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CHILE

SUPPORT FOR STRENGTHENING THE INSTITUTIONAL FRAMEWORK FOR SCIENCE, TECHNOLOGY, KNOWLEDGE, AND INNOVATION IN CHILE

(CH-L1148)

LOAN PROPOSAL

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3. Latin American entrepreneurial agencies: Future challenges
4. Training of advanced capital in Chile
5. Innovation in Chile survey 2015-2016
6. Evolution of total factor productivity in Chile

ABBREVIATIONS

ANID	Agencia Nacional de Investigación y Desarrollo [National Agency for Research and Development]
CNID	Consejo Nacional de Innovación para el Desarrollo [National Council on Innovation for Development]
CNP	Comisión Nacional de Productividad [National Productivity Commission]
CONICYT	Comisión Nacional de Investigación Científica y Tecnológica [National Science and Technology Research Commission]
CORFO	Corporación del Fomento de la Producción [Production Development Corporation]
GDP	Gross domestic product
MCTCI	Ministry of Science, Technology, Knowledge, and Innovation
MINECON	Ministry of Economy, Development, and Tourism
OECD	Organisation for Economic Co-operation and Development
PBL	Policy-based loan
PCR	Project completion report
R&D	Research and Development
STEM	Science, technology, engineering, and mathematics
STI	Science, Technology, and Innovation
STKI	Science, technology, knowledge and innovation
TFP	Total factor productivity

PROJECT SUMMARY

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SUPPORT FOR STRENGTHENING THE INSTITUTIONAL FRAMEWORK FOR SCIENCE, TECHNOLOGY, KNOWLEDGE, AND INNOVATION IN CHILE
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<table>
<tr><th colspan="6">Financial Terms and Conditions</th></tr>
<tr><td colspan="3">Borrower:</td><td colspan="3">Flexible Financing Facility[a]</td></tr>
<tr><td colspan="3">Republic of Chile</td><td>Amortization period:</td><td colspan="2">14 years</td></tr>
<tr><td colspan="3">Executing agency:</td><td>Disbursement period:</td><td colspan="2">2 years</td></tr>
<tr><td colspan="3">Ministry of Science, Technology, Knowledge, and Innovation (MCTCI)</td><td>Grace period:</td><td colspan="2">11 years[b]</td></tr>
<tr><td>Source</td><td>Amount (US$)</td><td>%</td><td>Interest rate:</td><td colspan="2">LIBOR-based</td></tr>
<tr><td rowspan="3">IDB (Ordinary Capital)</td><td rowspan="3">50,000,000</td><td rowspan="3">100</td><td>Credit fee:</td><td colspan="2">[c]</td></tr>
<tr><td>Inspection and supervision fee:</td><td colspan="2">[c]</td></tr>
<tr><td>Weighted average life:</td><td colspan="2">12.5 years</td></tr>
<tr><td>Total</td><td>50,000,000</td><td>100</td><td>Approval currency:</td><td colspan="2">United States dollar</td></tr>
<tr><th colspan="6">Project at a Glance</th></tr>
<tr><td colspan="6">Project objective/description: The general objective of the operation is to promote the country's technological development by fostering science, technology, and science- and technology-based innovation (STI) and knowledge transfer. The specific objectives are to: (i) maintain a stable macroeconomic environment; (ii) provide support for strengthening the legal framework for science- and technology-based STI; (iii) provide support for strengthening the institutional framework for science- and technology-based STI; and (iv) establish mechanisms to monitor and evaluate science, technology, knowledge, and innovation policies.
This operation is structured as a multi-tranche policy-based loan. The Bank loan proceeds will be disbursed in two tranches.</td></tr>
<tr><td colspan="6">Special contractual conditions precedent to the release of each loan tranche: The two disbursements of the Bank loan proceeds are subject to fulfillment of the policy reform measures described in the program components and set forth in the Policy Matrix (Annex II), in addition to other conditions established in the loan contract (paragraph 3.3).</td></tr>
<tr><td colspan="6">Exceptions to Bank policies: None.</td></tr>
<tr><th colspan="6">Strategic Alignment</th></tr>
<tr><td colspan="2">Challenges:[d]</td><td colspan="4">SI ☐ PI ☑ EI ☐</td></tr>
<tr><td colspan="2">Crosscutting themes:[e]</td><td colspan="4">GD ☑ CC ☑ IC ☑</td></tr>
</table>

[a] Under the terms of the Flexible Financing Facility (document FN-655-1), the borrower has the option of requesting changes to the amortization schedule, as well as currency, interest rate, and commodity conversions. The Bank will take operational and risk management considerations into account when reviewing such requests.

[b] Under the flexible repayment options of the Flexible Financing Facility, changes to the grace period are permitted provided that they do not entail any extension of the original weighted average life of the loan or the last payment date as documented in the loan contract.

[c] The credit fee and inspection and supervision fee will be established periodically by the Board of Executive Directors as part of its review of the Bank's lending charges, in accordance with the applicable policies.

[d] SI (Social Inclusion and Equality); PI (Productivity and Innovation); and EI (Economic Integration).

[e] GD (Gender Equality and Diversity); CC (Climate Change and Environmental Sustainability); and IC (Institutional Capacity and Rule of Law).

I. Description and Results Monitoring

A. Background, problem addressed, and rationale

1.1 **Macroeconomic situation.** In 2018, Chile achieved an annual per capita income adjusted for purchasing power parity of US$25,283, one of the highest in Latin America and the Caribbean,[1] thanks to a robust institutional, political, and macroeconomic framework. Yet gross domestic product (GDP) growth has slowed in recent years, averaging 2.2% between 2014 and 2018,[2] in which one relevant consideration has been a systematic decline in total factor productivity (TFP), even when in 2018, the economy grew by 4% and TFP grew by 1.3%.[3] Indeed, between 1990 and 1999, TFP expanded at an annual rate of 1.2%; then from 2000 to 2009 it contracted at an annual rate of -0.5%; and from 2010 to 2014, it declined at an annual rate of 1%.[4] Due to the slow growth, the central government debt ratio as a percentage of GDP has increased in the past few years, reaching 25.56%. However, the future debt trajectory appears stable based on the current administration's commitments to reduce the structural fiscal deficit by 0.2% of GDP per year. With regard to the recent slow growth and below-target inflation (target range of 2%-4%), the Central Bank has cut the monetary policy rate to 2%. External accounts remain stable. The floating exchange rate regime facilitates external adjustments, especially in the face of external shocks like the shock to copper prices, as well as sudden changes in foreign exchange flows, whether from foreign direct investment (particularly in the mining sector) or portfolio investment, fundamentally by pension funds. Furthermore, companies do not appear to have significant currency mismatches, and the financial sector does not show signs of stress with regard to liquidity, provisions, or profitability.

1.2 **The fiscal and monetary policies are based on sound regimes with clear rules.** Chile has a fiscal rule based on structural accounts that requires the government to announce its fiscal targets for the term, with caps on year-to-year government expenditure. The rule is acyclic in nature, but allows a certain degree of countercyclical policy. The recently formed Independent Fiscal Council will ensure the structural targets are met and will have its own funds for performing independent studies. Council members are appointed by the President of the Republic in consultation with the Senate. The Central Bank, an autonomous institution, is responsible for monetary policy, which is guided by inflation targets with a 24-month horizon, and ensures a balanced money supply.

1.3 **Productivity stagnation.** In Chile, productivity growth stagnation is a national concern, and a number of diagnostic assessments have been performed to identify the primary challenges. In 2015, the National Productivity Commission (CNP) was established to propose measures and policies to facilitate productivity growth. Among the factors found to be obstructing productivity growth, one specific to the Chilean economy stands out: the low level of effort put into research and

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1 World Bank (https://datos.bancomundial.org/).

2 World Bank (https://datos.bancomundial.org/).

3 National Productivity Commission (CNP). 2018 Annual Productivity Report.

4 Ibid.

innovation (CNP, 2016).[5] Along these lines, Rouvinen (2002) shows that increased investment in research and development (R&D) leads to higher TFP over the long term, with TFP elasticity of 0.38 to 0.58 with respect to investment in R&D. Likewise, according to neoclassical literature on endogenous growth, innovation and technological change are the most effective and sustained determinants of economic growth (Romer, 1990; Grossman and Helpman, 1991; Aghion and Howitt, 1992).

