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OPPORTUNITIES AND CHALLENGES FOR THE GENERATION OF SUSTAINABLE AGTECH STARTUPS IN LATIN AMERICA AND THE CARIBBEAN

White Paper

SUSTAINABLE AGTECH CHALLENGE

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Abbreviations and acronyms

AAPRESID: Argentine Association of Direct Sowing Producers
APL: Acuerdo de Producción Limpia
ASC: Aquaculture Stewardship Council
BCR: Bolsa de Comercio de Rosario
BOD: Biochemical Oxygen Demand
COD: Chemical Oxygen Demand
ECLAC: Economic Commission for Latin America and the Caribbean
ESG: Environmental, Social and Governance
FAO: Food and Agriculture Organization of the United Nations
FUCOA: Fundación de Comunicaciones, Capacitación y Cultura del Agro
GEM: Global Entrepreneurship Monitor
IDB: Inter-American Development Bank
IFAD: International Fund for Agricultural Development
IFPRI: International Food Policy Research Institute
IICA: Inter-American Institute for Cooperation on Agriculture
INTA: National Institute of Agricultural Technology (Argentina)
IoT: Internet of Things
ITC: International Trade Center
LAC: Latin American and Caribbean
LATAM: Latin America
MPV: Minimum Viable Product
NECI: National Entrepreneurship Context Index
NES: National Expert Survey
NGOs: Non-profit organizations
OECD: Organisation for Economic Co-operation and Development
OLS: Ordinary Least Squares
RTRS: Roundtable on Responsible Soy
SDGs: Sustainable Development Goals
SMEs: Small and Mid-size Enterprises
UNCTAD: United Nations Conference on Trade and Development
UNEP: United Nations Environment Programme
UNIDO: United Nations Industrial Development Organization
VC: Venture Capital
YLI: Yield Lab Institute

#1

Objectives and research focus

This white paper aims to inform policymakers about the state of Sustainable AgTech in the LAC region and suggest policy recommendations for supporting AgTech companies to transform to the third stage. As an industry, Sustainable AgTech is still in its infancy, mainly consisting of SMEs and startups.

These companies are innovative and dynamic with the massive LAC agri-food system, which is very heterogeneous among countries in terms of scale, sophistication, and contribution to the economy (World Bank, 2020). While large farms account for much of the commercial agribusiness that dominates agricultural powers such as Brazil and Argentina, more than half of the region's food production comes from smallholder farmers (Rabobank, 2015). This means that for the Sustainable AgTech sector to be successful, solutions must address sustainability concerns at the appropriate level while ensuring the benefits of technologies are shared by stakeholders of all sizes.

The challenge for the policy community is to produce an **innovation ecosystem** that enables Sustainable AgTech to be impactful at scale. This requires an in-depth understanding of what AgTech start-ups are doing, the extent to which they are driving sustainability and their needs. Then, with an ambitious policy, AgTech start-ups can be encouraged to be the force needed to drive sustainability in agri-food values chains. The LAC region can become a significant player in Sustainable AgTech while respecting planetary boundaries and allowing its rural populations to reap the rewards (Valoral Advisors and Quarterra, 2016). In this context, the paper will specifically focus on SMEs and startups producing and utilizing technology-driven solutions to address sustainability problems in LAC agri-food systems. In order to support targeted and effective policy, the following aspects of AgTech SMEs and start-ups will are analysed:

I. Agricultural verticals being targeted and the types of technologies that are being deployed in solutions.

II. Start-up demographics (including the gender balance, age, and level of education of teams).

III. Contributions to the SDGs examining which are targeted by AgTech startups and the specific mechanisms used to promote environmental and social impacts.

IV. Dimensions for business development: surveying opportunities for growth and scalability in LAC markets and perceived obstacles among enterprises, e.g., access to finance or markets.

The results will be inductive due to the relative youth of the Sustainable AgTech sector and the scope of the LAC region. Policymakers will benefit from information on AgTech solutions and businesses that specifically address unsustainable agricultural practices in the LAC region.

Drawing from the analysis of the current state of the Sustainable AgTech sector, the policy recommendations of this paper will focus on building a supportive innovation ecosystem that maximizes the innovation and impact of AgTech startups. This proposal means developing policies that target all relevant actors for Sustainable AgTech, for example, through public-private partnerships and engagement with academia, among other types of relationships. A wide variety of expertise and resources could become available to Sustainable AgTech start-ups. At the same time, other types of policies can drive uptake among industrial and smallholding agricultural players.

a. Data and methodology

Los datos utilizados en este estudio provienen de The data used in this study comes from various sources, whose obtaining, analysis, and validation was transversal to the entire research process. First, by doing a literature review of the sustainability challenges of agriculture and food production in LAC and of the role that start-ups in AgTech could have in providing solutions that contribute to overcoming the environmental sustainability challenges. Second, by supporting the design of the questionnaire for the **Sustainable AgTech Challenge**, which aimed at supporting "innovations and startups with products, services or technologies that are contributing to fight the causes and impacts of climate change, thus creating more regenerative, sustainable and inclusive agri-food systems".[1]

This questionnaire, answered by each participating applicant to the Challenge, included questions about the team's socioeconomic characteristics (e.g., age, gender composition, education level, among others), company customers, financials, their value proposal, the environmental and social impact of the company, the problems and limitations for new ventures in the AgTech sector, among other topics. In this way, the research team was able to build a database with the companies' responses. Third, by conducting interviews with startups[2], stakeholders, experts, academics, and venture capitalists[3] to obtain insights and deepen the knowledge about the AgTech in LAC and the factors that drive or hinder the growth of startups in this sector. Regarding the data analysis obtained from the Sustainable AgTech Challenge, traditional descriptive statistics and regression methods were used.[4][5] It is important to note that a decision was made to use the maximum number of valid answers for each question, regardless of whether the company had answered the entire questionnaire or not. This decision stems from the fact that less than half (47%) of the 115 participants of the Challenge completed the questionnaire thoroughly.

1 For more details, see: https://www.sustainableagtechlac.com/.

2 The interviewed startups were Agtools, Beevai, BloomsPal, Cladonia, ClearLeaf, Climate Sense, Kilimo, Mi Terro, OSE Systems, SAVR PAK, The Earth Says_, and Ucrop.it.

3 For more details, see the Appendix.

4 All tables and figures, with exceptions, are shown in the Appendix.

5 Given the fact that Challenge data comes from a small non-random sample, it is important to note that results obtained by the mentioned statistical methods are representative of the group of companies that applied to the Challenge and can not be extrapolated, necessarily, to the whole population of startups in the AgTech sector. From a technical perspective, this issue is known as "selection bias".

#2

Introduction

a. Sustainability challenges of agri-food systems: the case of Latin America and the Caribbean

The food journey is a central part of the agri-food system, from farm to fork, with the intermediate stages of primary production, harvesting, processing, packaging, transportation and distribution, trade, retail, consumption and waste disposal. The output of this system is also non-food products such as cotton, forestry, biofuels and players, and their economic activities that have a role in obtaining agri-food products (FAO, 2021). The life and health of every person in the world depend on agri-food systems, which also underpin cultures, economies and human relationships with the natural world.

However, many of the world's food systems are fragile and do not fulfil their functions. These trends were expedited by the COVID-19 pandemic, with a 20 per cent increase in the world's population facing hunger in just one year – the number of people that struggle for life and health reached 811 million in 2020 (FAO). Against this backdrop, a triple planetary crisis of climate change, nature and biodiversity loss, and pollution and waste follows a worrying trajectory (UNEP). Food production, supply chain, and consumption are affected by the adverse impacts of climate change and disruptions associated with natural disasters. At the same time, food systems contribute to one-third of greenhouse gas emissions, up to 80 per cent of biodiversity loss and use up to 70 per cent of freshwater (United Nations, 2021). Sustainable agri-food systems that nourish everyone for health and wellbeing produce in harmony with nature and facilitate inclusive, transformative and equitable recovery are urgently needed to achieve the 2030 Agenda for Development.

As home to 57% of the world's primary forests, with its extensive savannahs, the Latin American and Caribbean region (hereafter LAC) is the world's largest producer of ecosystem services, generating 35% of the world's water and playing a critical role in mitigating climate change (World Bank, 2020). This region accounts for 14% of global production and 23% of the world's agriculture and food products exports, which will rise to an estimated 25% in 2028 (OECD/FAO, 2019). While having fed a fast-growing population and contributed to economic development, the agri-food systems in the region have come at the cost of environment and health, with the sustainability challenges intertwined at the global and regional levels.

LAC agriculture uses over one-third of the region's land area, consumes nearly three-quarters of the region's freshwater resources, and generates almost one-half of the region's greenhouse gas emissions (World Bank, 2020). The reliance on natural resources creates a resilience challenge for the regional agri-food system in a context of growing food demand. At the same time, it puts global public goods in danger. For instance, the Amazon basin, the forests of Central America, and other biomes in the Andean region and the Southern Cone host vast stores of biodiversity, sequester large amounts of carbon and perform atmospheric regulatory functions that affect weather patterns worldwide (IDB, 2021). Despite the consistent food production surpluses, millions of people in LAC regularly go hungry or suffer from malnutrition and related diseases. Food insecurity affected 20 million more women than men in 2019, and the gap is projected to be even more prominent after the pandemic (ECLAC, FAO and IICA 2021). Behind the resource use, production and distribution models, it is a structure of regional agri-food systems consisting

of a small number of large establishments and a large number of small ones, which evolves as part of the global value chain and responds to the cycles of the world economy (IFPRI, 2021). Innovations and holistic approaches are needed for the LAC agri-food system to improve environmental sustainability in the long term.

b. Transforming agri-food systems: technology opportunities

Technologies and new business models, as enabled by technology applications throughout all stages of the value chain, have offered transformative opportunities for the global agri-food system to meet sustainability challenges. In the past decade, several technologies are gaining importance with an increasing number of use cases in agri-food systems.

- **Digital technologies:** the rapid development in sensors, mobile devices, satellite communications and 5G networks, cloud computing and artificial intelligence has fundamentally changed the landscape of data generation, processing, transferring and utilization. In the agri-food context, from precision agriculture, supply chain tracking, to smart bins, the growing business applications of digital technologies have illustrated the technological readiness to bring innovative solutions to sustainability challenges.

- **New materials and inputs**: advances in polymer technologies have meant that organic waste and biodegradable materials can be used to produce materials for essential polymers (UNEP, 2017). These materials are increasingly used to produce polymers for commercial use, such as in packaging, produced from biomass and industrially compostable. In agricultural inputs, biochemical advances have led to non-toxic herbicides and fertilizers that decrease environmental degradation (UNEP, 2021). Finally, these 'smart' materials have recently led to innovations such as 'active packaging', which can regulate exposure to humidity or temperature changes (UNEP DTU, 2021).

The use cases of technologies are often the result of their combined applications. For instance, digital platforms and automation can significantly speed up engineering biology to unlock the commercial potential of innovative materials (OECD, 2020). On top of those use cases, opportunities rise for changing business models behind the current agri-food value chains. Digitalization enables circular economy, sharing and user-based models which can optimize processes to reduce cost, waste and environmental impacts (United Nations, 2020). The "Farming as a Service" model provides technological solutions designed for agriculture, converting fixed costs into variable costs when charging for services such as data collection by sensors and machinery rental (OECD Forum, 2019). By converting daily records of agriculture activity data into financial credits, digital platforms offer access to financing and tailored services to empower. Such innovations can empower smallholder farmers and women who usually suffer from asymmetries in agriculture information, knowledge and financial resource of the value chain and, importantly, enable them to produce more sustainably based on data-driven intelligence (United Nations 2020; ITU and FAO, 2021). Digital food waste management is another example that can give a more precise measure of consumption that can alter the market mechanism from simply producing more to producing based on demand (GGKP, 2021).

Overall, technology applications and business models are growing in number and type in key value chains. For instance, it can help act on reducing food loss and waste, make more efficient use of natural resources and agricultural inputs, fight against climate change, encourage a shift to plant-based diets, and contribute to the creation of new value chains based on biomass waste. Moreover, they can be critical in restoring ecosystems on a large scale which offers multiple benefits, being one of the most recognised and efficient ways to offer nature-based solutions to social challenges.

c. The AgTech sector as players behind the technology and business trend

The deployment of technologies in the Agri-food value chain and the rise of new business models has led to the popularity of a new buzzword: 'AgTech'. AgTech is broadly defined as the set of unique technologies or a combination of innovations that are employed in the global industry of food, agriculture, livestock and other bio-based activities. Over time, the goals and objectives of the group of companies and entrepreneurs deploying AgTech have evolved.

The **first stage** of AgTech applications aimed to increase the competitiveness of agricultural companies in global markets. New technologies were used for efficiency gains and reductions in marginal costs, allowing farmers to produce more food at a lower cost. As a result, AgTech was a driving force behind the 'Green Revolution' of the mid-twentieth century, when the global food supply increased at a rate higher than the growth of population and the growth of cultivated land, generating a significant increase in productivity. (FAO et al., 2013).

The **second stage** of AgTech applications uses technologies to improve sensitivity to consumer demands for information of agri-food products; the sources, the produce and processing methods, health and nutrition implications, the resulting changing determinants of consumer preferences and maximizing the profit through targeted sales strategies. Companies track their supply chains and support their transparency statements through data collection and information management systems (ITC, 2015). Through social media and digital markets, companies engage with consumers, generate insights on consumer preferences and influence consumer choice through tailored advertisement and sales strategies (UNCTAD, 2019).

The **third stage** AgTech applications are based on technology to drive sustainability by reorganizing inputs and priorities in new business models at all stages of agri-food value chains. Ecosystem level changes are making this essential: incentives of impact investment, increasingly stringent ESG regulations and stakeholder pressure for agri-food value chains to internalize environmental impacts (Freshfields Bruckhaus Deringer LLP, 2021; IAIS, 2020). While the first and second stages of AgTech had not primarily focused on their social and environmental impact, the third stage directly seeks sustainability. Therefore, the success of the AgTech sector in these aims should be measured against the relevant SDGs.

The **Sustainable AgTech** sector refers to the group of companies and businesses at the third stage that aims at improving people, nature and prosperity as defined by the 2030 Agenda for Development through technologies and innovative business models. Throughout this document, those technologies and business models are referred to as Sustainable AgTech.

