



COUNTRY PRIVATE SECTOR DIAGNOSTIC

CREATING MARKETS IN CHILE

A Stronger Private Sector for a More
Productive and Inclusive Society

Executive Summary

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2121 Pennsylvania Avenue, N.W.

Washington, D.C. 20433

www.ifc.org

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EXECUTIVE SUMMARY

Chile has long had a strong private sector that has enjoyed an accommodating and supportive policy environment. Vibrant private activity, domestic and foreign, has supported a development success story, with sustained growth and falling poverty. Chile was the first country in Latin America to reach high-income status, joining the Organisation for Economic Co-operation and Development (OECD) in 2010. Economic growth was robust over several decades, averaging 6.0 percent during the 1990s and 4.5 percent between 2000 and 2013. Poverty plummeted, and the country now has one of the lowest poverty rates in Latin America. Substantial growth in wages also brought with it an expansion of the middle class to more than 60 percent of the population.

The imperative of building a green, knowledge-based, inclusive economy will inevitably continue to rely on the private sector playing a potent role as a partner in development. Remarkable opportunities are emerging to transform the economy, including through greater digitalization, the development of green hydrogen, and the expansion of climate-smart agriculture, as argued in this report. Yet today, the private sector and its role as an agent of inclusion, innovation, and growth are central issues in the ongoing debate over the future of Chile.

In an environment constrained by lower growth and productivity, Chileans are demanding access to better opportunities and improved services. The market liberalization reforms initiated in the late 1970s and early 1980s—which supported a private sector-driven and price-deregulated market economy, amplified by sustained commodity demand from China in later years—brought steady progress and economic growth until the mid-2000s. But lately growth rates have been on the decline. The end of the commodity cycle, combined with the lagging quality of some services, including tertiary education—which is provided largely by the private sector—have fed perceptions of unmet expectations. Segmentation continues in education and health care, and labor markets remain segregated, pointing to high inequality of opportunities. Moreover, many in the middle class are vulnerable to falling back into poverty. The impacts of the COVID-19 pandemic on jobs and incomes have strengthened these perceptions.

The current constitutional process is an opportunity to set the stage for the private sector to be a stronger partner in building a more inclusive society and an innovative, productive, and greener economy. For this to happen, this Country Private Sector Diagnostic (CPSD) argues that three avenues will be essential:

- Enhancing productivity,
- Building a knowledge-based economy through more support to innovation, and
- Upgrading skills for greater inclusion and innovation.

After a consideration of these transversal themes, the CPSD delves into three areas that illustrate the potential for the private sector to support a transition to a green, knowledge-based economy: green hydrogen development, climate-smart agriculture, and the digital economy.

Jumpstarting Productivity Growth

Economic growth in Chile over the past three decades has largely stemmed from substantial capital deepening, while growth in total factor productivity (TFP) has been weak or negative. Poor TFP growth is behind the growth slowdown, undercutting convergence with the average OECD income level. Factors linked to weak productivity performance in Chile include the concentration of the export base in natural resource sectors and limited adoption of, and investment in, new technologies as well as limits to competition, growing challenges in the regulatory framework, and inadequate labor force skills.

Upgrading managerial and worker skills, investing in innovation, ensuring better access to finance for new ventures, and strengthening competition can improve firm efficiency and support productivity growth. Gaps in these areas—skills, innovation, risk finance, and competition—may explain declining firm efficiency and abnormalities in the contribution of entries and exits to aggregate productivity. At the firm level, declining efficiency appears to be behind falling productivity, and to some extent to the exit of more productive firms, which are then replaced by less productive ones—the opposite of “creative destruction”.¹ The persistently negative contribution of firms’ internal efficiency to productivity, at least in manufacturing, is worrisome. On a positive note, more productive incumbents appear to be gaining in the reallocation process, growing in size as less productive firms shrink in comparison.

Enhancing competition to boost productivity

Chile enjoys a robust regulatory framework to promote competition as well as competent institutions that have gained more power to enforce the law over time. Chile compares well to regional peers in this respect, and its indicators are only slightly more restrictive than the OECD average.² Some of the gaps that remain explain the divergence in Chile’s indicators from top performers and include the need for additional simplification and consistent evaluation of regulations and the removal of barriers in services and obstacles to trade and investment.

Enhancing competition through reforms can spur productivity and efficiency and improve market outcomes in key enabling sectors and network industries. State-owned enterprises (SOEs) are present in some enabling sectors, and enhanced application of competitive neutrality principles could translate into a more level playing field for private operators. In some network industries such as telecommunications (telecom) and gas, despite growing competition in the former in recent years, regulation appears to protect incumbents.

Competition can be increased by reforms in three areas. First, the government could strengthen the competitive neutrality framework in sectors with SOE presence by evaluating the need for the state to directly participate in markets that are being served by the private sector and by separating the commercial and noncommercial activities of SOEs. Second, regulatory gaps in network industries such as telecom and gas should be addressed. These reforms include strengthening the independence of the telecom regulator; addressing within the gas sector public operator the lack of separation between transmission and distribution, production, and retail supply; and regulating (rather than negotiating) third-party access to the transmission grid and to the distribution networks. Third, the government could reinforce merger control by implementing the recently adopted regulation (Decree No. 41) and by reassessing proposals that could derail existing efforts to strengthen anticartel policy by allowing the public prosecutor to conduct parallel investigations of cartel cases.

