</tr>
<tr>
<td></td>
<td>Public spaces</td>
<td>437</td>
<td>859</td>
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<tr>
<td></td>
<td>Education</td>
<td>2,179</td>
<td>10,385</td>
</tr>
<tr>
<td></td>
<td>Hospitals</td>
<td>2,153</td>
<td>4,650</td>
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<tr>
<td></td>
<td>Jails</td>
<td>349</td>
<td>698</td>
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<tr>
<td>Total</td>
<td></td>
<td><strong>76,283</strong></td>
<td><strong>151,417</strong></td>
</tr>
</tbody>
</table>

Source: CChC.

According to recent estimates prepared by the Chilean Chamber of Construction (CChC), the long term elasticity of the public infrastructure to GDP is of about 0.15; that is to say, for every 10% increase in sector investment, the GDP increases 1.15%. Thus, if the estimated deficit in public infrastructure represented approximately 3.0% of the 2015 GDP, eliminating this gap would require an increase in the sector investment of 19% a year for the next ten years. In the short term, the impact of this greater pace of investment on the economy can be summarized in an increase of the GDP of 6.3% a year, an amount that is three times the present state of growth of the aggregate activity.
INTRODUCTION

FUTURE SCENARIO AND STRATEGIC AXES FOR CHILE BY 2025

There is global consensus about the need to increase public and private investment in infrastructure to reach the goals of social welfare and sustainable growth of countries, independent of their level of development. This analysis also indicates that if there are varied opportunities to invest in projects of infrastructure which have an impact on growth, the reality of each country is significantly different and, therefore, it is important to establish strategic goals according to the development profile projected for the future.

From a theoretical point of view, increases in investment in public infrastructure have a strict relation with the dual impact that generates on the economy: in the short term, it promotes aggregate demand through the fiscal multiplying effect—in a similar way to other types of public expenditure—and, in wider temporary horizons, fostering private investment given the existing complementarity with services associated with the provision of infrastructure.

According to recent estimates prepared by the CChC, the long term elasticity of the public infrastructure to GDP is of about 0.15; that is to say, for every 10% increase in sector investment, the GDP increases 1.15%. Thus, if the estimated deficit in public infrastructure represented approximately 3.0% of the 2015 GDP, eliminating this gap would require an increase in the sector investment

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Because of this, this report was prepared under two fundamental premises:

• The importance of identifying the needs of infrastructure that make it possible to reach greater economic growth through higher productivity in three strategic levels: basal, productive and social. The topics included in each chapter recognize deficit or key areas to release the brakes that limit efficiency in the productive activity.

• Having a long term view that makes it possible to identify both the trajectory and the quantification of the investments required in the ten-year period, in order to increase the potential growth of the economy. To do this, a future scenario was elaborated through objective indicators and standards that could be traceable in time, in order to establish a development vision to guide the sector investments by means of strategic plans viable in the ten-year period.

THE STRATEGIC AXES FOR INVESTMENT IN INFRASTRUCTURE

In order to recognize the importance of having a strategic view about the country’s needs in terms of infrastructure, this version of the Report considers a structure that acknowledges the investment needs in the three levels mentioned before, under the following openings:

• Infrastructure that sustains us or basal: water resource, energy and telecommunications.
• Infrastructure that connects us or logistic support: intercity roads, airports, ports and railroads.
• Infrastructure that involves us or of social use: city roads, public spaces, and educational infrastructure, hospitals and jails.

This overview seeks to acknowledge that in Chile at present there are multiple needs crosscutting our society. It became evident that new topics should be included in this version, such as telecommunications, education and public
spaces, in the understanding that they are not only deficit aspects in Chile at present, but they also present the higher possibility to generate efficiency revenue in the economic activity. In turn, revenue in product growth associated with this type of investment is short and long term, as long as there are clearly defined needs and efficient public investment management processes².

FUTURE SCENARIO AND TRENDS BY 2025

Concerning medium term development for Chile and the world, four elements can be identified that have a high probability of affecting strategic planning decisions for the next ten-year period³:

- Efficient and sustainable mega-cities, where cities grow physically and demographically, and the addition of technologies makes it possible to administrate them in a rational and coordinated way.

- A commercially integrated world, which implies big movements of goods, in short periods and at low costs. Great development of urban logistics.

- A personalized world, in which people using technology, can generate specific consumer patterns according to their preferences, promoting the development of decentralization and fragmentation of the world productive poles.

- A world affected by climate change, which requires having support systems, redundant and support roads to deal with the fact that many roads are often impassable.

In the next ten years, the most feasible trends indicate that Chile will have have very congested cities and will suffer the impact of climate change (and other geographical features), which will affect the continuity of passenger

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² Is it time for an infrastructure push? The macroeconomic effects of public investment, IMF 2014.
³ Delivering Tomorrow. Logistics 2050, DHL.
and freight transportation. So, it is necessary to anticipate investment in control technology in urban areas, possibly by means of concession models of control systems and to foresee the availability of infrastructure or redundant modes in the design of supply and distribution chains (given that, in the case of passenger transport, the impact can be controlled with the interruption of the transportation of goods to the regions, for example).

On the other hand, according to evidence and expectations gathered in different countries in the area of business, trends that will characterize the world in 2025 were identified, as well as their degree of certainty of occurrence.

Matrix of mega trends
Implications of the key mega trends on the global economy by 2025

Source: Frost & Sullivan.

Likewise, and similar to other publications, urban concentration is acknowledged as a high impact event highly likely to happen. Infrastructure also appears as one of the highest impact aspects, although, according to the publication, it should be accompanied by innovations that are not mature yet, coining the term “Smart Infrastructure” as a firm trend, with growth over 10% a year in the world.

Planned and strategic infrastructure will be key factors for Chile in this scenario for two reasons: first, because inevitably it is necessary to move forward towards a more sustainable and efficient development model in the use of resources; and, second, because to the extent that this is achieved, it is possible that investments can be pre-designed in order to capitalize their use more efficiently and for a longer time than with the present solutions.

**INDICATORS AND BENCHMARK COUNTRIES**

Once the structure and the future vision to be considered as guidelines for this document were defined, it was considered essential to define traceable indicators and a development goal for the country in the next ten years. The 2025 Vision then requires elements of comparison to make it tangible by means of indicators and conditions that shape the expected future state. To do this, the following sequence of actions was performed:

- Projection of the national GDP until the year 2025. In this case, the estimates updated in October 2015 by the International Monetary Fund (IMF) were used; they cover until the year 2020.