#3

Activity and characteristics of startups and innovators in the AgTech sector

The agri-food systems diversity of LAC makes the region the natural candidate for the emergence of technological innovations that provide sustainable solutions designed for the agri-food chains of the region. The AgTech experts consulted agree that currently, there is an immense opportunity for local startups since the local market is large and will continue to grow at a constant rate in the coming decades. They also agree that innovations developed for other regions of the world will not be able to compete with the local ones because, to do so, they would have to make great adaptations. Similarly, they consider that nowadays, there is much money seeking to invest and that producers need solutions to meet new challenges and risks, so startups may be the ones to provide those solutions.

Nevertheless, the AgTech experts stated that although the market has been enthusiastic about agri-food technologies, the focus on sustainability in the AgTech sector is still in its infancy. The diversity of LAC's agri-food systems could be an obstacle to the potential of new local businesses since it makes it difficult for entrepreneurs to develop successful solutions that can specifically respond to the different needs of producers in the region while remaining profitable and scalable. As a result, the adoption of specific solutions for different verticals could be delayed. This may explain why most AgTech startups have focused on general solutions. By being too general, they do not add value to the sophisticated producer, while the unsophisticated producer does not gauge the benefits of the solution they offer. Perhaps, what happens is that part of the innovations is not very disruptive but simply incremental. This observation would indicate a problem of product adaptation to the market, i.e. adequacy of the product or the solution to the market's needs. A phenomenon that in some LAC countries could be reinforced by indiscriminate state support policies, which facilitate the emergence of new ventures, but partially cancel the market incentives to produce disruptive solutions.

a. What are startups doing, and what solutions are they developing?

Among the enterprises mapped in LAC by IDB Lab (2019), 55% of startups offer general agriculture and food solutions, while 45% aim at specific verticals such as speciality crops, fruit and vegetables, and fish farming forestation and bioenergy. The focus of general innovations has been within the farm, accounting for 87% of the total and particularly in the digitalization of rural work -field, administrative and commercial- which reaches 67% of total enterprises.

According to the study mentioned above, Big Data and Precision Agriculture concentrate 30% of the innovations, like Acronex and SIMA in Argentina and Verge and Agrosmart in Brazil. Secondly, Management Software is the technology used by 23% of innovations; E-commerce Platforms concentrate 14% of these, such as Grao Direto in Brazil and Agrofy in Argentina. Genetics and New Crops represent 12% of the innovations, with companies like Bioheuris in Argentina; followed by those for the Mechanization of Work (7%); Innovative Foods (6%) such as Not Co in Chile; Logistics and Food Distribution (5%), such as Circular in Argentina; Bioenergy and Biomaterials (2%), such as Hiamet and Albardón Bio in Argentina; and, finally, New Production Systems (1%).

The focus of solutions in the AgTech sector has shifted towards more specific proposals this century. According

to some industry experts, the AgTech phenomenon had its first wave of innovation in 2013. In that year, multinational company Monsanto acquired The Climate Corp, which marked the promise of the digitalization of agriculture since technologies in development at that time focused on increasing the producer's productivity only. The fall in the price of raw materials at the end of the first decade of this century made the promise of increasing productivity no longer interesting for the producer, and the problem shifted towards marketing, the search for new market niches and financing. These new conditions triggered a second wave of innovation based on changes in eating habits and consumer preferences, the milestone of which was the IPO of Beyond Meat, a plant-based food company, in May 2019. This new wave of startups focuses on improving marketing, guaranteeing the traceability of the agri-food chain and responding to the new habits of consumers. In 2020, the COVID-19 outbreak revealed that the issue was not so much increasing productivity or improving marketing but ensuring a secure and resilient system across all value chains. In this new paradigm, startups have the new opportunity of providing information on traceability and food safety to consumers while allowing producers who have already adopted these sustainable production practices easier access to consumers whose preferences are better aligned with caring for the environment and social inclusion; thus connecting, in a value-add way, new demands with supply.

Although companies with a more generalist proposal still prevail, it is possible to identify some characteristic features of companies with more specific value proposals. In the first place, those countries with the most significant entrepreneurial activity also have a greater degree of specialization in AgTech entrepreneurship solutions. As the AgTech ecosystem becomes more mature, like in Brazil and Argentina, startup solutions are more specific, as entrepreneurs better identify the needs of producers and consequently develop more precise solutions to address these needs. In addition, as competition becomes solid, many companies focus their efforts on less exploited niches or on projects that require more excellent experience from the entrepreneurial team or more sophisticated developments to circumvent entry barriers to the market where competition is fierce. Argentina and Brazil have a similar diversified profile: a broad base of general innovation and a growing focus on extensive agriculture and livestock areas. At the same time, specific solutions are being developed for other sectors, including permanent crops, afforestation, food and beverages, and others. Within the first group -general innovation for extensive agriculture-, there are rural mechanization solutions such as Icrop and SIMA in Argentina, precision agriculture such as Auravant and Acronex in Argentina; and, within the second group -including permanent crops, afforestation, food and beverages-, vertical farm solutions such as Pink Farms in Brazil, frozen foods as Frizata in Argentina, organic drinks such as Las Brisas in Argentina and innovative foods such as Tomorrow Foods in Argentina can be named.

Instead, Chile and Peru, given their prominent fruit sectors, particularly capital and technology-intensive, show a high concentration of innovations in permanent crops. Hence, in those countries, innovations in irrigation technologies are highlighted, as well as biological solutions for the control of pests and diseases of permanent crops (e.g., PolyNatural in Chile). Uruguayan companies have focused on innovations in the livestock sector since this country is a leader in this area (e.g. Chipsafer). On the other hand, in Mexico and Colombia, innovations in the vegetable area have greater weight, both in production and in sales and distribution, with examples such as Frubana (Colombia) and Jüsto (Mexico), as well as some solutions related to fair trade (IDB Lab, 2019). Environmental issues are not as important in these markets as inclusion and fair trade are, which probably finds its origin in the extractive and agricultural exploitation characteristics that these countries had during the colonial era.

b. How are they doing it? What technologies are they using?

The solutions developed by AgTech enterprises at LAC are mostly technologies supported using Remote Sensing such as Nexto in Brazil, or Smartium and Sensify in Argentina, Geolocation and Mobile Technology such as Auravant in Argentina, while technologies linked to Artificial Intelligence, Big Data, Blockchain and Robotics are still in the earliest stages of development. Among the startups working with these technologies Ecotrace in Brazil, Neltume in Chile, or Ucrop.it and Deepagro in Argentina can be highlighted (IDB Lab, 2019). One possible explanation for the difference among the deepening levels in the technologies is that sensors, geolocalization and mobile are more mature

technologies, born in the 1980s that were already used in other industries such as refrigeration, military and security. Hence it was pretty easy for the AgTech startups to apply those technologies to the agricultural space. On the other hand, Blockchain, Robotics, Big Data and Artificial Intelligence are more recent technologies.

Within this portfolio of technologies used for AgTech innovation, a set of digital solutions -widely used across virtually every economic sector- has been the primary tool for entrepreneurs in the region. The following table shows the different digital technologies most used by the world of AgTech entrepreneurs in order of importance according to IDB Lab (2019).

Table 1. Digital technologies most used by the world of AgTech entrepreneurs

TECHNOLOGY	DESCRIPTION	SOME STARTUPS
Remote Sensing	Remote sensing takes different measurements or observations of soil and crops over time, allowing conditions to be analyzed and decisions to be made in real-time.	Smartium Sensify Acronex
Geolocation	Geolocation is a popular technology because it allows visual representations of information about specific locations.	Auravant Terramagna Kilimo VOA
Mobile Technology	Mobile technology can be potent in helping producers access real-time market and climate information and allow access to management solutions and financing platforms.	Ucrop.it Circular
Internet of Things (IoT)	Soil sensors, cameras, weather stations, and other instruments that collect information on environmental factors and agricultural activities and send information to processing systems to analyse and generate prescriptions.	Smartium @Tech

(Table continues on next page)

Big Data	Massive volumes of information from multiple sources, usually obtained through Internet of Things solutions, that can be captured, analyzed and used for general predictive analytics for agricultural activities and for real-time decision-making.	SIMA Eiwa DigiRodeo Croper
Artificial Intelligence	Artificial intelligence applications include robotization (autonomous robots to perform different tasks), soil and crop monitoring (computer vision and algorithms for processing information for soil and crop monitoring) and predictive analytics (learning models to evaluate different factors and generate predictive analytics.)	Deepagro microTERRA
Blockchain	Blockchain technology in agriculture has multiple applications, including traceability along the agricultural and food logistics chain.	Carnes Validadas dIGIrODEO
Robots	The use of robots in agriculture aims at the automation of certain tasks and processes, as well as the development of autonomous equipment for rural activities.	Saga Robotics VOA

Source: own elaboration based on the categorization of BID Lab technologies (2019)

Note 1: remote sensing, geolocation and mobile technology are among the most used technologies, while the use of Artificial Intelligence, Blockchain, Robotics and Big Data is still very emerging.

Note 2: It has to be taken into account that this classification of technologies does not show the interaction of many of them in the different uses. For example, Sensors are essential components of Internet of Things, which also contributes to spatial information.

c. Sociodemographic, geographic and economic profiles of the companies

(i) Empirical background in LAC

According to recent studies, most AgTech companies in LAC are founded by men; only 11% of entrepreneurial teams, in which IDB mapping was able to identify the gender of the founders, have female co-founders (IDB Lab, 2019). Within this small group, women's presence is relatively more significant in the i) genetics and crop and animal protection sectors, ii) innovative food products and services, and iii) bioenergy and biomaterials. This preponderance is partly explained in the entrepreneurial interest among women with training in biology, chemistry and veterinary medicine. There is also an entrepreneurial interest of women in food, which is reflected in their involvement in producing innovative food and the development of platforms to market from farm to consumer. Finally, there is also a particular interest in women for solutions focused on "Food Waste" and "Food Loss", an area in which women play a more active role throughout the world. Conversely, one of the areas with the lowest involvement of women is "Big Data and Precision Agriculture", which has the most significant digital technology component. This data is consistent with other observations indicating the less female presence in areas of high technological content (IDB Lab, 2019).

Brazil and Argentina currently lead the AgTech ecosystem in the LAC region. According to a mapping carried out by IDB Lab (2019), 51% of AgTech companies in Latin America are in Brazil, where the number of startups tripled in 2019, demonstrating the explosive growth of the industry in that country. On the other hand, Argentina represents 23% of the total number of startups. Chile is followed in importance, with 18% of all startups, while the rest divides between Mexico, Colombia, Peru, and Uruguay. The predominance of Argentina and Brazil is explained by the fact that their domestic markets are the largest, and by their local ecosystems favourable to technology-based companies, by the critical mass of professionals dedicated to intensive agriculture and by the trend towards greater specialization, with a view to more verticals. Other factors that make these two ecosystems the most advanced in the region include having an essential network of angel investors, accelerators, incubators and investment funds, and public-private collaboration. These synergies have allowed the regional industry to evolve faster than the rest of the region.

In a broad vision, as Peña (2021) mention, 'tecnolatinas (startups originated by latin entrepreneurs)' have geographic strategies that vary across Latin America. While Brazilian startups focus on their local market, startups from the rest of the region are forced to internationalize to scale. In Brazil, 83% of companies have local strategies and represent 74% of the value of the ecosystem. Instead, in the rest of the LAC region, half of the companies have local strategies but only represent 5% of the value of the ecosystem. he need for internationalization is explained partially by the asymmetry between Brazil and the rest of LAC in terms of domestic market size and the number of startups. In particular, the internationalization of startups demands playing in several different fields simultaneously, where regulations, markets and consumer preferences are idiosyncratic. Brazilian startups focused on the domestic market do not have to deal with these challenges but rather operate in a market whose size is more than enough for companies to scale without going to international markets. According to the experts consulted for this study, this general behaviour of the entrepreneurs in LAC countries occurs in AgTech startups for the same market reasons and taking into account the company's stage.

(ii) Description of the companies participating in the Challenge

1.- Gender and age of the founders/owners

Of the group of startups that provided information on the gender of their founding members, it is observed that most (64.8%) have a mixed composition, i.e., with at least one woman and one man within their founding team. Approximately a quarter of the companies are only men, while about 10% have an exclusively female conformation in their founding team.

In a more detailed look, it is interesting to analyze the composition by gender within each startup, for which the number of women is calculated as a percentage of the total number of founding members. First, it is noted that, on average, companies have a founding team made up of 35% women. However, this participation tends to be quite heterogeneous among startups, given that the

standard deviation as a percentage of the average[1] is 82%. Secondly, it is also noted that less than one-fifth of companies have a percentage of women above 60%. Indeed, women's participation in founding teams seems to have a right-skewed distribution, which statistically means that a significant concentration of companies has a relatively small percentage of founding women.

Another socioeconomic variable of interest to this report is the age of its members. At this point, the youngest member of the startups in the AgTech sector is, on average, 28 years old. If this variable is analyzed by age range, it can be observed that more than 85% of younger members have an age ranging from 20 to 39 years. Regarding the oldest team member, the average age is approximately 47 years old. Analyzed by ranks, it is observed that the distribution of this variable is more uniform than for the youngest members. In this sense, between 20% and 30% of the oldest members have an age that falls in any of the following ranges: 30-39, 40-49, 50-59, and more than 59 years old.

2.- Education

The education of startup members is another relevant variable for analysis since it gives us a general idea of their level of human capital, understood as the stock of knowledge and skills that contribute to their productivity. Firstly, focusing on the lowest educational level achieved by a team member, it is observed that half of the companies declare that this level is bachelor or equivalent, while an equally significant percentage (16.7%) claims to have reached a master level or equivalent. With these numbers, the lowest educational level of approximately two-thirds of startups is reasonably high. Secondly, if one analyzes the highest level of education achieved by a team member, it is noted that more than 80% of companies declare that this level is postgraduate, including master's degree (44.8%) and doctorate (38.9%).

3.- Countries and verticals

Naturally, it is interesting to study the geographical location of the startups that applied to the Challenge. At first glance, approximately 7 out of 10 companies are based in LAC, while the rest are elsewhere.

More precisely, it was analyzed in which specific countries the startups locate.[2] It is observed that four countries account for approximately 50% of the responses regarding where the companies are located, these being Argentina (15.9%), the United States (12.2%), Chile (11.2%) and Colombia (11.2%). Countries such as Brazil, Mexico and Peru have responses ranging from about 5% to 7%, while the rest have marginal shares (less than 4%).

