IDB LAB DELEGATION OF AUTHORITY TO COUNTRY OFFICES
PLAN OF OPERATIONS
PARAGUAY
PR-T1282

I. Individual Project of the Facility RG-O1676 - GENERAL INFORMATION

Project Title	Listening to the Plants' Needs.
Focus Area	Climate Smart Agriculture (CSA).
Executing Agency	**IDB Lab/CPR**
Project Beneficiaries	The project is expected to directly benefit ~350 smallholder tomato farmers whose productivity is expected to increase by 5% to 10% in terms of production quantity (economic return) while reducing water consumption by 5% to 20% (environmental return). Public and private organizations will also benefit from the knowledge to be captured from the project. On the scaling-up phase, it is expected to reach approximately 3,700 smallholder tomato and other agricultural producers that could potentially engage on climate smart horticultural production by making use of the affordable and accessible technology.
Coordination with Other Donors/Bank Operations	The project has been analyzed in coordination with IDB's Environment, Rural Development and Disaster Risk Management Division (CSD/RND). This individual project (PR-T1282) is part of the Facility RG-O1676
Source of Funding	IDB Lab Contribution: US$150,000 (Facility RG-O1676)[1] Counterpart Resources: US$85,000 **Total Budget: US$235,000**
Objectives	The main objective of the project is to test and adapt cost effective climate smart agricultural technology, that can increase outputs and quality of tomato production for smallholder farmers while lowering input costs of key resources such as labor, water, electricity and fertilizers.
Execution Timetable	The project will be executed in 18 months. The period for disbursement will be 24 months.
Project Team	Tetsuro Narita (LAB/INV) and Luis Alejandro Fernandez (INV/CPR), co-team leaders; Fermin Vivanco (LAB/DIS); Alvaro Garcia Negro (RND/CPR); and Juan Pedeflous (FML/FOM)
Environmental and Social Impact Review	The project has been pre-assessed and classified according to the IDB Environmental and Safeguard Compliance Policy (OP-703), being classified as Category "C".

[1] This Individual Project has been designed within the framework of the Line of Activity for Innovation Prototypes (RG-O1676), approved by IDB Lab Donors Committee on June 26, 2019. As such, funds for this individual project will come from the Facility RG-O1676

II. BACKGROUND AND JUSTIFICATION

A. What is the problem being addressed?

2.1. Paraguay has the potential to become a powerhouse in the production of food and other agricultural products. It has become, for example, one of the world leaders in soybean exports (with large-scale mechanized soybean farmers). However, the production of horticultural crops (e.g. vegetables) – mainly composed of small independent farmers – is deficient[2] and does not cover even domestic demand. Among these crops with supply-demand gap, tomato production stands out[3]. It is one of the most consumed vegetables in Paraguay, but local production only covers 35% of the local annual consumption demand.

2.2. To narrow this imbalance, innovative ways to apply newly available technologies to agricultural practices need to be sought. Since thousands of semi-urban and rural families engaged in horticultural activities live in poor and vulnerable conditions, such technological applications also need to be affordable and accessible to increase the productivity even among smaller producers (technology for inclusion).

2.3. Moreover, any technological applications in agricultural activities have to factor in the threat that climate change poses, the threat to which small producers are severely exposed[4]. Under the context of climate change, agricultural production is inordinately water-hungry activities, being the largest "consumer" of the world's freshwater resources. The challenge is how to achieve agricultural productivity increases with less predictable water availability due to climate change.

2.4. Thus, the solution presented herein, real-time adaptable climate smart irrigation, is to implement a system to produce savings on such key resources as water while proving increased productivity (and consequently increased income) to those who are traditionally excluded. The potential of climate smart irrigation has been identified, because irrigation is not only related to water consumption (and its cost), but also directly linked to the other agricultural inputs, for example, energy consumption to operate the water pumps, fertilizers since a common cultivation practice is fertigation (water plus nutrients), and human labor to manage and monitor the irrigation system.

III. PROJECT OBJECTIVES AND DESCRIPTION

A. Objectives

3.1. The main objective of the project is to test and adapt cost effective climate smart agricultural technology, that can increase outputs and quality of tomato production for smallholder farmers while lowering input costs of key resources such as labor, water, electricity and fertilizers.