- Estimate of the GDP per capita until the year 2025. In this case, the value provided by the IMF was used, expressed in local currency and on the basis of purchasing power parity (PPP) until the year 2020, which is the period published by the IMF. From there on, it was assumed that there is a relation that continues in time between the variation of GDP and the variation of GDP per capita. Using this ratio and the projected value of the variation of the GDP, it was possible to estimate the GDP per capita projected on a base consistent with the previous series.
As shown, the gap in terms of product per capita is of approximately ten years with respect to the countries in the comparison, which are a simple of those that have reached higher levels of development in the last decades. If the natural growth trend goes on, it will be difficult to close the gap in ten years, as it is evident that it is necessary to reactivate investment in infrastructure, breaking historical trends in order to improve productivity in the medium term.

As to the capacity to capture investments and improve the country’s competence, the Global Competitiveness Index (GCI), developed by the World Economic Forum, is a key element of comparison. GCI is constitutes by twelve pillars that reflect different determining aspects of competitiveness, both of infrastructure and of management and soundness of institutions for 144 countries.

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5 GCI: Global Competitiveness Index. World Economic Forum. 2015.
One of those pillars is infrastructure and it breaks down, in turn, into the performance of roads, ports and airports, thus partially covering the areas of interest of this report. The following chart shows the relative position of Chile with regards to the countries selected for the comparison, in terms of its position in the competitiveness ranking.

The evolution of countries is diverse. While New Zealand managed to move forward substantially in four years, Chile and Spain kept their places and Italy moved backward. This confirms that the level of income of a country does not necessarily reflect its competitive condition. Spain and Italy were affected in the global index by the strong impact of economic instability, for which New Zealand were better protected.

As for Chile, the 35th position in the ranking does not allow a first glance detection of key deficiencies that affect development. When observing the relative position per area, infrastructure does not appear as a contribution, as it is positioned more than twenty places below our capacity in the development of the financial market, for example.
INTRODUCTION

CRITICAL INFRASTRUCTURE FOR DEVELOPMENT

2016-2025

Evolution of the index in leading countries. 2nd pillar: Infrastructure

<table>
<thead>
<tr>
<th>N°</th>
<th>Pillars of the index</th>
<th>Position in the 2015 ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Institutions</td>
<td>32</td>
</tr>
<tr>
<td>2</td>
<td>Infrastructure</td>
<td>45</td>
</tr>
<tr>
<td>3</td>
<td>Macroeconomic environment</td>
<td>29</td>
</tr>
<tr>
<td>4</td>
<td>Health and primary education</td>
<td>74</td>
</tr>
<tr>
<td>5</td>
<td>Higher education and training</td>
<td>33</td>
</tr>
<tr>
<td>6</td>
<td>Efficiency of the stock market</td>
<td>40</td>
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<tr>
<td>7</td>
<td>Efficiency of the job market</td>
<td>63</td>
</tr>
<tr>
<td>8</td>
<td>Development of the financial market</td>
<td>21</td>
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<tr>
<td>9</td>
<td>Technological sufficiency</td>
<td>39</td>
</tr>
<tr>
<td>10</td>
<td>Size of the market</td>
<td>44</td>
</tr>
<tr>
<td>11</td>
<td>Sophistication of the market</td>
<td>53</td>
</tr>
<tr>
<td>12</td>
<td>Innovation</td>
<td>50</td>
</tr>
</tbody>
</table>

Value of the global index: 35

Source: WEF.

GCI Chile in the different areas

<table>
<thead>
<tr>
<th>N°</th>
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<tbody>
<tr>
<td>1</td>
<td>Institutions</td>
</tr>
<tr>
<td>2</td>
<td>Infrastructure</td>
</tr>
<tr>
<td>3</td>
<td>Macroeconomic environment</td>
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<tr>
<td>4</td>
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<td>6</td>
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<td>10</td>
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<td>11</td>
<td>Sophistication of the market</td>
</tr>
<tr>
<td>12</td>
<td>Innovation</td>
</tr>
</tbody>
</table>

Source: WEF.

Evolution of the index in leading countries. 2nd pillar: Infrastructure

Source: WEF.
Two points are particularly relevant: the first one is that Chile has fallen from the 41st to the 45th position between 2011 and 2015 in the infrastructure component of the competitiveness index. The second one is that the reference countries have gone up, so the gap based only on the difference of GDP per capita for a year of comparison underestimates the difference that changes in time. It is even more worrying to examine the comparison in terms of the index value with respect to the countries in the first ten places.

So, the challenge does not only cover closing the gap with the countries in the comparison according to the projected GDP per capita; it is also necessary to raise the levels in the evaluation, increasing the strength of the effort required.

A second group of strategic indicators to establish a benchmark by 2025 refers to social context conditions linked to development, particularly of homes in their capacity to be more productive and reach greater well-being added. To this end, the Human Development Index\(^6\) (HDI), developed by the United Nations was selected. The HDI revolves around three dimensions: longevity and quality of life (health), level of knowledge or human capital (education) and living standards in terms of purchasing power (income). The three dimensions evaluated can be summarized in an index for each one of them; the final HDI is their geometric mean.

### HDI 2010-2013

<table>
<thead>
<tr>
<th>Year</th>
<th>Chile</th>
<th>Spain</th>
<th>Italy</th>
<th>New Zealand</th>
</tr>
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<tbody>
<tr>
<td>2010</td>
<td>0.808</td>
<td>0.864</td>
<td>0.869</td>
<td>0.903</td>
</tr>
<tr>
<td>2011</td>
<td>0.815</td>
<td>0.868</td>
<td>0.872</td>
<td>0.904</td>
</tr>
<tr>
<td>2012</td>
<td>0.819</td>
<td>0.869</td>
<td>0.872</td>
<td>0.908</td>
</tr>
<tr>
<td>2013</td>
<td>0.822</td>
<td>0.869</td>
<td>0.872</td>
<td>0.91</td>
</tr>
</tbody>
</table>

Source: UN.

\(^6\) Human Development Index. United Nations Development Program. 2015.
For this analysis, the HDI level for 20137 was revised in all cases and the magnitude to which Chile still has to increase to reach the level consistent with the projected GDP per capita was determined.

Monitoring of the index among different countries for more than a decade shows that the most important advances take place in the low HDI levels, where countries emphasize the need to have the basic conditions of health, education and housing. Once this level is reached (approximately in an HDI=0.5), there is a basis that allows them to move forward in more dimensions, such as economic development and productivity. Likewise, in the case of countries with a higher level of income, the progress of the index is scarce even for meaningful GDP increases. Chile shows an index of 0.822. If it keeps the pace with which it has grown in the last four years, it would reach the level of Spain in the year 2025, the level of Italy in the year 2033 and the level of New Zealand in the year 2039.

It can be deduced, then, that reaching a substantial increase in the GDP per capita does not automatically imply achieving the welfare levels of the more developed countries. For this reason, it is necessary to define clear strategies and priorities that move the country in two directions: economic and social development, in a well-balanced way.