1.4 Indicators show that Chile lags behind in science, technology, and innovation (STI) activities. Notably, it has: (i) very low spending on R&D as a percentage of GDP (0.36%), which not only compares poorly to the average for the Organisation for Economic Co-operation and Development (OECD) (2.48%), but also to the Latin American average (0.78%);[6] (ii) poor innovation performance, as shown by the rate of 23 patents per 1 million inhabitants, compared to the OECD average of 646, and reflected in Chile's systematic decline in the Global Innovation Index ranking starting in 2016, when it was ranked 44, to 2019, by when it had fallen seven positions to 51;[7] and (iii) a lack of researchers, with only 1.17 researchers per 1,000 inhabitants, when in the OECD countries there are an average of 8.28 and in Argentina, 3. Furthermore, only a small proportion of these researchers (24.8%) work in the private sector, compared to the OECD average of 58.1%.[8]

1.5 There is also an additional set of problems unrelated to the lack of greater private-sector involvement in these activities and the low level of public financing for them. Rather, these problems reflect the lack of a clear, relevant, and robust institutional framework that would provide consistency over time with a visible, identifiable party responsible for designing and implementing public policies, and that would prevent coordination problems, especially within the government. In short, beyond market failures, as indicated above, the problems presented below are manifestations of so-called failures of the State.[9] Accordingly, the existence of an adequate legal and institutional framework that includes elements for coordinating and streamlining initiatives is fundamental in order to guarantee effectiveness and efficiency.

1.6 **Problems connecting stakeholders in the national system for STI.** Ties between the university/scientific sector and the private sector for generating new knowledge and potential applications are practically nonexistent (Benavente, 2004). In all, 19.3% of companies that innovated in the 2015-2016 period (15.1% of all companies), were engaged in some type of collaboration. Of those, 34.4% cooperated with universities (Ministry of Economy, Development, and Tourism (MINECON), 2018). University-industry relationships must be strengthened, given the evidence that companies that have formal cooperation contracts with universities on technology matters spend 85% more on R&D compared to companies that spend on R&D but do not have such ties. Furthermore, companies

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5 The CNP also suggests that the determining factors for this weak performance include the lack of competition in local markets, the shortage of advanced human capital, and the low level of women's participation in the job market.

6 OECD data (http://www.oecd.org/sti/).

7 https://www.globalinnovationindex.org/.

8 OECD data (http://www.oecd.org/sti/).

9 A description of these failures of the State in the context of the institutional framework for supporting STI can be found in Benavente et al. (2019).

with ties to universities innovate more in their products and processes, and have around 88% higher labor productivity compared to peer companies without university ties (Benavente 2006).

1.7 **Regional imbalances.** Chile is a centralized country. According to the OECD Regional Statistics (2013), it is the country with the second-highest concentration of GDP in metropolitan areas. Science, technology, and innovation (STI) are also concentrated in cities: in 2010, 67% of spending on R&D occurred in the metropolitan region, while 33% was divided among the other regions. Research efforts primarily take place in the metropolitan region, with 55.27% of the national total, followed by the Biobío region, with 12.42%. In 2012, 59.2% of National Scientific and Technological Development Fund projects were awarded in the metropolitan region (Verde Consultores, 2014). To address this situation, Chile created programs like the regional scientific and technological development centers. However, these centers were not as successful as expected because they did not necessarily represent an attractive alternative for researchers seeking to build long-term scientific careers, nor were they very appealing to researchers who already had well-established careers (Verde Consultores, 2014). Evidence exists regarding agglomeration economies, the generation of economies of scale, and network effects on productivity (Blochliger et al., 2016, OECD). However, in some countries, as in Chile, disparities in regional productivity can affect overall productivity, especially when they involve large differences in innovation efforts.[10] The lack of regional-level coordination mechanisms and an institutional structure to address this issue with a national perspective has perpetuated this concentration.

1.8 **Technology transfer.** Chile has a notably low level of technology transfer, mainly due to insufficient coordination between the productive sector and knowledge centers, a weak institutional framework and limited incentives for managing intellectual property, and inadequate financial and institutional mechanisms for encouraging the establishment of new technology companies (World Bank, 2009). Furthermore, researchers have little experience and involvement in technology transfer processes and intellectual property (Production Development Corporation (CORFO), 2016). The lack of a technology transfer law setting clear rules on partnerships and providing appropriate incentives adversely affects technology transfer in Chile.

1.9 **Overlapping of programs.** Despite the low levels of R&D, Chile has an excessive number of government mechanisms for supporting STI activities. For example, in 2015, CORFO had more than 60 instruments (Angelelli et al., 2017), many of which served the same target audiences as other public agencies, like the Technical Cooperation Service, the National Science and Technology Research Commission (CONICYT), PROCHILE, or entities within CORFO itself. Likewise, by 2010 CONICYT had more than 100 different lines of support for scientific/technological and dissemination activities, but their individual and aggregate amounts were relatively low compared to those in other countries with similar per capita income levels (Benavente et al., 2011). The lack of a ministry-level public institution to monitor and coordinate the various programs has exacerbated this overlap.

[10] England, which has the largest regional production disparities in the OECD, has identified policy actions to foster productivity and economic benefits in more remote regions without agglomeration economies.

1.10 **Failure to target research to strategic challenges.** According to Álvarez, Benavente, and Tejada (2018), between 2006 and 2012, Chile's population of research fellows mainly focused on natural resources (36.6%) and social sciences (21.7%), with only 17.3% dedicated to the field of engineering and technology. However, doctoral fellows abroad are predominantly enrolled in social sciences programs (41%), followed by natural sciences (23%) and humanities (13%). Given this situation, Chile must establish a research policy framework that supplements the current mission-oriented one targeting productive and social objectives, prioritizing areas with the highest potential for value added in the country, such as nonconventional renewable energies.[11] The missions are a means of charting the course of economic growth and development as well as a vehicle that can be used to get there (Mazzucato, 2018). Likewise, the public policy on STI should focus on anticipation, experimentation, participation, and directionality (Schot and Steinmueller, 2018). Having a science, technology, knowledge, and innovation (STKI) policy in place will make it possible to comprehensively implement mission-oriented research and ensure fellowship programs align with the country's needs.

1.11 **Lack of science and technology policies for low-carbon development.** The Government of Chile has committed to making progress toward carbon neutrality in 2050. To that end, it is currently reviewing and updating its nationally determined contribution, through which it presented, to the international community, its commitments to mitigate greenhouse gas emissions and implement climate change adaptation measures (Government of Chile, 2015). The country is also working on defining its long-term decarbonization strategy and developing a financial strategy that will allow it to fulfil its commitments. However, achieving these targets will only be possible if national and regional environmental authorities effectively coordinate with the new national institutional framework for STKI. In that respect, the Ministry of Science, Technology, Knowledge, and Innovation (MCTCI) will be a key stakeholder in: (i) helping to assess the technological needs for mitigating climate change and reducing the country's vulnerability to the impacts thereof; (ii) developing guidelines for researching, transferring, and adopting these technologies; (iii) providing assistance for developing the long-term strategy, sector mitigation and adaptation plans, and other climate change management tools; and (iv) contributing to monitoring progress and fulfillment of targets (paragraphs 1.15 and 1.16). To address this challenge, the country will actively include the issue of climate change in the national policy on STKI.

1.12 **Gender gaps.** There is a significant gender gap in STI activities, particularly in science, technology, engineering, and mathematics (STEM) disciplines. Only around one-third (33.12% in 2016) of the country's researchers are women. However, according to data from the Ibero-American and Inter-American Network for Science and Technology Indicators, the Latin American average is 46.87%. This is reflected in research funding dynamics: in fact, from 2010 to 2015, only 30% of CONICYT support programs were awarded to women-led projects, while in other countries in the region, for equivalent projects, the rate is close to 40% (Lopez Bassols et al., 2018). The MCTCI will include gender considerations within its STKI policy, to bridge these gaps (paragraph 1.27).

[11] See: "*Orientaciones estratégicas de cara a 2030*." CNID (2019), section III.

1.13 **Shortcomings in the monitoring and evaluation systems.** The large number of different tools and methodologies makes it difficult to monitor and evaluate programs, since the lack of clear mechanisms for coordinating the various evaluation requirements means that the organizations responsible for providing the indicators have to spend a considerable amount of money on generating information (Irarrázaval, 2012). Although this diversity produces more information, it has also been shown that some of the tools overlap, which leads to excessive, high spending on technical skills, resources, and implementation times. Furthermore, although the Chilean system evaluates programs and projects, it does not evaluate public policies in this area. Consequently, policies that are implemented across sectors often end up being evaluated in a segmented way. There is no systemic overview of all of the public-sector evaluations (Irarrázaval and De los Ríos, 2014), which is especially problematic given the increasing demand in the government for evidence-based policies. Further, with the increasing emphasis that many countries are placing on policies for driving innovation, governments need to justify how much and where they invest in innovation, and how much the public receives in return. Assessing the socioeconomic impacts of public R&D is crucial in order to evaluate the efficiency of public spending, assess its contribution to achieving social and economic objectives, and enhance public accountability (OECD, 2008). The MCTCI and the National Agency for Research and Development (ANID) will have a comprehensive, modern system for monitoring and evaluating STKI policies and programs.

1.14 **Government plan.** The economic targets established in the Government Plan 2018-2022[12] include doubling the prior administration's growth rate, bringing productivity up to positive levels, and raising the investment rate. To those ends, the Plan includes several measures to develop an innovative, competitive economy that invests, notably: (i) establishing the MCTCI as the lead agency coordinating these activities; (ii) implementing policies meant to bolster scientific/technological activities; and (iii) encouraging private-sector participation in these activities.

