TC Document/Appendix

I. Basic Information for TC

▪ Country/Region:	PERU/CAN - Andean Group
▪ TC Name:	**Cultivating Prosperity: Harnessing AI for Resilient Farming Communities**
▪ TC Number:	PE-T1591
▪ Team Leader/Members:	MINAYA FERNANDEZ, HILDA ELIZABETH Team Leader; OKUMURA, MASATO (LAB/DIS) Alternate Team Leader; PATRICIA GUEVARA (LAB/DIS); OKAHASHI KOTA (LAB/DIS); ARIMOTO TAMES, DAVID; MIRANDA BAEZ LUIS ENRIQUE (CSD/RND); NAKAYAMA MANAMI; NEGRON PERALTA FEDERICO ALFREDO (DIS/CPE); DAPHNE MORRISON (OII/OII); GARCIA DE PAREDES, MARGARITA RAQUEL (DSP/SEG); FRIEDMAN AROSEMENA, CAROL ESTEFANIA (GCL/FML); ARAYA ARAYA, YOSELIN (FNA/FCA); DANIELE BARRA, CARLA MARIA (DSP/DVF); DIAZ ORDONEZ, CHRISTIAN (GCL/FML); FERNANDEZ-BACA, JAIME (CSD/CCS);VENTURA, JUAN PABLO (IFD/CTI); GARCIA NORES, LUCIANA VICTORIA (INT/RIU)
▪ Taxonomy:	Client Support
▪ Operation Supported by the TC:	N/A
▪ Date of TC Abstract authorization:	June 28, 2024
▪ Beneficiary:	2,700 smallholder farmers in the Piura region of Peru
▪ Executing Agency and contact name:	PRODUCERS DIRECT
▪ Donors providing funding:	Japan Special Fund (JSF) Japan Enhanced Initiative for Quality Infrastructure, Resilience against Disaster and Health (JEI)
▪ IDB Funding Requested:	US$800,000.00
▪ Local counterpart funding, if any:	US$264,300.00 (cash and in-kind)
▪ Disbursement period (which includes Execution period):	36 months
▪ Required start date:	September 1, 2024
▪ Types of consultants:	Not applicable
▪ Prepared by Unit:	MIF - Multilateral Investment Fund
▪ Unit of Disbursement Responsibility:	CAN/CPE - Country Office Peru
▪ TC included in Country Strategy (y/n):	Yes
▪ TC included in CPD (y/n):	Yes
▪ Alignment to the IDB group country strategy with Peru 2022-2026	Strengthening environmental management with a focus on sustainability and climate change; and Improving agro-industrial productivity.

II. Objectives and Justification of the TC

2.1 Climate change significantly impacts smallholder farmers, exacerbating the challenges they already face in making a living from their farms. Rising temperatures, prolonged droughts, and unpredictable weather patterns have reduced crop yields. According to the World Bank, an estimated 100 million people are at risk of falling into extreme poverty due to climate change by 2030[1], with smallholder farmers being particularly vulnerable.

2.2 Climate change is exerting profound and detrimental effects, particularly on soil worldwide. Rising temperatures contribute to increased soil evaporation and moisture loss, leading to soil desiccation. This, in turn, diminishes soil fertility and hampers agricultural productivity. Additionally, extreme weather events such as heavy rainfall and droughts become more frequent and intense due to climate change, causing soil erosion and degradation. The altered climate conditions also disrupt soil microbial communities and nutrient cycling, affecting the overall health of soils. In essence, climate change poses a multifaceted threat to soils, jeopardizing their ability to support agriculture, biodiversity, and vital ecosystem functions. Addressing this challenge is crucial to ensure farmers' livelihoods and environmental sustainability in the face of a changing climate.

2.3 Particularly in Peru, climate change has left a discernible mark on the soils. According to Peru's Ministry of the Environment, over 22 million hectares (many of them categorized as agricultural land) have been affected by erosion, resulting in soil degradation and reduced agricultural productivity[2]. These changes in soil conditions have significant implications for Peru's agricultural sector, threatening the livelihoods of smallholder farmers. Addressing these issues requires a multi-faceted approach that includes sustainable land management practices and climate-resilient agricultural strategies to mitigate the adverse impacts of climate change on Peru's precious soils. Yet, smallholder farmers do not have the data, information, nor resources to face these challenges.

2.4 Smallholder farmers need access to crucial data, information, and tailored advice to manage their agricultural activities and adapt to changing conditions effectively. However, many of them face significant barriers to obtaining this knowledge.

2.5 Soil data is of particular importance for farmers as it serves as a foundational tool for informed decision-making in agriculture. Soil analysis data provides smallholder farmers with crucial insights into the nutrient composition, pH levels, and overall health of their soil. By understanding these factors, farmers can make informed decisions about the type and amount of fertilizers or soil amendments needed, leading to more efficient resource use. This data-driven approach helps optimize crop yields, reduce input costs, and enhance soil health over time. As a result,

---

1 Robin JP. Kristalina Georgieva. Global warming can add 100 million poor people by 2030. 2017. Available from: https://www.worldbank.org/en/news/opinion/2017/09/14/global-warming-can-add-100-million-poor-people-by-2030#:~:text=The%20World%20Bank%20has%20calculated,result%20in%20considerable%20population%20movements [cited on Nov 17th, 2023].

2 Ministerio del Ambiente Perú prioriza medidas para contribuir al manejo sostenible de la tierra. 2020. Available from: https://www.gob.pe/institucion/minam/noticias/187438-peru-prioriza-medidas-para-contribuir-al-manejo-sostenible-de-la-tierra [cited on Nov 17th, 2023].

smallholder farmers can increase their productivity, improve food security, and promote sustainable agricultural practices.