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7 The latest edition of the report was published in 2014, with data from 2013.
Section I

INFRASTRUCTURE THAT SUSTAINS US

BASAL
Water resources
Energy
Telecommunications
Water resources | HUMBERTO PEÑA
Energy | ALEXANDER GALETOVIC
Telecommunications | ROBERTO GUROVICH AND MARCELO MELNICK
Chapter 1
WATER RESOURCES

1 | EXECUTIVE SUMMARY

To define the management scenario that would be desirable by the year 2025, the concept of Water safety has been used; it means reaching: “a) Adequate water availability, in quantity and in quality, for human supply, subsistence uses, the protection of ecosystems and production; b) The capacity –institutional, financial and of infrastructure— to have access to and make use of that water in a sustainable manner and manage the inter-relationships among the different uses and sectors; and c) An acceptable level of risks associated with water, for the people, the environment and the economy”.

In this framework of analysis, the critical areas for the country to have appropriate water safety were identified, in order to define, in each of them, the risk criteria that are acceptable and the levels of water safety to be reached by the year 2025. The study carried out suggests the following critical areas for water safety:

- The availability of water to guarantee sustainable social and productive development.
- People’s access to adequate levels of drinking water and sanitation.
- Protection of the people against flooding.

Regarding the availability of water for social and productive development, the data analyzed shows that it is necessary to distinguish three very different areas related to the existing shortage levels and the nature that the water resources represent to achieve them.
They are:

- Metropolitan region to the north: It is an area that already uses almost all the resources generated naturally in the basins and where the availability of water represents a clear limitation for economic growth. On the other hand, the high productivity associated to water has led to an increase in the demand. So, for example, between the agricultural censuses 1996/7 and 2006/7, regions III, IV and V record an increase of watered areas of 25 to 50%. In this context, there are basins with sustainability problems in their present uses, which have been exposed with the latest droughts. With some exceptions (V Region), their storage infrastructure has been developed to its maximum potential, so in order to get better water safety, there must be management improvements and, in particular, upgrading of the watering systems.

- Regions VI to IX: It is an area that occasionally presents local water availability problems to attend their present demands. However, with adequate management and infrastructure, the existing water resources should be enough to allow the unrestricted development of the present demands, and also, the meaningful increase of watered areas (500,000 hectares), depending only on the profitability of the investments necessary for that objective. In this area, there is underutilization of groundwater and moderate development of storage infrastructure.

- Region X to the south: This area, in general, is characterized by an abundance of water resources and low consumptive demand (not taking hydroelectric demands into account).

From the above, it follows that the need to develop hydraulic infrastructure focus on the construction of regulatory works and on the updating of the canal irrigation system, a subject on which Chile shows a growing delay compared to developed countries.

As for storage capacity, the estimated requirement by the year 2025 is 1,270 Hm³ (17% of the present regulatory capacity) with an investment of 1,840 million dollars. Concerning the updating of the watering canal system, the suggestion is to modernize 250,000 hectares, with a total investment of 1,000 million dollars. These actions are meant to generate the adequate infrastructure to increase the watered areas with 85% water safety in 210,000 hectares (20% of the present areas).
As for the sanitation sector, this is supplied by service providers. It presents practically 100% coverage of drinking water supply and of collection and treatment of waste water, and it offers, in general, an adequate quality of service. The analysis of the gaps that must be bridged by the year 2025 identifies the need to reduce the vulnerability to face emergencies like droughts and natural disasters; besides, it should ensure a level of losses in the drinking water networks that is compatible with developed countries standards. According to this, the infrastructure requirements consider the supply of drinking water to cities in regions XIV to IV that have availability problems, by means of desalination plants, with an investment of 320 million dollars, and the increase of the historical investment of companies in the restoring of drinking water networks.

On the other hand, the rural drinking water system supplies water, at present, to about 2.1 million people, which corresponds to the whole of concentrated and semi-concentrated towns. The deficits and gaps to be covered include improving and widening existing systems, in particular considering the vulnerability they present to face droughts (400,000 people have received water from water
trucks in the latest emergencies), completing the coverage of semi-concentrated towns, and developing collection and treatment of waste water, which at present is estimated to be covered only in 10% of the existing systems.

Meanwhile, the infrastructure for protection from flooding under consideration has to do with drainage of urban rainwater, with river defenses and with mudslide control. The importance of this topic in the country is reflected in the fact that, according to the number of casualties, eight of the ten major natural disasters that have occurred in Chile in a thirty-year period are of this type.

### CHART 1.3
Investment needs in urban rainwater drainage, river works and mudslide control
Millions of dollars

<table>
<thead>
<tr>
<th>Type of work</th>
<th>Annual investment</th>
<th>2016-2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rainwater drainage</td>
<td>155</td>
<td>1,550</td>
</tr>
<tr>
<td>River works</td>
<td>45</td>
<td>450</td>
</tr>
<tr>
<td>Mudslide control</td>
<td>15</td>
<td>150</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>215</strong></td>
<td><strong>2,150</strong></td>
</tr>
</tbody>
</table>

Source: Prepared by the authors.

### CHART 1.4
Investment needs in water infrastructure
Millions of dollars

<table>
<thead>
<tr>
<th></th>
<th>2016-2020</th>
<th>2016-2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water availability</td>
<td>1,420</td>
<td>2,840</td>
</tr>
<tr>
<td>Drinking water and sanitation</td>
<td>3,775</td>
<td>7,550</td>
</tr>
<tr>
<td>Protection against flooding / mudslides</td>
<td>1,075</td>
<td>2,150</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>6,270</strong></td>
<td><strong>12,540</strong></td>
</tr>
</tbody>
</table>

Source: Prepared by the authors.

In urban areas, the deficits in water safety were determined in the Rainwater Master Plans, which define the primary drainage network in the main cities of the country. Concerning protection against river flooding, the situation is characterized by the absence of a general diagnosis that makes it possible to have a complete view of the situation at present. Concerning mudslide control, plans have been prepared and Works have been built in twelve districts of the
country. About the plans for urban drainage, it is worth noting that to date only 22% of the required infrastructure has materialized; 50% of the needs are expected to be covered by the year 2025.