On the other hand, it is crucial to analyze the distribution of the companies participating in the Challenge according to the category they applied, that is, the vertical in which their proposal is located (Proteins, Row Crops and Specialty crops).[3] The vertical with the most significant application by companies is Specialty crops, which accounts for almost half of the responses. In order of importance, it is followed by the Row Crops category, with a response rate of 37.6%. In contrast, the Proteins vertical accounts for startups' lowest number of applications (16.4%).[4]

If data crossed with the variables analyzed above, it is possible to obtain information on how verticals are distributed in different countries.[5] It is interesting to note that companies in Argentina and Brazil have a very similar composition, with more significant shares of

1 A statistical measure known as the coefficient of variation, which allows the degree of relative variability to be requested in a dataset.

2 Those companies that did not answer the question about where they are geographically located were assigned a country based on complementary information. Since each company can be based in more than one country, those with more than one answer are treated statistically as if they were different companies. In other words, distribution should be interpreted as a percentage of responses and not as a percentage of companies.

3 Since each startup could apply in more than one category, those with more than one answer are treated statistically as if they were different companies, in order to synthesize the information in the three categories mentioned.

4 If the distribution is analyzed in terms of percentage of companies, building mutually exclusive categories for companies' applications based on different combinations of responses, the following composition is observed: Special Crops Only (33.0%); Special Crops and Row Crops (25.0%); Row Crops Only (18.2%); Proteins Only (11.4%); Special Crops, Row Crops and Proteins (8.0%); Row Crops and Proteins (3.4%); Special Crops and Proteins (1.1%).

5 Given the fact that data is crossed from two variables that may have, simultaneously, more than one value per company, multiple responses on geographical location are converted into a single category indicating that the company is based in more than one country. This is not a major drawback, as only six cases are detected of companies that claim to be located in more than one country, which are also not concentrated in any particular country.

Row Crops and Specialty crops (more than 40% in each category) and lower weight of proteins (less than a fifth of the answers). This composition is different from that of Chile, Colombia and Mexico, where most (more than two thirds) of applications fall under the Specialty crops category, followed by Row Crops and Proteins. Peru, meanwhile, shows a concentration of responses in the Proteins category (42.9%), while the remaining two categories (which together represent 58.1%) have a similar weight to each other.

4.- Seniority of companies

The seniority of the companies participating in the Challenge allows us to explore, with certain limitations, to what extent the AgTech sector is a recent phenomenon in LAC. It is observed that more than three-quarters of the enterprises are less than or equal to four years old. Although the average age is approximately five years, the presence of a few companies with remarkably high values (which, in statistical terms, is known as outliers) means that the average is not an expected value of the distribution. For this reason, it is advisable to take a more robust indicator as a measure of central trends, such as the median. Assuming a value of three indicates that half of the companies are less than or equal to three years old. For its part, about 16% of companies are between five and nine years old, while only 8% of companies have ten or more years of existence.

On the other hand, it is worth asking in which LAC countries the AgTech phenomenon arose earlier. Considering the median seniority by country - for those with a reasonable number of responses (at least five) - Peru leads the ranking with seven years, followed by Colombia (six years), Argentina and Brazil (three years), and finally, Chile (1 year).

5.- Solutions implemented by companies

Naturally, it is important to inquire about the types of solutions that the startups participating in the Challenge are looking to implement.[6]

As a first approach, solutions were categorized according to the value chain stage to which they belong[7]. First, the responses are strongly concentrated in the first and last stages of the value chain. Specifically, Input Industry and Primary Production (stages located at the beginning of the value chain) concentrate nearly two-thirds of the responses, while the Waste Disposal category (end of the value chain) represents 20.0% of the responses. Second, Food Processing and Packaging also concentrate a great percentage of the responses (12.7%). Lastly, Food Service and Retail categories have marginal shares in total responses.

In the second place, company solutions were categorized from an innovation area perspective by following the IDB Lab (2019) criteria. At this point, the Genetics and New Crops category proved to be the most popular, with about a quarter of companies targeting such a solution. Innovative Foods follow it; then Mechanization of Work, Food and Irrigation Systems; and Management Software, with shares ranging from 12% to 14%. The rest of the categories show smaller shares (between 6 and 8%), although not substantially dissimilar.

By analyzing the type of solution per vertical, it is found that, in the case of Proteins, the most relevant categories are Innovative Foods (33.3%) and Genetics and New Crops (25.0%). This last type of solution is also the highest weight in Row Crops (21.2%, although it shares the first place with Mechanization of Work, Irrigation Systems and Food) and in Specialty crops (27.8%). Likewise, the categories Big Data and Precision Agriculture; Logistics and Food Distribution; and New Production Systems are also relevant for Row Crops, with shares of 12.1%. The Management Software category is equally significant within the vertical Specialty Crops (16.7%).

It is interesting to cross the data on companies' solutions with those in their geographical location. At this point, for companies located exclusively in LAC, the statistical distribution by type of solution implemented is very similar to that of the total.

On the other hand, a text statistical analysis of the open-ended question '*What do you do in detail?*' included in the Sustainable AgTech Challenge survey is performed.

6 To detect the type of solutions, the descriptions of the companies by the Challenge juries were analyzed.

7 These stages are: Input Industry, Primary Production, Food Processing and Packaging, Transport Logistics, Retail, Food Service, Individual Consumption, and Waste Disposal. Considering that the same company may be implementing a solution that can be assigned to more than one stage of the value chain, those for which this is the case are statistically treated as different companies.

The objective of the analysis is to find words that can synthesize and promote understanding of the answers to the question.[8] The methodology is briefly explained below.

One way to find words that make it easier to understand the answers to a question is to calculate the absolute frequency of certain words that have meaning in terms of the studied variable. To this end, in this document, the elimination of words that are typically found in every text is done first- such as connectors, prepositions and articles - and punctuation symbols since they do not generate content. This task was facilitated by preset word sets in the mentioned above words library. However, other words were added based on partial results that had no value for the proposed analysis. Secondly, the words were counted. The absolute frequency of each word is displayed through a word cloud for each question, in which the word size is related to the number of times it is repeated.

As sometimes words alone are not sufficient to inform us about the content of a given text, the analysis discussed in the previous paragraph was supplemented by studying the interaction between them, which allows us to understand the words within a context. To this end, words in each answer were grouped in two according to the order of appearance. This two-word subsequence is known as a *bigram*[9]. Because *bigrams* depend on interactions between words, it was attempted to keep most of them to avoid eliminating some that could integrate important combinations into the analysis of the questions. This is also why the *bigram* cloud of words usually shows some combinations that contribute little to the analysis being performed. Once the *bigrams* were obtained for each question, the word repetition was calculated to elaborate the respective clouds.

The text analysis of the mentioned question shows that the activities carried out by companies can be grouped around two axes: on the one hand, those that have an explicit commitment to the consequences of climate change and their activities are geared towards providing information (data) or processes to reduce the polluting effects of agricultural practices. These include those related to waste management and the emission of polluting gases. On the other hand, there are companies whose activities are related to the aggregation of value in agricultural practices, either by reducing the effects on the production of pests or soil deterioration or by providing better nutritional value in the products of the agricultural company through biotechnology.

8 Text analysis was performed using Python-Jupyter Notebook and the nltk, stylecloud, stopwords, WordCloud and scikit-learn libraries.

9 In general, the subsequence of words arising from a text is referred to as n-gram, where n represents the number of terms chained.

Figure 1. Word cloud: What do you do in detail?

Source: own elaboration based on data from Sustainable AgTech Challenge.

Figure 2. Word bigram cloud: What do you do in detail?

Source: own elaboration based on data from Sustainable AgTech Challenge.

6.- Type of technology used by companies

At first glance, it is interesting to explore what kind of technologies are being implemented by the startups participating in the Challenge.[10] In this regard, it can be observed that approximately one-third of the responses correspond to Big Data technology (31.8%), followed by the Internet of Things, with a 25% share. The majority of the technologies applied are circumscribed to these two categories. It is also noted that the Remote Sensing and Geolocation categories have similar response rates (15.9% and 13.6%, respectively). Finally, Robotics, Blockchain, and Artificial Intelligence technologies show the lowest shares, below 7%. It must be taken in account that this classification of technologies does not show the interaction of many of them in the different uses. For example, Sensors are essential components of the Internet of Things, which also contributes to spatial information.

On the other hand, it is helpful to analyze what type of technologies startups apply, disaggregating the data by verticals.[11] At this point, it can be observed that the distributions of technologies for the Row crops and Specialty crops categories are very similar to each other, with a majority weight of Big Data type technology (approximately one-third of the answers), followed by Internet of Things (about a quarter of the answers), Geolocation and Remote Sensors. The rest of the categories have small shares in total responses. In the case of Proteins vertical, there is a distribution of technologies different from that of the other two categories, totally concentrated in Big Data, Internet of Things and Blockchain. However, the number of companies that gave information on both variables (type of technology and vertical) is tiny (only five companies).

10 To categorize the technologies, the descriptions of the companies were analyzed by the Challenge juries and followed the IDB Lab (2019) classification criteria. Considering that the same company may be using more than one technology, those for which this is the case are statistically treated as different companies.

11 Since information from two questions with multiple possible answers is combined, to compute and summarize the distribution of technologies by verticals, firms that apply more than one technology and belong to more than one vertical are considered to be different from a statistical perspective. For example, if firm A says that it applies technologies X and Y, and belongs to verticals J and K, there are considered to be four different firms, given the possible combinations of answers (regardless of the order). These methodological clarifications also apply to other sections of this report where information from two multiple-choice questions is combined.

#4

Impacto medioambiental y social del sector AgTech

Sustainable AgTech can be a tool for helping the LAC region to meet the Sustainable Development Goals (SDGs) under the United Nations 2030 Agenda, particularly in rural areas. Agriculture in its current form is a significant source of climate risk in rural areas. However, with adequate attention and support from political actors, it can become an indispensable base for promoting rural sustainability and resilience while supporting economic livelihoods for rural populations (ECLAC, FAO and IICA, 2019). The data from the participants in the Sustainable AgTech Challenge indicates the opportunity Sustainable AgTech provides in this regard and shows the challenge of improving understandings of the SDGs and measuring impact.

In this section, the paper will discuss how AgTech startups align themselves with two critical aspects of sustainability: how they support climate-related SDGs and how they promote social inclusion, particularly among vulnerable groups such as women and youths. AgTech SMEs most commonly identified themselves as enabling a Sustainable Productivity Increase or contributing to Climate Change Mitigation regarding the environment. This contributes to a range of SDGs such as Sustainable Consumption and Production, Climate Action and Zero Hunger. Additionally, 9 out of 10 companies identified themselves as promoting social inclusion while highlighting the gaps in skills and awareness that prevented broader benefits from Sustainable AgTech solutions. Measurability has also been identified as a significant obstacle: only 20% of AgTech companies currently track their environmental impact, while just under 15% monitor how they contribute to social inclusion. In sum, the data shows that the AgTech sector provides dynamic solutions that target several SDGs. However, that general awareness of sustainability and how to track impacts must continue to improve for AgTech to maximize its influence on sustainable agriculture.

a. Are the AgTech companies contributing to advancing the Sustainable Development Goals (SDGs)?

(i) Which of the SDGs are most relevant to companies?

As discussed in the Introduction to this report, the LAC agri-food system faces the significant challenge of achieving sustainability while meeting growing demands driven by population and diet changes. The SDGs targeted by companies participating in the Challenge indicate the role AgTech can play in supporting an agri-food system that respects planetary boundaries and natural ecosystems.[1]

First, it is noted that the "most voted" SDG is Sustainable Production and Consumption, with a response rate of 18.4%. It is closely followed by Climate Action (16.2%), Zero Hunger (15.8%), Life of Terrestrial Ecosystems (14.5%) and Industry, Innovation and Infrastructure (13.6%). For its part, the goal of Gender Equality has a

1 Since companies could identify more than one SDG in their response -within a set of eight objectives that are of particular interest to the Challenge (Affordable and Clean Energy; Clean Water and Sanitation; Climate Action; Gender Equality; Industry, Innovation and Infrastructure; Life on Land; Sustainable Production and Consumption; Zero hunger)- as in other sections of this document, they are treated statistically as if they were different companies when analyzing the statistical distribution of SDGs. Therefore, this should be interpreted as a percentage of responses and not as a percentage of companies.

share of 10.1%, while Clean Water and Sanitation (7.5%), Affordable and Clean Energy (3.4%) are in the last places. Therefore, in general terms, it can be observed that the distribution of the SDGs has some uniformity without detecting, with exceptions, an extremely low or high concentration in any of the objectives.

Given that, as mentioned above, companies can potentially contribute, from their perspective to more than one SDG, it is natural to ask what the statistical distribution of the number of objectives they aim at is. On this point, it is noted that, on average, startups claim to contribute to four SDGs, this being a value similar to the median of the distribution, from which it can be inferred that half of the companies pursue four goals or less. Beyond this, it is noted that only about 10% of companies target only one SDG.

A more specific look at the startups' commitment to the SDGs requires an analysis of the distribution of these goals by verticals. First, it is observed that the types of SDGs to which companies in the Row crops and Specialty crops verticals potentially contribute are similar to those of all companies, although with lower participation of the Gender Equality objective within the Row crops category. Secondly, within the Proteins vertical, it can be observed that the SDGs Gender Equality and Industry, Innovation and Infrastructure have less weight compared to the distribution for the total of companies. However, the Zero hunger objective gains importance, representing more than a fifth of the responses.

(ii) How are companies contributing? The role of innovation and technology

As a first approach, it was analysed what carbon-smart outcomes companies' technologies are targeting, based on their perception.[2] Data show that the Sustainable Productivity Increase category is the result with the highest percentage of responses (43.8%), followed by Climate Change Mitigation (36.2%), and lastly Climate Adaptation and Resilience, with a share of one-fifth. As for the number of carbon-smart outcomes aimed at by companies, it can be seen that almost half of them contribute to a single result, while 32.8% and 19.7% point to two and three outcomes, respectively.

To understand how companies are contributing to the achievement of the SDGs the technologies applied by companies are analyzed for the different types of objectives. First, it is observed that for practically all the SDGs, Big Data seems to be the most used technology by companies. Secondly, it can be observed that for Gender Equality, Life on Land, and Climate Action objectives, geolocation technology is the second in importance, although it also has a substantial weight in other objectives. In the case of the Sustainable Production and Consumption and Zero hunger objectives, the second most voted technology is the Internet of Things. Thirdly, some SDGs have a significant share in Robotics and Remote Sensing technologies. Finally, it is worth noting that while the distribution of technologies for the Affordable and Clean Energy and Clean Water and Sanitation objectives shows some notable differences from the rest of the categories, a small number of companies within these SDGs provided information that could be useful in determining the type of technology applied.