Untapping the potential of global value chains and the services trade

Chile is rightly seen as a model of export diversification. Over the past 50 years, the country has evolved from one of the most highly concentrated commodity exporters in the world to a much more diversified exporter. This progress includes greater domestic value addition in the traditional mining sector as well as the development of successful agro-industries, including fresh-fruits and nuts, fish, wood, and wine, where Chile is a global leader. Although these products are linked to Chile's traditional comparative advantage in natural resources, most involve sophisticated logistics, processing, and manufacturing-based value addition.

However, exports have not played their role as a driver of economic growth and productivity in Chile in nearly two decades. The share of exports in Chile's gross domestic product (GDP) has declined steadily from its peak of 43 percent in 2004 to about 31 percent today. This drop in exports is correlated and contemporaneous with the fall in the contribution of TFP growth to overall GDP growth. Boosting export dynamism to promote productivity-driven growth is a priority in the post-COVID-19 recovery period and beyond.

Engaging with global value chains (GVCs) in manufacturing to a greater extent and boosting services trade are two options for Chile to spur greater integration and to further tap foreign direct investment to drive productivity growth. GVC participation in manufacturing and trading in services provide channels for firms to grow, specialize, access new technology, and increase the sophistication of their production chain. Cross-country comparisons also reveal that a higher portion of imported inputs used in export production translates into more dynamic growth in value addition in exports. Chile is currently located toward the lower end among countries in terms of growth in both backward GVC participation and domestic value addition in exports.

The potential for greater growth of trade in services is large, both for nontraditional export services, such as business services, and for service imports in the production of manufacturing exports. Business services (including consulting, research and development [R&D], and engineering services) have shown a positive trend, growing their share in total service exports from 17 percent in 2003 to 27 percent in 2019. Chile could also benefit from increasing the import value added of services in its manufacturing exports to drive greater export productivity. With more competitive services, firms adopt a more complex production structure and improve managerial practices.

While Chile's limited GVC participation and service trade can be explained by the country's high share of natural resources exports and its remoteness from GVC hubs, policy actions can help foster deeper integration. Although Chile performs in the midrange of peer countries in terms of average most favored nation tariffs, and it benefits from an extensive network of preferential trade agreements (PTAs), some nontariff barriers to trade remain. For instance, unlike in the case of merchandise imports, Chile employs fairly high trade restrictions in services, in particular in financial services but also in business services and telecom. Moreover, services trade is undermined by policies that, while not discriminating against foreign providers, inhibit transparency and competition. Chile stands out among OECD countries for the relatively large share of its restrictions in areas that deal with competition and domestic transparency procedures. This is particularly true for telecommunications and transport

services, activities that drive productivity and affect Chile's connectivity with the global economy. Restrictions impose significant markups in telecom, air and maritime transport, and warehousing. The coverage of Chile's PTAs is exceptional, reaching almost 98 percent of exports. However, increasing the depth of its agreements—in particular the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP)—for instance in the areas of intellectual property rights protection and competition, could also foster GVC upgrading, including in services sectors. Additional policies could include reducing transactions costs by aligning regulatory measures to those of key trading partners and improving connectivity and trade facilitation to overcome geographical disadvantages.

Raising productivity through digitalization

Chile is well-positioned to profit from a vibrant digital economy. Technological change could open a window of opportunity to transform Chile's economy and overcome structural weaknesses, including low firm productivity. Increasing digital uptake and exploring opportunities and synergies in, for instance, mining, solar, electro-mobility, and smart agriculture could be a game changer. Although digitalization accelerated among firms during the COVID-19 pandemic, the adoption of more sophisticated uses of technology in Chile would have an even more transformational impact. The use of digital platforms and digital finance has increased significantly, and the country is at the forefront of technology innovation in some respects. To push the frontier forward, Chile needs to close the remaining infrastructure, skills, and risk-financing gaps and address other barriers so that digital entrepreneurship and the digital economy can be developed further. The CPSD considers the potential of the digital economy in Chile in one of its three sector assessments.

Unleashing Innovation to Foster a Knowledge-Based Economy

Some of the stronger innovators in Chile are its young and exporting firms, but overall Chile's investment in innovation seems to have stagnated. According to the XI National Innovation Survey,³ 14 percent of firms innovated during the 2017–18 period, substantially below levels prevalent in OECD countries.⁴ Spending on R&D, at about 0.35 percent of GDP, is lower than would be expected for Chile's level of development, even after adjusting for its economic structure, and just one third of the total is financed by the private sector. As expected, exporting firms show higher innovation, in part because they are more exposed to international competitive pressures (Havranek and Irsova 2011) and the newest technologies (Meyer and Sinani 2009). Innovative clusters have emerged in the Chilean wine and fruit industries, for example, both major global exporters. Younger companies, those that are less than five years old, innovate more than companies that are older than 20 years. This observation highlights the importance of easing constraints to firm entry and fostering innovative entrepreneurship to spur productivity.⁵ Still, innovation by Chilean firms that operate in international markets lags the levels found in most OECD countries and in Chile's structural peers.

