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CHILE

**CLIMATE CHANGE RESILIENCE SOLUTION THROUGH THE DEVELOPMENT OF
THE HIGH-PROTEIN-CONTENT LUPINE VALUE CHAIN**

(CH-T1181)

DONORS MEMORANDUM

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PROJECT SUMMARY

CLIMATE CHANGE RESILIENCE SOLUTION THROUGH THE DEVELOPMENT OF THE HIGH-PROTEIN-CONTENT LUPINE VALUE CHAIN (CH-T1181)

Wedged between the Andes mountain range and the coastal mountains, Chile has a highly variable climate and a high degree of climate risk, and the Araucanía region is among those most affected by these factors. Araucanía is home to descendants of the indigenous Mapuche people, and it has Chile's highest poverty rate (23.6%, double the national average), high unemployment (7%), and a heavy dependence on agriculture for food security. The specific problem that the project aims to address is the decreasing productivity of the lands of Mapuche farmers caused by soil erosion associated with climate change. The agroclimatic region of Araucanía has seen significant increases in average and minimum temperatures in recent decades, along with a decrease in average annual precipitation. This has led to an aridification process and an estimated 30% reduction in annual productivity per hectare.

Mapuche farmers grow oats, wheat, and barley, planting these crops on a rotating basis. An age-old Mapuche farming method entailed the addition of a legume: lupine, which is generally bitter-tasting and of little market value, as it was considered fodder for fallow land rather than a rotation crop. The planting of lupine was gradually abandoned due to its sunk costs. In 2012 the Centro de Genómica Nutricional Agroacuícola [Center for Agricultural and Aquacultural Nutritional Genomics] (CGNA) joined with a number of Mapuche cooperatives to revive this age-old practice by biogenetically developing a non-genetically modified (non-GMO) high-protein variety of lupine, which was given the name *AluProt*-CGNA. This is a nitrogen-fixing variety, making it a climate-resilient technology for overheated, water-scarce conditions. It also consists of up to 60% protein, placing it in the category of superfoods ideal for animal and human consumption. The intellectual property associated with *AluProt*-CGNA, including its biogenetic composition, resides with the CGNA. The Mapuche cooperatives are licensed to use *AluProt*-CGNA and have combined to form a company, NG-Seeds S.A., for this purpose.

The bulk of the demand for *AluProt*-CGNA is in the salmon-farming chain, which is very strong in Chile. *AluProt*-CGNA is experiencing excess demand in this chain, with orders and future contracts for the domestic market and for export to China. The main buyer and strategic partner for this project is EWOS Group Inc., a multinational corporation with more than a 30% share in the worldwide market of fish feed. EWOS Group is co-promoting this project as part of its strategies for developing and financing suppliers. In addition, relatively simple transformation processes can help the product reach higher-value functional markets for human consumption, including the production of vegetable milk and a protein isolate from *AluProt*-CGNA, which is in high demand due to its properties as a food supplement for vegan and celiac consumers.

The project aims to demonstrate and implement a private-sector solution for climate-change resilience with enhanced productivity through its use by more than 2,000 Mapuche farmers in the valleys of the Araucanía region, based on the adoption of crop-rotation technologies using highly profitable *AluProt*-CGNA. The use of this technology will promote an economy of greater added value, with a socioeconomic impact at the household, cooperative, and regional levels. The main outcomes expected from the project by 2019 are (i) 2,000 producers adopting the climate-resilient technology based on

the rotation of *AluProt*-CGNA; (ii) 2,000 producers averaging a 10% increase in billing from sales of *AluProt*-CGNA; (iii) a 50% annual increase in sales of *AluProt*-CGNA; (iv) a 20% annual increase in productivity, for a total farmed area of 5,800 hectares; and (v) a 30% improvement in the soil resilience index (based on microbiological activity factors and measurements of soil erosion, moisture, and nutritional levels).

The project's innovation lies in the fact that it will enable development of a unique private-sector solution for climate resilience that (a) is based on a new technology that adds value and generates income that can be appropriated by the indigenous Mapuche people; (b) will be implemented on the basis of actual business opportunities and new startups; (c) with indigenous cooperatives to be included as owners of such ventures; and (d) in line with the multicultural worldview of the Mapuche people. From the perspective of climate-change adaptation, the model is based on the adoption of adaptation practices with strong immediate returns, breaking the season-to-season vicious cycle for adaptation. This is expected to lead to a self-driven pace of adoption reflecting actual market incentives.

This is an example of a joint project of the IDB Group, based on complementing the top-down actions of Chile's Production Development Corporation (CORFO) through the Bank's public-sector window: the Indigenous Development and Promotion Program (CH-L1105) and the Project for Productive Development Financing in Chile (CH-L1098), which focus on developing specific local markets, both real and financial, in collaboration with and at the initiative of leading private actors in the region. The operation is part of the IDB Group's country strategy with Chile, and it complements previous programs from the private-sector side using a demonstrative pilot approach. Once the technology transfer is validated, the Bank will support its scaling as part of this program.