On the other hand, it is relevant to detect what type of technology the startups deploy by disaggregating the data by carbon-smart outcomes. As can be seen, the distribution of technologies is relatively similar across Climate change mitigation and Sustainable increase of productivity categories, being Big Data the most crucial technology in terms of response percentage (around one third). Other important technologies within these groups are Geolocation, the Internet of Things and Remote Sensors. Instead, within the group of companies that potentially contributes to Climate change adaptation and resilience, the technology with the highest response percentage is Geolocation (40%), followed by Big Data (30%), the Internet of Things (20%) and Blockchain (10%).

(iii) Are companies tracking their environmental impact?

Beyond the SDGs that the Challenge startups may potentially be contributing to, it is of interest to analyze whether they are tracking their environmental impact in any way. At this point, it is noted that most companies (nearly 80% of them) claim not to be monitoring their environmental impact. In the group of

2 From a list of three possible categories of interest to the Challenge in terms of this type of outcome (Sustainable Productivity Increase; Climate Change Mitigation; and Climate Adaptation and Resilience), companies could point out more than one, so the same methodological clarifications previously made apply for this type of cases.

responses showing a commitment to the 'Clean Water and Sanitation' goal, the result is that the percentage that tracks its environmental impact amounts to approximately 30%. In contrast, this percentage is lower than average within the 'Climate Action' category group (14.3%). The rest of the SDG categories, on the other hand, show a percentage relatively similar to the average.

Some companies instead claim that their solution supports environmental goals, but they are working on defining the indicators of this impact. In some cases, they do so in conjunction with the university or a specialist. Some of the indicators used by these startups include, among others: kilograms of food that is not wasted along with the CO_2 saved as a result; number of trees planted and reforested land area; reduction of CO_2 by inorganic fertilizer replacement; yield of biofertilizers versus traditional fertilizers; reduction of the use of agrochemicals; litres of water saved per year; technical indicators of BOD (Biochemical Oxygen Demand, which is a procedure that measures the oxygen consumed by bacteria due to the decomposition of organic matter) and technical indicators of COD (Chemical Oxygen Demand), which allows measuring the organic content of wastewater and natural water) applied to the concentration of oils and fats in wastewater going into the river, reducing the use of fossil fuels.

b. Social inclusion: SMEs, female farmers and other vulnerable groups

(i) In which way do the companies include some groups of interest?

As mentioned in the Introduction to this report, the activity of companies in the AgTech sector should contribute to social sustainability, particularly vulnerable social groups, such as small and medium-sized enterprises, women farmers and indigenous communities. At this point, approximately nine out of ten companies report that their technology/ innovation points to this type of inclusion. If the information is opened by type of SDG, no significant differences are found between different groups of responses in terms of the proportion mentioned above.

(ii) Necessary conditions for the innovations to be adopted by vulnerable social groups

To explore what conditions are necessary for the innovations to be adopted by vulnerable social groups, a text analysis of the open-ended question '*What conditions, or business environment, are necessary for your innovation/technology to be adopted -or become more widely adopted- by SMEs, female farmers and other vulnerable social groups?*' is performed.[3] This analysis shows that companies identify as the main conditions for the adoption of their technology the need to raise farmers' awareness of climate change, conduct training on their practices and generate channels that enable them to show the results of their proposals. In addition, they stress the need for funding to promote their projects and form alliances or partnerships with other actors in the sector that facilitate access to farmers.

3 The text analysis of this question is similar to that performed in Section 2, but now a bigram is not built since its analysis does not yield additional information to that obtained from the word cloud without interaction.

Figure 3. Word cloud: 'What conditions, or business environment, are necessary for your innovation/ technology to be adopted -or become more widely adopted- by SMEs, female farmers and other vulnerable social groups?'

Source: own elaboration based on data from Sustainable AgTech Challenge.

(iii) Are the companies tracking their social impact?

Naturally, it is crucial to inquire whether startups are tracking their social impact. At this point, it is observed that most companies (85.7%) claim not to be tracking this type of impact. When this data is crossed with those of the SDGs targeted by companies, it can be observed that certain groups of responses show a higher value in the percentage that monitors their social impact, including the categories Gender Equality (31.8%), Affordable and Clean Energy (25.0%), and Zero Hunger (21.2%). The Climate Action category shows a slightly lower than average percentage (8.6%), while the rest of the response groups have values similar to the average.

Some social impact indicators that companies claim to apply include, among others: percentage of female farmers using their technology; percentage of field agents trained to implement technology to customers; the proportion of purchases made to micro-producers or women; the proportion of active suppliers who are micro-producers or women; the number of farmer training hours in organic farming; the number of rural employees in advanced and creative work; the number of staff with disabilities; percentage of small-scale producers using technology offered by the company; percentage of indirect labour employed by the company that are female heads of household.

#5

Business Development in the AgTech Sector

In this section, some aspects of the business development in the AgTech Sector in LAC are analyzed, using the data collected from the Challenge and some other studies conducted in specific countries, to see the most favourable conditions for growth and scalability of sustainable AgTech players. Additionally, we review the main problems that companies claim to have as obstacles to their development.

a. Growth and scalability opportunities of sustainable AgTech players

Given the differences between LAC countries, to get an overview of the business environment in the region, results provided by the Global Entrepreneurship Monitor report (GEM, 2021) were used, which presents the social and cultural aspects of each country, including entrepreneurial attitude, as well as the economic context in which companies operate. The GEM's National Expert Survey (NES) digs on each country's entrepreneurial context that affects individual decisions to start a new business and to continue it since country conditions can facilitate and nurture new business or it may hinder them through excessive bureaucracy and taxes, poor infrastructure, and social isolation. The GEM report is based on an expert evaluation of nine Entrepreneurial Framework Conditions, collected by a survey. These nine conditions give place to twelve factors derived from the academic literature about what is important to new businesses and more than twenty years of GEM experience and observation. Based on them, the Entrepreneurship Context Index (NECI) summarizes the average state of an economy's environment for entrepreneurship.

In the 2021 report, eight LAC countries are included: Uruguay, Chile, Colombia, Guatemala, Brazil, México, Puerto Rico and Panama. Uruguay leads the ranking of countries with the best conditions for entrepreneurship with a 4.9 (out of 10) score. Chile is in the second position, with a score of 4.4; Brazil and Panama are in third and fourth position. Of those countries, only Uruguay is above the GEM's average of forty-three participating countries (4.70). Those scores reveal that there is still a long way to go for LAC countries to implement the conditions that lead to maximizing the countries' capacity to promote and nourish entrepreneurship.

In a more detailed analysis of the participating countries' profiles, it can be seen that Brazil shows higher metrics than the average of GEM in the dimension of Market Dynamics, although it shows performances far below the rest of the forty-two countries in the dimension of bureaucratic and tax barriers. The latter is not enough to impede Brazil to be the most active AgTech ecosystem in LAC. In the case of Chile, while it also shows indicators that are below the average of the GEM countries - especially in the access to capital dimension- it shows higher performance in physical infrastructure, taxes, bureaucracy, and governmental programs to support entrepreneurs. For its part, Colombia and Mexico also show similar values to the rest of the LAC countries, except for the dimension of Entrepreneurship Education in Higher Levels, where they show indicators far above the average of the GEM countries. Guatemala, Puerto Rico, and Panama show indicators below the rest of the GEM countries in all their dimensions. However, the latter has higher indicators in physical infrastructure and cultural rules.

Uruguay, the best-positioned country of the region, is the one which differentiates the most from the rest, since it shows metrics that are above the

average in several dimensions, such as Physical Infrastructure, Governmental Programs, Governmental Policies to Support Entrepreneurs, Entrepreneurship Education in Higher Levels, I&D Transfer Policies, and Commercial and Professional Infrastructure.

Access to Entrepreneurial Capital is one of the most critical challenges that LAC entrepreneurs face, where all the participating countries, with no exception, show metrics far below the average of the GEM countries. Taxes and Bureaucracy seem to be another challenge for LAC entrepreneurs except for Panamá, Chile, and Uruguay, which shows a better performance in this dimension than the average of GEM countries. Research and Development Transfer seems to be another significant barrier for entrepreneurs.

In the 2021 report, for the first time and due to the pandemic, the GEM included some SDG aspects. The global changes accelerated by the COVID-19 pandemic have boosted the concerns related to entrepreneurs' motivations and to which extent these were only business-related or if they included sustainability goals.

The research showed some interesting patterns regarding those motivations. Much of the entrepreneurial population in Europe, North America, and the LAC region was motivated to create a business that "makes a difference". Such sentiment is a good starting point for the emergence of companies more oriented to adding value to society, addressing some of the world's most significant challenges following the SDGs. However, other studies reveal that during the pandemic, most of the world's business population was motivated to undertake the unemployment the pandemic generated (GEM, 2021).

Using the data obtained from the Sustainable AgTech Challenge, we deepen the analysis carried out so far by doing an exploratory econometric study to see which variables are more correlated with the growth possibilities of startups, paying particular attention to those linked to their environmental and social commitment. Score given by the Challenge jurors to the companies is taken as an approximation of their growth potential[1]. Specifically, by using Ordinary Least Squares (OLS) technique, the expected value of startups' average score is modelled linearly, conditional to a set of explanatory variables, which includes gender composition of the company, age and education level of its members, seniority, verticals, SDGs targeted, social inclusion, projected revenue, among others.[2] In this sense, how these variables "impact" on average on the startups' scores can be measured.[3]

This exercise sheds remarkable results. Since some models predict that, on average, a higher number of targeted SDGs (which could indicate that the company does not know precisely how their proposal contributes to these goals) reduce the score achieved by the company (i.e., their expected growth potential), while including vulnerable social groups and tracking environmental and social impacts increment that score. Instead, the type of SDG targeted does not seem to affect the score achieved by startups. In addition, it was found that the youngest startups are the most promising since, on average, they seem to have greater growth potential than those with higher seniority.

b. Problems and limitations

The companies that participated in the Challenge expressed the factors and barriers that prevent their growth and escalation. By analyzing the distribution of these factors[4], it is observed that the most pointed out obstacle is related to Access to Capital, with more than a quarter of the responses. In

1 More precisely, given the varied profiles of the jurors -i.e, there are experts in AgTech sector, entrepreneurs, sustainability experts, academics, venture capitalists, etc- we take their comprehensive and multidimensional evaluation as a representation of a latent variable linked to their opinion about the growth possibilities of the startup.

2 See the Table A32 of the Appendix for more details.

3 It is important to keep in mind some limitations about these estimates. Specifically, as was mentioned in the Data and Methodology section, results are representative of the group of companies that applied to the Challenge and cannot be extrapolated, necessarily, to the whole population of startups in the AgTech sector. In addition, estimated coefficient of each explicative variable cannot be, necessarily, interpreted as a causal effect, but could be interpreted as a "partial correlation", i.e., a correlation that have been filtered from the effect of the other variables.

4 Since each company could indicate more than one barrier, those with more than one response are treated as different companies in statistical terms.

order of importance, it is followed by the categories Access to markets (16.2%), Low interaction between the scientific and business worlds (13.0%), and Bureaucratic hurdles (11.9%). Regarding the rest of the factors with smaller shares, Infrastructure (8.1%) and Access to human capital (7.6%) is highlighted.

On the other hand, Navarro *et al.* (2019) inquired among the most representative startups of the AgTech ecosystem in Rosario regarding the factors preventing or hindering entrepreneurship's birth. These entrepreneurs also consider access to capital the main obstacle, focusing 85% of the answers in a high/medium level of importance, and being presented as a highly limiting factor in six out of ten cases. Access to the market is also an influential factor of medium to high importance for businesses inside the ecosystem for 78% of the surveyed companies.

Additionally, access to talent is also considered a difficulty. However, its importance is considerably less than Access to Capital since this factor is considered medium to low importance for 74% of the companies. At the same level of importance as a barrier now of starting a new venture, the mentioned study finds connectivity concentrating 81% of answers. On the other hand, the infrastructure factor is considered by 71% of surveyed companies at a medium/low level of limitation for starting a new company, while bureaucratic limitations are considered a medium level factor of influence in the entrepreneurial environment. This is expected since LAC, in general, has serious infrastructure problems; for instance, the gap in this dimension between LAC countries and the best-positioned country (Germany) in the Logistics and Performance Index of the World Bank is, on average, 43%.

The Navarro *et al.* (2019) study also gathered the opinion of twenty key referents of the Argentinian ecosystem, who were asked to mention the principal factors that limit the entrepreneurial activity in the country. The most frequently mentioned factors were the poor access to credit and funding to entrepreneurs, the lack of predictability, clear game rules, long-term state policies, and lastly, the lack of appreciation of the entrepreneur as a change agent of societies.

Other factors that interviewees remarked as hindering the entrepreneurial activity are lack of visibility of startups globally, an excessive tax burden for entrepreneurs and small and medium-sized companies, bureaucracy, the size of the Argentinian market, the lack of entrepreneurship education in the overall education system, and the little interaction between the academic world and businesses, among others. A striking and critical factor identified was that larger and more mature companies do not show interest in trying the startups' developments.

Likewise, the report by Endeavor México (2020) considers access to capital, technology adoption, and insecurity the main challenges entrepreneurs face to make their companies grow in this country. In the Mexican AgTech ecosystem and the Rosario ecosystem, access to entrepreneurial capital and funding, in general, is a challenge. On the one hand, the investor has uncertainty about the inherent risks of the sector, such as meteorological factors that can jeopardize the investment or the returns that can be fewer than in other industries. On the other hand, entrepreneurship takes more time to generate traction, so an investors' exit would take longer than in other industries. Another challenge that AgTech companies face, and which has been mentioned in the same study, is the conflict to access the market due to a lack of technology adoption by established companies. Given the existence of a significant fragmentation of the sector, especially among small producers, it is challenging to generate economies of scale that justify the investment, and big producers generally have imported innovative technology, which narrows the potential market.

c. Gaps among groups

According to the GEM (2021), although LAC economies have one of the highest levels of female entrepreneurship, with over one in five women starting a business, there is still a gender gap in entrepreneurial activity, and most of the new businesses are still more likely to be started by men rather than women.

On the other hand, it is essential to cross information about factors or barriers that -from the perspective of the startups participating in the Challenge- hinder or prevent the appearance or growth of new ventures in AgTech with various variables of interest.