The high quality of Chile’s institutions, its open economy, and the strength of its overall business environment have generally been conducive to innovation, but other factors undermine these advantages. As highlighted by the Global Innovation Index (GII), a focus on human capital and research, as well as on business sophistication and especially on linkages with the innovation system, is needed. Strong managerial skills lead firms to pursue innovation and improve their technological capabilities, but the latest management survey conducted in Chile indicates that management skills remain below those of its structural peers and most OECD countries. And although a growing number of Chileans pursue graduate degrees, few do so in STEM areas: 7.3 percent of graduates, compared to an average of 22.6 percent in the rest of the OECD.

Stronger linkages across the innovation system, especially between universities and firms, can foster the transfer of technology and broaden learning spillovers, as can widespread access to risk finance and vigorous competition. A significant part of the execution of R&D resources is concentrated in universities (46 percent versus the OECD average of 18 percent), but they have limited linkages to industry, especially SMEs. Risk-financing instruments, also important to support investments in intangibles and innovative entrepreneurship, are not adequately developed in Chile. The size of the venture capital industry barely reached US\$147 million in 2020, and most early-stage funds are publicly sponsored. Insufficient competition in some sectors might have also discouraged innovation efforts, but enabling greater competition without building firms’ capabilities will not induce innovation. These results point to the need to improve plant capabilities and managerial practices, which drive “the leaders,” as an important innovation policy complementing efforts to increase competition (Cusolito, Garcia-Marin, and Maloney 2021).

The new institutional framework for innovation is still under consolidation, and a top priority will be to build consensus around a long-term innovation strategy that provides more continuity to policy making. Other international experiences show that it takes time to develop capabilities and transform a country’s innovation ecosystem. A more dynamic innovation system will not only be important to productivity but will also foster a transition to a greener economy. The innovation strategy will also need to consider the process of decentralization under way in Chile and the role that the regions will progressively play in the design and implementation of innovation initiatives that complement efforts at the national level.

Developing Skills for an Inclusive and Innovative Economy

Steady growth in coverage and improved governance have placed Chile in a leading regional position in educational quality; despite this, there is a perception of crisis in the higher education system. This perception stems from continuing inequality of access to high-quality tertiary education—only 32 percent of 18–24-year-olds from the bottom-income quintile were enrolled in higher education, compared with 58 percent for the same age group in the top quintile in 2019. Student funding mechanisms, now moving to a tuition-free model, have helped expand access, with gross enrollment growing from 37 percent in 2000 to over 86 percent in 2016, creating a basis for a more inclusive society and supporting the acquisition of 21st-century skills. They have, however, also created new frictions in the system. Whereas for a majority of graduates higher education is a good investment, for a significant minority—10 percent—the returns are negative. High levels of student debt and unemployment, combined with a gap between acquired skills and job market needs, have added to dissatisfaction. A series of reforms have attempted to address the challenges in the system, including a major reform of higher education in 2018, but implementation on several important fronts (such as accreditation) has been incomplete.

Rapid growth of access to higher education has itself transformed the student profile, challenging the education system to find the flexibility and market relevance to respond to the needs of students and the job market. Today, roughly 60 percent of students in higher education are part of a first generation to access universities or technical and vocational education and training (TVET) institutions. Most are older and already working, many are women, some have families and pay for themselves, many live in remote locations, and most face greater responsibilities and time constraints. These students require a tertiary education system that is sufficiently flexible, diversified, and relevant to cater to their needs.

The need for flexibility is not yet reflected in policy priorities. Student funding schemes tend to be rigid, with limited funding available for part-time students or distance learners. The structure of degrees and titles is narrow and designed without full consideration of growing needs for life-long learning. Continuing education still lacks a legal definition or a clear place and role in educational trajectories. Quality assurance mechanisms, in some cases, deter innovation in modes of education and the granting of new credentials. The higher education system is struggling to meet the demands of an emerging knowledge-based, innovation-driven, inclusive society.

Through ongoing reforms, Chile can promote greater inclusion, flexibility, and curricular innovation in higher education and increase its relevance by decisively engaging the private sector in shaping its offerings. Bolder public-private partnership initiatives—such as in digitalizing higher education—and more fluid ways to obtain and update qualifications will be crucial to prepare Chilean higher education for the challenges of the future and prevent a widening of the skills gap. Stakeholders, including the private sector, should seize the opportunity provided by the discussion of new criteria and standards of accreditation to move toward a consensus in Chile for a flexible approach to quality education.

Greater flexibility in financing higher education institutions also could be considered. A financing system based on institutional performance may be more appropriate, based on indicators related to the quality of graduates and research, degree of employability, and other factors. More flexible rules for financing students are also needed, including financing for continuing education, modular programs, part-time study, and other forms of training. Engaging with the business sector could make higher education programs more market-relevant, including through flexible training programs with multiple entry and exit points between different types of institutions and the labor market, and a greater recognition of knowledge and competencies students have acquired previously. There is also a need to harness the power of high-performing TVET programs, especially short-cycle ones, to upskill and reskill workers and bridge a potentially widening the skills gap.

A more inclusive, integrated labor market could also incentivize skills acquisition.