1.15 **Institutional progress.** To address these challenges, the Congress of Chile approved Law 21,105, which creates the MCTCI, in August 2018.[13] This law introduces a number of reforms to improve coordination in policies supporting STKI, including: the transformation of CONICYT into the National Agency for Research and Development (ANID) and the creation of the National Council on STKI for Development, the Interministerial Advisory Committee on STKI, and regional ministerial offices. ANID's objective will be to administer and execute programs and instruments designed to promote, foster, and expand research, technological development, and science- and technology-based research. The mission of the National Council on STKI for Development is to advise on the prospective analysis of global and national trends, developing proposals, and preparing and reviewing the national strategy on STKI for development. The Interministerial Committee is responsible for providing advisory support for drafting, implementing, and monitoring the STKI policy (see Figure 1).

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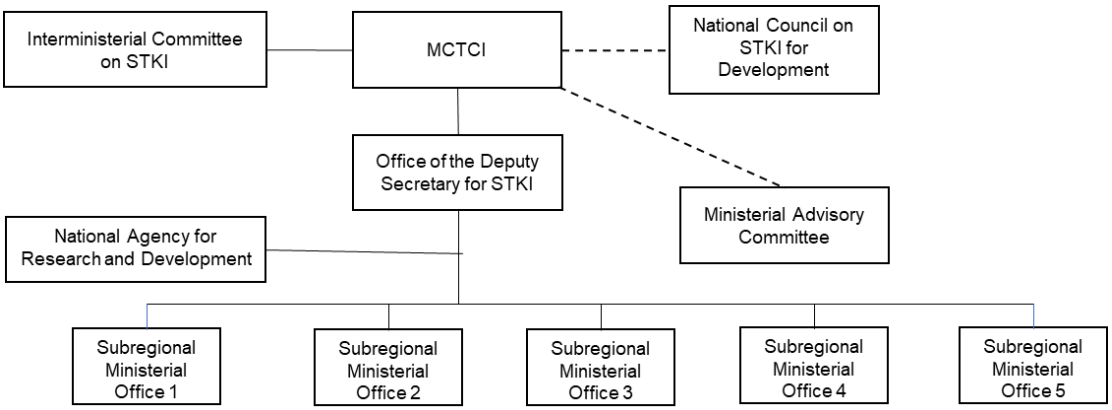
12 See: http://programa.sebastianpinera.cl/.

13 See footnote 22 specifying the scope of the MCTCI's functions.

Figure 1. New institutional organization for STKI



1.16 These institutional reforms are meant to resolve some of the aforementioned issues. They will be supplemented with legal reforms, such as draft legislation regulating the central aspects of technology transfer, and the establishment of Chile's first national policy on STI. Other efforts along the same lines are the establishment of geographic macroregions,[14] to encourage joint policies and initiatives among the regions and establish coordinating agencies in the respective regions to consolidate regional efforts, and the launch of a digital platform for monitoring and tracking Chile's government programs in support of STI.

1.17 **Reform summary and rationale.** In this context, the country has requested Bank support to pursue these reforms, in the form of a policy-based loan (PBL) and a nonreimbursable technical-cooperation operation to support the strengthening of STKI, currently in preparation. The PBL will include two tranches with actions for reducing three types of gaps: (i) legal: legal framework for emerging and developing STKI; (ii) institutional: weaknesses in mechanisms for coordinating public agents, lack of institutional mechanisms for promoting science- and technology-based innovation across regions, and failure to separate policy formulation and execution responsibilities; and (iii) monitoring and evaluation: lack of methodologies, data, and capacity for monitoring and regularly evaluating STKI plans and programs. The program strikes an appropriate balance between reforms that can be immediately implemented to strengthen the institutional and legal structure for STKI and other measures to strengthen mechanisms for coordination, policy formulation, policy execution, and monitoring and evaluation of STKI over the long term. Implementation of these reforms is expected to diminish the aforementioned government failures. Challenges that will remain pending include fostering greater private-sector participation in financing and executing STI activities and increasing the number of researchers and patent registrations. These

[14] CORFO defined five natural regions in continental Chile: (i) far north; (ii) near north; (iii) central; (iv) southern ; and (v) austral.

aspects should be considered in future policy proposals made by the Government of Chile.[15]

1.18 **Bank value added.** The Bank has supported the design of program reforms through activities involving ongoing dialogue with the government and key stakeholders who participated from the beginning in the conceptual design of the MCTCI and in writing the law creating it. This included providing technical support and engaging in discussions on the drafting of the law creating the MCTCI.[16] Furthermore, the Bank is supporting the institutional strengthening of the recently created ministry through: (i) technical support for drafting the strategy and methodology for coordinating the macroregional coordination agencies;[17] (ii) the analysis of best practices in legal frameworks for technology transfer; (iii) the analysis of institutional models for innovation agencies; and (iv) a study for monitoring ANID-executed programs and instruments. These activities, which include the exchange of international experiences and the analysis of best practices, will help enhance the mechanisms for coordinating stakeholders, and will improve the ministry's technical and coordination capacities.

1.19 **Complementarity with other Bank operations.** The design of the reforms will benefit from complementarity with a nonreimbursable technical-cooperation operation supporting the strengthening of the institutional structure for STKI, currently in preparation, through the: (i) strengthening of the MCTCI's technical capacities (including prospective studies and best practices); (ii) design and implementation of a monitoring and evaluation system; and (iii) dissemination and alliance-building activities. This operation also complements the Program to Improve Sustainable Investment Project Management (operation 4863/OC-CH) insofar as it helps improve Chile's investment climate by supporting STI and strengthening policy coordination mechanisms to that end.

1.20 **Bank experience in the region and the sector.** The Bank has experience in supporting reforms of the institutional framework for STI in the region, through PBLs in at least three cases: (i) installation of the National Research and Innovation Agency in Uruguay (operation 1840/OC-UR);[18] (ii) institutional reforms for innovation in Peru, supported by the programmatic series to enhance competitiveness in Peru (operation 3299/OC-PE); and (iii) creation in Chile of the Executive Secretariat of the Sustainable Project Advisory Committee (the Sustainable Project Management Office) through the Program to Improve Sustainable Investment Project Management (operation 4863/OC-CH). The Bank also supported institutional reforms through investment loans, in operations creating the National Agency for Promoting Science and Technology in Argentina

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15 Law 21,105 (Article 20) requires the new MCTCI to draw up an STKI policy proposal that addresses the issues including those related to promoting science and technology, the training of highly qualified human capital, and the national and regional priorities for STKI strategies. This proposal is expected to be ready by the first quarter of 2020.

16 Benavente et al. (2019). *Elementos Conceptuales de la Institucionalidad de Ciencia y Tecnología.* Discusses the elements that must be taken into account in designing science and technology institutions.

17 The macroregional coordination agencies bring together two or more regional ministerial offices to foster joint policies and initiatives among the regions, and to establish coordination agencies in the respective regions.

18 The creation of this agency was a condition of the PBL 1840/OC-UR, which was later consolidated with two additional investment loan operations, 3315/OC-UR and 4329/OC-UR.

and later, the Ministry of Science, Technology, and Productive Innovation in that same country (operations 2180/OC-AR, 2437/OC-AR, 3497/OC-AR, and 4025/OC-AR). The Bank has also been supporting the decentralization of productive development through, for example, the Program of Regional Productive Development Agencies (operation 1829/OC-CH). Also significant is the Bank's participation in institutional reforms to support STKI in the region,[19] including in Chile, where it has been engaged in a technical dialogue with the MCTCI as part of the process of setting up the ministry, and through other policy-based loan operations in which it comprehensively and cohesively supports the country's own growth efforts.[20]

1.21 **Lessons learned.** The lessons learned from the aforementioned operations underscore the Bank's relevance in building institutional frameworks for STI, and the need to equip institutions with the tools to ensure adequate coordination among stakeholders and the separation of planning and execution functions. Furthermore, in recent years, the Bank financed a series of programs to improve the business and innovation climate in Latin America and the Caribbean. A recent study[21] found that these programs had benefits and direct effects on private-sector activity and overall competitiveness. The lessons learned from these operations, which entailed making reforms to improve the business climate, show that: (i) the Bank can play a catalytic role in introducing groundbreaking reforms in strategic areas; (ii) programmatic operations tend to have a major impact when executed in conjunction with other Bank instruments; (iii) an executing agency's capacity to lead and continue the reform process is crucial; (iv) the private sector plays an active role in implementing and sustaining reforms; and (v) the benefits of this type of intervention become more apparent over the medium and long term. These lessons were incorporated into the design of this operation as follows: First, Bank support for the program reforms includes strong technical support from the design to the launch of the MCTCI through dialogue and the dissemination of Bank experiences in other countries, as well as support from a technical cooperation operation to strengthen the institutional framework for STKI, currently in preparation. Second, a dialogue with the private sector, academia, and other relevant stakeholders was undertaken to identify and design the program's measures. Third, the program helps build institutional capacity for implementing the reforms over the short, medium, and long terms. Lastly, it includes elements for coordinating and strengthening policy formulation and execution capacities, while maintaining the independence of the institutions involved.