The assessment of the barriers mentioned above

differs according to the gender of the founders of the startups. Within the group of companies founded only by women, obstacles like access to capital, bureaucratic hurdles, low interaction between the scientific and business world, and lack of recognition of the entrepreneur as a role model are more relevant to the responses provided by male founders, while the market access category it is less relevant.

It is also interesting to combine information about the barriers pointed out by companies and the maximum level of education achieved by a team member. It is observed that, within the group of companies in which the highest educational level is postgraduate, the distribution of barriers is similar to that of the total. On the other hand, for those companies in which the highest educational level is bachelor's or equivalent, the categories Access to capital, Access to markets, and Lack of recognition for the entrepreneur as a role model gain participation within the answers, while the factors Infrastructure and Low interaction between the scientific and business worlds show a lower percentage of responses compared to total companies.

On the other hand, it is important to investigate whether the distribution of the barriers shows differences when comparing the different verticals. First, it is observed that 'Access to Capital' is the most marked category in the three verticals. Second, 'Access to Markets' has a higher share within the Proteins and Row crops verticals, with around a fifth response rate. Thirdly, the category 'Bureaucratic Hurdles' have a greater weight within the vertical Proteins than the rest of the verticals. Finally, the 'Infrastructure' factor shows a higher percentage of responses within the Specialty crops vertical.

Regarding the distribution of barriers by geographical location, focusing on the LAC countries with the highest participation in the Challenge (i.e., Argentina, Brazil, Chile, Colombia, and Peru), it is found that the 'Access to Capital' factor is the one with the highest percentage of responses, reaching values close to a third in countries such as Chile and Colombia. Access to the 'Human Capital' category has a lower percentage of responses in Argentina but increases its participation in other countries, particularly in Brazil and Chile. Concerning 'Access to Markets', this factor shows low participation in Colombia, but the percentage of responses in the other countries increases significantly. The category 'Bureaucratic Hurdles' is frequently cited in Brazil, as are the 'Infrastructure', 'Connectivity' and 'Tax Burden' factors in Colombia, Peru, and Argentina, respectively. Finally, the factor 'Low interaction between the scientific and business worlds' has a significant percentage of responses in most countries analyzed.

It is valuable to ask whether the distribution of barriers shows differences according to the seniority of the companies participating in the Challenge. Again, it is observed that Access to capital is the most pointed out factor by companies, regardless of their seniority. However, it seems that Access to human capital, Connectivity, and Infrastructure are factors that have greater participation in the older companies (those that were founded more than ten years ago), while the opposite is true for the categories Access to markets, and Bureaucratic hurdles, which have a higher percentage of responses in the companies with less seniority (less than ten years). Finally, the category Lack of recognition for the entrepreneur as a role model shows a similar percentage of participation for the three seniority categories.

On the other hand, it is interesting to analyze the distribution of barriers by SDG. At this point, it can be seen that Access to capital is the most frequently pointed out factor, regardless of the SDG to which startups are potentially contributing. However, some specificities are observed. Thus, Access to human capital has a higher percentage of responses within the Affordable and Clean Energy SDG, as does Bureaucratic hurdles within the Clean Water and Sanitation objective. Infrastructure factor seems to have greater popularity within the Industry, Innovation, and Infrastructure; and Clean Water and Sanitation objectives. Within the Affordable and Clean Energy SDG, the factor 'Low interaction between the scientific and business worlds' has a lower percentage of responses compared to the other objectives, in which this barrier shows high participation. Finally, the remaining categories show similar shares when comparing the different SDGs.

Furthermore, it is interesting to explore whether those companies that do not have an AgTech ecosystem in the place where they reside (which represent about a fifth of the startups that answered the related question) show a different distribution of barriers compared to the rest. First, it is observed that 'Access to capital' is a factor that has lower participation of responses within the group of startups that do not have an ecosystem in its geographical location, compared to those that have this type of advantage (19.4% vs 27.5%). The same goes

for 'Bureaucratic hurdles' category (6.5% vs 13.4%). In contrast, companies that do not have an ecosystem, more frequently point out the factors 'Access to markets' (19.4% vs 15.5%), Lack of recognition for the entrepreneur as a role model (12.9% vs. 4.2%), 'Low interaction between the scientific and business worlds' (16.1% vs. 13.4%), and 'Infrastructure (9.7% vs. 7.0%).

Finally, barriers are not precisely the same between those companies whose commitment to sustainability is clear and the rest of the companies.[5] Although the three barriers considered most important by both groups of companies are the same (Access to capital, Access to markets, and Low interaction between the scientific and business worlds), only the first one (Access to capital) ranks first for both groups, but for green companies, access to capital has a higher weight than for the rest. In part, this difference responds to the difficulty that companies find in financing themselves through green funds –probably because they lack certifications that accredit them as such- or with risk capital, which does not know in depth the advantage of investing in sustainable ventures. Likewise, Market Access ranks second in importance for green companies, which is partly explained by the difficulty they have in financing their operations with current income, given that consumers are not yet aware of the advantages of consuming sustainable products or have income restrictions, and therefore cannot afford the higher prices that these products generally have.

5 To classify the companies into those that have a clear commitment to sustainability and those that do not, a multidimensional analysis was carried out on the value proposition of their solutions, the content displayed on their website, as well as the evaluation of the jury in the specific aspects of sustainability.

#6

Conclusions and policy recommendations

a. Main Findings

(i) Sociodemographic, geographic, and economic profiles of AgTech companies

I. The Sustainable AgTech Challenge startups come from the same countries recently mapped by the IDB Lab: Argentina, Chile, Colombia, Peru, Brazil, and Mexico. The weight of each nationality is different, probably due to the decision of participation of the companies.

II. They are young companies, with teams that are made up of highly educated people and remarkable female participation.

- More than three-quarters of the startups participating in the Challenge are four years old or younger. This result was expected since recently AgTech entrepreneurship increased rapidly in volume. Between 2017 and 2018, the number of AgTech startups in LATAM, mapped by IDB Lab, tripled. The new consumer demands require local producers to adapt their value propositions to be sustainable, providing specific solutions throughout the agri-food value chain since the technologies developed in the rest of the world for other regions are not necessarily applicable to LAC problems.

- Although the female presence is notorious in startups teams, the same is not the case in founding groups. The companies that participated in the Challenge have mostly male founders; only 35% of the founders are women, and the percentage of companies formed only by women is only 10%.

- The members of the companies in the Challenge have a high level of education (much higher than the LAC average). This result indicates that the technological solutions provided by AgTech startups require a high level of sophisticated knowledge, but this could also be indicating that the teams are made up of scientific profiles with high technological expertise who do not necessarily have knowledge or experience in agriculture or in the problems of agricultural producers that these startups seek to solve.

III. The solutions offered by startups are located at the ends of the value chain of LAC's agri-food system: primary production, inputs for the industry, and waste disposal. In the latter, there is an exciting market niche for AgTech's green entrepreneurs since the agri-food value chain produces a large amount of waste in all its different stages. This distribution of solutions is also consistent with the successive waves of innovation at AgTech, initially focused on improving productivity and competitiveness, and later focused on commercial and financial aspects and, more recently, on traceability aspects.

IV. It must take into account that although the most significant environmental impacts and resource consumption occur in primary production, these

actors have limited capacity to shape food systems. Middle-stage actors are structurally powerful and play a decisive role in what farmers produce and sell and the food that consumers buy and eat.

(ii) Environmental and social impact of AgTech sector

V. On average, Challenge companies report that their solutions contribute to four SDGs, but some declare that they contribute to eight goals. The "most voted" SDG by companies is Sustainable Production and Consumption, with a response rate of 18.4%. They are closely followed by Action for the Climate (16.2%), Zero Hunger (15.8%), Life on land (14.5%), and Industry, Innovation and Infrastructure (13.6%).

VI. Regarding carbon-smart outcomes, project data show that Sustainable Productivity Increase is the category with the highest percentage of responses (43.8%), explained by the Challenge's focus area –AgTech-. This result is also consistent with the successive innovation waves in AgTech, concerned primarily with improving productivity and competitiveness, as it was mentioned before. In the second place, companies selected Climate Change Mitigation (36.2%), and Climate Adaptation and Resilience, with one-fifth share.

VII. However, results show that social and environmental impact is not usually measured or tracked in most cases. This result suggests that companies still have an incipient commitment to the SDGs that could increase as startups more adequately measure the value of sustainability and, consequently, track their impact. The lack of SDGs monitoring could reflect the lack of knowledge on how to track environmental and social impact, specifically for startups that might still be in an early stage of business development, which often also limits impact investors who need defined metrics to make investments.

VIII. Nine out of ten companies report that their technology/innovation targets the social inclusion of vulnerable groups. However, they also state the following necessary conditions to achieve more inclusion:

- Raising farmers' awareness of climate change and training them in sustainability practices.
- Lowering the costs of the technology they offer and getting the market to pay more for eco-friendly products.
- Generating channels to enable the companies to show their results to vulnerable groups.

IX. As expected, the growth potential of the Challenge startups depend on their business model and profitability, but their impact tracking also seems to be relevant. Thus, social and environmental sustainability considerations add up to their economic sustainability.

X. Although the type of SDG that startups are targeting does not seem to determine their growth potential, it appears relevant that companies know precisely how their proposal contributes to the SDGs. Furthermore, focusing on the companies that declare they contribute to almost all the SDGs (13% of the companies that answer the related question asked in the Challenge), it was found that the declared SDGs does not appear in their explanation about their value proposition neither in the company's website, where it seems to be that they target to a lower number of SDGs. Conversely, regarding those companies that answer they contribute to only one SDG (10 % of the companies), it was found that the majority of them could target more than one goal.

XI. Another result is that the youngest startups are the most promising, in the sense that, on average, they seem to have greater growth possibilities than those with higher seniority. This result suggests that although the companies are young, the entrepreneurs or the entrepreneurial team has a substantial track record in the industry or much experience as an entrepreneur since they have founded other companies before this one. Another possible cause for this finding

is that, in the case of the oldest companies of the Challenge, if significant time has elapsed since its foundation without the startup being able to show growth acceleration, it is improbable that it will scale further.

(iii) Problems that hinder or prevent the mainstreaming of Sustainable AgTech

XII. Access to entrepreneurial capital is one of the most critical challenges LAC entrepreneurs face. Indeed, more than a quarter of the Challenge responses indicate the lack of access to capital as the most pointed out problem that hinders or prevent the appearance or growth of new ventures in AgTech. Even for companies that seem to have a more explicit commitment to sustainability, it is difficult for them to obtain financing from impact funds if companies lack certifications that accredit them, especially considering that tracking its impacts is still incipient. They neither could obtain funds from venture capital because the latter do not know the advantage of investing in sustainable ventures in depth.

XIII. Market access is also a significant limiting factor for entrepreneurs; one in six companies mentioned it. This barrier is the most mentioned within the vertical Proteins and Row crops. This difficulty is not minor for green startups, probably because consumers are not fully aware of the benefits of consuming sustainable products or have income restrictions. It could come from the fact that the registration procedures for sustainable startups and their products differ across LAC countries.

XIV. Other factors that prevent the growth of AgTech ventures in LAC are low interaction between the scientific and business worlds (13.0% of the responses) and bureaucratic hurdles (11.9% of the responses). In some countries, these latter barriers are substantial, as in Argentina and Brazil, where the bureaucracy and processes for starting a new company are cumbersome and very slow. According to the Challenge, this barrier has a greater weight within the Proteins vertical.

XV. Although the lack of connectivity and infrastructure is also a barrier mentioned by the companies participating in the challenge -particularly by those belonging to the speciality crops vertical- and by entrepreneurs, stakeholders and experts from the AgTech sector of Rosario (Argentina), it seems to be more urgent for the startups in the short term to reduce capital and market barriers.

XVI. The assessment of the barriers mentioned above differs according to the gender of the founders of the startups. Within the group of companies founded only by women, obstacles like the access to capital, bureaucratic hurdles, low interaction between the scientific and business world, and lack of recognition of the entrepreneur as a role model are more important in relation to the responses provided by male founders, while the market access category it is less relevant.

XVII. Analyzing by country, in Argentina, the access to human capital seems to be a less critical barrier than in Brazil and Chile. The bureaucratic hurdles are frequently mentioned by Brazilian companies and the infrastructure, connectivity, and tax burden in Colombia, Peru, and Argentina, respectively. The lack of interaction between the scientific and business worlds has great relative importance in these countries.

XVIII. As expected, given the structural deficiencies in LAC, connectivity and infrastructure are barriers that have greater incidence in the older companies, for which these deficiencies become more evident as they try to grow. Instead, the obstacles for companies with less seniority are related to the difficulty to access markets (difficulty reaching customers, low visibility of proposed innovations, lack of understanding of the benefits of these solutions for potential customers, impossibility of small producers to take the risk of trying new things, lack of integration and interoperability between the different solutions proposed) and bureaucratic hurdles.

XIX. Companies that do not belong to an AgTech ecosystem also point out the access to markets,

lack of recognition for the entrepreneur as a role model, low interaction between the scientific and business worlds, and infrastructure as barriers that prevent their growth. This result is reasonable given that ecosystems tend to reduce these types of barriers due to the synergy between large companies that act as early adopters, research centres that provide solutions, accelerators that facilitate mentoring and access to funds to grow, and an efficient public sector that reduces regulatory obstacles that hinder the development of startups. barriers that prevent their growth. This result is reasonable given that ecosystems tend to reduce these types of barriers due to the synergy between large companies that act as early adopters, research centres that provide solutions, accelerators that facilitate mentoring and access to funds to grow, and an efficient public sector that reduces regulatory obstacles that hinder the development of startups.

b. Policy Recommendations

(i) Raising the awareness of and incentivizing the tracking of SDG commitments

I. Raise farmers' awareness of climate change and train them in sustainability practices through producers' organizations and government agricultural institutions.

- Example: A program called "Activating the circular economy" [1]of Innpulsa-Colombia, or "Chile Agrícola"[2] developed by FUCOA and Ministry of Agriculture, trains agricultural producers on sustainability and climate change, water management and SDGs.

II. Train the agricultural producers in LAC to understand the dynamics of investment in sustainable startups and thus turn part of the surpluses of their principal activity into such ventures.

- Example: Developing specific training programs, such as investment boot camps like the Investment and VC workshop organized by BCR-Innova in Rosario[3].

III. Provide tax benefits to agricultural producers who adopt sustainable practices

- Example: Blue Stamp certificate in Chile[4], which allows deducting from income taxes the expenses incurred in the certification process of the APL Blue Certificate.