Segmentation in Chile's labor market—the persistence of differences in working conditions that cannot be attributed to difference in productivity alone—is a source of inequality and can be a constraint on productivity. Women, temporary workers, informal workers, and people engaged in telework tend to be disadvantaged in their labor arrangements, not always for reasons associated with skill or ability. Although Chile's dynamic labor market provides flexibility to adapt to cycles, the high proportion of temporary jobs reduces job quality, human capital accumulation, and productivity. Differences in contract types have contributed to labor market segmentation: 25 percent of private sector salaried workers in Chile are on temporary contracts,⁶ the third-highest proportion of temporary contracts in the OECD after Colombia and the Republic of Korea. Legislation provides little security to such workers. Workers on fixed-term contracts lose out on many work benefits, receive less training, and have less job security. This situation tends to reduce incentives for specialization and accumulation of human capital.

Greening the Economy While Ensuring a Just Transition

Chile has been a regional and global leader in sustainable development and has committed to achieving net zero emissions by 2050. Updated Nationally Determined Contributions reflect a renewed commitment to the country's increasingly competitive green and clean energies, as well as the promise to integrate adaptation measures in its productive sectors. Priority actions include extending transmission infrastructure and implementing regulatory reforms to allow the massification of renewable energy and greater electrification of the economy; promoting electromobility and the use of clean fuels in the transport sector; and consolidating carbon pricing instruments.⁷

For Chile to achieve its commitments and to increase its resilience to climate change, it will need to deepen the decarbonization of major greenhouse gas (GHG) sources, improve the absorptive capacity of natural sinks, harness digital technologies to reverse the high growth–high carbon trend, and support innovation and sustainable resource management. This report considers opportunities for Chile and for its private sector in three areas that can contribute to a greener, more resilient, and more inclusive economy, namely:

- Green hydrogen, which has the potential to reduce emissions and to become a significant new export sector;
- Climate-smart agriculture, whose more widespread use among producers of all sizes would strengthen the sustainable management of some of Chile's land and water resources while improving GHG absorption capacity; and
- The digital economy, which has the potential to decouple emissions and resource use from economic growth while transforming and democratizing education and jobs.

Adopting Green Hydrogen as a Source of Future Growth

Chile hopes to become a global leader in the nascent green hydrogen (GH) industry by leveraging the abundance and low cost of its renewable energy resources, key to the production of GH. Chile has the potential to be one of the most competitive countries for GH production in the world, with the capability to produce GH at costs of US\$1.60 per kilogram of GH (kgGH), or lower, in the long term. In addition to Chile's cost and capacity advantages in renewable energy, the country's ambitions are supported by (a) a strong overall policy environment, (b) concrete advances in regulations to incorporate GH into its energy matrix, (c) hosting of the largest number of GH projects under development in the Latin America and the Caribbean region, (d) international cooperation agreements with several international ports, and (e) the existence of important potential domestic off-takers in the mining industry, in ports, and for electricity supply. Technological advances will expand the list of uses for GH in the future.

GH investments have the potential to substantially support the greening of Chile's economy, as well as to create high-quality jobs across the country, boosting inclusion. Chile's National GH Strategy estimates that GH can create 100,000 associated jobs by 2030 and that the industry could lead to investment opportunities worth US\$200 billion and to exports of US\$30 billion in 2030, representing 10 percent of GDP and rivaling Chile's copper exports. GH also features in Chile's ambitious GHG emissions reduction goals as the second largest contributor to emissions reductions after industry by 2050.

Although GH production may become competitive relatively soon, the various GH applications vary in terms of their attractiveness and their timeframes for viable adoption. An analysis conducted for this report concludes that some GH uses are competitive today—assuming a secure GH supply and the announced willingness by countries to pay a premium for GH—whereas others may become attractive in the medium and longer term. Promising applications include ammonia exports, which represent a large potential market and are feasible at today's costs. GH forklifts in the mining sector also outperform the electric benchmark at today's costs, assuming a secure GH supply. GH in Chile may also have high potential in the near to medium term to integrate renewable electricity into isolated microgrids, most of which are currently supplied with 100 percent fossil fuels. GH blending into gas grids could reach parity in 2030, whereas ammonia for use as an explosive in mining and for hybrid combustion system for mining (CAEX) trucks used in the mining sector should reach competitive costs in the longer term (2030–50).

There remain significant challenges, however, to reaching economies of scale in GH production, despite encouraging signals that reflect high global expectations. These challenges include financing hurdles, difficulties in gauging market size for GH, significant technological issues, and competition from other GH producers. Green hydrogen projects are risky for investors: they are capital intensive, have high up-front costs, and are not profitable when competing against gray hydrogen unless sufficient carbon taxes or subsidies are in place. Uncertainties surround the scale of global demand and supply of GH. In Chile, the size of the domestic market is limited, thus there is a need to develop and rely on export markets for the development of GH—another risk. Competing technologies that may develop to outperform GH on costs include blue hydrogen, higher-capacity batteries, the production of hydrogen

from landfills, and others. And perhaps most critical today is the need to rely not only on supportive developments in climate policy and carbon taxation, but also on concessional and blended financial resources to incentivize early investment in costly, front-loaded projects. Nevertheless, the outlook for GH production has been bolstered by a number of significant signals reflecting high global expectations; these include the European Union (EU) Green Hydrogen Strategy and the decision by Japan to substantially increase reliance on GH use to reach decarbonization. These initiatives underscore the potential of GH to contribute substantially to the greening of economies, given the diversity of its applications and its game-changing potential for energy storage and transport.