Likewise, to implement a program oriented to the development of the critical infrastructure, it is necessary to consider that the systems of water resources are complex; in them, the management aspects and the provision of infrastructure condition and complement each other. For these reasons, the objectives related to water safety proposed in the 2025 Vision suppose both an adequate level of management and the provision of infrastructure. This is the reason why it is necessary to make a few comments about the legal framework and the public policies related to the three analyzed areas:

a) To emphasize the need to conceive the development of infrastructure within a framework of integrated management of water resources at the level of basins; this involves institutional and legal changes. Likewise, it is critical to carry out normative conditioning that favor a joint use of surface and underground water. Concerning public plans of infrastructure for certain basins, it is necessary to carry out a change of emphasis, from the increase of the regulation capacities of reservoirs to the updating of the canal systems. Besides, it is necessary to revise the financing mechanism and the methodologies to evaluate cost / benefits applied to public projects.

b) It is necessary to revise the way to finance new investments in urban areas, when they could affect price rates in a massive and significant way; the same with the provisions governing investments in the restoration of drinking water networks. On the other hand, in rural areas, it is urgent to reform the legal and institutional framework, especially what has to do with the sanitation service.

c) The regulations for land use should be improved in the areas at risk of being affected by floods or mudslides, as well as the regulation of the changes in basins that imply an increase in the generated runoff, affecting drainage systems. Together with this, in connection with investment and financing of protection works, it is convenient to evaluate the reactivation of the draft law that establishes a financing system of the master plans of drainage of rainwater with participation of the residents of the cities that would benefit and also the methodologies to evaluate cost / benefits in use.
Chapter 2
ENERGY

1 | EXECUTIVE SUMMARY

On the subject of electric development, Chile faces major challenges, although their nature is changing quickly. Not so long ago, the main concern was the high cost of energy and to invest quickly enough to increase the installed capacity and generation at the rates demanded by the fast economic growth. For example, between the years 2000 and 2013, the GDP grew a bit more than 5% a year, while the generation of electricity almost doubled, from 38,798 GWh in the year 2000 to 69,897 GWh in the year 2014.

However, nowadays, the future looks a bit more uncertain and it would seem that Chilean economy will go through a period of slower growth in the medium term. If this happens, the power plants being constructed at present will cover most of the investments during the next ten years and it will not be necessary to invest much more.

At the same time, in the year 2025, 20% of the energy hired by distributors or free customers after July of the year 2013, will have to be generated by non-conventional renewable technologies (wind power, voltaic solar energy, mini hydraulic plants, to name just a few examples). This change in the com-

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1 Power is the capacity to carry out mechanical work, and it is measured in watts (W). Energy is power use or generation in a period of time and is measured in watts per hour or watts-hour (Wh). So, for example, a 100 W power light bulb uses 50 Wh of energy if it is on for half an hour. A kilowatt (KW) is 1,000 watts; a megawatt (MW) is 1,000 KW and a gigawatt (GW) is 1,000 MW.
position of generation is already under way and at a very fast pace, mainly because voltaic solar plants are booming. The magnitude of these investments is considerable: even if the GDP and the electric demand grew rapidly in the near future, the projected capacity is enough to fulfill most of the objective established by 20/25 law. Because of this, during the next ten years, the investment in non-conventional renewable energy (NCRE) should be slower.

Nonetheless, the estimates of investment needs between the years 2016 and 2025 are marked by a significant reduction in the required infrastructure, particularly in the field of generation, reaching 11,566 million dollars by the year 2025.

### CHART 2.1
**Investment requirements 2016-2025**
Millions of dollars

<table>
<thead>
<tr>
<th>Detail</th>
<th>2016-2020</th>
<th>2016-2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generation</td>
<td>2,099</td>
<td>9,102</td>
</tr>
<tr>
<td>Transmission</td>
<td>251</td>
<td>567</td>
</tr>
<tr>
<td>Distribution</td>
<td>1,001</td>
<td>1,897</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3,351</strong></td>
<td><strong>11,566</strong></td>
</tr>
</tbody>
</table>

*Source: Prepared by the authors.*

*Note: Given the methodology of scenarios adopted for purposes of economic growth calculation and the type of generation, the assumed growth of the GDP is of 4% a year and the expansion of SIC with the possibility to invest in hydroelectric power plants respectively.*
1 | EXECUTIVE SUMMARY

Undoubtedly, our lives at present would be very different without the technological development of the last decades and, more specifically, without the progress in telecommunication services as facilitating agents of industrial, educational, inclusion, entertainment processes and many other activities pertaining to modern civilization.

In an information society, adequately facing the challenges of this “digital era” is essential to foster a strong and balanced development. In this respect, it becomes necessary to move forward on a range of fronts to foster access to and appropriate use of the available tools and technologies and, in particular, it is essential to have an adequate infrastructure, so as to ensure universal access to telecommunication services, at reasonable prices and quality for all the people.

As reported by the Central Bank1, communications have experienced sustained growth for several years, excelling as one of the main driving agents of the GDP. In fact, this sector presents annual average growth rates of more than 7% during the last few years, which is above the global growth of the economy.

1 Central Bank Report on National Accounts by the third term of 2015.
Nowadays, in comparison with the average of OECD countries, Chile presents a gap of over 50% of broadband connections. This deficit, by the end of 2015, is equivalent to almost 2,000 million dollars in infrastructure.

Looking to the future is even more challenging. Experts project that the demand for data traffic on the networks will multiply by ten in the next five years, so that massive investments are required in order to adequately support this traffic. Recently, the Government launched the 2020 Digital Agenda, which identifies ambitious goals in the area of connectivity to increase the penetration of land and mobile broadband services all over the country with the purpose of reaching levels similar to those of the other OECD countries.

The deployment of the necessary infrastructure requires special attention, not only in the landline and mobile access networks, but also in the fiber optic backbone networks that have to be connected to all the populated centers. It is necessary to increase access to broadband, both landline and mobile, in more than twelve million, as well as deploying more than 30,000 Km of backbone fiber optic, with a total investment of 10,710 million dollars additional to the present deficit. In turn, the projection to 2025 is another 13,649 million dollars, which makes a total of 26,346 million dollars for the next decade. All of this without taking into account the cost of the terminal equipment, which could double the previous amount as the total cost of the system. The industry, on the other hand, has invested about 19,000 million dollars in the last decade and a similar amount is projected for the next decade. This means that, if there are no significant changes in the market dynamics, Chile will have a deficit of at least 25% in investments in infrastructure for telecommunications.

In consequence, our country faces an important challenge in terms of investment in infrastructure in the area of telecommunications. The deployment of infrastructure is not only a question of resources, but there are also a series of conditions that obstruct projects or make them more costly, sometimes turning them unfeasible. Therefore, this challenge will have to be addressed by all the sectors involved: regulators, operators, public funds, associations, municipalities and, finally, the citizens.

If we do not take charge of this situation as a country, we would not only have gaps in coverage and quality of service of data, but it could also undermine the capacities for development and growth.
### CHART 3.1
Deficit and investment gaps in critical infrastructure
Millions of dollars

<table>
<thead>
<tr>
<th></th>
<th>Deficit by 2015</th>
<th>2016-2020</th>
<th>2016-2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access to fixed broadband</td>
<td>735</td>
<td>5,020</td>
<td>8,984</td>
</tr>
<tr>
<td>Access to mobile broadband</td>
<td>1,018</td>
<td>6,608</td>
<td>14,730</td>
</tr>
<tr>
<td>Km fiber backbone</td>
<td>234</td>
<td>1,069</td>
<td>2,632</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,987</strong></td>
<td><strong>12,697</strong></td>
<td><strong>26,346</strong></td>
</tr>
</tbody>
</table>

Source: Prepared by the authors.
Section II

THE INFRASTRUCTURE THAT CONNECTS US

LOGISTICAL SUPPORT

Intercity roads
Airports
Ports
Railroads
Chapter 4
INTERCITY ROADS

1 | EXECUTIVE SUMMARY

Insufficient capacity, in the case of city and intercity roads is perceived as an investment deficiency that is costly and upsetting for thousands of people. In fact, good quality road infrastructure is now considered an individual right, especially for those who need to travel around the country.