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	http://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=40745821

ABBREVIATIONS

CGNA	Centro de Genómica Nutricional Agroacuícola [Center for Agricultural and Aquacultural Nutrition Genomics]
CORFO	Corporación para el Fomento de la Producción [Production Development Corporation]
GMO	Genetically modified organisms
INDAP	Instituto Nacional de Desarrollo Agropecuario [National Institute for Agricultural Development]
INIA	Instituto de Investigaciones Agropecuarias [Institute for Agricultural Research]

EXECUTIVE SUMMARY

**CLIMATE CHANGE RESILIENCE SOLUTION THROUGH THE DEVELOPMENT
OF THE HIGH-PROTEIN-CONTENT LUPINE VALUE CHAIN**

(CH-T1181)

Country and geographic location:	Chile, Araucanía region		
Executing agency:	NG-Seeds S.A.		
Focus area:	Climate-Smart Agriculture		
Coordination with other donors/Bank operations:	This is an example of a joint project of the IDB Group, based on complementing the top-down actions of Chile's Production Development Corporation (CORFO) through the Bank's public-sector window: the Indigenous Development and Promotion Program (CH-L1105) and the Project for Productive Development Financing in Chile (CH-L1098). Once the technology transfer is validated, the Bank will support its scaling as part of this program. The project will be coordinated with the Competitiveness and Innovation Division (CTI) of the IDB Group as well as with CORFO and the National Institute for Agricultural Development (INDAP).		
Project beneficiaries:	2,000 Mapuche farmers in the Araucanía region		
Financing:	Nonreimbursable technical-cooperation funding	US\$800,000	20%
	Contingent-recovery technical-cooperation funding	US\$500,000	13%
	Total MIF contribution:	US\$1,300,000	33%
	Technical-cooperation counterpart (executing agency)	US\$1,044,000	26%
	Counterpart (other)	US\$629,000	16%
	Reimbursable cofinancing (CORFO, INDAP, EWOS Inc.)	US\$1,000,000	25%
	Total project budget:	US\$3,973,000	100%
Execution and disbursement periods:	48 months for execution and 60 months for disbursement.		
Special contractual conditions:	Conditions precedent to the first disbursement: (i) selection of the project director, and (ii) creation of the program steering committee.		
Environmental and social impact review:	This operation was pre-evaluated and classified in accordance with the Bank's Environment and Safeguards Compliance Policy (Operational Policy OP-703) on 2 November 2016. Due to its limited impacts and risks, this project is proposed as a category "C" operation.		
Unit responsible for disbursements	The IDB Country Office in Chile will be responsible for project supervision and disbursements.		

I. PROBLEM TO BE ADDRESSED

A. Description of the problem to be addressed

- 1.1 **Problem to be addressed.** The Araucanía region, which is home to descendants of the indigenous Mapuche people, has the highest poverty rate in Chile (23.6%, double the national average), high unemployment (7%), and a heavy dependence on agriculture for food security. The region's population is more rural (32%) than the national average, further exacerbating the problem of poverty, and agriculture is the main economic activity for this rural population. Families and communities of Mapuche origin have a strong presence in these rural areas, maintaining their culture, customs, and traditions as they pursue productive activities. With a distinct entrepreneurial outlook, they are striving to increase their productivity and position themselves in global value chains. This, coupled with the growing market for food products, opens up significant opportunities for agriculture in the region.
- 1.2 These circumstances stand in contrast with a family basket that is highly dependent on various public subsidies and on work as laborers in urban environments. Agriculture has declined in economic importance, with new activities taking its place amid a trend of rural-to-urban migration. Finding new opportunities linked to larger market trends could help restore local, endogenous, culturally relevant processes that can also aid in restoring the environment.
- 1.3 Wedged between the Andes mountain range and the coastal mountains, Chile has a highly variable climate and a high degree of climate risk from region to region. The Araucanía region is among those most affected by these factors, having seen significant increases in average and minimum temperatures in recent decades, along with a decrease in average annual precipitation. This has led to an aridification process and an estimated 30% reduction in annual productivity per hectare.¹ Taking this context into account, **the specific problem that the project aims to address is the decreasing productivity of the lands of Mapuche farmers caused by soil erosion associated with climate change**, in order to take full advantage of technological innovations and identified market opportunities.
- 1.4 **Technological innovation.** Mapuche farmers grow oats, wheat, and barley, planting these crops on a rotating basis. An age-old Mapuche farming method entailed the addition of a legume: lupine, which is generally bitter-tasting and of little market value, as it was considered fodder for fallow land rather than a rotation crop. The planting of lupine was gradually abandoned due to its sunk costs. In 2012 the Centro de Genómica Nutricional Agroacuicola [Center for Agricultural and Aquacultural Nutritional Genomics] (CGNA) joined with a number of Mapuche cooperatives to revive this age-old practice by biogenetically developing a non-genetically modified (non-GMO) high-protein variety of lupine, which was given the name *AluProt*-CGNA. This is a nitrogen-fixing variety, making it a climate-resilient technology for overheated, water-scarce conditions. It also consists of up to 60% protein, placing it in the category of superfoods ideal for animal and human consumption. The intellectual property associated with *AluProt*-CGNA, including its biogenetic composition, resides with the CGNA. The Mapuche

¹ According to data from the Foundation for Agricultural Innovation, 2015.

cooperatives are licensed to use *AluProt*-CGNA and have combined to form a company, NG-Seeds S.A., for this purpose.