B. Innovation

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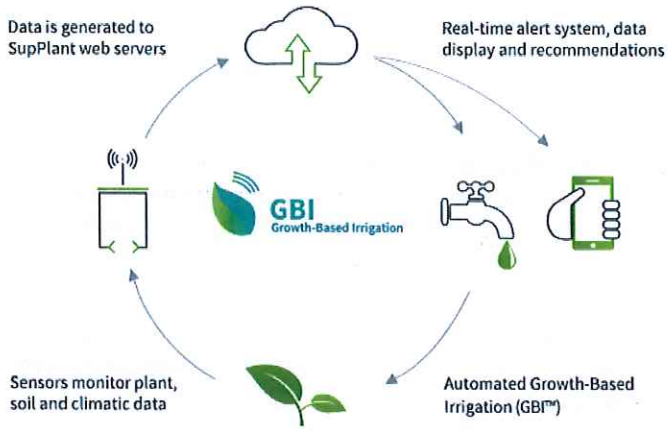
[2] According to latest FAO statistics (2017) on global tomato production: Paraguay with ~40 tons per hectare is lagging behind countries like Chile (~62 tons/ha), Brazil (~68 tons/ha), Uruguay (~75 tons/ha).

[3] Tomato has been pinned by the Ministerio de Agricultura y Ganadería (MAG) of Paraguay to be one of the seven strategic crops to fight poverty among small farmers, and the national government has recently launched a national strategy for the crop (February 7, 2019) that reflects its importance and also the current barriers.

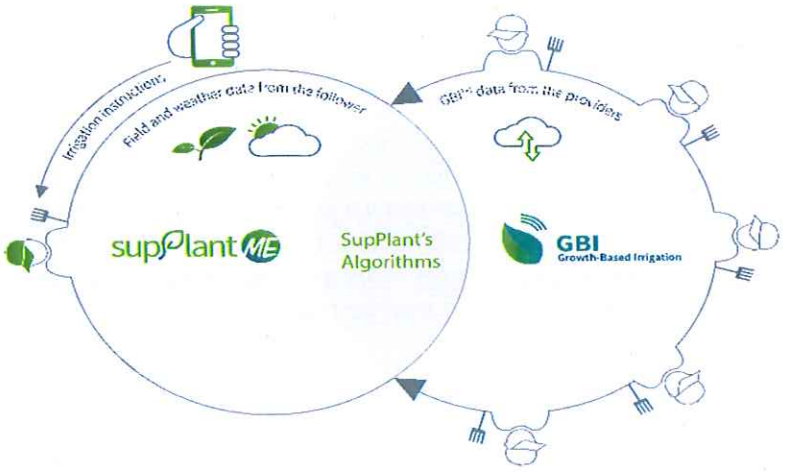
[4] A recent IDB Group publication summarizes how and to what extent Paraguayan economy is vulnerable to climate change (Eduardo Almeida, Fabiano Bastos, José Alejandro Quijada, and María Cecilia Acevedo, eds. *Paraguay: Rutas para el Desarrollo*. Banco Interamericano de Desarrollo (BID), 2018).

3.2. To tackle the challenges mentioned in the previous section and with a vision to help Paraguayan farmers produce more food with fewer resources, **Fundación Capital** has identified **SupPlant** – an Israeli agtech company. SupPlant has developed a unique artificial intelligence (AI)-powered, closed loop, automated irrigation system named **Growth-Based Irrigation (GBI™)**. GBI is the first-of-its-kind and the first commercial irrigation system that is fully autonomous, reactive to plant's exact needs in real time. Using its unique algorithms GBI is able to analyze data generated from crops through sensors and translate this data into irrigation commands, thus optimizing resource inputs (allowing farmers to keep costs under control and mitigate the risks related to climate change) and maximizing income. This solution is innovative as it targets both improving yields and reducing climate risks while reducing the usage of key inputs such as water.



GBI is based on real-time plant behavior and necessities (plant stress, plant and fruit growth patterns, real-time climate data, actual water content in the soil, forecasted climate conditions, forecasted plant growth patterns, etc.)