2.6 The National Agrarian Survey conducted in 2019 showed that only 2% of smallholders in Peru have had access to soil analysis information, despite the importance of soil information for agriculture[3]. The centralization of soil testing laboratories in major cities, combined with inadequate road infrastructure, poses significant obstacles for farmers seeking soil tests. Moreover, the process of collecting soil samples and soil analysis is expensive, involving specialized equipment and techniques. Consequently, the convergence of centralization, poor road connectivity, and the complexity and high cost make it exceedingly difficult for many smallholder farmers to access this critical information. This situation is no different for the Norandino Cooperative, where the project will be implemented. Due to limited economic and human resources, the cooperative can analyze only a small number of soil samples. Norandino's technical team reports that every year they get 20 soil samples from each province, which should provide information to 1,000 smallholder farmers on average, occupying an area of 1,500 hectares. In a geographically diverse region like Northern Peru, this limited sampling fails to represent the entire area. As a result, many smallholder farmers in Norandino are left without accurate soil information, hindering their ability to make informed decisions and optimize their farming practices.

2.7 Technology possesses great potential in supporting smallholder farmers to access the data and information they need. Nevertheless, they are not accessing these services. As of 2021, 82% of the global rural population was covered by at least a 3G mobile broadband network[4]. Even though internet connectivity gaps are being addressed, access to the internet is not enough to provide smallholder farmers with access to data-driven digital transformation. Despite the rapid proliferation of agricultural technology (AgTech) solutions, it is essential to recognize that these innovations do not always align with the specific needs and realities of smallholder farmers. Smallholders often face unique challenges related to limited resources, access to finance, digital literacy, and technology suitability for their diverse crops and farming practices. Many AgTech solutions are developed with larger commercial farms in mind and may not be scalable or adaptable to smallholder contexts. To truly benefit smallholder farmers, AgTech solutions must be designed with their input, tailored to their specific challenges, and made affordable and accessible to smallholder farmers. Recognizing and addressing these disparities is essential for harnessing the full potential of AgTech to improve the livelihoods of smallholder farmers and promote sustainable agriculture.

2.8 Peru's National Institute of Agricultural Innovation (INIA) highlights Big Data and Precision Agriculture as fundamental tools for soil analysis and environmental assessment, key aspects for the country's agricultural sustainability. Currently, there is little evidence of the real impact of precision agricultural technology. We believe this project will provide valuable evidence on the impact of this technology in improving the productivity of small-scale Peruvian farmers (only a few research

---

3 Pintado, M. Solo el 2% de los agricultores han realizado análisis de suelos en Perú. 2023. Available from: https://agraria.pe/noticias/solo-el-2-de-los-agricultores-han-realizado-analisis-de-suel-31302 [cited on Nov 17th, 2023].

4 Delaporte, A; Bahia, K. The State of Mobile Internet Connectivity 2022. 2022. Available from: https://www.gsma.com/r/wp-content/uploads/2022/12/The-State-of-Mobile-Internet-Connectivity-Report-2022.pdf [cited on Apr 17th, 2024].

papers about the use of satellite images for soil analysis have been found for Peru and other nearby countries[5]

2.9 This project aims to provide Peruvian sugarcane and coffee smallholder farmers with soil analysis and other complementary crop monitoring and yield estimation data and information, paired with agronomic tailored advice to promote smallholder leadership, information-based decision-making towards more productive and resilient farms. This will be achieved by integrating Producers Direct's Croppie farmer-friendly digital platform with Sagri's AI-powered technology to generate soil analysis and crop monitoring data.

2.10 Producers Direct will be the Executing Agency of the present project. Producers Direct is a non-profit organization headquartered in the UK with local branch registration in Peru and Kenya working with a network of producer organizations in Africa, Latin America, and the Caribbean (specifically in Peru, Colombia, Costa Rica, the Dominican Republic, Mexico, and Nicaragua, with the goal of scaling to more countries across the continent) since 2009 to co-design innovative solutions to challenges facing farmers. Producers Direct works with 10 producer organizations in Peru, supporting their farming members to become more sustainable and resilient to climate change. It is currently implementing a project funded by IDB Lab called "Paisajes Resilientes Impulsados por Datos" which aims to support farmers to become more resilient to climate change using data and technology at a farmer, cooperative, and landscape level. It has active support and funding by international organizations such as the World Food Programme, Dovetail Impact Foundation, GIZ, Bayer, Cafedirect, and Pret a Manger.

2.11 Over the last three years, Producers Direct, the Executing Agency, has been developing Croppie with the support of IDB Lab and GIZ. Croppie is a digital platform that uses data from farmers and third-party data (e.g. weather data) to estimate yields and deliver it, paired with tailored farmer-friendly advice, empowering smallholders to take on-farm actions. Croppie combines expertise in farmer-led design with pioneering data analytics, enabling remotely located smallholders to benefit from the power of data and information. The solution has been tested delivering yield predictions with tailored agronomic advice to 2,000+ coffee farmers.

2.12 The four years of testing and piloting Croppie with smallholder farmers from different regions of Peru (including producers from Norandino cooperative in Piura region), learnings have been identified and systematized. Key learnings include: 1) Farmers still prefer to use feature phones or WhatsApp; 2) Low literacy and digital skills is a reality for smallholder farmers, especially for women and older farmers, who also prefer local languages; 3) Insights and advice needs to be more personalized to be actionable for smallholder farmers; and 4) Data and information generated and shared needs to connect farmers to loans, inputs and other services that support farmers' resilience and income improvement.