- 1.5 As it is based on reviving an age-old crop, this technological innovation is fully compatible with cultural use of the soil and fits perfectly into the lifestyle of Mapuche communities. The physiological properties of the *AluProt*-CGNA lupine include a short vegetative cycle and quick blooming and grain-formation periods, which reduces water consumption to levels suited to restrictive water use patterns associated with climate change. The crop also has a positive effect on the soil, making it a solution for climate-smart agriculture. As a nitrogen-fixing variety, it increases soil fertility. It also releases phosphorus that has been retained in the soil and is unavailable for other types of crops.
- 1.6 **Market opportunities.** The bulk of the demand for *AluProt*-CGNA is in the salmon-farming chain, which is very strong in Chile.² *AluProt*-CGNA is experiencing excess demand in this chain, with orders and future contracts for the domestic market and for export to China. The main buyer is EWOS Group Inc., a multinational corporation with more than a 30% share in the worldwide market of fish feed, and a co-promoter of this project.³ In addition, relatively simple transformation processes can help the product reach higher-value functional markets for human consumption, including the production of vegetable milk and a protein isolate from *AluProt*-CGNA, which is in high demand due to its properties as a food supplement for vegan and celiac consumers.⁴
- 1.7 **NG-Seeds.** NG-Seeds is an atypical company, established for the corporate purpose of social development of the Mapuche communities. Its shareholders' agreement states that NG-Seeds is owned by the Mapuche cooperatives (which were established as part of a recent government policy for social management of Mapuche communities in the region), whose stated corporate purpose is the social and economic advancement of its individual members, and the CGNA, a nonprofit research organization. NG-Seeds, therefore, is wholly owned by nonprofit organizations, which means that the private returns that it generates will revert entirely to its low-income Mapuche beneficiaries. The shareholders' agreement also addresses the possibility of bringing in nonindividual shareholders, limiting this possibility to Mapuche cooperatives that meet these requirements. The agreement also states that the company's surpluses will be reinvested for the social and cultural benefit of the participating Mapuche cooperatives.
- 1.8 This company is the key stakeholder in the development of the *AluProt*-CGNA value chain. NG-Seeds is a small company that has been in operation for less than two years. It currently has a limited number of professional staff members and limited financial resources. Nonetheless, in its brief existence it has already positioned itself as the driver and primary link in the *AluProt*-CGNA value chain.

² Chile is the world's second largest producer of farmed salmon (after Norway), and salmon farming is one of the main drivers Chile's model of export competitiveness.

³ This company is expected to contribute to the project as part of its supplier development strategies, including in matters related to farming and postharvest standards, traceability, supplier certification, technical considerations, prepayment arrangements, advances against purchasing contracts, and other types of financing for production.

⁴ Products positioned in North American (United States and Canada) and European (Italy and France) markets.

- The role of NG-Seeds encompasses the following key activities in the chain: (i) identification of producers and production areas, and crop planting and purchasing contracts; (ii) planning of production to satisfy demand; (iii) provision of productive inputs to producers, including certified seed; (iv) technical and production assistance in the field to producers during planting and growing seasons; (v) crop purchasing, quality control, and preselection of the final product; (vi) processing of *AluProt*-CGNA and packaging for sale (subcontracted with processing plants that will provide this service); and (vii) identification and completion of purchasing contracts with producers of the various products. NG-Seeds is the only company that has the technology, the knowledge, and the network of producers to ensure that the *AluProt*-CGNA value chain operates effectively. Thus, strengthening its operational and financial capacity is the best way to ensure timely development of this business opportunity with the potential to become a significant generator of income, jobs, and other opportunities for Mapuche producers and cooperatives in the Araucanía region.
- 1.9 However, NG-Seeds has little capital of its own, and its production capacity depends largely on third-party services in processing the product. To meet the need for resources for the 2016 harvest, it has obtained a loan for working capital from INDAP, which will be fully repaid using proceeds from the harvest. In the future, and on the basis of its business plan, NG-Seeds needs a total of approximately US\$2 million from 2017 to 2020 to finance the construction and startup of its own *AluProt*-CGNA processing plant, as well as some US\$500,000 in working capital to cover operating costs in the first year and the cost of productive inputs advanced to its producers. Most of these financing needs are expected to be covered by two loans that are being negotiated (one from INDAP and another from a private bank to be identified) and which would be guaranteed by CORFO's program for indigenous enterprises. By buying and selling, it generates a return from which it draws capital, and gradually it will generate its own working capital. In addition, positive outcomes in the planting-harvest-sale cycle will improve its credit standing with financial institutions.
- 1.10 Other future sources of funding for NG-Seeds could include (i) short-term advances from its purchaser, EWOS Inc., against purchasing contracts; (ii) product warrants (certified seed or *AluProt*-CGNA) that could be used as guarantees for short-term lines of credit from INDAP or from banks; and (iii) by becoming eligible as a "nonbank intermediary" and receiving direct financing from CORFO under its resource intermediation program for indigenous enterprises. To qualify for this program, it should be able to reach some 1,000 clients and demonstrate that it is channeling resources to promote agricultural production among indigenous producers. According to projections, NG-Seeds will have reached this number of producers by 2018-2019.
- 1.11 **Target population.** The initial target population will be Mapuche farmers in the Moñenco, Huichahue, Los Robles, Peñiwen, and Wull-Agro rural cooperatives. In economic terms, the families associated with this proposal constitute an agricultural economy that combines subsistence farming with the sale of surplus stock, sometimes consisting solely of commercial production. This is a minority group that pursues complementary economic activity, selling all or part of its labor to third parties, either as wage-earning employees or as independent workers. Quantitatively, most of the target segment has annual household income in the