3.3. This project proposal for Paraguay combines the GBI technology for average-sized farmers with a new complementary tool called **SupPlantME** that is focused on even smaller farmers via a mobile application (App) that provides daily irrigation instructions based on the GBI algorithm. This combination of GBI and SupPlantME allows even the smallest farmers to receive an accurate and dynamic irrigation regime to their cellular phone, without the necessity of installing hardware in the field of the smaller farmers.



SupPlantME allows even the smallest farmers to receive an accurate and dynamic irrigation regime to their cellular phone, without the necessity of hardware in the field.

3.4. Therefore, the proposal (GBI plus SupPlantME) is a new solution with the potential of disrupting the nature of access to high-end technology by smaller farmers who could potentially benefit from growing high yield vegetables with reduced use of scarce resources like water.

3.5. Although SupPlant's GBI solution package has been commercially available for almost two years with clients in 14 different markets worldwide, including China, Australia, Spain and Brazil, it has focused on testing its technology on fruits that grow on trees (mango, avocado, peaches, apples, etc). The prototype proposed herein for Paraguay, beyond testing and adjusting the solution to various variables including climate and soil conditions in the country, will test the solution to horticulture – starting with tomatoes to eventually include other fruits that grow on vines and root vegetables, grown both in the field and in greenhouses. The prototype will also test a new combination of GBI and SupPlantME.

C. Project Beneficiaries

3.6. The project is expected to directly benefit ~350 smallholder tomato farmers whose productivity is expected to increase by 5% to 10% in terms of quantity (economic return) while reducing water consumption by 5% to 20% (environmental return), depending on level of technology adoption. Public and private organizations will also benefit from the knowledge to be captured from the project. The knowledge product will highlight the adaption process of the smart irrigation solution to the Paraguayan context, input savings (water, electricity, fertilizer, human labor, etc.) and yield increase, and economics of commercializing the combination of GBI and SupPlantME.

3.7. On the scaling-up phase (beyond the completion of this project – see Scalability section below), it is expected to reach approximately 3,700 smallholder tomato and other agricultural producers that could potentially engage on climate smart horticultural production by making use of the affordable and accessible technology.

D. Project Components

3.8. Following the guidelines established in the document for the creation of the Line of Activity for Innovation Prototypes (RG-O1676), this project will be implemented in the following three components/stages: ***(i) Definition of the prototype*** – this stage will be executed in close alignment among Fundación Capital, SupPlant, IDB Lab, IDB's CSD/RND and other stakeholders, and culminate with the definition of the parameters of the experiment; ***(ii) Implementation of the experiment and data generation*** – this stage will be executed by Fundación Capital and SupPlant and will include experiment implementation, data generation and analysis, and extraction and dissemination of lessons learned with identified scale-up partners; and ***(iii) Evaluation and knowledge dissemination stage*** – this stage will focus on evaluating the prototype results and dissemination activities within IDBG and identified private and public scale-up partners. The project execution period is estimated to be less than 18 months.

3.9. **Component I**: Definition and design of the prototype implementation considering local context in Paraguay The following activities will be conducted: GBI and SupPlantME solutions' final design/adjustment to the local context in Paraguay; selection of smallholder farmers for the first cohorts; data definition, collection and dissemination strategy; qualitative and quantitative diagnosis (baseline) of the current production practices of the project's target beneficiaries; design of training strategy for smallholder farmers that implement the solutions; and monitoring strategy. The execution of this component will result in a document compiling the definition of the prototype parameters and a detailed terms of reference for Fundación Capital to subcontract SupPlant for the next component.

3.10. **Component II**: Implementing the experiment in two production cycles of tomato cultivation. For the execution of the component, Fundación Capital will subcontract SupPlant. Such subcontract, however, does not exempt Fundación Capital from the responsibility of meeting project deliverables and targets. This component will include the following activities: set-up of GBI and SupPlantME solutions in situ; accompanying and monitoring smallholder farmers who implement the solutions (trial group and control group); data collection and analysis throughout the two production cycles to calibrate the algorithms; initial qualitative and quantitative assessment on smallholder farmers' productivity (both in terms of input usage and of output tomato production); and preparation of technical reports (intermediate at month 6 and final at month 12). Expected results of this component are: (i) the first cohort of 20 smallholder tomato farmers are fully trained and have started adopting the technology in their production cycles, serving as benchmark for the subsequent cohorts, and (ii) 12 training workshops.