2.13 With the present project and the learnings obtained, Producers Direct aims to start applying the solution to other crops, starting with sugarcane, and other functionalities (soil analysis, crop monitoring data, and satellite image-based yield estimations),

---

[5] Research papers showing the use of satellite images for soil analysis include the following:

- Mendoza. Uso de imágenes multiespectrales para determinar textura en suelos agrícolas. 2019. Available from: https://ri-ng.uaq.mx/bitstream/123456789/2103/1/RI005164.pdf [cited on Jul 15th, 2024].
- Castiglioni et al. Primeros aportes en la predicción de propiedades edáficas usando imágenes satelitales. 2021. Available from: https://50jaiio.sadio.org.ar/pdfs/cai/CAI-11.pdf [cited on Jul 15th, 2024].

leveraging the farmer friendliness of Croppie's interfac e. It is important to note that coffee and sugarcane are vulnerable to climate change through soil erosion and degradation, droughts and floods, pests, etc.

2.14 Sagri is a Japan-based startup working to optimize human activities on earth by utilizing satellite data and AI. Sagri is an impact startup from Gifu University that aims to solve problems in agriculture and the environment by combining satellite data (Satellite) ×, machine learning (AI), × plot technology (GRID). Sagri has its branches in India and Singapore, focusing on solving the problems in agriculture. Selected by the Ministry of Agriculture, Forestry and Fisheries of Japan as a university-launched venture in agriculture, forestry and fisheries technology. In addition, it won the Ministry of the Environment's Startup Grand Prize Business Concept Award. In 2023, the company was selected by the Ministry of Economy, Trade and Industry as one of J-Startup and - Startup Impact and won the ICC Summit KYOTO2023 Catapult Grand Prix.

2.15 Sagri was selected as one of the start-ups with high impact potential in Latin America and the Caribbean through the open innovation challenge TSUBASA (Transformational Start Ups' Business Acceleration for the SDGs) co-organized by IDB Lab and Japan International Cooperation Agency (JICA) in 2022. Its mission is to support smallholder farmers in developing countries by helping them to achieve self-fulfillment through farm management. To achieve this, Sagri uses satellite data, machine learning, and map plotting technologies to solve agricultural and environmental challenges.

2.16 Sagri's technology uses satellite data, which are reflected values of wavelengths from each sensor, and converts it into useful data by assigning meaning to what conditions on the ground are indicated by those reflected values. Sagri is training AI models to learn the characteristics of satellite data in various conditions on the ground, allowing AI to generate soil and crop data and information to support smallholder farmers making on-farm decisions.

2.17 Sagri has over five years of experience generating soil data for the agricultural sector and has provided soil analysis to sugarcane farmers in India for four years, having supported farmers to increase their yields by 5-10%, reduce their costs of fertilizer by 5%, and reduce their greenhouse gas emissions in 5 tons of CO_2 per hectare[6]. They have also supported farmers in other crops to increase their yields and profit margins[7].

2.18 This project will be the first time they generate this kind of information for smallholder farmers growing sugarcane to produce panela (an organic product that needs to be managed under sustainable practices, including partial harvesting - different from the total harvest system practiced in India). Also, this will be the first time Sagri generates soil and crop data for coffee farmers.

2.19 We are proposing to integrate Sagri's technology into Croppie. With this integration, Croppie will be able to deliver soil and crop information to farmers plus more detailed and accurate agronomic and financial advice directly to smallholders' phones. Data, information, and advice will enable smallholder farmers to make on-farm informed decisions that will support them to improve their productivity and adopt climate-smart

---

6 Sugarcane project in India hasn't been closed yet, and these results are estimates shared by Sagri.

7 Carrot: yield increased in 33%, margin increased from 50% to 76%. Beetroot: yield increased in 66%, margin increased from 59% to 77%. Potato: yield increased in 70%, margin increased from 50% to 77%.

agricultural practices. Currently, the plan is to provide this service to 2,700 coffee and sugarcane smallholder farmers from the Norandino Cooperative in Piura, strengthening their decision-making toward more profitable and climate-resilient farms.

2.20 By integrating Sagri's technology into Croppie, smallholder coffee and sugarcane farmers will gain access to actionable data insights, empowering them to make informed and effective decisions. This integration will help farmers answer questions such as:

- How healthy is my farm's soil and how can I fertilize it in a sustainable way?
- What other sustainable practices will improve my soil's health?
- How can I establish agroforestry systems to improve my productivity, income, and farm health?
- What sustainable pest management methods can I use?
- What irrigation systems can I use to optimize water resources and improve my productivity?
- What kind of nutrients is my crop missing and what climate-smart practices can I adopt to improve it?

This data, information, and advice will be delivered directly to smallholder farmers' phones through the Croppie platform, WhatsApp, SMS and/or IVR. These digital services, accompanied by the support of in-person Youth Agents, will enable farmers to make informed decisions and support behavioral change toward managing more profitable and climate-resilient farms[8].

2.21 Acknowledging the digital gap that exists in rural areas, and especially among farming communities, Producers Direct model includes the support from local Youth Agents[9], who oversee supporting farmers using the digital platform. Producers Direct has been using this local-youth-supported model to develop and deploy different digital solutions. Support from youth also aims to increase digital literacy among farmers, who will ultimately share the benefits of Croppie (the information they are getting and how easy it is to use) with their peer farmers, creating a robust and organic network of users.