In spite of the great advances achieved in this area, an international comparison of competitiveness shows that our country still needs to progress considerably in investments that improve the road offer. This is due to the impact it has upon productivity and upon specific aspects like tourism and logistics, both of them relevant for our development.

From the conditions observed and the projections for traffic growth based on a reference scenario, deadlines were determined by which it would be necessary to have new investments to manage to keep the required performance of the system of intercity roads. In short, it could be pointed out that:

- The gaps in intercity road infrastructure are of different nature and dimensions. Compared to countries with similar characteristics to Chile, the gap grew in recent years and keeps us at a disadvantage when competing. Together with this, at national level, there are still gaps among the regions, which show up in sections with deficient or inexistent connectivity which prevent an effective integration of the territory and of the people, especially in isolated areas. Therefore, there is a strong need to balance investments throughout the country.
There are several roads that will face limits of hourly capacity in the next years and no tender processes have been started to deal with such a problem. The urgency to do it increases as the number of vehicles and citizens’ income grow because there is the risk of achieving the additional capacity at the wrong time, losing the social benefits that justify the investments.

The investments required in intercity roads (including concession and non-concession roads), considering new works and maintenance capacity extensions amount to more than 20,000 million dollars in the period 2016-20251.

### CHART 4.1
Summary of investment requirements in intercity roads
Millions of dollars

<table>
<thead>
<tr>
<th>Detail</th>
<th>2016-2020</th>
<th>2016-2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investments associated to concessions</td>
<td>3,540</td>
<td>6,013</td>
</tr>
<tr>
<td>Investments associated to non-concession roads</td>
<td>7,093</td>
<td>14,185</td>
</tr>
<tr>
<td>Total</td>
<td>10,633</td>
<td>20,198</td>
</tr>
</tbody>
</table>

Source: Prepared by the authors.

The same as in other sectors, in the case of intercity roads it can be observed that, if the registered trend continues, the future investments will be insufficient. Therefore, in order to protect at least the present level of competitiveness, a special effort at levelling will be required. Not doing it will produce a negative impact on the country’s productivity and competitiveness.

1 In the case of concessions, the above figures do not include concession city roads (for example, improvements in the urban section of Route 5 north). Neither does it include amounts of investment of concession roads in construction at present (for example Route 43; Concepción Cabrero Highway, Route 5 North La Serena-Vallenar section).
Chapter 5
AIRPORTS

1 | EXECUTIVE SUMMARY

The planning of airport infrastructure attempts to respond to passenger and freight needs. Concerning the latter, the share of air operators in the transport of freight is less than 2% of the total volume transported. On the other hand, passenger terminals represent the component of infrastructure more sensible to episodes of congestion and their level of service directly affects millions of users all over the world. Given the above, the analysis concentrates on offer and demand of passenger facilities.

The high growth rates of domestic demand (over 10% a year between 2006 and 2013), together with an important increase in foreign travel, show that air transport has become an alternative that is accessible to large segments of the population. Therefore, there is a growing demand, which sometimes generates traffic scenarios above the existing capacity. In short, it can be pointed out that:

- Airport planning in Chile shows1 that, although the capacity of runways and facilities for aeronautical operations is enough until later than 2050, passenger areas are getting more and more cramped. In line with the above, the analysis will focus on the investment needs associated with this type of works.

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1 Information provided by the General Direction of Civil Aeronautics.
• Specifically, the present situation of Santiago international airport is an example of the cost it may represent for travelers, companies and the country the capacity deficit of terminals.

• Ultimately, the investments required for airport infrastructure, considering concessions and public funding amount to 1,729 millions of dollars in the 2016-2025 period.

<table>
<thead>
<tr>
<th>TABLA 5.1</th>
<th>Inversión estimada en aeropuertos</th>
<th>Millones de dólares</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detail</td>
<td>2016-2020</td>
<td>2016-2025</td>
</tr>
<tr>
<td>Investments associated with concessions</td>
<td>700</td>
<td>1.107</td>
</tr>
<tr>
<td>Investments associated with government resources. Airport Authority (AA)</td>
<td>311</td>
<td>622</td>
</tr>
<tr>
<td>Total</td>
<td>1.011</td>
<td>1.729</td>
</tr>
</tbody>
</table>

Source: Prepared by the authors.
Chapter 6
PORTS

The analysis of the national port infrastructure is increasingly interwoven with the concepts of logistic efficiency, productivity and competitiveness. Therefore, infrastructure needs depend on objectives more complex than the transfer capacity of each terminal: efficiency measures and impact on costs of the operations are relevant elements in the present discussion.

Possibly for this reason, in recent years there have appeared an important amount of documents and initiatives for discussion that account for this concern, from an integrating point of view. All of them refine the diagnosis and quite clearly identify the areas that show physical and operational deficit. All these publications agree on an unfavorable diagnosis. Our relative position in the area of logistics is not enough to place us advantageously in the markets we want to capture. In fact, there have been no individual cases of capacity increase that urgently require a commitment to action (for example, the decision about the large scale port in the central macrozone, the bidding for new capacity in Iquique or the space limitations in Arica).

It is interesting to highlight this issue because, as foreseen by the International Transport Forum, the increase in freight movement in the world will happen mainly in the maritime sector, with more than 85% of the total using the port networks. Given the high participation rates of foreign trade in our economy, it will be essential to ensure enough physical and human capacities in

the long term to face new patterns of demand. Therefore, if it materializes on time, the planned infrastructure should be able to respond to the new future requirements, avoiding congestion. However, even in this situation, there will be no reduction of the gaps that Chile still shows concerning the levels of efficiency and investment of the more developed countries. The concretion of these investments will prevent, in the best of cases, further descent in the ranking, but an effective advancement will still be pending. It should be noted that the descent increases as the leading countries continue increasing their performance indexes and incorporate innovations and automation to their processes. The great challenge seems to be to specify the changes that everyone subscribes, and materialize biddings and works. That is to say, to take the difficult step from definitions to action.

However, if the entire planned infrastructure is built in the medium and long term, it is not possible to ensure that the system will be more efficient. In fact, it is noteworthy that the proposals, in most of the reviewed documents, are related to processes, management, control systems, and planning. For this reason, covering the required investments would make it possible to reach only a part of the objectives of the sector; parallel progress in the updating of operations, particularly of the regulations and control and inspection mechanisms, is still pending.

