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DIGITAL AGRICULTURE ECOSYSTEM ASSESSMENT: COLOMBIA

A REPORT FOR USAID/COLOMBIA

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THE AGTECH NETWORK

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This Digital Agriculture Ecosystem Assessment for Colombia was authored by Leslie Arathoon and Alejandro Ruíz with the support and guidance of Natalia Pshenichnaya.

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LIST OF ACRONYMS

ACRONYM	DEFINITION
2G, 3G, 4G	second-generation, third-generation, fourth-generation mobile networks
ACORN	Agroforestry Carbon Removal Units for the Organic Restoration of Nature
ADR	Agencia de Desarrollo Rural
AI	artificial intelligence
ANT	Agencia Nacional de Tierras, National Land Agency
ART	Agencia de Renovación del Territorio (Agency for the Renovation of Territories)
BASF	Badische Anilin und Sodafabrik
B2B	business-to-business
B2C	business-to-consumer
C4IR	Center for the Fourth Industrial Revolution Colombia
CAF	Corporación Andina de Fomento (Andean Corporation of Development)
CCB	Bogotá Chamber of Commerce
CEPAL	United Nations Economic Commission for Latin America and the Caribbean
CIAT	Centro Internacional de Agricultura Tropical (International Center for Tropical Agriculture)
CGAP	Consultative Group to Assist the Poor
CGIAR	Consortium of International Agricultural Research Centers
CO^2	carbon dioxide
COP	Colombian pesos
CRC	Comisión de Regulación de Comunicaciones
CRU	Carbon Removal Units
CSICAP	Climate-smart initiatives for climate change adaptation and sustainability in prioritized agricultural production systems
DAI	DAI Global, LLC
DANE	Departamento Administrativo Nacional de Estadística (National Administrative Department of Statistics)
DECA	Digital Ecosystem Country Assessment
DFS	digital financial services
DIASCA	Digital Integration of Agricultural Supply Chains
DID	Développement International Desjardins
DGI	OECD Digital Government Index
DNP	Departamento Nacional de Planeación (National Planning Department)
EPSEA	Entidad Prestadora del Servicio de Extensión Agropecuaria (Entity Providing Agricultural Extension Services)
ESO	Entrepreneur Support Organizations
EU	European Union

FADQDI	Financière Agricole du Quebec Développement
FAO	Food and Agriculture Organization of the United Nations
FCMC	Forest Carbon, Markets and Communities
FNC	Federación Nacional de Cafeteros
FNFH	Fondo Nacional de Fomento Hortifrutícola (National Fruit and Vegetable Development Fund)
FSP	financial service provider
G2P	government-to-person
GBV	gender-based violence
GDP	Gross Domestic Product
GIZ	German Agency for International Cooperation
GPS	global positioning system
GSMA	Global System for Mobile Communications Association
ha	hectare
HCD	human-centered design
ICA	Instituto Colombiano Agropecuario
ICT	information and communications technology
ID	identification
IDB	Inter-American Development Bank
IICA	Inter-American Institute for Cooperation on Agriculture
INCAS	Iniciativa Cadenas Agrícolas Sostenibles (GIZ-supported project)
IoT	Internet of Things
IVR	interactive voice response
kg	kilogram
KII	key informant interview
km	kilometer
LPWA	low power wide area
MADR	Ministerio de Agricultura y Desarrollo Rural (Ministry of Agriculture and Rural Development).
MiCRO	Microinsurance Catastrophe Risk Organization
Minambiente	Ministerio de Ambiente y Desarrollo Sostenible (Ministry of the Environment and Sustainable Development)
Minciencias	Ministerio de Ciencia, Tecnología e Innovación (Ministry of Science, Technology and Innovation)
Mincit	Ministerio de Comercio, Industria y Turismo (Ministry of Commerce, Industry and Tourism)
Mintic	Ministerio de Tecnologías de la Información y las Comunicaciones (Ministry of Information Technology and Communications)
MNO	mobile network operator
NARP	Negro, AfroColombiano, Raizal, Palenquera (Black, Afro-Colombian, Raizal/Afro-Caribbean and Palenquera/ Descendant from first community of freed slaves).
NDC	Nationally Determined Contribution