2.22 Among rural smallholder farmers, female farmers are being particularly vulnerable. In Peru, only 31% of the farming units are led by women[10]. In the Norandino cooperative, only 10% of farmers managing sugarcane and coffee farms are female. Another crucial aspect is the participation of women in producer organizations and in decision-making in the agricultural sector, where they face significant barriers. The lack of care services, gender violence, and the lack of instruments for prevention and response to disaster and climate change risks are additional problems that affect agricultural women particularly.

2.23 Digital technology has the potential to contribute to strengthening female farmers' decision-making power. Nevertheless, the digital gender gap in rural areas of Peru

---

8 Some of the practices that will be monitored are adequate use of fertilizers, return crop residues to the soil, establishment of agroforestry systems, adoption of cover cropping, adequate use of pest management methods, adequate use of water for irrigation, among others.

9 These are young people from the communities who receive payment through the project.

10 MIDAGRI. Desafíos y reflexiones sobre la mujer agraria en el Perú. 2023. Available from: https://cdn.www.gob.pe/uploads/document/file/5490323/3847423-reflexiones-y-desafios-sobre-la-mujer-agraria-en-el-peru.pdf?v=1701180357 [cited on Apr 18th, 2024].

is still very high, with a difference of 8.8% between men and women (a difference that has increased over the last 12 years)[11].

2.24 One of the project's priorities is to overcome the diverse challenges female farmers are facing, by contributing to closing the digital gender gap and by empowering them to become leaders in their communities, strengthening their decision-making power. The project will count on a gender expert who will support the implementation of the project's activities and the design and refinement of Croppie's digital platform and services. Moreover, the gender expert will design and implement 10 female-focused workshops with female farmers involved in the project, which will have two main objectives: closing the digital gender gap & strengthening female farmers' decision-making power.

2.25 The project's sustainability and scalability are key aspects of the project. After piloting the integration of Sagri and Croppie's technology and its benefits, the project will be focused on designing a sustainable model with the potential to be replicated to other coffee and sugarcane smallholder farmers in Peru and other countries of Latin America. The Executing Agency will prepare a GHG emissions report to determine the best methodology to calculate GHG emissions reduction, calculate this reduction, and estimate the financial potential of this reduction (through the sale of carbon credits and other mechanisms). The Executing Agency will test at least two revenue models with the potential to financially sustain the model.

2.26 All these learnings and insights will be systematized in a Sustainability and Scalability Plan, which will be then shared with the other 9 producer organizations part of the network of Producers Direct in Peru[12] during a dissemination event. The main pathway intended to achieve the scale of this integration is via replication. Adopting organizations have already been identified (part of Producers Direct's network of Producer Organizations in Peru since 2009) and will be involved in the project's implementation. The project will replicate the model with these organizations in a post-pilot stage. This document will also be shared with other organizations (cooperatives, non-profit organizations, and government organizations working with smallholder farmers) in Latin America.

2.27 Moreover, the project's results and lessons learned will also create synergies with the "Project for the Improvement of the Network of Innovation, Technology Transfer, and Agricultural Extension Services at the Six Agricultural Experimental Stations of INIA", (PE-L1270), a project executed by the Ministry of Agriculture and Irrigation of Peru), through the National Institute of Agricultural Innovation (INIA).

2.28 Since the algorithm will be designed, validated, and integrated into Croppie's digital platform during the project's execution, it will have the potential to reach all coffee and sugarcane smallholder farmers in Peru once the project is completed and created synergies with INIA. It is estimated that there are over 265,000 coffee and

---

11 INEI. Perú Brechas de Género 2022: Avances hacia la igualdad de mujeres y hombres. 2022. Available from: https://www.inei.gob.pe/media/MenuRecursivo/publicaciones_digitales/Est/Lib1879/libro.pdf?fbclid=IwAR0OzoVpX9HHMaWUXWFoLYgijK8f5owTTUpJOdhd-bZSVxLIlCYpbbZqxNw [cited on Apr 18th, 2024].

12 Producers Direct's network of Producer Organizations in Peru is formed by: Norandino (Piura), Bagua Grande (Amazonas), La Prosperidad de Chirinos, Aprocassi, Frontera San Ignacio, Cenfrocafé (Cajamarca), Huadquiña (Cusco), Cecovasa, San Juan del Oro (Puno), and Pangoa (Junin). These ten Producers Organizations have in total more than 18,000 producer members (mainly coffee smallholder farmers).

sugarcane smallholder farmers in Peru. Considering that 73.8% of families in rural areas of Peru have at least one member with a mobile phone, we estimate that more than 195,000 smallholder farmers could have access to the integration between Sagri and Croppie

III. Description of activities/components and budget

3.1 The project's objective is to improve the productivity of Peruvian smallholders and promote the adoption of climate-smart practices through an innovative soil analysis solution, piloting a sustainable and scalable business model.

3.2 The project expects to benefit 2,700 smallholder farmers (500 female) who are a combination of poor, vulnerable, and low-income, occupying approximately 4,423 hectares of land in the Piura, Lambayeque, and Cajamarca regions in Peru. These smallholder farmers are part of the Norandino cooperative and cultivate sugarcane (mainly to produce panela, an unrefined whole cane sugar product, which is exported through the cooperative) and coffee (mainly to export as dry coffee through the cooperative). Based on the information shared by the EA, smallholder farmers members of the Norandino cooperative earn on average 124 USD/month (the minimum wage in Peru is 277 USD/month), and their average age is 50 years old.