To support the development of GH production, the CPSD recommends measures that the government can introduce to incentivize investors, establish financial mechanisms to reduce risks for early adopters, and bridge the gap between supply and demand. Most measures focus on the demand side, because it is critical to achieve economies of scale to enable project investment. Price-based mechanisms could provide a stable and predictable source of revenue for GH investments to achieve a level of installed capacity. Supporting the aggregation of demand for GH from early movers, including hard-to-abate sectors and ports, is also needed. A strategy that could be feasible in the near to medium term is the promotion of GH as a long-duration energy storage medium and as a balancing asset that can enable the integration of renewables in isolated microgrids. On the supply side it would be important to design and deploy blended finance mechanisms to attract private investment for infrastructure while mitigating exogenous risks and reducing market uncertainty from shared infrastructure assets.

Enhancing Resilience and Competitiveness through Climate-Smart Agriculture

Climate change poses important risks to Chile's agricultural sector, which together with the food industry is the second-most important contributor to GDP and exports after mining. Chile accounts for nearly 60 percent of all fruit exports from the southern hemisphere and is the largest global exporter of grapes, plums, apples, blueberries, nectarines, and peaches. Climate variability and extreme weather events, such as the megadrought that lasted from 2010 to 2015, are already increasing. Chile is among the 30 countries in the world with the highest water stress and is the only one in Latin America that will undergo extremely high water stress by 2040. Wind, solar radiation, and forest fires will also increase, and new pests will be unleashed on crops as observed during the past decade.

This study, in partnership with the Chilean Climate Risk Atlas (ARLCIM) team, offers new estimates of the costs of climate change for 13 priority agricultural and livestock value chains. To date, few studies have provided estimates of the impact of climate change, and they have mostly focused on specific regions or basins. According to this study's results, most of Chile's regions are expected to suffer losses across a wide range of agricultural products. The areas most affected correspond to the agricultural land located from the Bío Bío region and toward the north, which contains the largest high-value fruit and vegetable production in the country. Without new climate adaptation measures, total annual losses in the 10 priority agricultural value chains are estimated at close to CH\$0.330 billion (US\$410 million) on average for the period 2030–50. Apples, walnuts, cherries, and corn will experience the largest losses.

The adoption of climate-smart agriculture (CSA) practices can lead to substantial reductions in GHG emissions and production costs, more resilient crops, and new export opportunities. CSA technologies comprise a broad range of complementary strategies that embody different degrees of technological sophistication and upfront investments, including the use of renewable energy and technically sophisticated irrigation; organic nutrients and biodigesters; more resilient plants through genetic improvements; and precision agriculture to optimize the application of inputs. As discerning importers place greater value on sustainably produced goods, access to prime international markets will be increasingly determined by the use of green production practices, while traditional exports are expected to stagnate, relegated to low-value market segments if CSA practices are not embraced more widely. Changes are being spurred by the demand side in both high- and middle-income countries (especially China) and also by regulatory changes such as the General Food Law in the EU, which limits the amount and type of waste produced throughout the production chain, and new carbon taxes that demand deforestation-free products.

Chile's large producers are increasingly adopting CSA practices, especially to address growing water scarcity, and the government is already promoting CSA technologies. Large producers have been investing in better water management technologies, and investments in genetic innovation to increase yields and resilience are growing, spearheaded by innovative public-private research in the wine and fruit consortiums. Precision agriculture has also expanded in the fruit sector, resulting in higher yields and savings on water and agro-chemicals. A few large agribusinesses have pioneered in the issuance of green bonds. In the public sector, the Ministry of Agriculture (MINAGRI) and its agencies are making important investments in CSA initiatives, including the recently released "Agri-Food Sustainability Strategy 2020–2030," the first of its kind, which provides strategic guidelines for advancing CSA technologies in the country.

The adoption of CSA technologies, however, remains quite limited among small producers. Several obstacles are hindering the adoption process. Access to finance and information are among the most important barriers to adoption of CSA technologies—especially, but not only, among small producers. The financing of agriculture is typically challenging, but the characteristics of CSA projects, including high upfront investments and long maturities, make financing them even more complex. Producers and financial institutions often have insufficient knowledge of how CSA will improve production, thus raising their perceptions of the risks. High upfront costs also deter investments in renewable energy that would significantly reduce emissions. Higher penetration of digital technologies in rural areas together with capacity building, as noted in the discussion of the digital economy, would also support the broader adoption of precision agriculture and other CSA practices. Agri-environmental information can also be strengthened to support policy making and investments by the private sector. More intense efforts are also needed on innovation and R&D as well as better coordination among the various agencies supporting CSA innovation and technology transfer.

Embracing climate-smart agriculture is essential to maintaining one of the country's most dynamic and competitive export sectors and to enhancing the resilience and productivity of family agriculture. The expansion of the digital infrastructure in rural areas at affordable rates will be critical to advancing CSA and precision agriculture. Opportunities abound for government institutions and the private sector to expand innovative financing instruments for CSA, including along supply chains, and a strategy to foster such initiatives would fill a critical gap. Efforts to expand insurance coverage need to be complemented with CSA measures that foster sustainability and prevent market distortions, especially when insurance programs are subsidized. The expansion of more efficient irrigation systems is necessary but will not suffice, and sizable investments in physical infrastructure to increase reservoir capacity will have to be undertaken in the long term. In terms of strategy, the “Agri-Food Sustainability Strategy 2020–2030” fills an important vacuum, but it would benefit from a detailed roadmap that identifies concrete targets to be monitored over time and resources needed to achieve those targets. Governance mechanisms could be strengthened by including the Ministry of Science, Technology, Innovation and Knowledge within the new Inter-ministerial Committee on Agri-Food Sustainability since R&D and technology transfer are central to the CSA agenda. Agri-environmental information could also be strengthened to guide policy making as well as private investments.