NGO	non-governmental organization
OEC	Observatory of Economic Complexity
OECD	Organization for Economic Cooperation and Development
OFIS	Olam Farmer Information System
PDET	Programas de Desarrollo con Enfoque Territorial (Development Plans with a Territorial Focus)
PC	personal computer
PNFH	Plan Nacional de Fomento Hortifrutícola (National Fruit and Vegetable Development Plan)
QR	quick response code
RFS	Bureau for Resilience and Food Security
RSPO	Roundtable on Sustainable Palm Oil
SDC	Swiss Agency for Development and Cooperation
SIG	Sistema Informativo Geográfico (Information Geographic System)
SIGRA	Sistema de Información para la Gestión de Riesgos Agropecuarios (Information System for Agricultural Risk Management)
SIIPO	Sistema Integrado de Información para el Posconflicto (Integrated Information System for Post Conflict Areas)
SIM	subscriber identity module
SIPRA	Sistema de Información para la Planificación Rural Agropecuaria (Information System for Rural Agricultural Planning)
SMB/SME	small or medium business / small or medium enterprise
SMS	short message service
SRC	Significant Rural Connectivity
TV	television
UNDP	United Nations Development Programme
UPRA	Unidad de Planificación Rural Agropecuaria (Rural Agriculture Planning Unit)
USAID	United States Agency for International Development
USD	United States dollar
USDA	United States Department of Agriculture
UTP	Universidad Tecnológica de Pereira (Pereira Technological University)
VCM	voluntary carbon market

EXECUTIVE SUMMARY

Colombia has emerged as a leading worldwide agricultural producer. It has a varied terrain that includes tropical forests, grassland plains, and mountainous regions that makes the landscape suitable for a wide array of tropical and temperate-weather crops, as well as livestock. It also enjoys plentiful access to freshwater sources as well as significant rainfall throughout the year. According to the FAO, Colombia is the tenth-largest agricultural producer in the world, and the second-largest in Latin America.

Despite its worldwide status as a top producer, Colombia's agriculture industry is failing to meet its potential. The industry has been hampered by low productivity, a decrease in cultivated land caused by the rise in input prices and migration to cities, crop losses stemming from climate events and inefficiencies at all stages of the agricultural cycle, and a long history of violence that has led to the isolation of millions of Colombians living in rural areas.

Unlike regional agro-industrial powerhouses such as Argentina and Brazil that are characterized by capital-intensive and highly mechanized farming processes, **Colombia is characterized by the prevalence of smallholder farming.** According to local statistics agency DANE, there are an estimated 2.7 million smallholder farmers in the country, who produce roughly 80% of domestic food consumption on plots averaging under 5 hectares. These smallholder farmers face a number of challenges, including geographic isolation, rising production costs, limited access to information, limited access to financing, difficulty accessing markets, and vulnerability to changing weather patterns. The result is a value-add per agricultural worker that is roughly half that of Brazil and one-twentieth that of the United States.

Digital agriculture solutions can transform rural communities by helping smallholder farmers more quickly and cost-effectively gain access to information, financial services, markets for their crops, and assets that enable them to become more productive and improve their incomes. Digital agriculture solutions can also help rural communities build resilience against climate change by giving farmers the tools they need to optimize the use of natural resources and inputs, reduce their carbon footprint, and adopt climate-smart practices. Given the potential of digital agriculture solutions to positively impact rural communities, it is no surprise that agriculture sector stakeholders, ranging from government agencies to agribusinesses and farmer groups to NGOs to established technology companies and startups, are investing millions to develop digital agriculture solutions throughout Colombia.

This report presents the findings of the Digital Agriculture Ecosystem Assessment in Colombia, commissioned by the United States Agency for International Development (USAID) through DAI. The main objective of the assessment is to develop a better understanding of the digital agriculture landscape in Colombia to identify opportunities for positive intervention. Our analysis suggests that, as arguably the largest agricultural market in Latin America centered around smallholder farmers, **Colombia has an opportunity to become a regional digital agriculture innovation hub focused on addressing the challenges faced by smallholder farmers and the ecosystem partners that work alongside them.** Colombia is ideally suited to fill this role given its size as the third-largest economy in the region, its supportive startup ecosystem, and its geographic location strategically situated between agtech hubs in North America (US) and South America (Argentina/Brazil).

Based on our analysis of Colombia's digital agriculture landscape, we have developed a series of recommendations for USAID and other agriculture sector stakeholders to underpin the development and scaling of digital agriculture solutions in Colombia:

1. **SUPPORT THE DEVELOPMENT OF A DIGITAL AGRICULTURE STRATEGY FOR COLOMBIA.**
   The broader digital agriculture ecosystem would benefit from clearer direction from the government about its priorities for digital agriculture in Colombia, as well as the roles of each individual government ministry and agency.