1 https://www.activandolaeconomiacircular.co

2 https://www.chileagricola.cl/

3 https://www.innova.bcr.com.ar. Bootcamp: Oportunities and challenges of investing in technology-based startups. Workshop organized by BID Lab, BCR Innova, CREA and EmpreAr. July 7th-8th, 2020.

4 https://fch.cl/iniciativa/certificado-azul/

(ii) Facilitating the flow of green investment to the sustainable AgTech sector

IV. Increase the visibility of local startups in global green capital markets, generate more instances of value connection between international investors and LAC companies, and support startups in obtaining international sustainability certifications.

- Example: The training session's meetings of AAPRESID (Argentina), Bayer, the international certifiers RTRS and ASC to train the Red Bayer Dorados (distributors and producers) in certification[5].

V. Boost the development of green corporate investment in LAC by creating and supporting agencies and innovation hubs that promote the connection and interaction between sustainable startups and leading companies of the agri-food value chain.

- Example: the AgTech meet-ups by BCR Innova (Rosario, Argentina) provides connections between AgTech startups and agricultural producers[6]; the programme "Intensive Connection"[7] of AgTech Garage (Piracicaba, Brazil); the Venture Corporate's program in Cubo Itaú [8](San Pablo, Brazil), seeking to connect big companies and startups.

VI. Enhance the expansion of green corporate investment in LAC through national fiscal policies.

- Example: enabling corporate sustainable investments disctounts from tax payment like in Israel where there are different financial incentives or tax rebates depending on the type of investment and its location[9] [10].

(iii) Improving market access through consumer education and promoting trade services

VII. Enhance sensibilization policies about the urgency of climate change in LAC. Climate Actions are present in LAC countries, but these actions do not always have the strength, scale, impact, or awareness needed to be fully considered part of the global climate change solution. There is a lack of technical knowledge and methodologies to analyze and formulate development actions in terms of climate impact. It is also necessary to monitor these actions and communication channels to disseminate results to global audiences and funds.

VIII. Improve the access of small rural producers to connectivity services to take advantage of many opportunities for sustainable production and the creation of quality jobs, which rely on access to IoT as a necessary condition.

- Example: by implementing LoRa technology designed for low power applications but long-range and low consumption. INTA (Argentina) is already implementing LoRa antennas in several experimental units for precision livestock farming.[11]

(iv) Facilitating the science and business interface and reducing the cost of sustainable AgTech uptake

IX. Generate spaces for connection and teamwork between green entrepreneurs and researchers to combine their distinctive capabilities in projects with a firm scientific-technological base and a solid approach to the market.

5 https://responsiblesoy.org/bayer-and-rtrs-encourage-sustainable-production-in-argentina

6 https://bcrnews.com.ar/innovacion/bcr-innova-desarrollo-el-meet-up-agtech-2020-junto-a-crealab/

7 https://www.agtechgarage.com/intensive-connection-es/

8https://www.itau.com.ar/Documents/Sobre%20itau/Cubo%20Ita%C3%BA%20m%C3%A1s%20conexiones%20entre%20startups%20y%20grandes%20corporaciones.pdf

9 https://investinisrael.gov.il/

10 https://www.trdf.co.il/eng/

11https://inta.gob.ar/noticias/el-inta-impulsa-la-ganaderia-de-precision-en-la-provincia-de-la-rioja-y-en-la-region?fbclid=IwAR0hX4j_dlUS92REBA8xJnC_rWuOs7X_z9Gu3Pozl111C42uKluk2u7duVU

- Example: the Technion model[12] (Israel), which encourages and accompanies scientists interested in founding a startup based on their line of research, helping them to manage their patent and find co-founders, and the FONTAGRO programs[13] that bring together scientists and entrepreneurs from LAC.

X. Make accessible to startups the use of specific infrastructures, such as laboratory and AI development spaces, equipment and connectivity, for the development of MVP[14].

- Examples: the 39 North innovation district[15] in St. Louis (USA);GeoFutures[16], especially in geospatial location data (St. Louis); the Cortex Center[17] in biosciences (St. Louis), and AgTech Garage (Piracicaba)[18].

XI. Promote financial inclusion policies that reduce the risk of the activities of small and medium farms.

- Example: through a financial and insurance system that promotes efficiency while safeguarding equity by providing products specifically designed for this segment of agricultural producers[19].

- or by establishing credit lines without reimbursement for new AgTech solutions pilot tests through public banks focalized in the agricultural and food sector[20].

12 https://www.trdf.co.il/eng/

13 https://www.fontagro.org/es/iniciativas/como-funciona/

14 Insight from interview with Robert Luo, founder of MiTerro.

15 https://39northstl.com/

16 https://geofutures-greeninvest.com/

17 https://cortexcentre.com/

18 https://www.agtechgarage.com/inicio/

19 Insight from interview with Paul Daintree, founder of Climate Sense.

20 Insight from interview with Martha Montoya, founder of Agtools.

(v) Creating a supportive government environment

XII. Establish service-oriented approaches for government administration such as E-Government and Single Windows[21].

XIII. Reduce bureaucratic obstacles for startups to access national and international markets through reciprocal agreements inside and between countries that facilitate the registration procedures for sustainable startups and their products in the different LAC countries[22].

Finally, the research team finds this study a valuable conversation starter for LAC. The region still faces numerous economic and social problems that it will not be able to solve without a significant leap in innovation. As the region is the world's leading net food exporter and given the urgency that climate change imposes, LAC needs to transform its production structure into a sustainable one throughout the entire agri-food value chain. This ambitious undertaking requires the commitment of their governments but also a strong involvement of the entire AgTech ecosystem. The region faces a huge challenge, but it also has great opportunities that should not be overlooked.

21 Insight from interview with Carolina Trivelli.

22 Insight from interview with Nestor Zuñiga, founder of Clear Leaf.

#7

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#8
Appendix

a. Sustainable AgTech Challenge distinguished startups

Value Chain: Food Processing and packaging
Innovation Area: Logistics and Food Distribution
Web: https://www.SAVRpak.com
Country: USA
Founder: Bill Birgen
Foundation year: 2020

SAVRpak manufactures and sells its patented universal packaging tech which extends the shelf life of agriculture products like leafy greens and berries by as much as 2 weeks longer, a powerful tool against the rising tide of global food waste! Food waste is a huge contributor to greenhouse gases. Impacting food waste saves money for growers and for real families. SAVRpak is a technology company that uses compostable, non-chemical, sachets to extend the quality of foods, agriculture products and delivery (hot) foods. Bill, the founder, is a serial entrepreneur, passionate about technology and with broad experience in the aerospace industry, which he has applied to this venture.

It contributes with the **compliance of the following SDGs**: 9 (Industry, Innovation and Infrastructure), 12 (Sustainable Consumption and Production), 13 (Climate Action), 2 (Zero Hunger).

This solution contributes to the preservation of food and harvest, by delaying the decomposition process avoiding waste and greenhouse gas emissions. This technology allows producers in areas far from markets to arrive on time with their goods in good condition and to get better prices.

Value Chain: Primary Production
Innovation Area: Blockchain
Web: https://ucrop.it/
Country: Argentina
Founders: Diego Hoter (CEO) - Matias O'Keefe - Marcos Botta – Ignacio Rico
Foundation year: 2018

Ucrop.it is a collaborative mobile platform that articulates agro actors to boost crops cycles expected results, through the simple registration of agronomic events and its realization evidence on blockchain. They replace the trust component amongst actors, with certainty that the agronomic events that explain the crop generation and value occur. They are in the paying customers´ stage. It is a well-balanced team. Diego, the CEO, has a broad experience in the industry. For his part Matías, one of the founders, has great experience in the technology industry.

It contributes with the compliance of the following SDGs:12 (Sustainable Consumption and Production), 9 (Industry, Innovation and Infraestructure), 13 (Climate Action) and 15 (Life on land).

It collaborates with the **traceability of products under certain sustainability standards** determined by the client company. It helps producers to get their practices more sustainable.

Value Chain: Input Industry
Innovation Area: Genetics and New Crops
Web: http://www.clearagro.com
Country: Costa Rica
Founders: Agustín Buschert and Néstor Zuniga
Foundation year: 2017

ClearLeaf uses patent-pending technology, organic certified in Japan and the EU, to provide a line of non-toxic fungicides and bactericides for agricultural use. ClearLeaf S.A. was launched in Costa Rica to commercialize GotaBlanca©, a non-toxic contact action liquid emulsion that uses nanotechnology for the control and management of agricultural fungal and bacterial pests on living plants and post-harvest on fruits, vegetables and flowers. GotaBlanca© is a variant of a patented, FDA approved dermatology product developed by bioTD, a pioneer in the biotechnology sector in Costa Rica.

GotaBlanca® is one of the only non-toxic fungi-bactericides currently on the market, anywhere in the world. It is broad-spectrum, does not cause microbial resistance, enhances plant growth (rather than impeding it like most current products), does not effect on-farm (or off-farm) biological diversity, and can be applied at any time in the growing cycle (off-season, budding, growth, fruiting, and up to the moment of harvest). GotaBlanca® can also be used for the protection of post-harvest produce, to reduce damage and deterioration between the farm and the end consumer.

It contributes with the **compliance of the following SDGs**: 12 (Sustainable Consumption and Production), 6 (Clean Water and Sanitation), 15 (Life on Land) and 13 (Climate Action).

The product promotes sustainable agriculture by providing a non-toxic and certified organic bactericidal / fungicidal product as an alternative to agrochemicals. It reduces the toxicity of food, promoting health. “We are what we eat”. The product does not pollute water sources, coexists with pollinators and the entire natural world and does not have the climatic impact that agrochemicals do.

b. Interviews with key stakeholders in LAC AgTech

During the elaboration of this report, we conducted several interviews with various stakeholders and experts in the AgTech sector and in high-impact technologies for agriculture-driven sustainability, in order to obtain insights and deep knowledge about the AgTech phenomenon in LAC, as well as the factors that drive or hinder the growth of startups in this sector. Below we detail a list of the experts interviewed.

Jaari Antero Altonen

Manager of the Barbados' Cleantech Cluster, from United Nations Industrial Development Organization (UNIDO). He has a great experience in the sustainable innovation world in Barbados

Luis Azevedo

Venture Partner at the Yield Lab LATAM. Luis has spent his career in agriculture and agtech, abroad and in LATAM and currently serves on the board of several LATAM agtech startups. He is a Doctor of Veterinary Medicine and has spent most of his career in the animal health sector.

María Teresita di Marco

Expert and Investigator in International Relations, Sustainable Development and Cultural Management. She has great expertise in the development and execution of projects with social, economic and environmental impact since 2006 and has participated in important projects implemented in Argentina, Spain and Switzerland.

María Carolina Gomez Mahecha

Director of Innovation and Growth in Innpulsa Colombia. Carolina has great experience implementing different government programs in order to boost sustainable entrepreneurship in Colombia. She has a graduate degree in microbiology.

Michael Hayes

Country Director at Agora Partnerships in Chile and most recently a new Venture Partner with the Yield Lab LATAM. Michael has an extensive amount of experience and perspective on agtech startups and innovations in LATAM.

Camila Petignat

Partner at the Yield Lab LATAM. Camila is a serial entrepreneur, founding her own agtech startup and supporting others as an entrepreneur-in-residence in LATAM and currently supports our portfolio LATAM agtech startups. She has graduate degrees in molecular biology and biotech.

Carolina Trivelli

Senior Strategic Analysis Advisor at FAO. She has also great knowledge in financial inclusion, social policies, rural development and public policies mainly from her experience in Peru.

c. Tables and Figures

Table A 1. Companies' distribution by gender

Gender (founding team)	% of companies
Female only	10.1%
Male and female	63.8%
Male only	24.6%
Male, female and other	1.4%

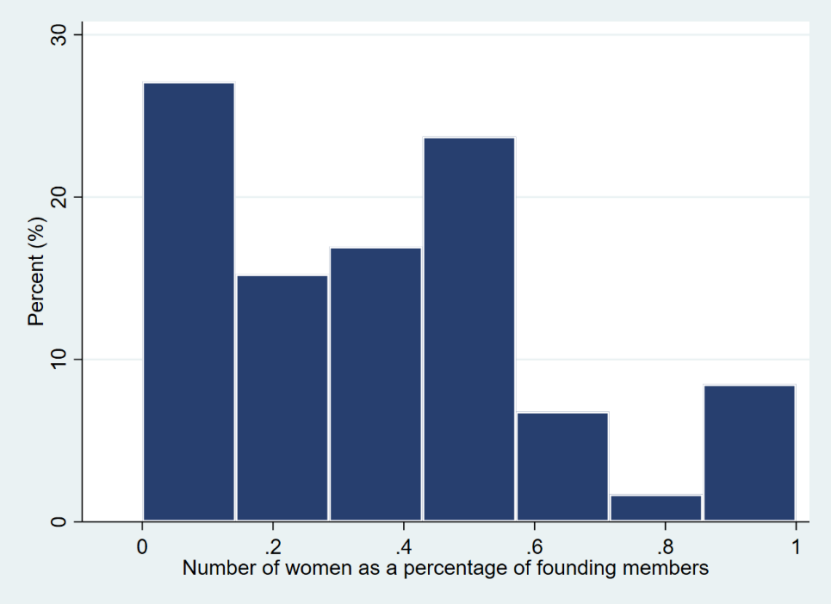
Source: own elaboration based on data from Sustainable AgTech Challenge.

Tabla A 2. Estadísticas descriptivas de las variables de género y edad

Variable	Description	Mean	Median	Std. Dev.	Min	Max
female_ percentage	Number of women as a percentage of founding members	0.35	0.33	0.29	0.00	1.00
youngest_ member_age	Age of the youngest member of the team	28.25	26.00	7.57	17.00	53.00
oldest_ member_age	Age of the oldest member of the team	46.94	46.00	12.64	17.00	80.00

Source: own elaboration based on data from Sustainable AgTech Challenge.

Figure A 1. Number of women as a percentage of founding members



Source: own elaboration based on data from Sustainable AgTech Challenge.

Table A 3. Companies' distribution by age of the youngest member

Age range	% of companies
Age 20-29	57.1%
Age 30-39	28.6%
Age 40-49	6.3%
Age 50-59	1.6%
Less than 20 years old	6.3%

Source: own elaboration based on data from Sustainable AgTech Challenge.