3.11. **Component III**: Evaluation and dissemination of learning. This component will produce a final report/publication on key results and learning, which will be disseminated among key stakeholders and identified scale-up partners. In case that Fundación Capital and SupPlant become interested, based on the project results, in launching a joint venture to bring the solutions to market, this component will also produce a scalability plan (a deck).

E. Project Results and Impacts

3.12. In terms of productivity of tomato cultivation, the project sets the goal of increasing the yield per plant from the current level and/or lowering the use of inputs. It is expected that the prototype results in an increase of yield both in terms of quantity (by between 5% and 10%) and quality.

3.13. The project also targets environmental impacts, in particular, building up small producers' resilience and adaptation to climate change. Currently, there is a lack of data on water

usage in agriculture, particularly, at small producer level[5]. The project plans to incorporate environmental data collection strategy and define indicators to be tracked (for example, not only water usage, but also fertilizer usage). The tested prototype is expected to save between 5% and 20% of the water usage of the project beneficiaries.

3.14. In addition to the reduction in water usage, the GBI and SupPlantME solutions are expected to allow smallholder farmers to optimize other agricultural inputs such as electricity, fertilizer and labor. The savings in energy, fertilizer, and labor input will be tracked during the prototype implementation.

3.15. Given the active role and high participation of women in small family farms, the project will seek to integrate a gender transformative approach with tomato producers involved in the pilot through Fundación Capital's ongoing gender initiatives[6] and through current government programs[7] focusing on empowerment of women in small farms.

3.16. The project is aligned with the following United Nations Sustainable Development Goals (UN SDGs): SDG Goal 1 – No Poverty; SDG Goal 2 – Zero Hunger; SDG Goal 5 – Gender Equality; SDG Goal 6 – Clean Water and Sanitation; SDG Goal 8 – Decent Work and Economic Growth; SDG Goal 9 – Industry, Innovation and Infrastructure; and SDG Goal 13 – Climate Action.

IV. Alignment with the IDB Group, Scalability, and Project Risks

A. Alignment with the IDB Group and IDB Lab Approach

4.1. The proposed solution is a good fit for IDB Lab strategy for the following reasons: (i) It aligns to Climate Smart Agriculture (CSA) area – "farm level solution" in particular, as it directly improves productivity by making technology both affordable[8] and accessible[9] to small producers that can seize market opportunities with sustainable farming practices. (ii) It leverages private sector innovation and technology (SupPlant, one of the leading agtech companies in Israel). (iii) It directly addresses "last mile" clients by partnering with a local entity, Fundación Capital, and taking advantage of its network among public and private players and its track record of supporting vulnerable small producers.

4.2. This project strengthens IDB Lab's portfolio[10] on CSA by adapting internet of things (IoT) and artificial intelligence (AI) to address the productivity gap, one of the biggest challenges to feed increasing population given less available resources. The proposal is aligned with

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[5] There is no data on water usage by crop in Paraguay. AQUASTAT by the Food and Agriculture Organization (FAO) has statistics of water usage for agriculture in Paraguay estimated at 1,897 million m^3 in 2012.

[6] Under a recent collaboration agreement with the International Development Research Centre (IDRC), Canada, Fundación Capital will integrate gender transformative approach into all its projects in Paraguay. The approach is set to tackle economic vulnerability and other gender-based constraints such as domestic violence, lack of intra-household decision making power and limited reproductive health rights.

[7] The Paraguayan Government through the Ministry of Women are fostering initiatives and promoting laws related to public policies for rural women, seeking the adequacy of the legal framework and women empowerment in the rural sector.

[8] A license cost is typically US$1 per month during crop season.

[9] According to 2017 data from SENATIC – Secretaría Nacional de Tecnologías de la Información y Comunicación, 94.2% of households in the Oriental Region has access to internet through smartphones.