2. **SUPPORT PUBLIC AND PRIVATE SECTOR EFFORTS TO EXTEND NETWORK CONNECTIVITY AND INTERNET ACCESS TO RURAL AREAS.**
   Lack of network availability and internet access in rural areas remains the leading bottleneck for the scaling of digital agriculture solutions in Colombia. Given the urgency around network buildout, a multi-pronged approach based on private-public collaboration should be pursued.

3. **FOSTER DEVELOPMENT OF THE DIGITAL FINANCIAL SERVICES ECOSYSTEM IN RURAL COLOMBIA.**
   The Colombian government has made great strides in creating an enabling environment for digital financial services in the country, but more can be done, including open banking and real-time-payments legislation.

4. **BUILD ROBUST, CENTRALIZED, UP-TO-DATE REPOSITORIES OF AGRICULTURE SECTOR DATA, INCLUDING FARMER REGISTRIES.**
   Colombia's agriculture sector would greatly benefit from the creation of an up-to-date database of agriculture-sector data easily accessible to all ecosystem players. Dissemination campaigns should be put in place to ensure all ecosystem actors are aware of this important resource.

5. **FACILITATE NETWORKING AND SHARING OF BEST PRACTICES.**
   Industry actors should support the development of innovation hubs and other spaces that encourage collaboration, the sharing of best practices, and information sharing.

6. **ENCOURAGE ENTREPRENEURSHIP IN AGRICULTURE.**
   Agricultural programs at the universities across Colombia should add entrepreneurship to their curriculum. Students should be encouraged to translate promising projects developed at university into entrepreneurial ventures upon graduation. Grants could be made available to encourage development of the most promising projects and transform ideas into viable business opportunities.

7. **FACILITATE ESSENTIAL SKILLS TRAINING, INCLUDING DIGITAL AND FINANCIAL LITERACY PROGRAMS.**
   Leverage engagement with rural communities to offer digital and financial literacy programs to reduce barriers to adoption.

8. **CONTINUE INCLUDING GENDER TARGETS IN INTERVENTIONS.**
   Ecosystem stakeholders can also identify best practices for the inclusion of women and seek partnerships with organizations with a successful track record in working with rural women.

9. **SEEK PARTNERSHIPS WHEN ENTERING REMOTE/PDET REGIONS.**
   Digital agriculture service providers should leverage the expertise of organizations that have been operating on the ground in remote regions, that understand the nuances of the region, and that have gained the trust of local smallholders.

10. **SUPPORT THE DEVELOPMENT OF A VOLUNTARY CARBON MARKET SUPPORTING SMALLHOLDER FARMERS IN COLOMBIA.** The government, donors and NGOs should support agribusiness, value chain association and farmer group efforts to generate new income sources through participation in international carbon markets.

11. **ADAPT STRATEGIES TO LOCAL CONTEXT.**
    Prior to launching any digital agriculture service, digital agriculture service providers should undertake a thorough review of the local operating environment as there is significant variation in cultures, climates, and crops.

12. **ENSURE THE USER IS AT THE CENTER OF PRODUCT DESIGN.**
    Digital agriculture service providers should ensure that users (farmers, extension officers, and agents supporting financial services companies, among others) are involved at every stage of service design, from service ideation to product development, product launch, and subsequent scaling.

01.

INTRODUCTION

1. INTRODUCTION

The primary objective of this digital agriculture assessment for Colombia is to develop a better understanding of the digital agriculture landscape in the country and identify opportunities for positive intervention. This assessment was developed as part of an ongoing effort by the Bureau for Resilience and Food Security (RFS) to develop digital agriculture assessments for several countries around the world[1]. Our research was focused on answering several key questions as outlined in **Figure 1:**

FIGURE 1: QUESTIONS GUIDING THE RESEARCH IN COLOMBIA

1.	Who are the leading stakeholders implementing digital agriculture solutions in the Colombian market?
2.	What are the challenges faced by smallholder farmers in Colombia that digital tools are seeking to address?
3.	What are the main digital agriculture use cases implemented in Colombia?
4.	What are some of the key enablers promoting the adoption of digital agriculture solutions in Colombia?
5.	What are some of the key challenges stakeholders face when deploying digital agriculture solutions?
6.	What are the strategies and business models being adopted that are driving scale and sustainability?
7.	How are digital agriculture solutions helping to promote climate adaptation and resilience against extreme weather events?
8.	How can digital agriculture solutions promote economic growth and development in the regions designated PDET?
9.	How are digital agriculture solutions benefiting traditionally marginalized populations (women, youth, indigenous, AfroColombian populations)?