3.3 The project will provide soil analysis, crop monitoring, yield estimation, and tailored agronomic advice to enhance productivity and resilience, targeting at least 50% of poor, vulnerable, or low-income beneficiaries The training will be provided by the young agents both in person and virtually through the Croppie platform. At the end of the project, support will be offered through the digital advisory platform. In 2023, Piura's poverty rate was 33.1%, with rural poverty at 39.8% and extreme poverty at 16.2%. Data from Norandino show 47.45% of farmers have per capita incomes below the poverty line (446 soles), and 72.81% earn below the rural average income (700 soles). Furthermore, 87.5% earn below the minimum living wage (1,025 soles). A conservative estimate using additional income data shows that 28.9% of farmers fall below the per capita poverty line, and 55% earn below the rural average income. Additionally, 69% earn below the average rural salary (854.6 soles), and 75.6% fall below the minimum living wage. Using World Bank criteria, over 70% are classified as vulnerable.

3.4 The project aims to increase smallholder productivity by 10% through data and advice. Sagri's experience in India, which has some similarities with Peru in terms of the level of infrastructure and climate conditions, shows potential yield increases of 5-10% and fertilizer cost reductions of 5%. Other crop yields and margins also saw significant improvements. The small-scale farmers benefiting from the project will have access to both the platforms and advisory services through the local young agents who will assist farmers in using digital platforms, enhancing digital literacy and technology adoption among farmers. Those agents will receive training and get a fee for the fieldwork.

3.5 The project is organized around four components: (i) AI-model training and design; (ii) Delivery of data and agronomic advice to coffee and sugarcane farmers; (iii) Scalability and sustainability; (iv) MERL+Admin.

3.6 **Component I: AI-model training and design (IDB Funding: US$157,620, Counterpart: US$3,680).** The objective of this component is for Producers Direct and Sagri to work closely with Norandino cooperative and sugarcane and coffee smallholder farmers (with the support of Producers Direct's Youth Agents) to get the data (soil samples) to design and train the AI models to obtain soil analysis, crop monitoring, and yield estimation data based on satellite images. The component's results are the following:

- 6 Youth Agents trained on data gathering and sharing data with Sagri to feed the algorithms.
- 270 smallholder farmers (10% of total participants) trained in data and sample gathering and sharing it with Youth Agents.
- 6 AI algorithms designed, validated, and integrated into Croppie platform (3 AI models soil analysis, crop monitoring, and yield prediction- will be designed for 2 crops -sugarcane and coffee- total of 6 models. These will be integrated into Producers Direct's already designed interface, Croppie.)

3.7 **Component II: Delivery of data and agronomic advice to coffee and sugarcane farmers (IDB Funding: US$452,140, Counterpart: US$198,360).** The objective of this component is to make available to farmers the data, information and tailored advice generated and deliver it directly to farmers' phones (through different channels, including the Croppie platform, WhatsApp, SMS and/or IVR), and provide in-person support with the lead of on-the-ground local youth agents. The component's results are the following:

- 6 themes of data dashboards and agronomic advice designed and made available to smallholder farmers. The dashboards and agronomic advice will be available for smallholder farmers through different platforms, including the Croppie digital app, WhatsApp, SMS and/or IVR[13].
- 10 Youth Agents trained in the platform's use and in supporting smallholders of the project.
- 2,700 smallholder farmers continually receive data and information through the different digital platforms and in-person support from Youth Agents.
- 10 female-focused workshops produced (the design and implementation of these workshops will be led by a gender expert. These workshops will have the objective of 1) Contributing to closing the digital gender gap: this part of the workshop will be focused on supporting female farmers on the use of digital technologies and giving them a safe space where they can familiarize with this kind of tools. This will also enable the continual refinement of Croppie for it to respond, even more, to female farmers' needs), and 2) Strengthen female farmers' decision-making power: this part of the workshop will be focused on providing leadership skills to the participating female farmers, with a specific

[13] Activities to strengthen the cybersecurity of the producers will be included.

focus on leadership behaviors in the agricultural sector, on their family farms, and in the use of digital technologies for decision making).

- 8 focus groups with smallholder farmers to improve usability and adoption of the digital platform.

3.8 **Component III: Scalability and sustainability (IDB Funding: US$32,700, Counterpart: US$34,000).** Key to the project's success is the scalability and sustainability potential of the technology designed, integrated, and made available for smallholder farmers. Big emphasis will be placed on ensuring that, by the end of the project, there is a plan to make the technology financially sustainable and to replicate the project with other producers and cooperatives in Peru and, ultimately, in other countries in Latin America and the Caribbean. The component's results are the following:

- One Greenhouse Gases (G) Emissions report. The report will at least include: 1) Systematization of lessons learned from other carbon credit projects supported by IDB and other organizations in Latin America, 2) Methodology to measure GHG emissions reduction based on data and information received by farmers, 3) Measurement of GHG emissions reduction, and 4) Financial potential of GHG emissions reduction.
- 2 revenue models piloted. The revenue models piloted will be at least: Subscription fee paid by actors in the value chains to obtain anonymized data, Carbon credits sold by the cooperative based on the measurement of GHG emissions reduction through the algorithm generate incomes to pay for the service provided.
- One Sustainability and Scalability plan document. The plan will at least include Systematization of the model for replication, Prospection of Latin American producer's organizations with the potential of replication, Business model based on the results of the pilot of revenue models.
- 9 producer organizations/cooperatives attend a dissemination event of the project's results and opportunities of collaboration and scaling.