Enhancing Productivity and Entrepreneurship through the Digital Economy

Technological change could transform and green Chile's economy and overcome structural weaknesses such as low firm productivity, disparities in service delivery, and high territorial concentration of economic opportunities. Chile has built a solid telecommunications infrastructure with high penetration rates and good-quality services that position it well to benefit from the digital economy. The telecom market has seen rapid growth, and recent regulatory changes and the entry of a new provider have increased competition, although operators still have considerable market power. Penetration rates are high, especially for mobile broadband, and the government recently awarded fifth-generation (5G) spectrum to different operators, the first country in Latin America and the Caribbean to do so. However, infrastructure gaps in fixed broadband remain in peri-urban and rural areas, while affordability issues limit access by lower-income households even within cities. Some regulatory issues continue to challenge fostering effective competition and network deployment. For example, the spectrum assignment process, which currently relies on comparative selection, could be modified to include modern approaches to auctions and spectrum pricing and trading. Infrastructure sharing could lower the costs of network deployment and help expand connectivity to the unserved population.

Although digitalization has accelerated among firms during the past year as a result of the COVID-19 pandemic, the adoption of more sophisticated uses of technology would have an even more transformational impact on firms. Chilean firms use social networks, clouds, mobiles, and digital marketing quite widely, but the use of digital management tools or more advanced technologies that leverage big data or artificial intelligence is far more limited. In this sense, the deployment of 5G will be a game changer in Chile, unleashing a new series of applications, including in mining, logistics, and telemedicine. While fourth generation (4G) is the dominant mobile technology in Chile today, 5G deployment is advancing rapidly and will shape the market in coming years owing to much faster data speeds and lower latency. Building wireless links to connect mobile towers and fostering infrastructure sharing will be crucial to the successful deployment of 5G in Chile. World Bank research estimates that building wireless links to connect mobile towers is the most cost-efficient strategy to reach universal mobile coverage.

Successful Chilean flagship entrepreneurship cases have recently disrupted consumption and production patterns and have attracted attention and international capital; however, most digital ventures in Chile do not grow. One of the main challenges for start-ups to scale up is inadequate financing, with low levels of venture capital beyond the early stage and with high dependence on public support. The government has fostered entrepreneurship through the Chile Economic Development Agency (Corfo), using both direct and indirect funding, but effectiveness has been mixed. This is partly due to bureaucratic and administrative constraints, and some of the instruments might not be fit for purpose. Gaps in technical and managerial skills also hinder successful business growth. Other factors include a small domestic market size, which forces many ventures to consider internationalization from the start, combined with insufficient contestability in some sectors. In addition, limited linkages between universities, firms, international buyers, and investors make thriving in the ecosystem more challenging.

The digital entrepreneurship ecosystem could benefit from attracting private investment to Chilean venture capital (VC) from high-net-worth individuals, local institutional investors, and the growing regional VC funds. Strategies to increase risk financing include the creation of VC funds focused on strategic sectors, a fund-of-funds initiative in which the public sector could better leverage private financing as implemented in many other countries, well-promoted corporate venturing and open innovation, and increased buzz around Chile's ecosystem, especially after the consolidation of Chile's first unicorns.

Reforms that strengthen regulation and encourage private investments in local venture capital and ecosystem networking will help spur further digitalization in Chile. Regulatory changes, including in data protection, financial technology, and infrastructure sharing, could contribute to the expansion of the digital economy and infrastructure development. Setting up an independent regulator for the telecom sector would help strengthen regulatory capacities and increase the sector's efficiency. The country could also leverage the region's relative homogeneity in terms of language and culture to scale up. Investing in technical skills will take time but will be critical to expand digital entrepreneurship and the digital economy more broadly.

Advances in regulation, infrastructure maturity, and digitalization will also enable cloud market development. Cloud computing can be transformational to firms, allowing them to scale up technical resources and to gain flexibility in a cost-effective manner and increase their productivity. Chile’s competitive cloud market reached approximately US\$328 million in 2020, increasing at a strong 7 percent annually since 2018. Strengthening regulations will be key for cloud market growth, especially the approval of a bill proposal submitted to Congress in 2017 on the processing and protection of personal data (Chamber of Members and Deputies 2017). In addition, robust international connectivity, well-performing national backbones, and ample development of last-mile fiber-optic networks will be critical for cloud market development.

Reform Recommendations

The CPSD makes a series of recommendations across the themes and sectors covered in the report. Table ES.1 highlights a subset of priority recommendations to support the role of the private sector as an engine spurring greater inclusion, innovation, and resilience.