1.22 **International evidence and external validity.** In the past few years, there has been a trend towards strengthening the institutional framework for STI by increasing and better targeting budgets for R&D (OECD, 2018). Several countries, as well as the European Union, have set specific objectives for encouraging public- and private-sector spending on R&D. Public funds are increasingly allocated to

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19 CNID (2014) and Navarro et al. (2016).

20 Benavente (2016).

21 Hunt Howell, Juan Carlos Navarro, Claudia Stevenson, and Kayla S. Grant, 2017. *Supporting Policy Reforms in Business Climate and Innovation in Latin America and the Caribbean: Lessons Learned from the Inter-American Development Bank's Experience with Policy-based Lending* /. p. cm. — (IDB Technical Note; IDB-TN-1262).

scientific and technological fields, considered to have high economic and social value, and within those fields, more specifically to information and communications technologies, biotechnology, and nanotechnology. Some countries, including Germany, Denmark, Norway, and the Netherlands, have created special funds to finance research in priority fields. Furthermore, reforms have been made to public research organizations to improve their contributions to society and to the economy, and to facilitate technology transfer to industry as well as budgetary increases for R&D. For example, Denmark, Japan, and the Slovak Republic have given universities more autonomy, by transforming them into private or semi-private institutions or eliminating the barriers that prevented them from collaborating with industry. Many countries have also modified financing structures so that universities and public laboratories depend less on institutional financing and more on research funds granted to competitively compensated projects (OECD, 2012).

1.23 **Strategic alignment.** The program is aligned with the Update to the Institutional Strategy 2010-2020 (document AB-3008), contributing to the challenge of productivity and innovation through technological development and by fostering science- and technology-based STI and knowledge transfer; and with the crosscutting themes of: (i) gender equality and diversity, through improvement in conditions for women in financing STKI activities explicitly set forth in the policy to strengthen the legal framework for science- and technology-based STI (paragraph 1.27); (ii) climate change and environmental sustainability, considering that 7.69% of the operation's resources are invested in climate change mitigation and adaptation activities; in accordance with the joint methodology of the multilateral development banks, these resources contribute to the IDB Group's target of increasing the funding for climate-change-related projects to 30% of total approvals by the end of 2020. The program will help promote technological research to mitigate climate change and reduce vulnerability, and will provide support for decarbonization and low-carbon development projects, which are specifically discussed in the policy for strengthening the legal framework for science- and technology-based STI; and (iii) institutional capacity and the rule of law, through reforms to strengthen the public agencies that are part of the STKI ecosystem.

1.24 The program also contributes to the Corporate Results Framework 2016-2019 (document GN-2727-6), especially with the indicator of government agencies benefited by projects that strengthen technological and managerial tools to improve public service delivery, through the institution-strengthening actions for the public stakeholders in the STKI ecosystem. In addition, the program is consistent with the Innovation, Science, and Technology Sector Framework Document (document GN-2791-8), regarding the business climate for private-sector development; and it is aligned with the priority area of the Sector Strategy: Institutions for Growth and Social Welfare (document GN-2587-2) regarding strengthening institutional capacities for designing and implementing efficient regulations for productive sector development. The program is also aligned with the IDB Group Country Strategy with Chile 2019-2022 (document GN-2946), supporting the priority area of "stronger investment and enhanced productivity" and the strategic objective of "promote business innovation." Lastly, the project is included in the Update to Annex III of the 2019 Operational Program Report (document GN-2948-2).

B. Objectives, components, and cost

1.25 **Objectives.** The general objective of the operation is to promote the country's technological development by fostering science- and technology-based STI and knowledge transfer. The specific objectives are to: (i) maintain a stable macroeconomic environment; (ii) provide support for strengthening the legal framework for science- and technology-based STI; (iii) provide support for strengthening the institutional framework for science- and technology-based STI; and (iv) establish mechanisms to monitor and evaluate STKI policies. The program is organized into four components, described below:

1.26 **Component I. Macroeconomic sustainability.** This component sets out the policy objective of ensuring that the macroeconomic environment will remain consistent with the program objectives and policy letter guidelines.

1.27 **Component II. Legal framework for science, technology, knowledge, and innovation.** This component will provide support for strengthening the legal framework for science- and technology-based STI, including the following actions: (i) establishment of the MCTCI by law;[22] (ii) launch of MCTCI operations; (iii) creation of the Office of the Deputy Secretary for STKI within the MCTCI;[23] (iv) MCTCI development of proposed good practices for policies supporting technology transfer, to contain, at a minimum, international benchmarking and reference countries; and (v) MCTCI drafting of a proposal for the STKI policy, to contain, in addition to the objectives and guidelines set forth in Article 20 of Law 21,105,[24] the following elements, at a minimum: (a) institutional framework; (b) strengthening of the STKI system; (c) linkages with society; (d) future; (e) gender;[25] and (f) climate change.[26] The policy commitments for the second disbursement are: (i) the creation of the Ministerial Advisory Council; (ii) the Office of the Deputy Secretary for STKI is operating and has been allocated budgetary resources under the corresponding chapter of the Public Sector Budget Act; (iii) the MCTCI has prepared a draft bill on technology transfer; and (iv) the Executive Decree approving the national STKI policy has been fully processed.

1.28 **Component III. Institutional framework for science, technology, knowledge, and innovation.** This component will provide support for strengthening the institutional framework for science- and technology-based STI, through the following actions: (i) the National Council on Innovation for Development (CNID) has met under the new structure established in MINECON Executive Decree 70 of

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22 Pursuant to Article 3 of Law 21,105, the MCTCI will be responsible for advising the President of the Republic on the design, development, coordination, implementation, and evaluation of the policies, plans, and programs meant to foster and strengthen science- and technology-driven STI.

23 Among other duties, this Office is responsible for the internal administration of the MCTCI, coordinating the actions of the public services and agencies that report to the MCTCI, and acting as authenticating officer.

24 This article includes the following objectives and guidelines: (i) scientific development and innovation; (ii) training of highly qualified human resources; (iii) priorities or focal points based on the STKI for Development Strategy; (iv) regional development strategies or strategic sector challenges, etc.

25 For example, improved financing conditions to help women remain in STKI activities, including extended deadlines for mothers, for publications to be considered in applications.

26 Promoting technological research for mitigating climate change and reducing vulnerability, as well as decarbonization and low-carbon development programs and projects.

2019;[27] (ii) adoption of guidelines for the functioning of the Interministerial Committee on STKI; (iii) appointment of the macroregional coordinating agencies and determination of the geographical locations where they are based (seats); (iv) launch of the new ANID; and (v) in the Public Sector Budget Act, under the budget for the Office of the Deputy Secretary for STKI, the Fund for Innovation, Science, and Technology program will be included. This will ensure that the MCTCI has the capacity to design and finance support for innovation. The policy commitments for the second disbursement are: (i) operational launch of the National Council on STKI for Development, replacing the CNID; (ii) operational launch of the Interministerial Committee on STKI; (iii) operational launch of the regional ministerial offices geographically located as seats of the macroregional coordinating agencies; (iv) establishment of the ANID's internal organizational structure; and (v) the Fund for Innovation, Science, and Technology will have been allocated budgetary resources under the Public Sector Budget Act.

1.29 **Component IV. Monitoring and evaluation mechanisms.** This component will establish mechanisms for monitoring and evaluating STKI policies, and will include: (i) preparation of design proposal for a system for monitoring ANID-executed programs and instruments; and (ii) a survey of the internal processes associated with ANID-executed programs and instruments, which will serve as a baseline for an evaluation system. The policy commitments for the second disbursement are: (i) testing of a system for monitoring ANID-executed programs and instruments; and (ii) preparation of a design proposal for the system for evaluating programs and instruments, including the establishment of indicators and the corresponding baselines, for the ANID.

1.30 **Beneficiaries.** Given the program objective and the broad, crosscutting nature of the reforms, this program is expected to have a large number of beneficiaries, including universities, research institutions, and enterprises that will be able to increase their linkages; women in STEM who will have greater incentives to participate in open calls for proposals; innovative companies and the scientific community, which will benefit from more transparent, inclusive processes; the regions, which will benefit from more equitable spending on R&D; and the public agencies in the ecosystem that will be provided with mechanisms for monitoring and evaluating national and foreign STI plans and programs. The program will also benefit the public and private organizations that engage in scientific/technological activities.

C. Key results indicators

1.31 The framework to measure this program's development effectiveness is embodied in the Results Matrix (see Annex III). The outputs listed in that matrix replicate the structure of the Policy Matrix (Annex II). In turn, the policies are described in the program components. The expected impact is an improvement in Chile's ranking on the innovation index published by the World Economic Forum, which includes private spending on R&D, patents per one million inhabitants, university/industry collaboration, availability of scientists and engineers, and government procurement

[27] The CNID was created by the MINECON in Executive Decree 177 of 2014 and entered into operation on 22 July 2014. However, it has been inoperative since 11 March 2018. MINECON Decree 70 of 1 July 2019 appoints the new chair of the CNID, a necessary step to start the process of replacing the CNID with the new Council on STKI for Development.

of advanced technology products among its determining factors. Spending on R&D as a percentage of GDP is also expected to increase.