3.9 **Component IV: MERL + Admin (IDB Funding: US$157,540, Counterpart: US$28,260).** This component's objective is to support the Monitoring, Evaluation, Research and Learning activities, plus other administrative activities (Baseline and Endline Surveys, Project Management, Financial Management, equipment, and contingencies). The component's results are the following:

- One Baseline Survey
- One Endline Survey[14]

3.10 **The project's expected results include:**

- 50% of smallholder farmers involved in the project are poor, vulnerable, or low-income.
- 10% average productivity increase across smallholders accessing data, information, and advice.
- 60% of farmers have adopted at least one climate-smart practice (the practices that will be monitored include: Adequate use of fertilizers, returning crop

[14] Baseline and endline survey include the following big topics: 1) Background data of farmer, 2) Overall Livelihood, 3) Innovative, climate-smart farming practices, 4) Access to data and information.

residues to the soil, establish agroforestry systems, adopting cover cropping, adequate use of pest management methods, adequate use of water for irrigation).

- 75% of farmers report interest in continuing receiving data and information through the platform.

IV. Indicative Budget

The total cost of the TC is US$1,064,300 of which US$800,000 will be financed by the resources of the Japan Special Fund (JSF) Japan Enhanced Initiative for Quality Infrastructure, Resilience against Disaster and Health (JEI). The remaining US$264,300 ($231,720.00 in cash and $32,580.00 in-kind) will be provided by the Executing Agency or any other partners.

Indicative Budget

Component	IDB Funding (JSF)(JEI)	Producers Direct (co-financing)		Total
		Kind	Cash	
Component 1 AI-model training and design	$157,620.00	$2,080.00	$1,600.00	$161,300.00
Component 2 Delivery of data and agronomic advice to coffee and sugarcane farmers	$452,140.00	$0.00	$198,360.00	$650,500.00
Component 3 Scalability and sustainability	$32,700.00	$30,500.00	$3,500.00	$66,700.00
Component 4 (Inc. PM, contingencies, etc.)	$157,540.00	$0.00	$28,260.00	$185,800.00
Total	$800,000.00	$32,580.00	$231,720.00	$1,064,300.00

**Producers Direct is co-financing 24.83% of the project*
**Translation fee of US$ 11,000 (Japanese- English - Spanish) - Component 1*
**The supervision of this technical cooperation will be under the IDB Peru Country Office.*

V. Executing Agency and execution structure

5.1 Producers Direct will be the Executing Agency of the present project. Producers Direct is a non-profit organization headquartered in the United Kingdom with local branch registration in Peru and Kenya. Producers Direct invests in smallholder farmers to address power imbalances in the way food is grown, distributed and accessed. Producers Direct has a trusted network of 1 million+ smallholder farmers, using its powerful voice to tackle persistent global challenges. They blend traditional wisdom and new technology to strengthen smallholder farmers' incomes and resilience, by providing training, data, financial, and market services.

5.2 Producers Direct has a diverse team located in Peru, the United States, the United Kingdom, Kenya, and Uganda. The Producers Direct team in Peru consists of professionals from various disciplines, including philosophers, political specialists, gender experts, and forest engineers. This team has been responsible for implementing the project "Paisajes Resilientes Impulsados por Datos," funded by IDB Lab in 2020. With extensive experience in using digital technology to support smallholder farmers' incomes and climate resilience and strong relationships with producer organizations, the team adds significant value to this project's execution.

5.3 Producers Direct works with 10 producers' organizations in Peru and one producer organization in Colombia. It is currently implementing a project funded by IDB Lab called “Paisajes Resilientes Impulsados por Datos”, which aims to support coffee farmers to become more resilient to climate change using data and technology at a farmer, cooperative, and landscape level. Part of this funding has been used to design and develop Croppie, a digital platform that uses data from farmers and third-party data to estimate coffee yields and deliver this information to farmers, paired with tailored farmer-friendly advice. 2,000+ smallholder farmers have been part of the process of designing and piloting Croppie, whose model has achieved an accuracy level of 90%.

5.4 Producers Direct goal is to leverage Croppie’s interface friendliness and continue integrating services and crops into Croppie’s digital platform. We aim for Croppie to be a system that allows smallholder farmers with different levels of access to technology, needs, and diverse value chains to access the data and information they need to strengthen their resilience to climate change and improve their productivity.

5.5 Sagri will be the principal provider of the technological solution and will work with Producers Direct to train and design AI models to obtain crop monitoring, yield estimation, and soil analysis data for sugarcane and coffee crops. Sagri is a Japan-based startup working to optimize human activities on earth by utilizing satellite data and AI. Sagri was selected as one of the start-ups with high impact potential in Latin America and the Caribbean through the open innovation challenge TSUBASA (Transformational Start Ups’ Business Acceleration for the SDGs) co-organized by IDB Lab and Japan International Cooperation Agency (JICA) in 2022. Its mission is to support smallholder farmers in developing countries by helping them to achieve self-fulfillment through farm management. To achieve this, Sagri uses satellite data, machine learning, and map plotting technologies to solve agricultural and environmental challenges. Sagri has already developed models to generate soil information for crops such as paddy, wheat, soybeans, sugarcane, potato, and corn used in Japan, Thailand, Vietnam, India, and Kenya. As part of this project, Sagri will leverage its broad experience in agricultural data science to design models to obtain crop monitoring data, yield estimations, and soil analysis for sugarcane farms under a new management system (partial harvest) and for coffee farms. Regarding Sagri, the justification for direct contracting is that it is the sole provider of a unique AI-based soil analysis model with accessible pricing. This value was recognized in the open innovation challenge in Japan, co-organized by JICA and the IDB Group