SOURCES: The AgTech Network, DAI, USAID.

Although the report was developed in support of USAID and its implementing partners in Colombia, our hope is that the insights and analysis presented will be helpful to the broader digital agriculture ecosystem working to advance the adoption of digital solutions to improve the livelihoods and resilience of smallholder farmers in the country. Supply-side actors like agtechs, fintechs, mobile network operators (MNOs), and technology companies will gain insight into the different types of solutions being implemented in Colombia, as well as the models and strategies being leveraged to scale them. Investors, NGOs, and international development agencies can benefit from the lessons learned, which can help them reduce the risk of investment going forward.

1 Agrilinks and DAI, Digital Agriculture Ecosystem Assessments.

ASSESSMENT ROADMAP

SECTION 1:
Introduction provides an overview of the Assessment objectives and roadmap.

SECTION 2:
Agriculture sector context assesses the sector's overall contribution to the economy and employment.

SECTION 3:
Digital ecosystem overview provides the digital context for our analysis, leveraging the DECA framework developed by USAID and DAI.

SECTION 4:
The role of different stakeholders examines the role different ecosystem stakeholders have played in the development of digital agriculture solutions. We assess various initiatives led by a range of different actors from the public and private sectors including government agencies, academia and research organizations, donors, NGOs and development agencies, incubators, accelerators and innovation hubs, and investors.

SECTION 5:
Digital agriculture landscaping assesses the current digital agriculture landscape in Colombia by taking a deeper look at the various solutions currently available in Colombia. We segment solutions by use case, outlining some of the leading trends and innovations observed within each individual use case. We take a look at how digital agriculture solutions can help farmers become more resilient to climate change, how they can be deployed in the most remote and underserved regions of the country, and how they can support inclusivity.

SECTION 6:
Key findings outlines some of the key enablers supporting the adoption of digital agriculture solutions as well as some of the key challenges standing in the way. We also highlight some of the key business models being employed as well as some of the key findings from our research.

SECTION 7:
Recommendations outlines some of the recommendations for different ecosystem players to maximize impact.

APPENDICES:
Provide additional resources for ecosystem players active in Colombia's digital agriculture market.

METHODOLOGY

The AgTech Network relied on a combination of desk research and key informant interviews (KIIs) with industry stakeholders for the elaboration of this assessment. During the desk research phase, which extended from January through March 2023, we consulted hundreds of secondary sources, including academic journals, reports, news articles, videos, press releases, social media, financial statements, annual reports, websites, databases, and dashboards. The team relied on both local sources (e.g., DANE, UPRA) as well as international sources (e.g., World Bank, ILOSAT, IICA). A sampling of the resources consulted can be found in **Appendix 3.**

On the basis of a thorough review of secondary materials, The AgTech Network developed a database of digital agriculture solutions deployed in Colombia and the stakeholders behind these solutions (see **Appendix 2**). This database, which included more than 150 solutions, informed the selection of targets for the primary interview phase of the project. We prioritized solutions that met several of the criteria outlined in **Figure 2,** though made exceptions when a solution appeared to have a unique value proposition or there was significant investment or institutional support behind it.