1.32 Implementation of these products should have an impact on the country's scientific/technological development through seven outcomes related to the aforementioned objectives: (i) stronger ties among universities, research institutions, and companies; (ii) a higher percentage of women in government-funded R&D projects; (iii) fewer lines of support for promoting R&D due to the elimination of current overlaps; (iv) a smaller percentage of companies linked with more than one institution supporting STKI activities, to prevent duplicate fundraising and inefficiencies among programs; (v) decreased number of principal investigators who have committed to working on research projects more hours than are available, affording new researchers and scientists more equitable access to support programs; (vi) improved geographical balance in the distribution of public resources for these activities, as well as more efficient use thereof; and (vii) a better system for monitoring and evaluating the different STKI support options in Chile.

1.33 **Economic analysis.** Based on the recommendations made by the Office of Evaluation and Oversight in its 2011 Evaluability Review of Bank Projects[28] and on the findings of the review of evaluation practices and standards for policy-based lending conducted by the Evaluation Cooperation Group (comprising the independent evaluation offices of the multilateral development banks),[29] as provided for in paragraph 1.3 of Review of the Development Effectiveness Matrix for Sovereign Guaranteed and Non Sovereign Guaranteed Operations (document GN-2489-5), which indicates that an analysis of efficiency in the use of financial resources is unnecessary,[30] it was decided that an economic analysis would not be performed for this type of loan, as reported to the Bank's Board of Executive Directors. Accordingly, this loan operation does not include an economic analysis, and thus none was used for the purposes of measuring the evaluability score in the program's Development Effectiveness Matrix.

II. Financing Structure and Main Risks

A. Financing instruments

2.1 **Financing instrument.** This operation is structured as a multi-tranche PBL based on the document Policy-based Loans: Guidelines for Preparation and Implementation (document CS-3633-2). A multi-tranche PBL with two tranches was chosen due to the Chilean government's interest in having Bank support for spearheading sector policy reforms, given that the details of the essential measures of the medium-term reform process are well known, and that the

[28] Document RE-397-1: Currently, the economic analysis section is computed as the maximum between the cost-benefit analysis and the cost-effectiveness analysis. Yet neither a cost-benefit analysis nor a cost-effectiveness analysis is applicable to policy-based loans.

[29] Good Practice Standards for the Evaluation of Public Sector Operations. Evaluation Cooperation Group, Working Group on Public Sector Evaluation, 2012 Revised Edition. February 2012.

[30] According to the Evaluation Cooperation Group, PBLs should be evaluated according to their relevance, effectiveness, and sustainability. Efficiency was not included as a criterion, since policy-based loan amounts are tied to the country's financing needs, independent of the project's benefits.

government is determined to carry out the program of medium-term reforms or institutional changes and to adhere to the execution timeline. This choice is also justified by the government's extensive knowledge of and high level of commitment to the scope and content of the established policy reform process, whose continuity over time will be strengthened by this instrument, which is appropriate for supporting institutional reforms and is a good vehicle for helping to resolve coordination failures among stakeholders.

2.2 **Dimensioning.** The program will be financed with a US$50-million loan from the Bank's Ordinary Capital resources. The proceeds will be disbursed in two tranches (US$25 million each) upon verification that the conditions for the release of each tranche have been fulfilled. The scale of the operation is justified pursuant to the provisions of paragraph 3.27 (b) of document CS-3633-2, taking into account the countries current needs for fiscal resources in the broad sense, although they are not directly related to the costs linked to the reform to be borne by the borrower. This operation will provide fungible resources to support a mutually agreed program of policy reforms and/or institutional changes in a sector or subsector. It amounts to 0.63% of the public sector borrowing authorization approved in the 2019 Public Sector Budget Act and 16.6% of financing from multilateral organizations.

B. Environmental and social risks

2.3 In accordance with Directive B.13 of the Bank's Environment and Safeguards Compliance Policy (Operational Policy OP-703), and based on the results of the Safeguard Policy Filter, this operation does not require classification. No environmental or social risks are associated with the program. The program does not finance physical investments and should not involve any activities that adversely impact natural resources. Since the Policy Matrix contains elements for including scientific/technological development policies that should positively impact climate change and incentives for reducing gender gaps, the project is expected to produce positive environmental and social impacts.

C. Fiduciary risks

2.4 The proposed financial instrument will support the implementation of institutional and policy reforms. Therefore, it is deemed not to entail fiduciary risks because the borrower receiving the proceeds has sound country financial management systems in place.

D. Other key issues and risks

2.5 **Public management and governance.** There is a medium-level risk that public opinion will consider the macroregional equity mechanisms insufficient. To mitigate this risk, the technical cooperation funding in support of this operation will be used to hold a number of publicity and outreach activities to better explain these mechanisms to the principal stakeholders and public-opinion shapers. The second medium-level risk identified is the possibility of difficulties in gathering information and establishing baselines for the evaluation of the different policies and programs. This risk will also be mitigated through the use of the technical cooperation funding, in this case to finance expert consultants who will develop baselines for the programs to be evaluated.

2.6 **Sustainability.** The Government of Chile has committed to the actions agreed upon in the policy matrix, as stated in its policy letter. This program will help improve the productivity of the Chilean economy, which is one of the priorities of the current government plan. The program design contains elements to support the project's sustainability, namely support for coordination agencies like the Interministerial Council on STI and the National Council on STKI for Development, which include elements of participatory dialogue and coordination among public agencies and among public and private agencies, with elements in their design to ensure technical independence and long-term management of STKI policies and strategies. In addition, the technical assistance to be provided through the technical cooperation operation, in preparation, will support the intervention's sustainability by strengthening the Ministry's technical capacities, including its monitoring and evaluation capacity and its capacity to communicate with and involve key stakeholders in the development of its policies.

III. Implementation and Management Plan

A. Summary of implementation arrangements

3.1 **Borrower and executing agency.** The borrower is the Republic of Chile and the executing agency is the MCTCI. The Ministry will have the following responsibilities: (i) providing evidence that the policy commitments for each release have been fulfilled; (ii) supporting the actions required to carry out the program; and (iii) upon completion of the release of each tranche under the program, obtaining the information on performance indicators needed to evaluate program outcomes. Even though the MCTCI and Office of the Deputy Secretary for STKI were only established recently, they are already operating and supporting fulfillment of the Policy Matrix. The operation design includes elements to guarantee the institutional strengthening of the new ministry, especially of the councils in charge of coordination and strategic development. To further the MCTCI's execution and monitoring and evaluation work, the technical cooperation operation, in preparation, will be used to support the Ministry's technical and monitoring and evaluation capacities.

3.2 **Interagency coordination.** The MCTCI, through the Office of the Deputy Secretary, will coordinate with other public and private organizations participating in the various policy measures included in this program. The program will support implementation of institutional coordination mechanisms for public stakeholders, through support for the launch of the Interministerial Committee on STKI, the National Council on STKI for Development, and the macroregional coordinating bodies established in the law creating the MCTCI. At present, the Office of the Deputy Secretary, responsible for providing technical support and material to the coordinating agencies, is already performing coordination work and supporting the fulfillment of conditions. The coordinating bodies, such as the Interministerial Advisory Committee, the National Council on STKI, and the macroregional coordination agencies, have been established by law and some are already operating.

3.3 **Special contractual conditions precedent to the release of each tranche of the loan: The two disbursements of Bank loan proceeds will be contingent on fulfillment of the policy reform commitments described in the program**

components and in the Policy Matrix (Annex II) and on fulfillment of the other conditions specified in the loan contract. Fulfillment of the policy conditions will be verified using the tools indicated in the Policy Matrix (Annex II), Means of Verification Matrix, and Monitoring and Evaluation Plan. The Bank may request an external audit of the program if deemed necessary, as established in the loan contract.

B. Summary of arrangements for monitoring results

3.4 **Monitoring.** The program's Monitoring and Evaluation Plan is based on tracking of the indicators and targets specified in the following instruments: (i) Policy Matrix; (ii) Means of Verification Matrix; and (iii) Results Matrix. These instruments define the key parameters for supervising and evaluating program results. The Bank will monitor program execution, and the executing agency will be responsible for monitoring and tracking the operation's outcomes, in coordination with the Bank.[31] The executing agency will provide the Bank with any information needed to measure fulfillment of the two tranches of program disbursement and will furnish timely information on program progress and achievements to prepare the project completion report. The Bank will support the MCTCI monitoring and evaluation activities with technical cooperation funding.