So, concerning the investment requirements in infrastructure, the analysis of the port sector shows that the needs in the sector between 2016 and 2025 amount to 4,390 millions of dollars, considering both the works under way as well as the new projects of port operating companies in the pipeline. This figure includes approximately 2,400 dollars in facilities for the grand scale port in the central macrozone, with its accesses and complementary systems.

**CHART 6.1**
**Estimated investment in ports**
Millions of dollars

<table>
<thead>
<tr>
<th>Detail</th>
<th>2016-2020</th>
<th>2016-2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern Zone</td>
<td>562</td>
<td>700</td>
</tr>
<tr>
<td>Central Zone</td>
<td>1,084</td>
<td>3,611</td>
</tr>
<tr>
<td>Southern Zone</td>
<td>79</td>
<td>79</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,725</strong></td>
<td><strong>4,390</strong></td>
</tr>
</tbody>
</table>

Source: Prepared by the authors.
Chapter 7
RAILROADS

1 | EXECUTIVE SUMMARY

For several decades, the evolution of railroad services in Chile was characterized by instability, complex administration problems and weakness in the development of feasible development plans.

However, gradually, in recent years the State Railroad Company (EFE), has managed to reduce loses and develop a long term strategy that aims at more than doubling the participation of the sector in the transport of freight, together with the consolidation of passenger services by means of the development and operation of commuter services in the Metropolitan and Biobío regions.

The operative master plan and its corresponding support in the three-year plan that assigns them a budget, reflect the structural modernization guidelines that the company requires to consolidate its growth under conditions of financial soundness and high quality of operations and services.

Now, when this study attempts to determine infrastructure gaps from the difference between projected demand and capacity, in the case of railroads a different approach is required. In this case, the investment expectations are not based on an unsatisfied demand, but on the results of a strategy through which the State Railroad Company (EFE) plans to attract passengers and freight to its system, as a result of quality improvements, increase in frequencies and organizational modernization, among the most important aspects. So, although the projects will try to close historical gaps about the presence of railroad transport, the projections are rather the reflection of the objectives
that EFE stated in terms of market capture and long term growth. The offer gap in this case is equivalent to the one that covers the sizeable demand needed to make investments feasible.

On the other hand, it is worth noting that the gaps remain and tend to deepen, in terms of international comparison. In fact, according to the competitiveness index of the World Economic Forum1, in its railroad infrastructure component, Chile is in the 79th place among 144 countries, while Spain, for example, is in the 4th place and Portugal in the 25th. This position compares negatively even with the national road infrastructure, where Chile is in the 35th place. In the railroad sector, then, our country faces a lag that exceeds the effort to cover the accumulated unsatisfied demand. A process of gradual recuperation of the system is required that will then allow it to move forward in terms of competitiveness.

Taking this into account, there are two elements that signal the beginning of this effort: the Plan to Promote Railroad freight 2, that intends to double the participation of the system in the transport of intercity freight, and the projects for commuter trains for passengers (Rancagua Express and Santiago-Melipilla), that appear at the right moment to cover massive movements of people who live around Santiago. In the latter city, the plan is to transport more than twenty million passengers a year from the year 2016. This concept is expected to allow the network to expand in the future by adding high load

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tracks to reach other more distant turban poles (for example, Concepción), with the same standard of the new trains. Then, the expansion by sectors to the north and to the coast is planned.

One characteristic of this design is the assignation of tracks only for freight, considering the need to safeguard the productivity of the system and to move forward efficiently in both markets of interest.

Thus, a synthesis of the investments planned for the state railroad system between the years 2016 and 2025 shows figures of about 4,036 million dollars, of which 990 million dollars should be executed in the period 2016-2020 and the rest towards the year 2025. It is noteworthy that the previous figure considers 2,400 million dollars in projects that will probably developed after the year 2025, which will depend mainly on the needs generated by urban growth and port activity (reinforcement of the railroad system to San Antonio; by-pass to Santiago and Santiago-Valparaíso railroad).

However, in spite of these investments, the improvement of the railroad offer requires complementary actions, additional to the investment in infrastructure of operational systems.

Therefore, the needs for action in the area of freight have to do mainly to the modernization of regulations, to the establishment of a regulatory framework that allows balanced competition between modes, the establishment of contracts that ensure levels of service, and the relationship between regulation and control measures.
In the area of passengers, on the other hand, recommendations are geared towards strengthening the capacity of commercial and operational management of the new mass services, the exploration of new sections and the treatment of trains as an integrated mode in further reaching networks.

The result of these plans will be measured in the change in the relative position of our country in terms of its railroad system. Just like in other areas of infrastructure, but more so in this case, it is proved that the trend behavior will not allow that change in position. The new investments will allow the country towards an improved basis; however, the challenge that we face will imply significant investment for the next twenty years if we are to level our situation in comparison with countries of reference more permanently.
Section III
THE INFRASTRUCTURE THAT INVOLVES US OF SOCIAL USE
City roads
Public spaces
Education
Hospitals
Jails
Chapter 8
CITY ROADS

1 | EXECUTIVE SUMMARY

In general terms, city transport systems are constituted by a diverse set of modes that make it possible to meet the transport needs of the citizens. So, this study carried out a critical analysis of the state of the road infrastructure and of city transport (public and private) in seven cities in Chile, which have the highest concentration of urban population in the city. Associated with this, there was an estimate of the investment required to replace or improve it, when necessary, and at the same time criteria were defined for the identification and prioritization of different investment projects.

As from the information provided in the 2011 Pre Census at the level of blocks, it was estimated that the stock of existing urban infrastructure (sidewalk surface and roads) which will have to be replaced because of their poor conservation state. Such analysis led to the conclusion that 51% of the sidewalk surface and roads should be replaced as they were classified as poor or barely adequate, which represents a size equivalent to the whole urban area of the districts of Las Condes and Providencia. In monetary terms, the deficit is of approximately 2,380 million dollars.

Likewise, as from the transport projects considered in the Concession Plan, Road and Mass Public Transport Projects for each of the studied cities, it was estimated that the deficit related both to improvement and construction of relevant city roads as well as to the execution of road management plans (by the year 2016) besides the gap by the years 2020 y 2025. In the first case, the deficit amounts to 3,892 million dollars. In the second case,
the gap amounts to 5,283 million dollars and 8,175 million dollars by 2020 and 2025, respectively.

Finally, from an international comparative analysis, at the level of cities, it was estimated that the deficit in urban trains for Santiago is 249 km and, for the rest of the cities analyzed in the regions, 149 km, which corresponds to an associated amount of 14,800 million dollars, approximately. Concerning the gaps associated with the years 2020 and 2025, the amounts totaled 8,131 million dollars and 11,359 million dollars, respectively.