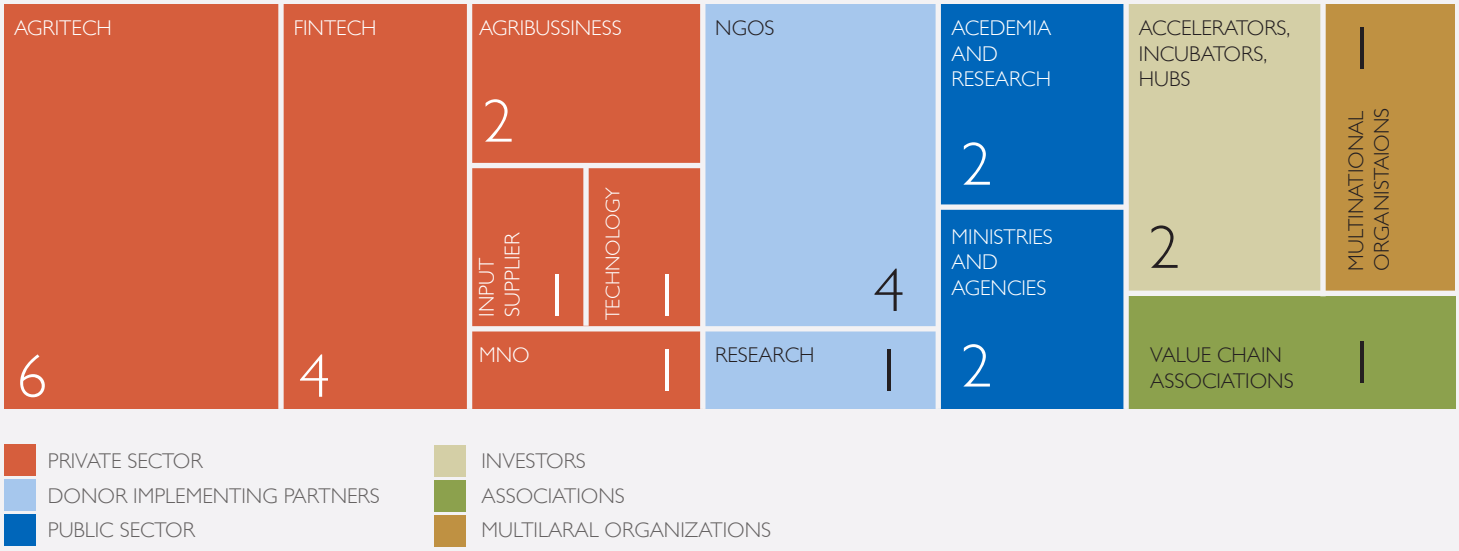
FIGURE 2: THE AGTECH NETWORK DIGITAL AGRICULTURE SOLUTION SELECTION CRITERIA

1.	2.	3.	4.	5.	6.	7.
Addresses challenges faced by smallholder farmers	Commercially available, rather than a pilot	Falls within one of the five priority use cases identified	Aimed at farmers working in value chains with significant farmer engagement (e.g., coffee, cocoa, palm oil, livestock, fresh produce)	Available in remote areas, with priority given to solutions available to farmers in PDET regions	Endeavors to reach under-represented groups (women, youth, ethnic minorities)	Promotes climate adaptation or climate mitigation

SOURCES: The AgTech Network, USAID, DAI.

We also sought to capture a wide variety of experiences and perspectives to inform our analysis. We therefore targeted different types of organizations, including government agencies, research and academia, NGOs, investors, farmer associations, agribusinesses, technology companies, agtechs, and fintechs. Between March and May 2023 The AgTech Network consultants conducted 31 interviews per the distribution outlined in **Figure 3** using an interview guide targeted at each stakeholder type. A full list of participants can be found in **Appendix 1.** The majority of interviews were conducted using video conferencing platforms, as many of the interview targets continued to work remotely post-pandemic and expressed a preference for remote meetings.

FIGURE 3: DISTRIBUTION OF KEY INFORMANT INTERVIEWS BY STAKEHOLDER TYPE



SOURCE: The AgTech Network.

Within this assessment we include several case studies. These are used to provide real-world examples of the trends highlighted in the analysis. When selecting the initiatives to be included in the case studies, we opted for solutions that were particularly innovative or had achieved some level of scale (by Colombian standards). We also opted for examples where we had access to specific insights and data that could strengthen our assessment. A solution's selection as a case study should not be interpreted as an endorsement of that solution by The AgTech Network, USAID, or the United States government.

LIMITATIONS

The AgTech Network endeavored to build one of the most comprehensive databases available of digital agriculture solutions targeted at smallholder farmers in Colombia. We are confident that the solutions with the widest reach and impact are included in our analysis. Nevertheless, we acknowledge that some digital agriculture solutions, particularly those that are developed in-house by smaller farmer groups and associations, may not appear in the database given our inability to reach every stakeholder as well as these solutions' lack of coverage in local media. It is also important to highlight that much of the information provided on specific solutions, including active user numbers and segmentation, farmer outcomes, pricing, and costs, is self-reported. The AgTech network sought to validate information received through KIIs with publicly available sources or insights obtained through interviews with implementing partners or investors. We also endeavored to standardize definitions across organizations, though we acknowledge this was not always feasible. When we came across contradictory information, we revisited interview targets and sought clarification.

The AgTech Network was limited in its ability to conduct formal interviews with the Ministry of Agriculture and Rural Development (MADR) and the Ministry of Information Technology and Communications of (Mintic), as the president replaced the leadership of both ministries in the middle of the interview phase, which resulted in our meetings being postponed indefinitely.