[10] For example: "E-kakashi" – The Agriculture AI Brain project in Colombia (CO-T1448), Umitron: Turning Aquaculture into a Science in Peru (PE-T1406/PE-L1243), and Precision Agriculture in Suriname (SU-T111).

the forthcoming new IDBG Country Strategy with Paraguay (2019-2023) that aims to "support the productive and sustainable transformation of the country, with economic and social inclusion". In addition, the project is aligned with IDB's sector framework: "Modernization of agriculture services in Latin America and the Caribbean improves productivity and preserves the environment."

4.3. This project has been designed under the new framework of IDB Lab's Line of Activity for Innovation Prototypes (RG-O1676). Therefore, this operation incorporates specific agile procedures as outlined in the document RG-O1676, which include: (i) executing the project through a maximum of three service provision contracts; and (ii) approval by delegated authority. This project also complies with the requirements established under the Line of Activity, including the support of the IDB or IDB Invest (CSD/RND specialist in COF Paraguay is a team member) and the alignment with the UN SDGs.

B. Scalability

4.4. The path to scale is planned in three phases. Beyond the project completion under the framework of the Line of Activity, the first step will be to amplify the base of GBI and SupPlantME users among tomato producers by partnering with the Ministerio de Agricultura y Ganadería (MAG) and engaging on the National Plan for Tomato (Plan Nacional del Tomate – launched by the national government in February 2019). A partnership with Crédito Agrícola de Habilitación (CAH) that provides affordable loans targeted to small producers is expected to encourage them to implement the smart irrigation solution.

4.5. The second step will be to provide involved smallholder farmers with consulting services regarding product commercialization. This will allow farmers to seize business opportunities with higher quality products in order to access specialty markets (supermarkets, restaurants, etc.). For this phase, a joint venture (a company) may be incorporated by Fundación Capital, SupPlant and/or other interested investors, through which sales of the technological solution and consulting services will be made. As a result of the prototype, it is expected to obtain enough data, inputs and insights to update the business plan for the scalability and full commercialization phase.

4.6. With the updated business plan, Fundación Capital and SupPlant will plan more clearly to move into a full commercialization phase with wider revenue streams: not only selling the smart irrigation solution to farmers through GBI and SupPlantME, but also selling other essential inputs and providing consulting services. The updated business plan will identify other fruits and vegetables for the replication and expansion of the solution service coverage.

4.7. The updated business plan as a result of the project is expected to present an investment opportunity for IDB Lab and/or IDB Invest. According to preliminary analysis, the to-be-established joint venture/company expects to consolidate its business within three years and reach annual sales equivalent to US$300,000 per year.

4.8. The third step will be to apply the same set of technologies for other high value crops such as pepper, strawberries and green vegetables. In Paraguay there is an unsatisfied demand for horticultural fruits and vegetables with high added value. This represents a business opportunity for many small-scale farmers who have basic productive resources, but do not have access to CSA production schemes. The initial target will be crops with unsatisfied demand in the domestic market, but then shift into high value crops with export potential.

C. Project Risks

4.9. **Data calibration risk.** There is a risk that data calibration for the smart irrigation system takes longer time than expected, requiring multiple cropping cycles. According to SupPlant's past experience, data calibration is expected to be done after two cropping cycles, enabling the project to deliver initial results during the project execution period.

4.10. **Lack of connectivity.** The proposed technology works with IoT and requires internet networks. The proposed experimental field has access to sound networks close to the country's capital.

4.11. **Market risk.** Tomatoes have a complicate price structure that fluctuates according to import permits, local production and yields. Prospect clients could face economic impact due to price downfalls. To mitigate this in mid-term, the scale-up phase includes consulting services on product commercialization so that smallholder farmers are better informed on the market condition and gain access to more stable markets and prices.

4.12. **Farmers' ability to adopt newly available technologies.** It is a common phenomenon that farmers do not adopt innovations simultaneously as they appear on the market. Supports through a non-reimbursable technical assistance through the Line of Activity is needed to convince and train as much farmers as possible during the execution period.

V. Summary Budget for Project Financing

5.1. The project will have a total budget of US$235,000, of which IDB Lab will provide up to US$150,000 (64%) through the Facility RG-O1676, Line of Activity for Innovative Prototypes. Fundación Capital and Supplant will be providing, in aggregate, up to US$85,000 as counterpart funding.