Table A 4. Companies' distribution by age of the oldest member

Age range	% of companies
Age 20-29	8.1%
Age 30-39	17.7%
Age 40-49	32.3%
Age 50-59	19.4%
Less than 20 years old	1.6%
More than 59 years old	21.0%

Source: own elaboration based on data from Sustainable AgTech Challenge.

Table A 5. Companies' distribution by education level of the least educated member

Education level	% of companies
Bachelor's or equivalent	50.0%
Master's or equivalent	16.7%
Primary education	1.5%
Secondary education	15.2%
Tertiary education	16.7%

Source: own elaboration based on data from Sustainable AgTech Challenge.

Table A 6. Companies' distribution by education level of the most educated member

Education level	% of companies
Bachelor's or equivalent	14.9%
Doctorate or equivalent	38.8%
Master's or equivalent	44.8%
Secondary education	1.5%

Source: own elaboration based on data from Sustainable AgTech Challenge.

Table A 7. Companies' distribution by headquarters region

Region	% of companies
LAC	70.5%
LAC and rest of the world	2.3%
Rest of the world	27.3%

Source: own elaboration based on data from Sustainable AgTech Challenge.

Table A 8. Answers distribution by headquarters country

Country	% of answers
Argentina	15.9%
Austria	0.9%
Barbados	1.9%
Brazil	5.6%
Canada	1.9%
Chile	11.2%
China	0.9%
Colombia	11.2%
Costa Rica	1.9%
Ecuador	0.9%
France	0.9%
Grenada	0.9%
Honduras	0.9%
India	3.7%
Israel	0.9%
Jamaica	2.8%
Japan	0.9%
Kenya	0.9%
Mexico	4.7%
Peru	7.5%
Russia	0.9%
Rwanda	0.9%
Scotland	0.9%
South Africa	1.9%
Spain	0.9%
Sweden	0.9%
Tanzania	0.9%
Thailand	1.9%
United States	12.1%
Uruguay	1.9%

Source: own elaboration based on data from Sustainable AgTech Challenge.

Table A 9. Answers distribution by verticals

Vertical	% of answers
Proteins	16.4%
Row crops	37.5%
Specialty crops	46.1%

Source: own elaboration based on data from Sustainable AgTech Challenge.

Table A 10. Vertical distribution by company headquarters country

Country	% of companies		
	Proteins	Row crops	Specialty crops
Argentina	17.6%	41.2%	41.2%
Barbados	33.3%	0.0%	66.7%
Brazil	20.0%	40.0%	40.0%
Canada	0.0%	50.0%	50.0%
Chile	10.0%	20.0%	70.0%
China	50.0%	50.0%	0.0%
Colombia	7.1%	14.3%	78.6%
Costa Rica	0.0%	50.0%	50.0%
Ecuador	0.0%	100.0%	0.0%
France	0.0%	100.0%	0.0%

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Honduras	0.0%	50.0%	50.0%
India	40.0%	40.0%	20.0%
Israel	100.0%	0.0%	0.0%
Jamaica	0.0%	66.7%	33.3%
Mexico	0.0%	33.3%	66.7%
More than one country	11.1%	55.6%	33.3%
Peru	42.9%	28.6%	28.6%
Russia	0.0%	50.0%	50.0%
Rwanda	0.0%	0.0%	100.0%
Scotland	0.0%	0.0%	100.0%
South Africa	0.0%	0.0%	100.0%
Sweden	0.0%	100.0%	0.0%
Tanzania	100.0%	0.0%	0.0%
United States	13.3%	46.7%	40.0%
Uruguay	0.0%	100.0%	0.0%

Source: own elaboration based on data from Sustainable AgTech Challenge.

TTable A 11. Descriptive statistics of company seniority

Variable	Description	Mean	Median	Std. Dev.	Min	Max
seniority	Seniority of the company, computed as 2021 minus its year of foundation	4.89	3.00	9.87	0.00	70.00

Source: own elaboration based on data from Sustainable AgTech Challenge.

Table A 12. Companies' distribution by seniority

Seniority of the company	% of companies
0-4 years	76.1%
10 years or more	8.0%
5-9 years	15.9%

Source: own elaboration based on data from Sustainable AgTech Challenge.

Table A 13. Median of company seniority by headquarters country

Country	Median seniority
Argentina	3.0
Austria	0.0
Barbados	1.0
Brazil	3.0
Canada	3.0
Chile	1.0
China	3.0
Colombia	6.0
Costa Rica	4.0
Ecuador	4.0
France	4.0
Grenada	3.0
Honduras	0.0
India	2.0
Israel	5.0

(Table continues on next page)

Jamaica	3.0
Japan	4.0
Kenya	1.0
Mexico	1.5
Peru	7.0
Russia	0.0
Rwanda	1.0
Scotland	0.0
South Africa	3.5
Spain	0.0
Sweden	3.0
Tanzania	0.0
Thailand	4.0
United States	4.0
Uruguay	0.0

Source: own elaboration based on data from Sustainable AgTech Challenge.

Table A 14. Answers distribution by type of solution: value chain perspective

Value chain stage	% of answers
Food Processing and Packaging	12.7%
Food Service	1.8%
Input Industry	21.8%
Primary Production	41.8%
Retail	1.8%
Waste Disposal	20.0%

Source: own elaboration based on data from Sustainable AgTech Challenge.

Table A 15. Companies' distribution by type of solution: innovation area perspective

Type of solution	% of companies
Innovative Foods	13.7%
Big Data and Precision Agriculture	7.8%
Bioenergy and Biomaterials	5.9%
Genetics and New Crops	23.5%
Logistics and Food Distribution	7.8%
Mechanization of Work, Food and Irrigation Systems	13.7%
New Production Systems	7.8%
Purchase and Sale Platform, Outsourced Services and Financing	7.8%
Management Software	11.8%

Source: own elaboration based on data from Sustainable AgTech Challenge.

Table A 16. Solution distribution by verticals

Type of solution	% of answers		
	Proteins	Row crops	Specialty crops
Innovative Foods	33.3%	0.0%	8.3%
Big Data and Precision Agriculture	8.3%	12.1%	8.3%
Bioenergy and Biomaterials	8.3%	9.1%	0.0%
Genetics and New Crops	25.0%	21.2%	27.8%
Logistics and Food Distribution	8.3%	12.1%	8.3%
Mechanization of Work, Food and Irrigation Systems	0.0%	21.2%	11.1%
New Production Systems	8.3%	12.1%	8.3%
Purchase and Sale Platform, Outsourced Services and Financing	8.3%	9.1%	11.1%
Management Software	0.0%	3.0%	16.7%

Source: own elaboration based on data from Sustainable AgTech Challenge.

Table A 17. **Solution distribution by company headquarters region**

Type of solution	% of companies		
	LAC	LAC and rest of the world	Rest of the world
Innovative Foods	11.1%	50.0%	15.4%
Big Data and Precision Agriculture	8.3%	0.0%	7.7%
Bioenergy and Biomaterials	2.8%	0.0%	15.4%
Genetics and New Crops	27.8%	0.0%	15.4%
Logistics and Food Distribution	5.6%	0.0%	15.4%
Mechanization of Work, Food and Irrigation Systems	13.9%	50.0%	7.7%
New Production Systems	8.3%	0.0%	7.7%
Purchase and Sale Platform, Outsourced Services and Financing	8.3%	0.0%	7.7%
Management Software	13.9%	0.0%	7.7%

Source: own elaboration based on data from Sustainable AgTech Challenge.

Table A 18. **Answers distribution by type of technology**

Type of technology	% of answers
Big Data	31.8%
Blockchain	4.5%
Geolocation	13.6%
Artifical Intelligence	2.3%
Internet of Things	25.0%
Robotics	6.8%
Remote Sensing	15.9%

Source: own elaboration based on data from Sustainable AgTech Challenge.

Table A 19. Type of technology distribution by verticals

Type of technology	% of answers		
	Proteins	Row crops	Specialty crops
Big Data	57.1%	32.4%	34.4%
Blockchain	14.3%	5.9%	3.1%
Geolocation	0.0%	14.7%	15.6%
Artifical Intelligence	0.0%	2.9%	3.1%
Internet of Things	28.6%	23.5%	28.1%
Robotics	0.0%	8.8%	3.1%
Remote Sensing	0.0%	11.8%	12.5%

Source: own elaboration based on data from Sustainable AgTech Challenge.

Table A 20. Answers distribution by SDGs

SDG	% of answers
Affordable and Clean Energy	3.9%
Clean Water and Sanitation	7.5%
Climate Action	16.2%
Gender Equality	10.1%
Industry, Innovation, and Infrastructure	13.6%
Life on Land	14.5%
Sustainable Production and Consumption	18.4%
Zero hunger	15.8%

Source: own elaboration based on data from Sustainable AgTech Challenge.

Table A 21. Companies' distribution by number of targeted SDGs

Number of SDGs	% of companies
1	9.8%
2	18.0%
3	21.3%
4	23.0%
5	11.5%
6	3.3%
7	9.8%
8	3.3%

Source: own elaboration based on data from Sustainable AgTech Challenge.

Table A 22. SDGs distribution by verticals

SDG	% of answers		
	Proteins	Row crops	Specialty crops
Affordable and Clean Energy	5.1%	4.6%	4.3%
Clean Water and Sanitation	8.5%	8.5%	7.4%
Climate Action	16.9%	16.9%	16.7%
Gender Equality	6.8%	7.7%	11.1%
Industry, Innovation, and Infrastructure	8.5%	14.6%	12.3%
Life on Land	13.6%	14.6%	14.8%
Sustainable Production and Consumption	18.6%	18.5%	17.9%
Zero hunger	22.0%	14.6%	15.4%

Source: own elaboration based on data from Sustainable AgTech Challenge.

Table A 23. Answers distribution by Carbon-Smart Outcome

Carbon-Smart Outcome	% of answers
Climate change adaptation and resilience	20.0%
Climate change mitigation	36.2%
Sustainable increase of productivity	43.8%

Source: own elaboration based on data from Sustainable AgTech Challenge.

Table A 24. Type of technology distribution by SDGs

Type of technology	% of answers							
	SDG							
	Affordable and Clean Energy	Clean Water and Sanitation	Climate Action	Gender Equality	Industry, Innovation, and Infra-structure	Life on Land	Sustainable Production and Con-sumption	Zero hunger
Big Data	20.0%	42.9%	33.3%	36.4%	35.0%	35.3%	30.8%	35.3%
Blockchain	0.0%	0.0%	5.6%	0.0%	5.0%	5.9%	3.8%	0.0%
Geolocation	0.0%	14.3%	27.8%	27.3%	15.0%	23.5%	19.2%	17.6%
Artifical Intelligence	0.0%	0.0%	5.6%	9.1%	0.0%	5.9%	0.0%	5.9%
Internet of Things	0.0%	14.3%	22.2%	9.1%	15.0%	5.9%	23.1%	23.5%
Robotics	60.0%	14.3%	0.0%	9.1%	15.0%	17.6%	3.8%	5.9%
Remote Sensing	20.0%	14.3%	5.6%	9.1%	15.0%	5.9%	19.2%	11.8%

Source: own elaboration based on data from Sustainable AgTech Challenge.

Table A 25. Type of technology distribution by Carbon-Smart Outcome

Type of technology	% of answers		
	Carbon-Smart Outcome		
	Climate change adaptation and resilience	Climate change mitigation	Sustainable increase of productivity
Big Data	30.0%	35.0%	33.3%
Blockchain	10.0%	5.0%	0.0%
Geolocation	40.0%	15.0%	16.7%
Artificial Intelligence	0.0%	0.0%	3.3%
Internet of Things	20.0%	15.0%	23.3%
Robotics	0.0%	15.0%	3.3%
Remote Sensing	0.0%	15.0%	20.0%

Source: own elaboration based on data from Sustainable AgTech Challenge.

Table A 26. Are the companies tracking their environmental impact?

Does the company track its environmental impact?	% of companies
No	78.6%
Yes	21.4%

Source: own elaboration based on data from Sustainable AgTech Challenge.

Table A 27. Are the companies tracking their environmental impact? Distribution by SDGs

SDG	% of companies Does the company track its environmental impact?	
	No	Yes
Affordable and Clean Energy	75.0%	25.0%
Clean Water and Sanitation	71.4%	28.6%
Climate Action	85.7%	14.3%
Gender Equality	77.3%	22.7%
Industry, Innovation, and Infrastructure	82.8%	17.2%
Life on Land	77.4%	22.6%
Sustainable Production and Consumption	74.4%	25.6%
Zero hunger	78.8%	21.2%

Source: own elaboration based on data from Sustainable AgTech Challenge.

Table A 28. Are the companies including vulnerable social groups?

Does the company's technology/innovation target vulnerable social groups?	% of companies
No	10.7%
Yes	89.3%

Source: own elaboration based on data from Sustainable AgTech Challenge.

Table A 29. **Are the companies including vulnerable social groups? Distribution by SDGs**

SDG	% of answers Does the company's technology/innovation target vulnerable social groups?	
	No	Yes
Affordable and Clean Energy	12.5%	87.5%
Clean Water and Sanitation	7.1%	92.9%
Climate Action	11.4%	88.6%
Gender Equality	9.1%	90.9%
Industry, Innovation, and Infrastructure	13.8%	86.2%
Life on Land	6.5%	93.5%
Sustainable Production and Consumption	12.8%	87.2%
Zero hunger	9.1%	90.9%

Source: own elaboration based on data from Sustainable AgTech Challenge.

Table A 30. **Are the companies tracking their social impact?**

Does the company track its social impact?	% of companies
No	85.7%
Yes	14.3%

Source: own elaboration based on data from Sustainable AgTech Challenge.

Table A 31. Are the companies tracking their social impact? Distribution by SDGs

SDG	% of answers Does the company track its social impact?	
	No	Yes
Affordable and Clean Energy	75.0%	25.0%
Clean Water and Sanitation	85.7%	14.3%
Climate Action	91.4%	8.6%
Gender Equality	68.2%	31.8%
Industry, Innovation, and Infrastructure	86.2%	13.8%
Life on Land	83.9%	16.1%
Sustainable Production and Consumption	87.2%	12.8%
Zero hunger	78.8%	21.2%

Source: own elaboration based on data from Sustainable AgTech Challenge.