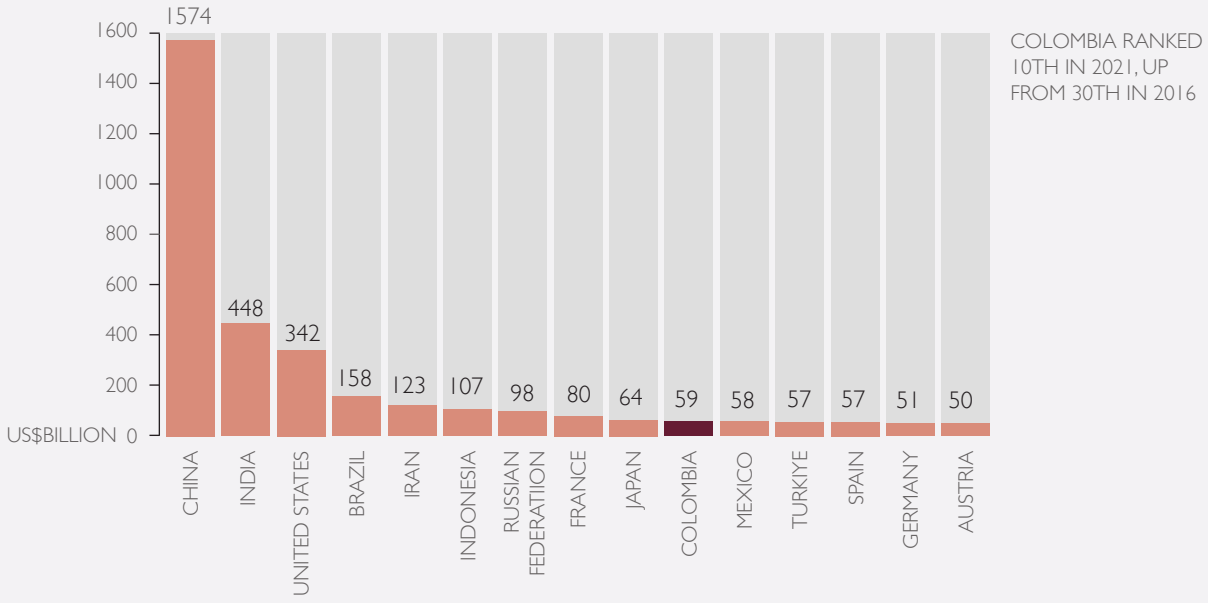
02.

COLOMBIA'S AGRICULTURE SECTOR CONTEXT

2. COLOMBIA'S AGRICULTURE SECTOR CONTEXT

Colombia, Latin America's third-most populous country with 52.2 million people,[2] has emerged as a leading global agricultural producer. It has a varied terrain that includes tropical forests, grassland plains, and mountainous regions that makes the landscape suitable for a wide array of crops and livestock. It also enjoys plentiful access to freshwater sources as well as significant rainfall throughout the year. Because of its location and climate, Colombia can grow crops year-round, often getting a second agricultural cycle from crops that in other countries are limited to a single cycle per year. From an export perspective, Colombia is ideally located between North and South America while having access to both the Pacific and Atlantic Oceans, gateways to Asia and Europe, respectively. According to FAO data, Colombia is the tenth-largest agricultural producer in the world, and the second-largest in Latin America (see **Figure 4**). Perhaps more telling, it climbed 20 positions (from 30th to 10th) in just five years.

FIGURE 4: TOP 15 AGRICULTURAL PRODUCERS GLOBALLY, VALUE OF AGRICULTURAL PRODUCTION (US$BILLION)