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1. An analysis of plant-level data, conducted for the CPSD using the Chilean Annual Manufacturing Survey (Encuesta Nacional Industrial Annual) for the period 1996–2015, sheds new light on the factors driving changes in aggregate productivity.
 2. Product market regulation (PMR) indicators for Chile stand at 1.41 versus an OECD average of 1.38.
 3. The survey covers firms with sales above US\$10,000. See <https://observa.minciencia.gob.cl/datos-abiertos/base-de-datos-de-encuesta-nacional-de-innovacion-2017---2018---macrozona>.
 4. According to the OECD, 53 percent of firms introduced a new product or business process in the median OECD country in 2014–16 compared with 24 percent of firms in Chile during 2015–16. See OECD 2020a.
 5. The analysis in section 3.1 of this report indicates that low productivity growth in Chile is primarily explained by a negative “within-firm component” (technical efficiency) of TFP, which in turn reflects that firms are not increasing their internal capabilities, including innovation capacity, managerial skills, workforce skills, and technology-absorption capability.
 6. Encuesta Nacional de Empleo, July 2021.
 7. More details are available in the Chile Policy Note, “[Opportunities for a Resilient and Low-Carbon Development](#),” World Bank 2021b.

TABLE ES.1 MATRIX OF POLICY RECOMMENDATIONS

Cross-Cutting Themes			
Priority reforms	Short term (< 2 years)	Medium-long term (> 2 years)	Implementation
A. Trade			
Strengthen services and GVC trade to drive productivity-led growth.		<p>Review nontariff measures, including sanitary and phytosanitary standards and technical barriers to trade for both goods and services, to ensure that regulatory objectives, where necessary, are accomplished at the lowest possible cost to traders.</p> <p>Deepen existing trade agreements to facilitate trade in services and GVC participation by including provisions on intellectual property and competition; ease the recognition of professional titles and qualifications, which is unnecessarily burdensome to FDI in services.</p>	Ministry of Commerce
B. Competition			
Strengthen competitive neutrality in sectors with SOE presence, address regulatory gaps, and reinforce merger control and anticartel policy.	Monitor closely and assess potential implications of the proposed bill that attempts to modify the current competition system—notably, the strong investigative tools and elements such as leniency.	Separate the commercial and noncommercial activities of SOEs, at least through account separation.	Legislative bodies (National Congress); line ministries, (Ministry of Industry and Commerce; Ministry of Public Works and Communications; Ministry of Defense; and Ministry of Finance); Technical Secretary of Planning; National SOEs Council; FNE
C. Innovation			
Consolidate the new institutional framework and improve the efficiency and effectiveness of public programs.	Develop and build consensus around a long-term public innovation strategy that can provide more continuity to policy making.		Interministerial Committee of STKI National Council of Innovation STKI and Innovation; Corfo; ANID; Ministry of Economy, Development and Tourism; Ministry of STKI; Ministry of Education

Priority reforms	Short term (< 2 years)	Medium-long term (> 2 years)	Implementation
D. Education and skills			
<p>Support quality assurance and institutional accreditation and improve market relevance and digital skills.</p>	<p>Ensure that the development of new criteria and standards of institutional accreditation by the CNA (according to Law N°21186) caters to institutional diversity, is sufficiently flexible to encompass a diversity of types of students, and is able to prepare graduates for changing future scenarios in the labor market</p> <p>Evaluate the potential of incorporating microcredentials and stackable degrees into the official certification and qualification framework.</p>	<p>Establish a periodic nationwide survey to assess development of transversal and digital skills and involve students of all levels of education, as well as a representative sample of the general population, to inform public policy. Base the survey on the experience of UNESCO-Asia (2019)</p>	<p>National Commission on Accreditation, higher education associations, business associations</p> <p>Ministry of Education, Ministry of Labor</p>

Green Hydrogen

Strategic objective	Short-medium term	Potential Partners for implementation
<p>Design and deploy blended finance mechanisms to attract private investment for infrastructure.</p>	<p>Establish forecasts of expected infrastructure investments required under different GH adoption scenarios, with a focus on meeting demand niches that are closer to break-even.</p> <p>Rapidly deploy remuneration schemes under PPP mechanisms.</p> <p>Establish mechanisms for the continuous review of local technology needs.</p> <p>Develop comprehensive EHS regulation.</p>	<p>Government of Chile, Chilean agencies that promote exports and foreign investments, international financial institutions</p>
<p>Provide a stable and predictable source of revenue for GH investments through price-based mechanisms.</p>	<p>Design and implement a CfD scheme for GH and GH-derived products through an auction process that matches bankable off-takers with a competitive supply of Chilean GH.</p>	<p>GIZ, Government of Germany, Agencia de Sostenibilidad Energética, Invest Chile, and other multilateral development banks and sources of concessional funding</p>
<p>Support the aggregation of demand for GH from early movers.</p>	<p>Implement a domestic GH quota scheme combined with a tradable GH certificate scheme. Domestic end-users, retailers, or both would produce or buy a certain quota of GH defined by national GH demand targets, similar to renewable portfolio standards.</p>	<p>Partner with the EU's Fuel Cells and Hydrogen Joint Undertaking and with the HTP.</p>
<p>Leverage Article 6 of the Paris Agreement to support expansion into GH projects.</p>	<p>Launch procurement of emission reduction certificates by using funding assistance from donors and by leveraging a CfD scheme applied to greenhouse gas offsets. The purpose is to mitigate the risk of the upside (offset), reduce the viability gap for new projects, and define market signals to trigger GH demand.</p>	<p>GIZ, multilateral development banks</p>
<p>Promote GH as a long-duration energy storage (> 10 hours) medium and as a balancing asset that can enable the integration of renewables in isolated microgrids.</p>	<p>Elaborate a comprehensive assessment methodology that showcases and monetizes the advantages of this GH application, identifying the different services and their expected revenues (or avoided costs) together with a broader social and environmental cost-benefit analysis.</p>	<p>Ministry of Energy and research centers; multilateral development banks</p>