Table A 32. Growth possibilities of companies: partial correlations between the jury's score and selected variables

Explanatory variables	Model		
	1	2	3
	Explained variable		
	Startup score (in log)	Startup score (in log)	Startup score (in log)
Number of women as a percentage of founding members	-0.235	-0.0674	-0.219
	(0.357)	(0.787)	(0.323)
Average age of the team members			
Age 20-29 (base category)	-	-	-
	-	-	-
Age 30-39	-0.0339	-0.0582	-0.215**
	(0.756)	(0.634)	(0.0260)
Age 40-49	0.265	0.226	0.00304
	(0.130)	(0.197)	(0.985)
Age 50-59	0.143	0.272	-0.000574
	(0.398)	(0.146)	(0.996)
Highest education level			
Bachelor's or equivalent (base category)	-	-	-
	-	-	-
Doctorate or equivalent	-0.385**	-0.235	-
	(0.0432)	(0.214)	-
Master's or equivalent	-0.170	0.100	-
	(0.357)	(0.593)	-
Lowest education level			
Bachelor's or equivalent (base category)	-	-	-
	-	-	-
Master's or equivalent	0.0275	-	0.135
	(0.881)	-	(0.469)

(Table continues on next page)

Primary education	0.215**	-	0.126
	(0.0193)	-	(0.148)
Secondary education	0.328**	-	0.547***
	(0.0309)	-	(0.000523)
Tertiary education	0.399***	-	0.310**
	(0.00528)	-	(0.0338)
Geographical location			
LAC (base category)	-	-	-
	-	-	-
Rest of the world	0.159*	0.198**	0.151**
	(0.0682)	(0.0119)	(0.0267)
Vertical			
Proteins (base category)	-	-	-
	-	-	-
Row crops	0.0318	0.0447	0.0708
	(0.331)	(0.274)	(0.192)
Specialty crops	0.0165	0.0118	0.0612
	(0.503)	(0.745)	(0.244)
Seniority of the company			
0-4 years (base category)	-	-	-
	-	-	-
10 years or more	-0.154	-0.328**	-0.349*
	(0.487)	(0.0387)	(0.0542)
5-9 years	-0.415**	-0.269*	-0.524***
	(0.0463)	(0.0783)	(0.00749)
SDGs			
Affordable and Clean Energy (base category)	-	-	-
	-	-	-
Clean Water and Sanitation	-0.0148	-0.00174	0.0363
	(0.609)	(0.965)	(0.512)

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Climate Action	-0.0327	-0.0362	-0.0529
	(0.229)	(0.164)	(0.106)
Gender Equality	-0.0258	-0.0204	-0.0446
	(0.323)	(0.423)	(0.171)
Industry, Innovation, and Infrastructure	-0.0240	-0.00425	-0.0436
	(0.313)	(0.820)	(0.182)
Life on Land	-0.0380	-0.0466*	-0.0594
	(0.162)	(0.0930)	(0.100)
Sustainable Production and Consumption	0.0413*	0.0411	0.00977
	(0.0511)	(0.104)	(0.732)
Zero hunger	-0.0290	-0.0311*	-0.0433
	(0.142)	(0.0852)	(0.104)
Number of targeted SDGs	-0.0240	-0.00737	-0.0753***
	(0.513)	(0.764)	(0.00393)
Social inclusion (dummy)	0.345*	0.619***	0.500**
	(0.0527)	(4.06e-05)	(0.0169)
Social tracking (dummy)	0.0730	0.119	0.172*
	(0.390)	(0.158)	(0.0513)
Environmental tracking (dummy)	0.327**	0.0662	0.258
	(0.0297)	(0.625)	(0.138)
Barriers			
Access to capital (base category)	-	-	-
	-	-	-
Access to human capital	0.00573	0.0331	0.0108
	(0.624)	(0.114)	(0.443)
Access to markets	-0.00464	0.0239	-0.0209
	(0.780)	(0.449)	(0.311)
Bureaucratic hurdles	0.00144	0.0397	0.0207
	(0.951)	(0.215)	(0.482)

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Connectivity	0.0715	0.0910	0.0828
	(0.297)	(0.225)	(0.245)
Infrastructure	-0.0356	-0.0429	-0.00613
	(0.499)	(0.551)	(0.911)
Lack of recognition for the entrepreneur as a role model	0.0234	-0.0557	0.0849
	(0.772)	(0.450)	(0.396)
Low interaction between the scientific and business worlds	-0.0412	-0.0111	-0.0348
	(0.110)	(0.700)	(0.204)
Other factors	-0.0794	-0.133*	-0.102
	(0.248)	(0.0835)	(0.186)
Tax burden	-0.0416	-0.0983	-0.0613
	(0.469)	(0.232)	(0.233)
Ecosystem (dummy)	-0.0703	-0.156	-0.0259
	(0.743)	(0.389)	(0.878)
Company's projected revenue			
0 USD - 499,999 USD (base category)	-	-	-
	-	-	-
500,000 USD - 999,999 USD	0.453***	0.266**	0.238*
	(0.00396)	(0.0118)	(0.0832)
Constant	0.889***	0.583***	0.851***
	(2.59e-06)	(0.000775)	(3.41e-05)
Observations	488	488	488
R-squared	0.832	0.782	0.807

Source: own elaboration based on data from Sustainable AgTech Challenge.

Note 1: all models were estimated by Ordinary Least Squares (OLS).

Note 2: since some variables can have more than one value for the same company, we pooled the information, i.e., from a statistical perspective, we treat a company with more than one response on a given variable as if it were several different companies. To account for this issue in the statistical inference, we clustered standard errors by companies. P-values in parentheses. *** p-value<0.01, ** p-value<0.05, * p-value<0.1.

Note 3: if applicable, the expected income reported was converted into dollars using the current exchange rate at the time of the declaration.

Table A 33. Answers distribution by barriers that hinder/prevent the appearance or growth of new ventures in AgTech

Barrier	% of answers
Access to capital	26.5%
Access to human capital	7.6%
Access to markets	16.2%
Bureaucratic hurdles	11.9%
Connectivity	4.9%
Infrastructure	8.1%
Lack of recognition for the entrepreneur as a role model	5.4%
Low interaction between the scientific and business worlds	13.0%
Other factors	2.2%
Tax burden	4.3%

Source: own elaboration based on data from Sustainable AgTech Challenge.

Table A 34. Barriers that hinder/prevent the appearance or growth of new ventures in AgTech: distribution by gender

Barrier	% of answers			
	Gender (founding team)			
	Female only	Male and female	Male only	Male, female and other
Access to capital	29.4%	27.4%	23.3%	25.0%
Access to human capital	0.0%	8.5%	4.7%	0.0%
Access to markets	11.8%	16.2%	20.9%	0.0%
Bureaucratic hurdles	17.6%	12.8%	4.7%	25.0%
Connectivity	0.0%	6.0%	4.7%	0.0%
Infrastructure	5.9%	7.7%	9.3%	25.0%
Lack of recognition for the entrepreneur as a role model	11.8%	4.3%	7.0%	0.0%
Low interaction between the scientific and business worlds	17.6%	10.3%	18.6%	25.0%
Other factors	5.9%	0.9%	4.7%	0.0%
Tax burden	0.0%	6.0%	2.3%	0.0%

Source: own elaboration based on data from Sustainable AgTech Challenge.

Table A 35. Barriers that hinder/prevent the appearance or growth of new ventures in AgTech: distribution by education level of the most educated member

Barrier	% of answers			
	Education level			
	Bachelor's or equivalent	Doctorate or equivalent	Master's or equivalent	Secondary education
Access to capital	30.0%	24.4%	28.7%	0.0%
Access to human capital	5.0%	7.7%	6.3%	0.0%
Access to markets	20.0%	15.4%	16.3%	33.3%
Bureaucratic hurdles	10.0%	12.8%	11.3%	0.0%
Connectivity	5.0%	6.4%	3.8%	0.0%
Infrastructure	0.0%	10.3%	8.8%	0.0%
Lack of recognition for the entrepreneur as a role model	10.0%	2.6%	6.3%	33.3%
Low interaction between the scientific and business worlds	10.0%	14.1%	12.5%	33.3%
Other factors	10.0%	1.3%	1.3%	0.0%
Tax burden	0.0%	5.1%	5.0%	0.0%

Source: own elaboration based on data from Sustainable AgTech Challenge.

Table A 36. Barriers that hinder/prevent the appearance or growth of new ventures in AgTech: distribution by verticals

Barrier	% of answers		
	Vertical		
	Proteins	Row crops	Specialty crops
Access to capital	27.9%	26.3%	26.6%
Access to human capital	9.3%	8.1%	7.0%
Access to markets	20.9%	19.2%	14.1%
Bureaucratic hurdles	16.3%	13.1%	11.7%
Connectivity	4.7%	4.0%	5.5%
Infrastructure	4.7%	6.1%	9.4%
Lack of recognition for the entrepreneur as a role model	0.0%	4.0%	6.3%
Low interaction between the scientific and business worlds	11.6%	13.1%	13.3%
Other factors	2.3%	2.0%	2.3%
Tax burden	2.3%	4.0%	3.9%

Source: own elaboration based on data from Sustainable AgTech Challenge.

Table A 37. Barriers that hinder/prevent the appearance or growth of new ventures in AgTech: distribution by selected countries

Barrier	% of answers				
	Country				
	Argentina	Brazil	Chile	Colombia	Peru
Access to capital	25.0%	27.3%	30.0%	33.3%	23.1%
Access to human capital	3.6%	18.2%	10.0%	6.7%	7.7%
Access to markets	17.9%	18.2%	30.0%	3.3%	23.1%
Bureaucratic hurdles	10.7%	18.2%	0.0%	6.7%	7.7%
Connectivity	7.1%	0.0%	0.0%	6.7%	15.4%
Infrastructure	0.0%	0.0%	0.0%	16.7%	7.7%
Lack of recognition for the entrepreneur as a role model	10.7%	9.1%	10.0%	6.7%	0.0%
Low interaction between the scientific and business worlds	14.3%	9.1%	10.0%	16.7%	15.4%
Other factors	0.0%	0.0%	10.0%	0.0%	0.0%
Tax burden	10.7%	0.0%	0.0%	3.3%	0.0%

Source: own elaboration based on data from Sustainable AgTech Challenge.

Table A 38. Barriers that hinder/prevent the appearance or growth of new ventures in AgTech: distribution by company seniority

Barrier	% of answers		
	Company seniority		
	0-4 years	10 years or more	5-9 years
Access to capital	26.0%	23.8%	30.0%
Access to human capital	4.7%	14.3%	10.0%
Access to markets	18.9%	4.8%	13.3%
Bureaucratic hurdles	13.4%	4.8%	10.0%
Connectivity	3.9%	19.0%	0.0%
Infrastructure	6.3%	19.0%	6.7%
Lack of recognition for the entrepreneur as a role model	4.7%	0.0%	13.3%
Low interaction between the scientific and business worlds	13.4%	14.3%	13.3%
Other factors	3.1%	0.0%	0.0%
Tax burden	5.5%	0.0%	3.3%

Source: own elaboration based on data from Sustainable AgTech Challenge.

Table A 39. **Barriers that hinder/prevent the appearance or growth of new ventures in AgTech: distribution by SDGs**

Barrier	% of answers							
	SDG							
	Affordable and Clean Energy	Clean Water and Sanitation	Climate Action	Gender Equality	Industry, Innova-tion, and Infrastruc-ture	Life on Land	Sustainable Production and Consumption	Zero hunger
Access to capital	29.6%	21.1%	24.4%	24.7%	25.3%	24.1%	26.4%	24.6%
Access to human capital	14.8%	7.0%	7.6%	9.1%	10.1%	5.6%	7.0%	7.9%
Access to markets	14.8%	15.8%	19.3%	15.6%	15.2%	15.7%	17.8%	17.5%
Bureaucratic hurdles	14.8%	17.5%	11.8%	14.3%	11.1%	13.0%	12.4%	14.0%
Connectivity	3.7%	5.3%	5.0%	3.9%	6.1%	3.7%	5.4%	5.3%
Infrastructure	7.4%	12.3%	9.2%	7.8%	12.1%	9.3%	9.3%	7.0%
Lack of recognition for the entrepreneur as a role model	3.7%	3.5%	3.4%	6.5%	3.0%	6.5%	3.9%	3.5%
Low interaction between the scientific and business worlds	7.4%	14.0%	12.6%	15.6%	12.1%	16.7%	11.6%	14.0%
Other factors	0.0%	1.8%	1.7%	0.0%	1.0%	0.9%	1.6%	0.9%
Tax burden	3.7%	1.8%	5.0%	2.6%	4.0%	4.6%	4.7%	5.3%

Source: own elaboration based on data from Sustainable AgTech Challenge.

Table A 40. **Do the companies have an ecosystem in its geographical location?**

Does the company have an ecosystem in its geographical location?	% of companies
No	19.3%
Yes	80.7%

Source: own elaboration based on data from Sustainable AgTech Challenge.

Table A 41. **Do the companies have an ecosystem in its geographical location? Distribution of barriers that hinder/prevent the appearance or growth of new ventures in AgTech**

Barrier	% of answers	
	Does the company have an ecosystem in its geographical location?	
	No	Yes
Access to capital	19.4%	27.5%
Access to human capital	6.5%	7.7%
Access to markets	19.4%	15.5%
Bureaucratic hurdles	6.5%	13.4%
Connectivity	6.5%	4.2%
Infrastructure	9.7%	7.0%
Lack of recognition for the entrepreneur as a role model	12.9%	4.2%
Low interaction between the scientific and business worlds	16.1%	13.4%
Other factors	0.0%	2.8%
Tax burden	3.2%	4.2%

Source: own elaboration based on data from Sustainable AgTech Challenge.

Table A 42. **Do the companies have a clear commitment to sustainability?**

Does the company have a clear commitment to sustainability?	% of companies
No	30.0%
Yes	70.0%

Source: own elaboration based on data from Sustainable AgTech Challenge.

Table A 43. **Do the companies have a clear commitment to sustainability? Distribution of barriers that hinder/prevent the appearance or growth of new ventures in Ag**

Barrier	% of answers	
	Does the company have a clear commitment to sustainability?	
	No	Yes
Access to capital	23.9%	29.2%
Access to human capital	10.9%	5.6%
Access to markets	13.0%	19.1%
Bureaucratic hurdles	10.9%	7.9%
Connectivity	4.3%	7.9%
Infrastructure	8.7%	7.9%
Lack of recognition for the entrepreneur as a role model	4.3%	4.5%
Low interaction between the scientific and business worlds	15.2%	11.2%
Other factors	4.3%	2.2%
Tax burden	4.3%	4.5%

Source: own elaboration based on data from Sustainable AgTech Challenge.