5.6 The project will be implemented with the Norandino Cooperative, which has been a partner with Producers Direct since 2009. Norandino is a producer organization (cooperative) based in the Piura region integrated by 6,778 members committed to the development and growth of sustainable agriculture in the region. Norandino is a

leader cooperative with social, economic, and environmental responsibility. It is made up of smaller producer organizations of coffee, cocoa, panela, carbon credits, and other products whose cultivation is present in various areas of the coast, mountains, and jungle of northern Peru (Piura, Tumbes, Lambayeque, Amazonas, Cajamarca, San Martín and Ucayali regions). They provide farmers with competitive quality services, which promote sustainable development with equity, aimed at improving the living conditions of associated families, articulating their production to the local and international market. Besides its broad experience in sustainable agriculture, Norandino has also been working on the carbon credits market through reforestation projects. They have generated incomes of 281,735 euros since 2018 selling carbon credits, benefitting 539 rural families.[15] Their main clients are Cafedirect, Bewleys, P3Value, La Siembra, and Fair Climate Fund. They are now excited about exploring financial opportunities for greenhouse gas emissions reduction through other climate-smart practices such as fertilization optimization.

5.7 The executing agency agrees to adhere to the standard IDB Lab arrangement for results-based disbursements, the procurement and financial management policies applicable to the private sector, in accordance with the Financial Management Guidelines for IDB-financed Projects (document OP-273-12) of 17 June 2019 and specified in the Guide for Milestones-based Management and Financial Supervision for IDB Lab and SEP Technical Cooperation Projects.

5.8 The Executing Agency shall prepare a procurement plan acceptable to the Bank, that describes the contracts for goods and services required to carry out the Project, including the estimated cost of each contract, and the proposed methods for acquisition of its goods and services, including consultants' services. The Bank may request annual reports on the execution of the Procurement Plan by the Executing Agency. Implementation of the procurement policies, terms of reference, and contracts for the acquisition of goods and services, as well as the Procurement Plan and fulfillment thereof, may be subject to ex-ante review or ex-post supervision by the Bank, at its discretion.

5.9 The level of risk, as determined by the Diagnostic Assessment of Integrity and Institutional Capacity (DICI), was low, confirming that the Executing Agency has an acceptable financial management system for IDB Lab and has a monitoring and accountability structure for the presentation of its institutional financial statements to the Bank.

5.10 The executing agency will be responsible for carrying out the project's monitoring and tracking activities, taking the indicators agreed upon in the results matrix as a reference. The executing agency will annually submit to the Bank a summary of the project's status through the Project Reporting System (PSR). This report will specify the fulfillment of component, results, and impact indicators of the project, the milestone report, among others. IDB Lab will hold working meetings and field visits

[15] Some of the key results highlighted by the Norandino cooperative in their 2023 annual report specifically for the carbon credits value chain are: 1) Creation and registration of a reforestation association with more than 500 members, 2) Reforestation of 85 hectares of pine and alyssum with more than 94,000 trees, 3) Training on reforestation to 259 farmers (56 female farmers), 4) Obtention of funding from INCOFIN for a research on native species with reforestation potential in the Piura region.

to verify in situ the completion of activities, the quality of services provided to the beneficiaries, and the results achieved.

5.11 An initial and final baseline study of the project has been planned to capture the initial and final indicators of the project's execution at the level of the project's results matrix, with the aim of validating the project's impact thesis.

VI. Alignment with IDB Group strategies

6.1 The proposal is aligned with the strategic objective of "Strengthening environmental management with a focus on sustainability and climate change and improvement of agro-industrial productivity", with the expected result of "Improving environmental quality and ecosystem performance", of the Bank's Strategy with Peru (2022-2026) (GN- 3110-1), and with the Sector Framework Documents for Agriculture (GN- 2709-10), Food Security (GN-2825-8).

6.2 This project is aligned with the priorities of the Japan Special Fund (JSF) in the line of poverty reduction that seeks to promote rural development, food security and community development.

6.3 The project is also aligned with the Forestry Investment Program (PE-L1232) of the Climate Change and Sustainable Development division through the Incentive Fund for small producers; the business plans of the enterprises may include Sagri's satellite technology as part of the technology package.

6.4 The project is aligned to SDG 2: Zero Hunger with objective 2.4 of “By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality” (with the indicator: % of farmers who have adopted at least one smart climate practice). It also aligns SDG 8: Decent Work and Economic Growth with objective 8.2 “Achieve higher levels of economic productivity through diversification, technological upgrading, and innovation, including through a focus on high value-added and labor-intensive sectors” (with the indicator: Average productivity increase across smallholders accessing data, information, and advice)

6.5 The project is also aligned with the portfolio of IDB Lab projects in Peru in the Ag Tech line that seeks greater efficiency and productivity of small farmers, including PE-T1482 "Data-driven resilient landscapes"; PE-T1423 "Expansion of financing for climate change adaptation in the coffee production chain"; PE-T1528 "Digital Identity for non-digitized rural small producers".

6.6 The project will establish synergies and collaboration with the Program for Improving the Network of Innovation Services, Technological Transfer, and Agricultural Extension in the six Agricultural Experimental Stations of the National Institute of Agricultural Innovation (PE-L1270). Among the objectives of this project is to

enhance and strengthen research and technological solutions for small rural producers, with particular attention to climate change, and to promote lines of research on soil analysis, fertilization, water needs, and irrigation, among other aspects.

6.7 The proposed project aligns perfectly with these objectives. The combination of soil analysis and climate prediction through the digital solution Croppie will significantly contribute to the mentioned research. Also, there is the possibility of generating a knowledge product or case study of the project and integrating it into a knowledge exchange ecosystem.