3.5 **Evaluation.** The program policy measures include implementation of a system for monitoring ANID-executed programs and instruments and a system for evaluating the MCTCI's policies, plans, and programs. The Monitoring and Evaluation Plan has monitoring indicators; and the Policy Matrix (Annex II), the Means of Verification Matrix, and the Results Matrix (Annex III) set the parameters for program supervision and evaluation. The team will evaluate fulfillment of program objectives using the targets and indicators established in the policy and results matrices as references.

3.6 When the operation has been completed, a project completion report (PCR) will be prepared. The PCR is the primary accountability tool used by the Bank to show its internal and external partners the performance of its sovereign guaranteed operations and their development effectiveness. This report will present the main findings and recommendations so as to improve the design and execution of future projects.

IV. POLICY LETTER

4.1 The Bank and the Government of Chile have agreed on the policy commitments that this program will support. These commitments are reflected in the Policy Matrix (Annex II), the Means of Verification Matrix, and the Results Matrix (Annex III). The Policy Letter reiterates the government's commitment to the objectives and actions envisioned for the operation as a whole.

[31] The Office of the Deputy Secretary is already operating, with core staff members working towards fulfillment of the policy conditions. The Interministerial Committee was created by Law 21,105 of 2018 and its operational guidelines will be ready in the fourth quarter of 2019. The CNID is already operating and its chair has been appointed.

Development Effectiveness Matrix		
Summary		
I. Corporate and Country Priorities		
1. IDB Development Objectives		
Development Challenges & Cross-cutting Themes	-Productivity and Innovation -Gender Equality and Diversity -Climate Change and Environmental Sustainability -Institutional Capacity and the Rule of Law	
Country Development Results Indicators	-Government agencies benefited by projects that strengthen technological and managerial tools to improve public service delivery (#)*	
2. Country Development Objectives		
Country Strategy Results Matrix	GN-2946	Promote business innovation
Country Program Results Matrix	GN-2948-2	The intervention is included in the 2019 Operational Program.
Relevance of this project to country development challenges (If not aligned to country strategy or country program)		
II. Development Outcomes - Evaluability		Evaluable
3. Evidence-based Assessment & Solution		7.7
3.1 Program Diagnosis		3.0
3.2 Proposed Interventions or Solutions		1.7
3.3 Results Matrix Quality		3.0
4. Ex ante Economic Analysis		N/A
5. Monitoring and Evaluation		7.0
5.1 Monitoring Mechanisms		2.5
5.2 Evaluation Plan		4.5
III. Risks & Mitigation Monitoring Matrix		
Overall risks rate = magnitude of risks*likelihood		Low
Identified risks have been rated for magnitude and likelihood		Yes
Mitigation measures have been identified for major risks		Yes
Mitigation measures have indicators for tracking their implementation		Yes
Environmental & social risk classification		B.13
IV. IDB´s Role - Additionality		
The project relies on the use of country systems		
Fiduciary (VPC/FMP Criteria)	Yes	Financial Management: Budget, Treasury, Accounting and Reporting, External Control, Internal Audit.
Non-Fiduciary		
The IDB's involvement promotes additional improvements of the intended beneficiaries and/or public sector entity in the following dimensions:		
Additional (to project preparation) technical assistance was provided to the public sector entity prior to approval to increase the likelihood of success of the project	Yes	An operational support TC, registered as CH-T1229, will be undertaken, and will include the following main activities: (i) review of best practices on legal frameworks of technological transfer; (ii) a study on impact evaluation methodologies for institutional reforms supporting STKI activities; and (iii) a study on innovation agencies' models and their adaptability to the Chilean local context; among others.

Note: (*) Indicates contribution to the corresponding CRF's Country Development Results Indicator.

After a decade of growth that lasted up until 1999, total factor productivity in Chile has contracted, falling at a rate of -0.5% annually between 2000-2009 and even more acutely at a rate of -1% during 2010-2014. Amongst factors that inhibit productivity growth, in Chile the lack of innovation efforts is evident. The government seeks to implement policies oriented at promoting scientific and technological activities. Currently in Chile there is a multiplicity of public policy instruments that aim to support innovation but that are scarcely articulated to each other or organized. Furthermore, the link between private sector and universities is weak and it is known that linked companies tend to invest 85% more in research and development (R&D). It is also concerning that the utilization of public resources for R&D is very centralized in metropolitan regions and there is a very low technology transfer level due in part to a lack in institutions especially for the management of intellectual property. Thus, it is necessary to organize existing efforts, prioritize, and have an institution that gives clear mandates. In this context, this first tranche of a PBL has amongst its specific objectives to support the strengthening of the (i) legal framework and (ii) institutional framework for science, technology, and innovation (STI) of technological basis and (iii) to establish mechanisms of monitoring and evaluation for such policies. The program addresses institutional failures and supports the commencement of operations by MCTCI – the government lead agency for innovation policies. As part of the program a new proposal for policies incorporating best practices for technological transfer will be developed. Furthermore, the program will promote reforms that seek to establish a policy framework that orients research by mission; and that will incorporate, among others, the issue of climate change in the innovation agenda given the country's commitment to mitigate emissions. Reforms that foment STI of technological basis will also be supported; for example, support will be given to the Interministerial Committee that addresses topics in CTI. Likewise, even though multiple efforts exist to generate information these are duplicitous and oriented by project and not by mission. The program will seek to establish a mechanism that organizes such efforts. Expected results to be measured at closure include an increase in the percent of innovating firms that are linked with universities, a measure of the rationalization of the total number of support lines that promote R&D, a decrease in the multiplier that exists between R&D expenses per population assigned to the metropolitan region vis-à-vis the rest of the country. At closure a reflexive analysis will be utilized to evaluate the program's results.

POLICY MATRIX

Objective: The general objective of the operation is to promote the country's technological development by fostering science, technology, and science- and technology-based innovation (STI) and knowledge transfer. The specific objectives are to: (i) maintain a stable macroeconomic environment; (ii) provide support for strengthening the legal framework for science- and technology-based STI; (iii) provide support for strengthening the institutional framework for science- and technology-based STI; and (iv) establish mechanisms to monitor and evaluate science, technology, knowledge, and innovation (STKI) policies.

Components/ Policy objectives	Policy conditions Tranche I	Status of fulfillment of conditions Tranche I[1]	Policy conditions Tranche II
Component I. Macroeconomic sustainability			
Ensure the macroeconomic environment is consistent with program objectives and policy letter guidelines.	1.1 The macroeconomic environment is conducive to achieving program objectives and consistent with the policy letter.	1.1 Fulfilled	1.1 The macroeconomic environment is conducive to achieving program objectives and consistent with the policy letter.
Component II. Legal framework for science, technology, knowledge, and innovation			
Provide support for strengthening a legal framework for science- and technology-based STI.	2.1 The Ministry of Science, Technology, Knowledge, and Innovation (MCTCI) has been created by law.[2]	2.1 Fulfilled (Q3 2018)	2.1. The Ministerial Advisory Council has been created.
	2.2. The MCTCI has entered into operation.	2.2 Fulfilled (Q1 2019)	
	2.3. The Office of the Deputy Secretary for STKI has been created within the MCTCI.[3]	2.3. Fulfilled (Q2 2019)	2.3 The Office of the Deputy Secretary for STKI is operating, with budgetary resources allocated in the corresponding chapter of the Public Sector Budget Act.
	2.4. The MCTCI has developed a proposal of good practices in policies to support technology transfer, containing, at a minimum, international benchmarking and reference countries.	2.4. Pending (Q1 2020)	2.4. The MCTCI has prepared a draft bill on technology transfer.

[1] This information is merely indicative as of the date of this document. In accordance with document GN-3633-2 (Policy-based Loans: Guidelines for Preparation and Implementation), fulfillment of all specified tranche disbursement conditions, including the maintenance of an appropriate macroeconomic policy framework, will be verified by the Bank upon receipt of the corresponding disbursement request from the borrower and reflected in the disbursement eligibility determination memorandum in a timely manner.

[2] Pursuant to Article 3 of Law 21,105, the MCTCI will be responsible for advising the President of the Republic on the design, formulation, coordination, implementation, and evaluation of the policies, plans, and programs designed to foster and strengthen science- and technology-based STI.

[3] Among other duties, this Office is responsible for the internal administration of the MCTCI, coordinating the actions of the public services and agencies that report to the MCTCI, and acting as authenticating officer.