Climate-Smart Agriculture

Strategic objective	Short term (< 2 years)	Medium-long term (> 2 years)	Implementation
Improve water resource governance through comprehensive watershed management.	Establish a legal framework that defines the responsibilities and competencies of the actors involved in water management, including the roles of MINAGRI and its agencies regarding other public agencies.	Strengthen governance systems to improve the capacity to capture and use water efficiently. An integral management of hydrographic basins needs to be the main criterion to define the location of investments in infrastructure.	MMA SEGPRES MINAGRI MOP
Facilitate dissemination, financing, and adoption of existing CSA technologies, especially by small and medium farmers.	Conduct a review of available CSA financing instruments and identify opportunities for expanding access to existing instruments and for promoting new financing.	Raise awareness among farmers, especially smaller farmers, of the benefits of innovating and adopting CSA approaches. Promote collaborative knowledge networks similar to GTTs for small producers, by enhancing coordination among INDAP, FIA, and INIA.	MINAGRI INDAP INIA FIA SNA -Codesser
Promote the use of renewable energy in agriculture.		Explore PPPs, or private partnerships (such as ESCO) to facilitate farmers' access to renewable energy markets.	MINAGRI MinEnergia MMA
Expand the availability of fresh water through public investment in infrastructure.		Invest in water accumulation systems, favoring medium and minor reservoirs and considering the scarcity of public resources and the environmental and social impact of major works. Increase the coverage of technified irrigation systems.	MINAGRI CNR Corfo-ASCC Small and large-scale producers

Digital Economy

Strategic objective	Short-medium term	Potential Partners for implementation
<p>Increase competition and improve regulation.</p>	<p>Create a politically and financially independent regulator for the telecommunication sector, with strong technical capabilities.</p>	<p>Ministry of Transport and Telecommunications</p>
<p>Foster higher mobile access network mutualization and reinforce high-speed broadband access for the population.</p>	<p>Enhance the regulatory environment:</p> <ul style="list-style-type: none"> • Improve the spectrum assignment process. • Approve and enforce the bill proposal on data protection. • Enforce the bill to declare telecom services a public interest to guarantee telecom's universality and affordability. • Enforce unbundling of the local loop regulations. 	<p>SUBTEL Congress Private sector</p>
<p>Develop a fixed broadband access network in rural and underserved areas through regulatory measures that foster broader mutualization.</p>	<p>Several options could be considered:</p> <ul style="list-style-type: none"> • Issue specific licenses allowing nontelecom players to own and operate infrastructure. • Support mandatory open access for all telecom actors to active and passive infrastructure. • Build civil work regulations with mandatory obligations across industries to adhere to specific building and construction guidelines and facilitate infrastructure sharing. <p>The government could also improve regulation to</p> <ul style="list-style-type: none"> • Establish a universal access obligation for operators to increase telecom coverage in rural and low-income urban areas. • Regulate last-mile and long-distance infrastructure access. 	<p>SUBTEL Congress Private sector</p>
<p>Accelerate emerging local and regional cloud actors.</p>	<p>Approve and enforce the bill proposal on data protection.</p>	<p>SUBTEL Congress Private sector</p>

Note: ANID = National Research and Development Agency; ASCC = Sustainability and Climate Change Agency; CfD = contract-for-difference; CNA = Chile's National Accreditation Commission; CNR = National Irrigation Commission; Corfo = Chile Economic Development Agency; CSA = climate-smart agriculture; EHS = environment, health, and safety; ESCO = energy service company; EU = European Union; FDI = foreign direct investment; FIA = Foundation for Agricultural Innovation; FNE = Chile National Economic Prosecutor; GH = green hydrogen; GIZ = Deutsche Gesellschaft für Internationale Zusammenarbeit; GTT = technology transfer group; GVC = global value chain; HTP = Hydrogen Territories Platform; IDB = Inter-American Development Bank; INDAP = Institute for Agricultural and Livestock Development; INIA = Chilean Agricultural Research Institute; MINAGRI = Ministry of Agriculture; MinEnergía = Ministry of Energy; MMA = Ministry of Environment; MOP = Ministry of Public Works; PPP = public-private partnership; SEGPRES = Ministry General Secretariat of the Presidency; SNA = National Society of Agriculture; SOE = state-owned enterprise; STKI = science, technology, knowledge and innovation; SUBTEL = Undersecretary of Telecommunications.

IFC

2121 Pennsylvania Avenue, N.W.
Washington, D.C. 20433 U.S.A.

CONTACTS

Bledi Celiku

BCeliku@worldbank.org

Esperanza Lasagabaster

ELasagabaster@ifc.org

Zeinab Partow

ZPartow@worldbank.org

ifc.org



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