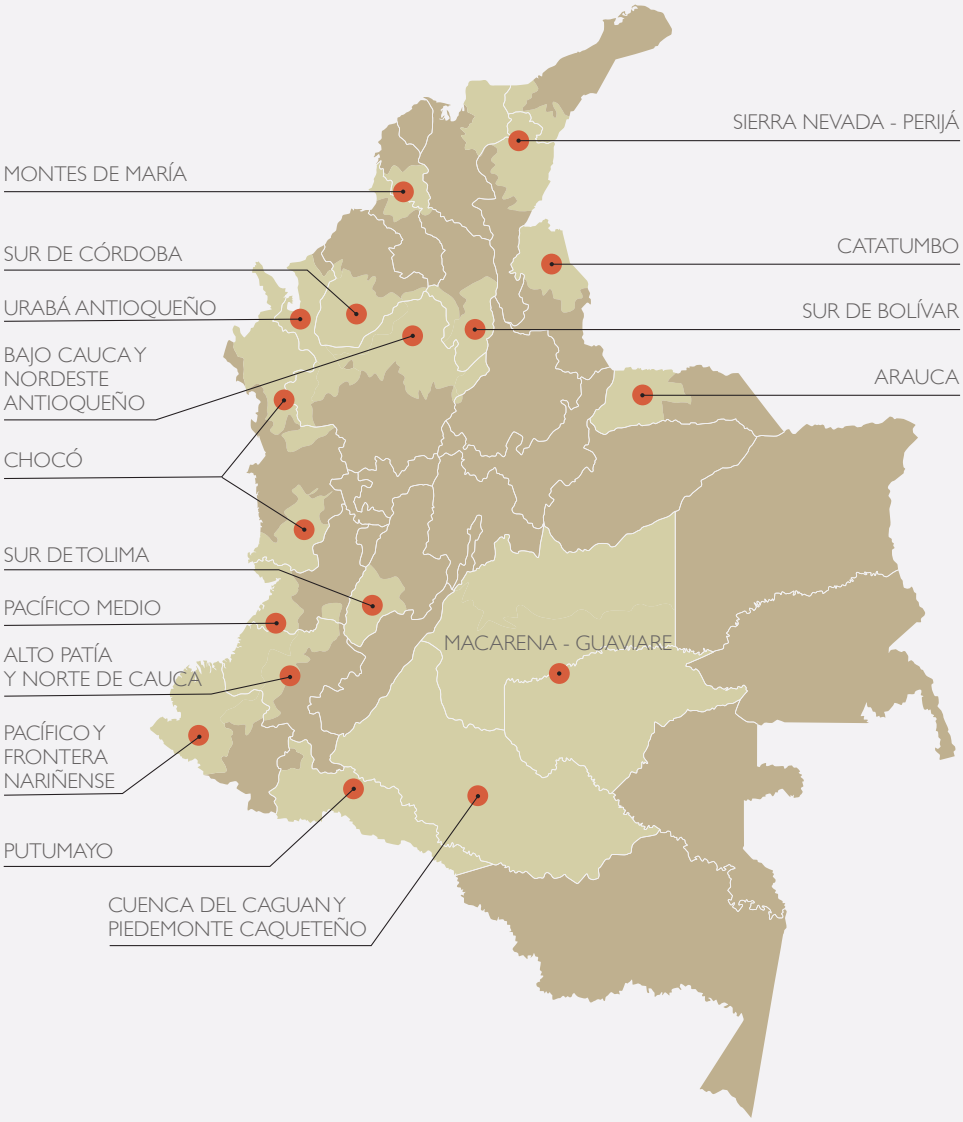


SOURCE: FAOSTAT.[3]

Despite its worldwide and regional status as a top producer, there is broad consensus among agriculture industry stakeholders that Colombia's agriculture sector is failing to meet its potential. According to Minagricultura, Colombia ranks 25th of 233 countries when it comes to potential to expand agricultural production.[4] Historically, Colombia's agriculture sector has been hampered by a number of factors, including low productivity, a decrease in cultivated land caused by the rise in input prices and migration to the cities, crop losses stemming from climate events and inefficiencies at all stages of the agricultural cycle, and a long history of violence that has led to the isolation of millions of Colombians living in rural areas, particularly those designated as PDET (see **Figure 5**).[5]

2 DANE (2023), Encuesta Nacional de Calidad de Vida, 2022.
3 FAOSTAT (2021), Value of Agricultural Production.
4 Minagricultura (2020), "Colombia cuenta con un potencial para sembrar alimentos en 39 millones de hectáreas"; La República (2022), "Solo se está aprovechando 13,5% de las 39.2 millones de hectáreas con potencial."
5 PDET stands for Programas de Desarrollo con Enfoque Territorial (Development Plans with a Territorial Focus), a planning and management tool that looks to transform areas affected by violence, poverty, the presence of illicit crops, and lack of institutional support. It is one of the most ambitious such programs to be developed worldwide.

FIGURE 5: OVERVIEW OF COLOMBIA'S PDET REGIONS



- **16** REGIONS
- **170** MUNICIPALITIES
- **6.6** MILLION INHABITANTS (**24%** OF COLOMBIA'S TOTAL)
- **41%** WOMEN
- **25%** ETHNIC MINORITY
- **28.7%** MULTIDIMENSIONAL POVERTY, **1.75X** COLOMBIAN AVERAGE
- ILLITERACY **2X** COLOMBIAN AVERAGE
- **25%** WITH INTERNET ACCESS
- **32,808** INITIATIVES

SOURCE: Agencia de Renovación del Territorio (ART).[6]