Components/ Policy objectives	Policy conditions Tranche I	Status of fulfillment of conditions Tranche I[1]	Policy conditions Tranche II
	2.5 The MCTCI has prepared an STKI policy proposal containing, in addition to the objectives and guidelines set forth in Article 20 of Law 21,105,[4] the following elements: (a) institutional framework; (b) strengthening of the STKI system; (c) linkages with society; (d) future; (e) gender; and (f) climate change.	2.5 Pending (Q1 2020)	2.5 The Executive Decree approving the national STKI policy has been fully processed.
Component III. Institutional framework for STKI			
Support the strengthening of a legal framework for technology-driven STI.	3.1 The National Council on Innovation for Development (CNID) has met under the new structure established in Ministry of Economy, Development and Tourism Executive Decree 70 of 2019.[5]	3.1 Fulfilled (Q4 2019)	3.1 The National Council of Science, Technology, Knowledge, and Innovation for Development, replacing the CNID, has entered into operation.
	3.2 The Interministerial Committee on STKI has adopted operational guidelines.	3.2 Pending (Q4, 2019)	3.2 The Interministerial Committee on STKI has entered into operation.
	3.3 The macroregional coordinating agencies have been appointed and the geographic locations where they are based (seats) have been determined.	3.3 Fulfilled (Q3 2019)	3.3 The regional ministerial offices, located in geographical areas that are the seats of the macroregional coordination agencies, have entered into operation.
	3.4 The new National Agency for Research and Development (ANID) has entered into operation.	3.4 Pending (Q4 2019)	3.4 The internal organizational structure of the ANID has been established.
	3.5 In the Public Sector Budget Act, under the budget for the Office of the Deputy Secretary for STKI, the Fund for Innovation, Science, and Technology program has been included to ensure that the MCTCI has the capacity to design and provide financing in support of innovation.	3.5 Pending (Q1 2020)	3.5 The Fund for Innovation, Science, and Technology has budgetary resources allocated in the Public Sector Budget Act.

[4] This article includes the following objectives and guidelines: (i) scientific development and innovation; (ii) training of highly qualified human resources; (iii) priorities or focal points based on the STKI for Development Strategy; (iv) regional development strategies or strategic sector challenges, etc.

[5] The CNID was created by the MINECON in Executive Decree 177 of 2014 and entered into operation on 22 July 2014. However, this Council has been inoperative since 11 March 2018. MINECON Decree 70 of 1 July 2019 appoints the new chair of the CNID, a necessary step for beginning the process of replacing the CNID with the new National Council on STKI for Development.

Components/ Policy objectives	Policy conditions Tranche I	Status of fulfillment of conditions Tranche I[1]	Policy conditions Tranche II
Component IV. Monitoring and evaluation mechanisms			
Establish mechanisms for monitoring and evaluating STKI policies.	4.1 The proposed design of a system for monitoring ANID-executed programs and instruments has been prepared.	4.1 Pending (Q1 2020)	4.1 The system for ANID-executed monitoring programs and instruments has been tested.
	4.2 A survey of the internal processes associated with ANID-executed programs and instruments has been conducted, to serve as a baseline for an evaluation system.	4.2 Pending (Q1 2020)	4.2 A proposed design of a system for evaluating tools and programs, including establishment of the indicators and the corresponding baselines, has been prepared for the ANID.

RESULTS MATRIX

Program objective:	The general objective of the operation is to promote the country's technological development by fostering science, technology, and science- and technology-based innovation (STI) and knowledge transfer. The specific objectives are to: (i) maintain a stable macroeconomic environment; (ii) provide support for strengthening the legal framework for science- and technology-based STI; (iii) provide support for strengthening the institutional framework for science- and technology-based STI; and (iv) establish mechanisms to monitor and evaluate science, technology, knowledge, and innovation (STKI) policies.

EXPECTED IMPACTS

Indicator	Unit of measure	Baseline		Midterm target		Final target		Means of verification	Observations
		Value	Year	Value	Year	Value	Year		
Impact 1: Increase in the composite innovation index									
Innovation index (World Economic Forum)	Index	3.5	2018	3.6	2021	3.8	2023	Score on the composite innovation index produced by the World Economic Forum	Among its determining factors, this index includes: company spending on research and development (R&D), patents per one million inhabitants, university-industry collaboration, availability of scientists and engineers, and government procurement of advanced technology products. The index ranges from 0 to 4; the higher the score, the better.
Impact 2: Increased spending on R&D									
Spending on R&D/GDP	%	0.36	2017	0.45	2021	0.70	2023	National survey on R&D spending and staff, prepared annually by MINECON	The target values correspond to an average country with a per capita income of around US$25,000 and US$28,000 (purchasing power parity) using the methodology proposed by Lederman and Maloney (2004), which uses all of the countries with information available on R&D/GDP and GDP per capita to establish the ratio between the two variables.

OUTCOMES

Indicators	Unit of measure	Baseline		Midterm target		Final target		Means of verification	Observations
		Value	Year	Value	Year	Value	Year		
Expected outcome 1. University-industry ties (Component II)									
Percentage of innovative companies linked with universities and research institutions	%	4.0	2017	6.5	2021	8.0	2023	Biannual report of the results of the National Innovation Survey	This value is calculated solely for companies that innovate. MINECON (www.minecon.cl) gathers the data every two years following OECD guidelines in the Oslo manual. The target comes from the average change in this variable observed for OECD countries between 2013 and 2017 for this question on the innovation survey (www.oecd.org/innovation/inno/inno-stats.htm).
Expected outcome 2. Women's participation (Component II)									
Percentage of participants in publicly-funded R&D projects who are women	%	30.0	2017	32.0	2021	40.0	2023	Annual report on allocations to public research projects (National Science and Technology Research Commission (CONICYT))	This indicator will continue to be reported by the new National Agency for Research and Development (ANID), which is the successor to the CONICYT (as part of this policy-based loan). The target value comes from the experience of OECD countries reported in López-Bassols et al. (2018).
Expected outcome 3. Available lines of support for promoting STKI (Component II)									
Total number of lines of support for promoting R&D	Number of lines of support	48	2017	35	2021	32	2023	Annual CONICYT statistical compendium, section describing science and technology support programs	The data should be calculated from the compendium as it is not published directly. It should be based on lines of support and not programs, since the latter is an organizational rather than operational concept. The target value results from the CONICYT value when spending on R&D in Chile reached 0.48% of GDP. The objective is to reduce the number of lines of support given the overlapping reported in the diagnostic assessment.

Indicators	Unit of measure	Baseline		Midterm target		Final target		Means of verification	Observations
		Value	Year	Value	Year	Value	Year		
Expected outcome 4. Innovative companies connect with similar lines of support from different agencies (Component II)									
Percentage of innovative companies that connect with more than one STKI-supporting institution with similar lines of support	%	20.1	2017	12.0	2021	10.0	2023	Analysis of the National Innovation Survey question on linkages (p. 12.2)	Similarity is defined by the market failures that the line of support seeks to resolve. This outcome seeks to reduce duplicate fundraising by beneficiary institutions as well as to better align programs to the type of targeted beneficiaries.
Expected outcome 5. Principal investigators' commitment to participate in STKI projects (Component IV)									
Percentage of principal investigators simultaneously participating in more than two research projects	%	TBD	2017	Baseline *0.95	2021	Baseline *0.90	2023	Variable that can be calculated by cross-referencing the databases of the various CONICYT lines of support based on the researchers' tax ID numbers	Principal investigators are those with the highest number of hours committed to the project total.[1] The baseline should be ready by the first quarter of 2020.

[1] The National Scientific and Technological Development Fund projects supported by CONICYT have a principal or lead investigator and a co-investigator. This indicator considers principal investigators to be the researchers with the most responsibility, measured in the number of hours committed to the project for all CONICYT-supported projects.

Indicators	Unit of measure	Baseline		Midterm target		Final target		Means of verification	Observations
		Value	Year	Value	Year	Value	Year		
Expected outcome 6. Regional distribution of resources to STKI (Component III)									
Ratio between spending on R&D allocated to the metropolitan region divided by the population and the country's total spending on R&D divided by the country's population.	Multiplication factor	2	2017	1.8	2021	1.8	2023	National Survey on R&D Spending and Staff	With the proposed target, spending on R&D in the metropolitan area would drop from 70% to 50%, in terms of absolute amounts.
Expected outcome 7. Evaluation of STKI lines of support (Component IV)									
Percentage of STKI lines of support with an impact-evaluation design	%	0	2017	2	2021	5	2023	Report	The Budget Office, at the request of the National Congress, evaluates the impact of public programs. However, the most recent evaluations in the STKI field were performed in 2009. [2]

OUTPUTS

Output	Indicator	Baseline		Year		Means of verification	Responsible party
		Value	Year	2019/2020	2021		
Component II. Legal framework for STKI							
a) Ministry of Science, Technology, Knowledge, and Innovation (MCTCI) created by law (Tranche I)	• Law 21,105 published in the Official Gazette on 13 August 2018	0	2017	1	0	• Copy of Law 21,105 published in the Official Gazette on 13 August 2018	• MCTCI
b) Creation of the Ministerial Advisory Council (Tranche II)	• Executive Decree creating the Ministerial Advisory Council issued through the MCTCI, fully processed.	0	2018	1	0	• Copy of the fully processed Executive Decree issued through the MCTCI creating the Ministerial Advisory Council	• MCTCI

[2] On the Development Partnership Projects and the Technical Assistance Fund, under CORFO.