US\$5,000 to US\$6,000 range. However, some producers have started up agricultural service enterprises with incipient farm machinery service units. Although the cooperatives constitute the basic commercial structure, many producers pursue their economic activity on an individual basis. At the social level, the main organizational units are the “communities,” which look out for the common interests of residents but do not play a role in business or production. These units recognize the social and cultural authority of their traditional leaders and show respect for traditions, culture, and the environment, which they consider the source of life.

- 1.12 Mapuche women have traditionally played a role in society significantly removed from participation in the productive process, although they do play a governance role in the Mapuche community. Women have been playing an increasing role in production in recent years, especially as agricultural production has begun to incorporate business development concepts, such as inventory controls for inputs and harvests, incorporation of technical methods, and accounting. Women are expected to make up 30% of the direct beneficiaries of this project, which will mean greater opportunities for women to participate in production.
- 1.13 **Financing for production.** Mapuche producers farm an average of five to six hectares each, and their production-related financing needs range from US\$2,500 to US\$3,000 per producer. To obtain external financing for these costs from INDAP or a private financial institution, collateral worth two to three times the loan amount is often required. Although an estimated 30% to 40% of producers can cover these costs with their own resources or by obtaining loans from banks or INDAP, 60% to 70% have difficulties in this regard. A significant part of the financing problem is the fact that these families have no assets to use as collateral. Under Chilean law, indigenous lands may not be used as bank collateral. As a result, producers and NG-Seeds must find another way to meet these financing needs.
- 1.14 To cover these costs, producers may avail themselves of the following sources of financing: (i) a subsidy (grant) from INDAP for approximately US\$400 to US\$500; (ii) loans from INDAP or private banks (INDAP is a State-owned financial intermediary that provides loans directly to producers or to other indigenous enterprises; with the contract for sale of the product to NG-Seeds, plus the guarantee that producers may obtain from CORFO, INDAP may be an option for financing part of the costs); (iii) producers with collateral may obtain loans from private banks, and CORFO’s guarantee program may enable these banks to provide loans to producers who lack the normally required collateral, although this alternative is unproven and its effectiveness uncertain; and (iv) advances from NG-Seeds. If NG-Seeds has the liquidity to advance inputs to the producers, this may be the most viable and reliable way to finance production and ensure the level of planting and production needed to fulfill the contracts for the sale of *AluProt-CGNA*.

II. THE PROPOSED INNOVATION

A. Project description

- 2.1 **Project objective.** The project objective is to demonstrate and implement a private-sector solution for climate-change resilience with enhanced productivity

through its use by more than 2,000 Mapuche farmers in the valleys of the Araucanía region, based on the adoption of crop-rotation technologies using highly profitable *AluProt*-CGNA. The use of this technology will promote an economy of greater value added, with a socioeconomic impact at the household, cooperative, and regional levels.

- 2.2 **The proposed solution.** The project aims to have a demonstration effect in the framework of CORFO's efforts for the adoption of climate-change adaptation technologies, based on establishing market incentives with identified high-value business opportunities and technical support from large companies that are buyers in the chain, as part of its supplier development strategies to reduce dependence on inputs of marine origin.⁵ The project will also receive technological support from the CGNA, a local research and development center, for the adoption of technology by Mapuche farmers, the development of new productive alternatives for crop rotation in accordance with economic and environmental requirements, as a means of support in dealing with large buyers. A first phase will entail planting *AluProt*-CGNA over an expanded surface area of 2,000 hectares on the lands of producers and Mapuche cooperatives to produce the crop for both commercial sales and certified seed. A second phase will entail supporting the process of technology adoption for up to a total of 11,000 hectares by year 4 of the project. To make the project viable and lay the groundwork for the accelerated expansion process ramping up to the commercial phase, the project calls for comprehensive actions for the adoption of technology and the transfer of capacities needed for (i) productive and organizational development for the adoption of technology and its use in the field, (ii) strengthening of the local agricultural credit market for the adoption and use of technology, and (iii) measurement of the impact and systematization of the model for coordination with IDB Group programs.
- 2.3 **Project innovation.** The project's innovation lies in the fact that it will enable development of a unique private-sector solution for climate resilience that (a) is based on a new agricultural technology (the first *AluProt*-CGNA value chain in the world) that adds value and generates income that can be appropriated by the indigenous Mapuche people, and (b) will be implemented on the basis of actual business opportunities and new entrepreneurial ventures, (c) with indigenous cooperatives to be included as owners of such ventures, and (d) in line with the multicultural worldview of the Mapuche people. From the perspective of climate-change adaptation, the model is based on the adoption of adaptation practices with strong immediate returns, breaking the season-to-season vicious cycle for adaptation. This is expected to lead to a self-driven pace of adoption reflecting actual market incentives. This is an example of an IDB Group project, based on complementing the top-down actions of CORFO alongside the IDB Group and focused on developing specific local markets, both real and financial, in collaboration with and at the initiative of leading private actors in the region.
- 2.4 **Component I: Development and transfer of technology and development of the *AluProt*-CGNA value chain.** The objective of this component is to transfer