CHART 8.1
Deficit and Infrastructure Gap Road - City Transport
Millions of dollars

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Antofagasta</td>
<td>810</td>
<td>1,084</td>
<td>1,036</td>
<td>1,829</td>
</tr>
<tr>
<td>Coquimbo-La Serena</td>
<td>1,044</td>
<td>1,458</td>
<td>1,447</td>
<td>2,554</td>
</tr>
<tr>
<td>Greater Valparaíso</td>
<td>1,225</td>
<td>2,979</td>
<td>1,496</td>
<td>2,950</td>
</tr>
<tr>
<td>Greater Santiago</td>
<td>6,187</td>
<td>11,019</td>
<td>15,469</td>
<td>20,459</td>
</tr>
<tr>
<td>Greater Concepción</td>
<td>1,394</td>
<td>1,927</td>
<td>1,308</td>
<td>2,656</td>
</tr>
<tr>
<td>Greater Temuco</td>
<td>395</td>
<td>439</td>
<td>1,382</td>
<td>2,439</td>
</tr>
<tr>
<td>Puerto Montt</td>
<td>500</td>
<td>823</td>
<td>793</td>
<td>1,402</td>
</tr>
<tr>
<td>Total</td>
<td>11,555</td>
<td>19,730</td>
<td>22,931</td>
<td>34,290</td>
</tr>
</tbody>
</table>

Source: Prepared by the authors.
Chapter 9
PUBLIC SPACES

1 | EXECUTIVE SUMMARY

The growing process of urbanization of the countries has imposed great pressure upon the goods and services of communal use available in the cities, such as streets, sidewalks and areas open to the community, showing the importance of public spaces as the central element for the satisfaction of collective needs inherent to city life, such as sport, recreation, culture, among others\(^1\).

At present, Chile lacks a cohesive and integrated regulation and institutional framework that allows the adequate provision of public spaces to satisfy the needs of access (coverage) and capacity for all the population, generating poles of inequality in areas that have fewer resources for their development and management. In spite of this, there have been partial efforts in terms of regulations and management to adjust the provision of public spaces to the collective needs. However, these advances are below what has been observed in countries with similar levels of development.

Thus, considering international standards for the definition of provision of public spaces relative to the allowance provided for recreation, culture and sport, needs were estimated at local and metropolitan (great works) level, taking into account the seven biggest urban centers in the country. Summarizing, the total amount of infrastructure requirements of publics spaces amounts to 859 million dollars.

\(^1\) UN-Habitat 2013, “Streets as public spaces and drivers of urban prosperity.”
Beyond the investment amounts committed to solve the needs of equipment of public spaces, it is necessary to acknowledge some regulation and management aspects that are key to ensure the optimal provision for the citizens:

- The existence of regulations that define explicit standards for the provision of goods and public services at local scale that include the equipment of public spaces for recreation and sport, both in coverage and in capacity.

- To identify potential demands and the priorities of society in terms of public spaces, by means of periodical surveys that allow directing the strategic axes, both of the provision of infrastructure as well as its management, use and maintenance.

- Investment policies at metropolitan scale in matters of sport, recreation, culture and civic action that commit infrastructure plans in accordance with the needs for appropriate spaces and with the integrated planning in cities in general.

- Strategic objectives for the use of public spaces, which would allow to maximize their social profitability and to adequately program the resources intended for their maintenance and management over time.

**CHART 9.1**

Summary of investment requirements in public spaces

<table>
<thead>
<tr>
<th>Detail</th>
<th>2016-2020</th>
<th>2016-2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large public spaces (culture, sport, recreation)</td>
<td>395</td>
<td>790</td>
</tr>
<tr>
<td>Local provision (squares and sport facilities)</td>
<td>42</td>
<td>69</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>437</strong></td>
<td><strong>859</strong></td>
</tr>
</tbody>
</table>

Source: Prepared by the authors.
Chapter 10

EDUCATION

1 | EXECUTIVE SUMMARY

Nowadays, educational establishments must be able to incorporate innovation criteria in the configuration of educational spaces, dimensioning standards and changes of materials that approach energy efficiency norms. In this context, changes and adjustments to present educational spaces are suggested, the most important of which is the use of minimum area per student standards, resorting, as a basis, to the data of other OECD countries, where the area of the classroom is the most relevant aspect. In parallel, the need to incorporate sustainability and energy efficiency standards in educational establishments is identified.

The country’s future requirements of educational infrastructure were calculated establishing new standards, based on the evolution of the school age population, using an estimate until the year 2025. This was done having as the focus the improvement of school infrastructure standards in dimensions of educational spaces, their variety, and the incorporation of energy efficiency standards and comfort. To carry out the study, a sample was selected, with students from Day Schools of Pre-school, Primary, Secondary and Technical-Professional systems.

The present scenario is highly uncertain, mainly in what is related to high costs associated with projects of educational infrastructure and the present restructuring that the educational system is undergoing all over the country.
In spite of this, the analysis identifies the need to improve and innovate the present educational spaces, so that they contribute to the strengthening of public education and facilitate learning. The parameters of the dimensions of classrooms, libraries, Learning Resource Centers, dining-rooms, kitchens, gyms, multisport grounds, etc., per student must be taken into account when they are planned.

An outstanding finding is the estimation of the present deficit to achieve a universal full-time school program. To close the present gap, the materialization of 5,717 classrooms is necessary and, if this is extended to all educational levels, it would be 16,233 classrooms.

As a recommendation, the Ministry of Education should prioritize the areas of investment it wishes to implement as a first stage and it should also select the establishments it wishes to strengthen in the first place. Data shows that establishments that have coverage of educational services for all the cycles should be intervened first. From these, the most vulnerable establishments would be the focus groups.

The financing instrument of the investments could be the National Fund of Regional Development (NFRD) or the sector funds, which should be available once the modifications of ownership of the properties come through, nowadays in the hands of municipal sustainers. The way to address the implementation of the investment plans would be gradual and it will open discussion about institutional structure to carry out the management of investments.
Now, the most effective mechanisms to close need gaps in order to improve educational processes are targeted programs. Likewise, when the implementation of the program is done in stages, it must define criteria for the selection and prioritization of establishments for each stage. It will also be convenient to indicate the requisites and obligations that the sustainer of establishments that wish to participate in the program should comply with. It should also be stated if there will be financing restrictions and the mechanisms for transfer and control of resources. Likewise, the technical requirements of the projects must be established, as well as execution deadlines and instruments for the formalization of agreements and transfer of resources.