Output	Indicator	Baseline		Year		Means of verification	Responsible party
		Value	Year	2019/2020	2021		
c) MCTCI operating (Tranche I)	• Report issued by the Minister of Science, Technology, Knowledge and Innovation certifying the start of operations and resumption of relevant activities of the MCTCI.	0	2017	1	0	• Report issued by the Minister of Science, Technology, Knowledge and Innovation certifying the start of operations and resumption of relevant activities of the MCTCI.	• MCTCI
d) Office of the Deputy Secretary for STKI created within the MCTCI (Tranche I)	• Law 21,105 published in the Official Gazette on 13 August 2018	0	2017	1	0	• Copy of Law 21,105 published in the Official Gazette on 13 August 2018	• MCTCI
e) Office of the Deputy Secretary for STKI operating, with budgetary resources allocated in the corresponding chapter of the Public Sector Budget Act (Tranche II)	• Public Sector Budget Act for 2021 • Report issued by the Deputy Secretary for STKI certifying the start of operations and resumption of relevant activities by the Office of the Deputy Secretary for STKI	0	2019	1	0	• Copy of the Public Sector Budget Act for 2021 • Report issued by the Deputy Secretary for STKI certifying the start of operations and resumption of relevant activities by the Office of the Deputy Secretary for STKI	• Ministry of Finance • MCTCI
f) Proposal of good practices in policies to support technology transfer, containing, at a minimum, international benchmarking and reference countries, developed by the MCTCI (Tranche I)	• Proposal of good practices for policies to support technology transfer, prepared by the MCTCI and sent to the IDB	0	2018	1	0	• Copy of the proposal of good practices for policies to support technology transfer, prepared by the MCTCI and sent to the IDB	• MCTCI
g) Draft bill on technology transfer prepared by the MCTCI (Tranche II)	• Draft bill on technology transfer sent to the IDB	0	2018	0	1	• Copy of the draft bill on technology transfer sent to the IDB	• MCTCI

Output	Indicator	Baseline		Year		Means of verification	Responsible party
		Value	Year	2019/2020	2021		
h) Proposed STKI policy prepared by the MCTCI and containing, in addition to the objectives and guidelines set forth in Article 20 of Law 21,105, the following elements: (a) institutional framework; (b) strengthening of the STKI system; (c) linkages with society; (d) future; (e) gender; and (f) climate change (Tranche I)	• Draft STKI policy proposal delivered by the MCTCI Minister and sent to the IDB	0	2018	0	1	• Copy of the draft STKI policy proposal delivered by the MCTCI Minister and sent to the IDB	• MCTCI
i) Executive Decree approving the national STKI policy fully processed (Tranche II)	• Copy of the Executive Decree approving the national STKI policy issued through the MCTCI, fully processed	0	2018	0	1	• Copy of the Executive Decree approving the national STKI policy issued through the MCTCI, fully processed	• MCTCI
Component III. Institutional framework for science, technology, knowledge, and innovation.							
a) National Council on Innovation for Development (CNID) has met under the new structure established in Ministry of Economy, Development, and Tourism Executive Decree 70 of 2019 (Tranche I)	• Minutes of the first 2019 meeting of the CNID	0	2018	1	0	• Copy of the minutes of the first 2019 meeting of the CNID	• MCTCI
b) National Council on STKI for Development, replacing the CNID, operating (Tranche II)	• Executive Decree creating the National Council on STKI for Development issued through the MCTCI, fully processed • Minutes of the first 2019 meeting of the National Council on STKI for Development	0	2018	0	1	• Copy of the fully processed Executive Decree issued through the MCTCI creating the National Council on STKI for Development • Minutes of the first meeting of the National Council on STKI for Development	• MCTCI
c) Guidelines for the operation of the Interministerial Committee on STKI, adopted (Tranche I)	• Agreement of the Interministerial Committee on STKI, with copy sent to the IDB	0	2018	1	0	• Agreement of the Interministerial Committee on STKI, with copy sent to the IDB	• MCTCI

Output	Indicator	Baseline		Year		Means of verification	Responsible party
		Value	Year	2019/2020	2021		
d) Interministerial Committee on STKI, operating (Tranche II)	• Copy of the minutes of the first Committee meeting	0	2018	0	1	• Copy of the minutes of the first Committee meeting	• MCTCI
e) Macroregional coordinating agencies appointed and geographic locations where they are based (seats) determined (Tranche I)	• One or more Executive Decrees issued through the MCTCI fully processed	0	2018	1	0	• Copy of one or more Executive Decrees issued through the MCTCI fully processed	• MCTCI
f) Regional ministerial offices, located in geographic locations which are the seats of the macroregional coordination agencies, operating (Tranche II)	• One or more Executive Decrees appointing the regional ministerial offices, issued through the MCTCI and signed by the President of the Republic, fully processed • Certificate issued by the Office of the Deputy Secretary for STKI documenting the start of operations of the regional ministerial offices	0	2018	0	1	• Copy of one or more fully processed Executive Decrees issued through the MCTCI and signed by the President of the Republic appointing the ministerial regional offices • Certificate issued by the Office of the Deputy Secretary for STKI documenting the start of operations of the regional ministerial offices	• MCTCI
g) ANID operating (Tranche I)	• Executive report certifying the start of operations and resumption of relevant activities of the new ANID, issued by the agency's director.	0	2018	1	0	• Copy of the executive report certifying the start of operations and resumption of relevant activities of the new ANID, issued by the agency's director	• Director of the ANID
h) Internal organization of the ANID established (Tranche II)	• Resolution of the Director of the ANID establishing the agency's internal organization	0	2018	1	0	• Copy of the resolution of the Director of the ANID establishing the agency's internal organization	• Director of the ANID
i) Public Sector Budget Act includes the Fund for Innovation, Science, and Technology in the budget for the Office of the Deputy Secretary for STKI (Tranche I)	• Copy of the Public Sector Budget Act for 2020, which includes the Fund for Innovation, Science, and Technology in the MCTCI Office of the Deputy Secretary entry	0	2018	1	0	• Copy of the Public Sector Budget Act for 2020, which includes the Fund for Innovation, Science, and Technology in the MCTCI Office of the Deputy Secretary entry	• Ministry of Finance

Output	Indicator	Baseline		Year		Means of verification	Responsible party
		Value	Year	2019/2020	2021		
j) Fund for Innovation, Science, and Technology has budgetary resources allocated in the Public Sector Budget Act (Tranche II)	• Public Sector Budget Act for 2021	0	2018	0	1	• Copy of the Public Sector Budget Act for 2021	• Ministry of Finance
Component IV. Monitoring and evaluation mechanisms							
a) Proposed design of a system for monitoring programs and instruments executed by the ANID, prepared (Tranche I)	• Proposal sent by the Office of the Deputy Secretary of the MCTCI to the IDB	0	2018	1	0	• Copy of the proposal sent by the Office of the Deputy Secretary of the MCTCI to the IDB	• MCTCI
b) System for monitoring ANID-executed programs and instruments, tested (Tranche II)	• Note documenting receipt and approval of the first systematized report on the monitoring of programs, approved by the MCTCI Office of the Deputy Secretary and sent to the IDB	0	2018	0	1	• Copy of the note documenting receipt and approval of the first systematized report on the monitoring of programs, approved by the MCTCI Office of the Deputy Secretary and sent to the IDB	• MCTCI
c) Survey of the internal processes associated with ANID-executed programs and instruments, conducted to establish a baseline for an evaluation system (Tranche I)	• Survey report on the internal processes associated with ANID-executed programs and instruments, sent by the Office of the Deputy Secretary for STKI to the IDB	0	2018	1	0	• Copy of the survey report on the internal processes associated with ANID-executed programs and instruments, sent by the Office of the Deputy Secretary for STKI to the IDB	• MCTCI
d) Proposed design of a system for evaluating tools and programs, including establishment of the indicators and the corresponding baselines, for the ANID, prepared (Tranche II)	• Report on the design of a system for evaluating tools and programs, including establishment of the indicators and the corresponding baselines, for the ANID, approved by the Office of the Deputy Secretary for STKI and sent to the IDB	0	2018	0	1	• Report on the design of a system for evaluating tools and programs, including establishment of the indicators and the corresponding baselines, for the ANID, approved by the Office of the Deputy Secretary for STKI and sent to the IDB	• MCTCI

DOCUMENT OF THE INTER-AMERICAN DEVELOPMENT BANK

PROPOSED RESOLUTION DE-___/19

Chile. Loan ____/OC-CH to the Republic of Chile. Support for Strengthening the Institutional Framework for Science, Technology, Knowledge, and Innovation in Chile

The Board of Executive Directors

RESOLVES:

That the President of the Bank, or such representative as he shall designate, is authorized, in the name and on behalf of the Bank, to enter into such contract or contracts as may be necessary with the Republic of Chile, as borrower, for the purpose of granting it a financing to cooperate in the execution of the program for the Support for Strengthening the Institutional Framework for Science, Technology, Knowledge, and Innovation in Chile. Such financing will be for an amount of up to US$50,000,000 from the Ordinary Capital resources of the Bank, and will be subject to the Financial Terms and Conditions and the Special Contractual Conditions of the Project Summary of the Loan Proposal.

(Adopted on ___ _____ 2019)

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