⁵ EWOS Group Inc., a buyer, is actively working on supplier development processes as part of its corporate sustainability plans and business strategies, for the purpose of finding substitutions for raw materials of marine origin (for high-protein nutrition and fattening) given the limitations related to the sustainable use of such raw materials.

technology to and develop 2,000 small-scale Mapuche producers through technical assistance and development of suppliers in strategic partnership with EWOS Inc. This component will include (i) adaptation of the technological package to the scale of the project and the productive units, (ii) testing and development of new technologies and standards for planting certified seeds and agricultural processes suited to this crop, (iii) provision of organized advisory services on demonstration plots, visits in the implementation phase, and remote assistance technologies developed in strategic partnership with the Institute for Agricultural Research (INIA), producers' organizations, and other outreach service providers; (iv) training of farmers for the crops to be incorporated into the rotation, starting with the *AluProt*-CGNA lupine; (v) monitoring of rotations with improved productivity and resilience based on nitrogen-fixing; (vi) implementation of standards for farming and post-harvest processing, traceability, and certification of sustainable and non-GMO agriculture with support from EWOS Inc.; (vii) development of entrepreneurial ventures for the agroindustrial transformation of the product, specifically (a) animal feed, (b) a line of fortified flours and premixes for foods for human consumption, (c) protein isolates for export, and (d) agricultural services (mechanization in planting, growing, harvesting, etc.); (viii) coordination of public and private stakeholders and of the different levels of government involved in the local innovation system; the key actors for this specific social and environmental innovation project are the regional government, rural cooperatives and federations, the regional department of agriculture, the National Corporation for Indigenous Development, councils of traditional Mapuche leaders in the Araucanía region, INDAP, the CGNA, the INIA, and CORFO; in particular, INDAP has a special program to promote indigenous initiatives, called the Indigenous Regional Development Program, which could support Mapuche producers who join the project; (ix) training of technical advisers from public and private institutions associated with the proposed development model; and (x) implementation on a test scale of a work protocol and development of social capital for indigenous communities by CORFO with support from the Bank.

2.5 Component II: Development of financing for the *AluProt*-CGNA value chain.

The objective of this component is to make the required external financing available under the terms needed to meet the needs of the links of planting/production, harvesting, processing, and sales in the *AluProt*-CGNA value chain. This objective will be achieved through the collaboration of, coordination among, and financial contributions from the MIF, the IDB, NG-Seeds, INDAP, CORFO, local banks, and large buyers of the product.

- 2.6** This component will support the following activities: (i) support for NG-Seeds using a new MIF financing instrument called early innovation recoverable funding to provide necessary resources in a timely manner and satisfy liquidity needs during the various phases of the planting-harvest-sale-collection cycle (see the description of this instrument in paragraph 2.7); (ii) supplementing the indigenous investment guarantee funds created by the Bank and CORFO (operation CH-L1105), strengthening of the credit offered by INDAP and other local financial intermediaries for producers of *AluProt*-CGNA and NG-Seeds, by a local financial intermediary interested in lending to the agricultural sector; (iii) support for NG-Seeds to strengthen its advances of productive inputs to producers, which will be used to ensure full repayment through sales transactions with producers; (iv) in

partnership with EWOS Inc. and other large buyers, as well as with local banks, management of new ways of financing the chain through partial prepayment arrangements for buyers and/or factoring or warrants with financial intermediaries; and (v) an analysis to determine the viability of supplementing the financial model through NG-Seeds as a nonbank financial intermediary, including the provision to CORFO of proposed guidelines and operations to this end.

- 2.7 **Description of early innovation recoverable funding.** In the context of multiple possible sources of financing for producers and companies—none of which are fully certain due to the reasons described above—the best way to ensure sufficient and timely resources for the planting-harvest-sale cycle of *AluProt*-CGNA is a working capital fund for NG-Seeds. However, because its balance sheet is not yet strong enough to support an MIF loan, resources for a working capital fund will be provided to NG-Seeds through a new MIF financing instrument called early innovation recoverable funding (ERF). This instrument is used when private for-profit companies need flexible funding to roll out new technology or implement a new way of doing business, as is the case with *AluProt*-CGNA and NG-Seeds. Resources are disbursed against the fulfillment of agreed milestones and are reimbursed when the company has attained agreed levels of revenues or profits. According to the company's current projections, the early innovation recoverable funding may begin to be reimbursed to the MIF starting in 2020 and over the course of three years. The proposed conditions for this funding are summarized in the project's technical files.
- 2.8 The purpose of this working capital fund is the *timely* availability of resources for NG-Seeds to satisfy any liquidity needs during the various phases of the planting-harvest-sale-collection cycle. The resources will be used to purchase inputs that will be provided in the form of an "advance" to *AluProt*-CGNA producers or in order to cover the company's operating costs related to the collection, processing, and sale of the product. This is a reliable way of supporting the company because these resources, once disbursed, are invested in the planting, harvesting, and sale of a product that has a guaranteed market value, and therefore this does not represent an intangible expense. As each planting-harvest-sale cycle draws to a close, these resources grow with a profit margin.
- 2.9 Of the 400 hectares that NG-Seeds has supported with advances of inputs during the 2016 season, only two hectares are at risk of nonpayment (as of October 2016), which equates to a 0.5% risk.
- 2.10 **Component III: Measurement of impact and systematization of the model for scaling.** The objective of this component is to measure and systematize the impact in terms of production and climate-change adaptation associated with the *AluProt*-CGNA crop and the business development of NG-Seeds as policy models for the productive development of indigenous peoples and development of nonbank intermediaries. This will entail (i) use of rigorous impact-evaluation methodologies with a specific focus on improved productivity, social impact, impact on income, and climate-change resilience; (ii) development and transfer of the project's knowledge products as a model of indigenous productive development, within the context of the indigenous development policy; (iii) development and transfer of knowledge products on the productive support model with advances of inputs within the context of the policy for promoting nonbank financial intermediaries;