6.8 The specific financing of project PE-L1270 in soil analysis and climate change offers a unique opportunity. The project intervention results could facilitate the scalability and replicability of the model nationally.

6.9 The proposed project aligns perfectly with these objectives. The combination of soil analysis and climate prediction through the digital solution Croppie will significantly contribute to the mentioned research. Also, there is the possibility of generating a knowledge product or case study of the project and integrating it into a knowledge exchange ecosystem.

6.10 The specific financing of project PE-L1270 in soil analysis and climate change offers a unique opportunity. The project intervention results could facilitate the scalability and replicability of the model nationally.

6.11 IDB Lab can add value to the project aimed at developing and improving the productivity of small-scale farmers in the following ways:

- IDB Lab can connect project beneficiaries with specialized markets that demand high-quality, sustainable, and traceable products, thereby facilitating the expansion and diversification of their marketing channels and reducing the risk of a decline in demand from their current customers.
- IDB Lab can promote access for project beneficiary producers to green microcredits that enable them to finance investments in clean technologies, energy efficiency, and climate change adaptation. These credits would be based on successful experiences from IDB Lab's current project portfolio and contribute to the sustainability of good agricultural practices.
- IDB Lab can facilitate access to data and information on soil characteristics and conditions, as well as to tools and methodologies for their analysis and interpretation. These resources would help producers optimize input usage, improve water and soil management, and increase resilience to the effects of climate change.
- This operation was reviewed for the Paris Alignment and is considered aligned with BB1 (mitigation) as it promotes low-emission development pathways through sustainable agricultural practices, enhances soil health, and reduces

GHG emissions. Furthermore, the project is strongly aligned with BB2 (adaptation and resilience) by addressing the vulnerabilities of smallholder farmers, enhancing their resilience to climate change through data-driven decision-making, and implementing specific adaptation measures. In addition, the project will include content to raise awareness of the environmental consequences of land use during the training.

- The project is consistent with Peru's Nationally Determined Contribution (NDCs), National Climate Change Strategy (ENCC), and National Adaptation Plan (NAP).

VII. Major Risks

7.1 **Technical risks related to the development of the AI models and platform functionalities design.** This project has multiple technical steps to integrate new functionalities into Croppie's platform (i.e. Sagri designing the models, design of dashboards and advice, etc.). To mitigate this, Producers Direct will work with Sagri, who has broad experience in implementing similar projects with smallholder farmers in other regions of the world.

7.2 **Effects of climate change on sugarcane and coffee production.** Climate change effects pose a significant risk to sugarcane and especially coffee production, which could affect the project's outcome. Producers Direct and Sagri, are both dynamic and fast organizations that can adapt to different agricultural scenarios. Both organizations will be constantly monitoring weather from secondary sources and will provide ground-truth secondary information with the support of an on-the-ground technical team from Norandino and Youth Agents and Coordinators.

7.3 **Low access to technology and digital literacy in rural areas.** Unfortunately, low access to technology and digital literacy in rural areas is a reality in the world and Peru is not the exception (although there are currently no clear statistics regarding digital literacy in Peru). The Executing Agency has broad experience in designing digital solutions using Human Centered Design. Croppie has been co-designed with smallholder farmers and with the support of IDEO (experts in HCD), ensuring its adoption by smallholder farmers. Further, we acknowledge that smallholders above a certain age might struggle with technology in general. This is why Producers Direct uses different channels such as WhatsApp, SMS, and/or IVR. Moreover, they count on their network of Youth Agents and Youth Coordinator who support smallholders access data and information through the digital platform.

7.4 **Gender Digital Divide.** Within the urban-rural digital divide, there exists a gender digital divide, putting female smallholder farmers in rural areas in a very vulnerable position. The Executing Agency has broad experience working and designing solutions that are inclusive for female smallholder farmers. Specifically, Croppie has been developed with different cohorts of farmers, including female-only cohorts. For this project, Producers Direct will hire a Gender Expert who will support the implementation of the project (including app design and development, and advisory services design), and the design and implementation of female-only workshops.

7.5 **Data and Information Management.** The Executing Agency has broad experience in smallholder-owned data and information management. While the dashboards that will be delivered will be designed using farmers' data, these data will always be anonymized and shared for smallholders' benefit. Further, the Executing Agency will always request farmers' consent before using their data for any purpose.

7.6 **Coffee Price Volatility.** Due to the volatility of coffee prices in international markets, a decline in coffee prices may occur, leading to reduced income for smallholder farmers. The project recognizes the threat that low market prices pose to increasing producers' income levels. Despite improvements in farming practices and data access, price volatility remains a significant challenge. To address this, the project provides crucial information on harvest predictions and market trends, empowering cooperatives to make informed decisions. This includes diversifying income sources and implementing purchase price guarantees to protect farmers. Collaboration with Cafedirect enhances traceability and information exchange, further mitigating risks.

7.7 **Access to information.** The information contained in this document is classified as public upon approval under the Bank's Access to Information Policy[16] **.**

7.8 **Intellectual property**. The Executing Agency and the solution providers will retain ownership of all intellectual property rights to the products developed and studies conducted under the project, and will grant IDB Group a nonexclusive, free license to use them for non-commercial purposes in Peru and throughout the region with the exception of the app and algorithms. This will ensure that the lessons learned from the project are disseminated as widely as possible throughout the region.

VIII. Exceptions to Bank policy

8.1 None.

IX. Environmental and Social Strategy

Based on IDB's Environmental and Social Policy Framework (GN-2965-21), the classification for this operation is "C".

[16] https://www.iadb.org/en/access-information/home