### CHART 10.1
Requirements of Educational Infrastructure
Millions of dollars

<table>
<thead>
<tr>
<th>Intervention</th>
<th>2016-2020</th>
<th>2016-2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classrooms to be added</td>
<td>196</td>
<td>2,250</td>
</tr>
<tr>
<td>Classrooms to be renovated (50% classrooms available)</td>
<td>263</td>
<td>1,995</td>
</tr>
<tr>
<td>Improvement of educational spaces</td>
<td>361</td>
<td>2,745</td>
</tr>
<tr>
<td>Dining rooms and kitchens</td>
<td>79</td>
<td>593</td>
</tr>
<tr>
<td>Gyms (First stage 1000)</td>
<td>408</td>
<td>816</td>
</tr>
<tr>
<td>Completion of full-time school day</td>
<td>326</td>
<td>652</td>
</tr>
<tr>
<td>Design and implementation</td>
<td>442</td>
<td>884</td>
</tr>
<tr>
<td>Furniture and equipment (5%)</td>
<td>104</td>
<td>450</td>
</tr>
<tr>
<td><strong>Total investment</strong></td>
<td><strong>2,179</strong></td>
<td><strong>10,385</strong></td>
</tr>
</tbody>
</table>

Source: Prepared by the authors.
Chapter 11
HOSPITAL INFRASTRUCTURE

1 | EXECUTIVE SUMMARY

Chilean health indicators are outstanding in the context of the Latin American region; they show one of the highest life expectancy rates and low child mortality rates. Some of the most relevant variables that allow the characterization of the situation of the sector are the following:

• Chile presents good health indicators with respect to Latin America, with a life expectancy at birth (LEB) of 79 years compared to the regional average of 74 years, low infant mortality and low prevalence of child malnutrition.

• The higher life expectancy is associated with the accumulation of an older population; the country is in a gradual aging phase, with an accumulation of population with dependence on care, both health and social.

• One of the most relevant problems is the high rates of overweight and obesity, which reach 38 and 22% of the adult population respectively. At the same time, it presents high tobacco consumption. These issues, together, constitute important risk factors of Chronic Non-Communicable Diseases (CNCD) that generate the main cause of mortality.

• Concerning financing, it presents strong access inequality, which is reflected in the high out-of-pocket costs: they represent 4.6% of family expenditure. This amount is higher than the regional average and it is the highest among OECD countries.
The trends mentioned will continue in the next decade. So, the country will face a deepening of the aging process, which will put special pressure on the National Health Service. To respond to this demand, the network has more than two million square meters of hospitals built, but nearly 60% of them are in barely acceptable or poor conditions. At national level, there is consensus about the need to improve this situation, so the government has assigned a growing amount of resources to the program. However, recent history shows that it is not enough to have the available resources, but it is also essential to have the capacity of institutional management to allow their efficient and timely use. In this respect, the changes in administration affect the management capacity of the investments. This has an impact on the investment priorities, on the management mechanisms and especially on the technical teams responsible for the processes.

Thus, the main effort during the next decade will be to continue replacing existing establishments and to strengthen primary health care; it would also be appropriate to start identifying the interventions necessary to develop a network of health care associated with the rapid aging the country is undergoing. This process will be under stress due to growing social expectations, technological development and regulatory demands that will generate increases in the dimensioning of the required resources.

Therefore, if the country is to respond to these demands, it will be necessary to at least keep the 2015/16 budget availability and set deadlines of at least fifteen years to fill the gap. It is advisable to strengthen the use of programming agreements that allow incorporating regional resources to the health

<table>
<thead>
<tr>
<th>CHART 11.1</th>
<th>Summary of investment needs in hospitals</th>
<th>Millions of dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2016-2020</td>
<td>2016-2025</td>
</tr>
<tr>
<td>Sector specific existing portfolio</td>
<td>2,140</td>
<td>3,384</td>
</tr>
<tr>
<td>Poor and barely acceptable hospitals outside of portfolio</td>
<td>13</td>
<td>914</td>
</tr>
<tr>
<td>New hospitals and long-term stay establishments</td>
<td>-</td>
<td>352</td>
</tr>
<tr>
<td>Total</td>
<td>2,153</td>
<td>4,650</td>
</tr>
</tbody>
</table>

Source: Prepared by the authors.
sector, as well as reconsidering the use of concessions. At the same time, it is essential to ensure efficiency in the execution of these resources so that they can perform as expected.

All of the above makes it highly advisable to transform the investment program into a State Policy with cross-cutting support and that generates stability in the construction, financing and equipment markets, as well as the state management capacity for this complex portfolio.
EXECUTIVE SUMMARY

The Chilean jail system has suffered a complex dynamic in terms of the real feasibility to comply with minimum standards of habitability for people deprived of their liberty, in all its forms. This scenario became evident at the beginning of the 1990s, when discussions began about ways to bring these standards closer to the country’s economic and political reality. At the same time, an analysis began about this need in the justice system, so as to make it more transparent and change the existing model for one with more speedy processes and with stronger defense of people’s rights.

In the area of prison policies, at the beginning of the 1990s it became clear that there were no social rehabilitation policies and there were extreme levels of overcrowding in the jails of that time; there were also no strategies of segregation of prisoners based on their dangerousness and degree of delinquency, which led, in most cases, to most prison establishments having no impact on prisoners’ rehabilitation and reintegration.

When analyzing figures of recent years, it can be observed that as from the reform of criminal justice, there was a growing demand for closed prison establishments, with a noticeable increase in jail population incarcerated in establishments of this type. This situation led, on the one hand, to an increase in the rates of overcrowding in this type of establishment and, on the other hand, an important concern at political and government level about the efficiency of these measures from the point of view of rehabilitation, motivating a significant analysis of the effectiveness of these measures.
When applying a standard of space assumed as of better quality that considers 28.32 m² per prisoner, the requirement of new investments can be established at the level of requirements of constructed m² to close that gap. Of all the studied scenarios, the one that seems the most realistic is the one with the gap detected the year 2013, without redistribution of prisoners. From such analysis, a need emerges to cover a total of 8,641 places, which represents a requirement of 244,540 m² of construction.

Assuming that the stock of prison establishments by the year 2015 has an important obsolescence rate, the data of the previous report can be applied; they quantified the total stock of prison establishments closed by the year 2013 as 754,914 m², with an obsolescence rate of 24% by that year. From said calculation, it results that, by an obsolescence effect, a total of 181,179 m² should be replaced.

Considering a standard cost of construction of 34 UF/m², and that there have been no tender processes for similar establishments that allow the incorporation of more information, the result is a total amount of 19,061,692UF of construction costs, which implies a total of 698 million dollars by the year 2025.

<table>
<thead>
<tr>
<th>CHART 12.1</th>
<th>Investment required in prison establishments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Millions of dollars</td>
</tr>
<tr>
<td><strong>Construction item</strong></td>
<td><strong>2016-2020</strong></td>
</tr>
<tr>
<td>Closing of gaps due to overuse</td>
<td>152</td>
</tr>
<tr>
<td>Requirements due to increase in population</td>
<td>84</td>
</tr>
<tr>
<td>Reposition due to obsolescence</td>
<td>113</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>349</strong></td>
</tr>
</tbody>
</table>

Source: Prepared by the authors.