(iv) prospective study on potential markets for *AluProt*-CGNA as a solution for climate-change resilience in other countries; and (v) dissemination events among public actors on the use of lupine as a solution for climate-change resilience and on the impact evaluation of the execution model, both in Chile and in other countries.

B. Project outcomes, measurement, monitoring, and evaluation

- 2.11 **Main outcomes.** The main outcomes expected from the project by 2019 are: (i) 2,000 producers adopting the climate-resilient technology based on the rotation of *AluProt*-CGNA; (ii) 2,000 producers averaging a 10% increase in billing from sales of *AluProt*-CGNA; (iii) a 50% annual increase in sales of *AluProt*-CGNA; (iv) a 20% annual increase in productivity, for a total farmed area of 5,800 hectares; and (v) a 30% improvement in the soil resilience index (based on microbiological activity factors and measurements of soil erosion, moisture, and nutritional levels)
- 2.12 **Monitoring and evaluation plan.** To implement the project, important indicators in the analysis model will be identified, and the baseline assessment will then be conducted, including in-field observations of parameters associated with the productive units (representative sample) plus the corresponding controls (control groups not involved in the project, for contrast purposes). The evaluation criteria will include social, economic, cultural, and environmental indicators established in accordance with relevant international protocols applicable to the project's scale and local operating conditions. In addition, an open database containing all recorded data will be built, and this database will be able to provide data for other studies that may stem from this experience. Lastly, the analysis tools will be based on multivariate methodologies, both of factors and groups of variables, due to the aggregate and endogenous nature of the processes in this type of productive activity.
- 2.13 The data that is gathered will be used to develop a multivariate model in order to determine social, cultural, environmental, and economic impact, as well as the main factors that go into this determination. The panel data methodology will be used for this purpose, and the key variables will be identified using the method of primary discriminants combined with a factor and cluster analysis.
- 2.14 The evaluation plan calls for data to be gathered from three main sources: social and cultural surveys to be administered annually; technical and production-related information to be included in the open database as the information is generated; and onsite evaluations, primarily related to environmental factors of fertility, erosion, and microbiological activity.⁶
- 2.15 The project will base its monitoring activities on the data collection system developed by NG-Seeds. It will issue periodic reports through the project status report system and will use a project completion report for the project's final outcomes.
- 2.16 **Monitoring and evaluation plan for gender-related matters.** The social, economic, and cultural analyses to be conducted during the project using the

⁶ Also, in order to conduct multidimensional observations, the methodology described by Masera (2000) and Díaz (2008) will be used for annual reports.

methods described above will be based on data disaggregated by gender and will include analyses on existing gender gaps and on projected increases in women's participation in the productive process and in governance of the cooperatives as a result of the business development provided under the project. These analyses will focus on the implications of this increased participation in terms of the balance between men and women in family decision-making and in the traditional decision-making bodies of Mapuche society.

III. ALIGNMENT WITH THE IDB GROUP, SCALABILITY, AND PROJECT RISKS

A. Alignment with the IDB Group

- 3.1 **Alignment with the IDB Group.** This operation is part of the IDB Group's country strategy with Chile 2014-2018, which, under section D, "Crosscutting issues: Indigenous peoples and gender," in paragraph 3.34, states the following: "In terms of development challenges linked to the identity of indigenous peoples, the Bank proposes to collaborate with the government by means of technical assistance and public and private sector operations as follows: ... (iv) support for indigenous businesses."
- 3.2 **Joint project with the IDB Group.** This is an example of an IDB Group project, as it embodies the MIF's role as an innovation laboratory for the IDB Group. This operation complements, from the private-sector side and using a demonstration pilot approach, a technical cooperation operation of the Bank to support the competitive development of Region XI – Araucanía (CH-T1110), as well the Indigenous Development and Promotion Program (CH-L1105) and the Project for Productive Development Financing in Chile (CH-L1098), both executed by CORFO. Once the technology transfer is validated, CORFO will support its scaling as part of the Indigenous Development and Promotion Program and the Project for Productive Development Financing in Chile.