(US$)	IDB Lab	Counterpart		Total
		Cash	In-kind	
Component I:	800	-	5,150	5,950
Component II:	141,700	6,800	48,000	196,500
Component III:	7,500	900	1,800	10,200
Administration	-	19,050	800	19,850
Contingency	-	-	2,500	2,500
Total	150,000	26,750	58,250	235,000
% of Financing	64%	11%	25%	100%

VI. Executing Agency and Other Partners

6.1. IDB Country Office in Paraguay, through IDB Lab, will be the executing agency following the guidelines established in the document for the creation of the Line of Activity for Innovation Prototypes (RG-O1676), seeking a simplified execution mechanism where it will execute a maximum of three contracts.

6.2. **Fundación Capital**, an international purpose-oriented private company headquartered in Colombia and with office in Paraguay, is a pioneer in financial inclusion. It also incubates innovation solutions to fight against poverty through access to education, capital and productive opportunities. It operates in Paraguay with key partners from public, private and international donors in wide range of projects including promoting income generating opportunities for vulnerable smallholder farmers. More recently, Fundación Capital had been awarded on the first round of calls from Co-Impact to support the Government of Paraguay from 2019-2023 on lifting 75,000 families out of poverty. Fundación Capital's international outreach and network is its "assets" to seek proven solutions scaled up.

6.3. **SupPlant Ltd.** is an Israeli company organized and existing under the laws of the State of Israel. It has developed innovative irrigation systems based on the use of AI, IoT and cloud technology. It operates in several countries and with different crops providing promising results in terms of increasing quality and yields while reducing key inputs such as water for irrigation, fertilizers and workload. It currently has ongoing projects in Mexico, Panama and Peru, but these projects are for fruits that grow on trees (e.g. mango). This prototype presents a unique opportunity for testing SupPlant's new product offering (GBI plus SupPlantME) and applying for fruits that grow on vines and root vegetables.

6.4. The founder of SupPlant is Mr. Zohar Ben Ner. The current shareholding structure of SupPlant is: Mr. Ben Ner with 65%, SNI Land Management Inc. with 10%, and the remaining 25% allocated to various employees through the employee stock ownership plan (ESOP). SNI Land Management Inc. is a Panamanian company with whom SupPlant is conducting several projects in Panama. Recently, in August 2018, Mivtach Shamir Holdings Ltd., a well-known Israeli finance company, entered into a US$3 million convertible note financing transaction with SupPlant.

6.5. Besides the unique technological developments, the main factor that attracts clients to adopt SupPlant's solution is the human support behind it. SupPlant's support department consists of experienced agronomists who monitor all of customers' plots and provides them with periodic professional reports on their fields and on the actions taken by their system.

VII. PROJECT EXECUTION MECHANISM

7.1. The project will be executed by Fundación Capital under a consulting service agreement to be signed with IDB Lab. The draft terms of reference for the consulting service are found in Annex III. As mentioned in Annex III, Fundación Capital will subcontract SupPlant as technology service provider. The terms of reference for such subcontract will be drafted by Fundación Capital and submitted to IDB Lab for its approval ex-ante and will consider IDB's current applicable Procurement Policies.

7.2. **Project Summary Report (PSR):** Fundación Capital is responsible in presenting a PSR to IDB Lab within 30 days following the end of each semester or more frequently if required by IDB Lab. The PSR must include information on the implementation of the project, results obtained and contribution to reaching the project objective as presented in the Result Matrix (Annex I) and other planning instruments. Additionally, the document must include information on challenges encountered during the implementation period and possible paths to address these challenges. Within 90 days of finishing the execution period, Fundación Capital will present to IDB Lab a Final PSR giving priory to reporting on key results achieved, a sustainability plan, scaling up strategy and lessons learned.

7.3. **Period for execution and disbursement.** The execution period for the project is 18 months and the disbursement of IDB Lab funding will be completed within 24 months. Upon signature of the consulting service agreement and approval of the final document deliverable related to Component I, IDB Lab will disburse 60% of its contribution to Fundación Capital. The remaining IDB Lab funding shall be disbursed upon approval of the intermediate technical report (deliverable of Component II) (20%) and upon approval of the final report publication on key results and learning (deliverable of Component III) (20%). The table below indicates disbursement periods and deliverables.