B. Scalability

- 3.3 **Scaling of the project.** In the Araucanía region, once the viability of commercial production for 11,000 hectares has been demonstrated, the program is expected to reach a scale of 100,000 hectares by 2030. This equates to a tenfold scaling ratio, making this one of the most far-reaching CORFO-backed programs for incorporating new agricultural varieties.
- 3.4 Beyond the specific context of growing and selling *AluProt*-CGNA, the seed market has been identified as a climate-resilience solution highly profitable to farmers and as an opportunity that can be applied to rotating crops of wheat, corn, oats, canola seed, and barley in temperate areas of other countries in the region, which represents an opportunity to triple the total farmed surface area in Chile (up to a projected total of 300,000 hectares). At the regional level (South America), this crop could replace soybeans—widely grown in Brazil, Argentina, Bolivia, Peru, and Colombia—resulting in a more than tenfold increase in demand for this grain. This would entail the partial substitution of soy protein in animal and human foods, especially for the market segment that demands non-GMO crops, and also for segments that demand crops labeled "natural," "regional," and/or "Mapuche."

- 3.5 The model is expected to be scaled with support from the Bank as part of its Indigenous Development and Promotion Program (CH-L1105) and its Project for Productive Development Financing in Chile (CH-L1098), with considerable scaling potential. The project has also been identified as a model for public-private complementarity that can be replicated by CORFO as part of its Program for Development of Healthy Agrifood Chains (Functional Foods), which has a three-year budget of US\$100 million and a projected total coverage of more than 80,000 small farmers.

C. Project and institutional risks

- 3.6 **Project risks.** The project considers the following potential risks: (i) **technology-adoption risks:** The low absorption capacity of Mapuche producers and the low productivity of the soil may interfere with projected adoption rates. To address this risk, a technology training, demonstration, and dissemination plan will be proposed, as will a land management (rotation) plan and a plan for the crop to be implemented; (ii) **environmental risks:** The increased income from lupine production, and subsequently from other high-value crops, may encourage the farming of land not currently designated for agricultural use, or of land designated for subsistence farming, which would have an environmental and social impact regardless of any increase in household income. To reduce these risks, the proposal calls for contract-based agriculture, which entails a land management plan to ensure the rational use of land in a manner conducive to coexistence and respect for traditional cultural uses of the land; (iii) **risks of climate-change exacerbation:** According to projections for the next 30 years in Chile, the region will see changes in its water and heat patterns that could have an adverse effect on production, regardless of adaptation capacity. The initial variety to be used is well adapted to short cycles and short springs, thereby promoting successful crops in adverse conditions. However, this may not be enough if conditions are more extreme than envisaged in the scenarios used. To this end, NG-Seeds has entered into a strategic partnership with the CGNA to develop new genetic materials adapted to more complex situations, and it is already conducting genome studies to this end; (iv) **business and organizational risks:** NG-Seeds is a nascent company and, even though most of the decision-makers at NG-Seeds and the targeted cooperatives have strong leadership and high degrees of credibility among peers, greater business-management skills are needed. To this end, the project will include institutional strengthening and development of business capacities for NG-Seeds and for the cooperatives and producers; (v) **risk of delays in external financing:** The approval or disbursement of resources expected from INDAP and/or local banks lending to producers or NG-Seeds may be delayed, causing setbacks in key activities in the planting-harvest-sale cycle of *AluProt*-CGNA. To this end, the project calls for contingent-recovery technical cooperation to provide NG-Seeds with the liquidity it needs to honor its commitments to producers. Coordinated action among the parties (MIF, NG-Seeds, INDAP, and CORFO) is also expected to reduce the risk of major delays in the provision of financing.

IV. FINANCING INSTRUMENTS AND PROPOSED BUDGET

- 4.1 The total cost of the project is US\$3,937,174, of which US\$1.3 million (33%) will be provided by the MIF, US\$1,008,266 (26%) are counterpart resources from the executing agency, US\$628,908 (16%) will be contributed by third parties, and US\$1 million (25%) will be in the form of reimbursable cofinancing from CORFO, INDAP, and EWOS Inc.
- 4.2 The project will use two MIF financial instruments: US\$800,000 in nonreimbursable technical-cooperation funding and US\$500,000 in contingent-recovery technical-cooperation funding, also known as early innovation recoverable funding. The nonreimbursable technical-cooperation funding is for providing technical assistance, training, and technology transfer directly to the Mapuche cooperatives participating in the project. The contingent-recovery technical-cooperation funding is aimed at ensuring sufficient and timely resources for the planting-harvest-sale cycle of *AluProt*-CGNA, as needed to make the project viable.
- 4.3 Retroactive recognition of counterpart funds. The project allows for the retroactive recognition of expenses incurred on or after the date on which the operation is approved by the Donors Committee, up to a maximum of US\$100,000.

	MIF nonreimbursable technical- cooperation funding	MIF contingent- recovery technical- cooperation funding	Counterpart (executing agency)	Cofinancing and others	Total
Component 1: Development and transfer of technology and development of <i>AluProt</i> -CGNA value chain	378,240		667,022	541,839	1,587,193
Component 2: Development of financing for the <i>AluProt</i> -CGNA value chain	116,367	500,000	82,898	1,029,755	1,729,020
Component 3: Measurement of impact and systematization of the model	146,688		175,460	57,111	379,259
Project management (costs of execution unit)	78,705		118,619	204	197,528
Final evaluation	30,000				30,000
Ex post reviews	15,000				15,000
Audited financial statements	20,000				20,000
Contingencies	15,000				15,000
Total	800,000	500,000	1,044,000	1,629,000	3,973,000
% of financing	20%	13%	26%	41%	100%

V. EXECUTING AGENCY AND IMPLEMENTATION STRUCTURE

A. Description of executing agency

- 5.1 **Executing agency.** NG-Seeds S.A. will be the executing agency for this project and will sign the agreement with the Bank. NG-Seeds is a company consisting of

- five Mapuche cooperatives from Temuco and Padre Las Casas, with the assistance and participation of the CGNA for matters related to biotechnology innovation, oversight of implementation in the field, and management support. NG-Seeds is licensed by the CGNA to use the *AluProt*-CGNA variety of lupine. Specifically, NG-Seeds reproduces, processes, and sells the seed and industrially processes and sells the grain. NG-Seeds grows the yellow *AluProt*-CGNA lupine variety, which was licensed by the CGNA to the company for commercial scaling and agroindustrial processing, on the land of members of the Mapuche cooperatives. On a complementary basis, the cooperatives provide a venue for Mapuche producers who belong to other organizations in their regions, under Mapuche social and cultural norms and beliefs. Some producers are from the communities to which the cooperatives belong, while other Mapuche producers come from other areas; all of them make up the base that is conducive to achieving the projected impacts and the dissemination at the regional level that will provide access to other members of the Mapuche people. In legal terms, NG-Seeds is a corporation whose shares have not yet been fully allocated, and therefore new cooperatives may become shareholders (the by-laws state that only cooperatives formed by small farmers are eligible), as called for in the context of expanding production and achieving the broader participation needed for the project. The number of shareholders is therefore expected to increase, and the cooperatives that belong to the FEDERCOOP federation of Mapuche cooperatives—and which meet the requirements set forth in the by-laws and by the shareholders' meeting—are expected to become shareholders.
- 5.2 At year-end 2015, NG-Seeds had US\$1.13 million in total assets, mainly in inventory and accounts receivable; US\$1.1 million in liabilities, mainly in accounts payable and short-term loans from INDAP; and US\$28,000 in equity. NG-Seeds posted US\$25,000 in losses in 2015. Due to the lack of liquidity, NG-Seeds has been less active and expects to end the year with US\$258,000 in losses, US\$136,000 in assets, US\$366,000 in liabilities, and –US\$230,000 in equity. The project's financial projections indicate that the company may reach equilibrium in 2019 and post increasing profits thereafter, as it is a volume-based business and needs at least 2,500 hectares to be in production in order to be profitable. The financial projections are available in the project's technical files.
- 5.3 CORFO is a leader and benchmark institution for Latin America and the Caribbean in terms of development of competitiveness, innovation, entrepreneurship, and development of financial markets for growing enterprises. CORFO works with the Foundation for Agricultural Innovation, the INIA, research and development centers, and universities on projects that, like this one, entail a high degree of applied technological innovation and high capacity for transfer to the sector. This is a project of the IDB Group. The project was identified by the Bank as part of its programs for indigenous development and development of financial markets with nonbank financial intermediaries with CORFO, which provide complementary technical and financial resources for carrying out and scaling the project.
- 5.4 EWOS Inc., which is part of the Cargill Group, is the largest multinational corporation in the worldwide market of aquaculture products, with a more than 30% market share. For this project, EWOS Inc. will serve as an anchor company with its policies for developing suppliers for the strategic substitution of marine-origin inputs with land-origin inputs (for high-protein nutrition and for animal fattening);

with advantages in terms of predictability of supply, preferred final markets, and environmental sustainability. The anchor company's commitment and business interest in the project is concrete and makes a significant contribution to its viability, not only from a market perspective but also from a technical and financial perspective. On the market side, EWOS Inc. agrees to sign long-term purchasing contracts using target pricing for the market of substitute products related to *AluProt*-CGNA. The company also plans to provide technical assistance to implement farming and postharvest standards among participating producers, in accordance with its technical requirements for suppliers and traceability for non-GMO certification, as well as financial facilities to cover working capital, including prepayment arrangements, factoring, and warrants.

B. Implementation structure and mechanism

- 5.5 NG-Seeds will establish an execution unit and the structure needed to execute project activities and manage project resources effectively and efficiently. NG-Seeds will also submit progress reports on project implementation. Detailed information on the structure of the execution unit and the requirements for progress reports is available in Annex V in the technical files for this operation.

VI. FULFILLMENT OF MILESTONES AND SPECIAL FIDUCIARY ARRANGEMENTS

- 6.1 **Results-based disbursements and fiduciary arrangements.** The executing agency will use the MIF's standard arrangements for results-based disbursements and will abide by the Bank's procurement⁷ and financial management policies,⁸ as specified in Annex V and Annex VI.

⁷ Link to the [Policies for the Procurement of Goods and Works Financed by the IDB](#).

⁸ Link to the [Financial Management Guidelines for IDB-financed Projects](#).