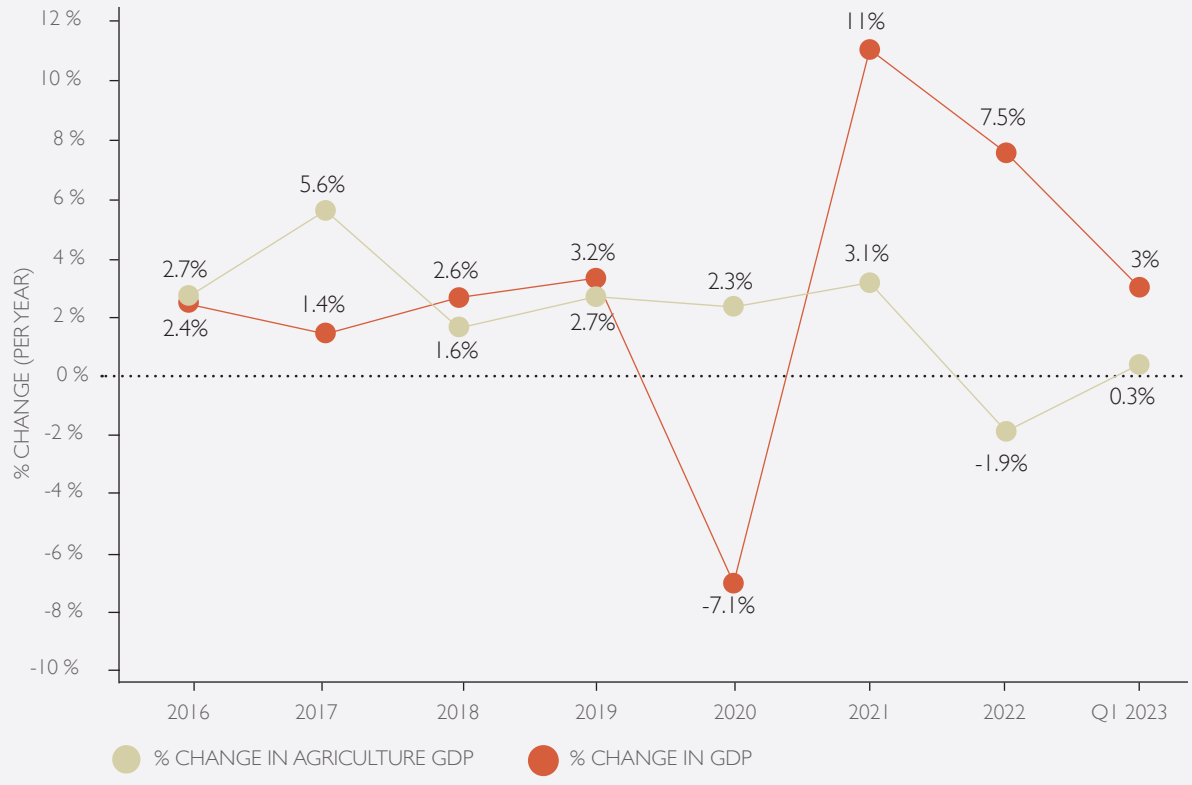
6 ART (2015), Municipios PDET Subregiones.

2.1 AGRICULTURE'S CONTRIBUTION TO COLOMBIA'S ECONOMY AND EMPLOYMENT

Agriculture, forestry, and fishing accounted for 9.2% of Colombia's GDP in 2022,[7] above the Latin American average of 6.5%.[8] The sector is the fourth-largest in Colombia, after retail/wholesale trade, public sector/defense, and manufacturing.

The agriculture sector exhibited resilience during the COVID-19 pandemic, expanding at an annual rate of 2.3% in 2020, compared with -7.1% for the economy as a whole (see **Figure 6**). 2022 proved a more difficult year, with agriculture's GDP declining by 1.9%, underperforming the economy as a whole by 9.4 percentage points. The sector was negatively impacted by several key trends, including a prolonged La Niña weather phenomenon and rising fertilizer prices due to the war in Ukraine, which led to lower input usage. (See **Appendix 4** for more information on the impact of fertilizer price increases on Colombia's agricultural sector.) These factors had an especially pronounced impact on the coffee sector (see **Figure 7**). Excluding coffee from the analysis, the growth in agriculture sector GDP would have reached 0.6%, according to analysis conducted by Bancolombia.[9] Although the effects of La Niña and high input prices continue to impact the sector in early 2023, agriculture saw improved performance in Q1 2023, expanding at a rate of 0.3%, compared with 3.0% for the economy as a whole.[10]

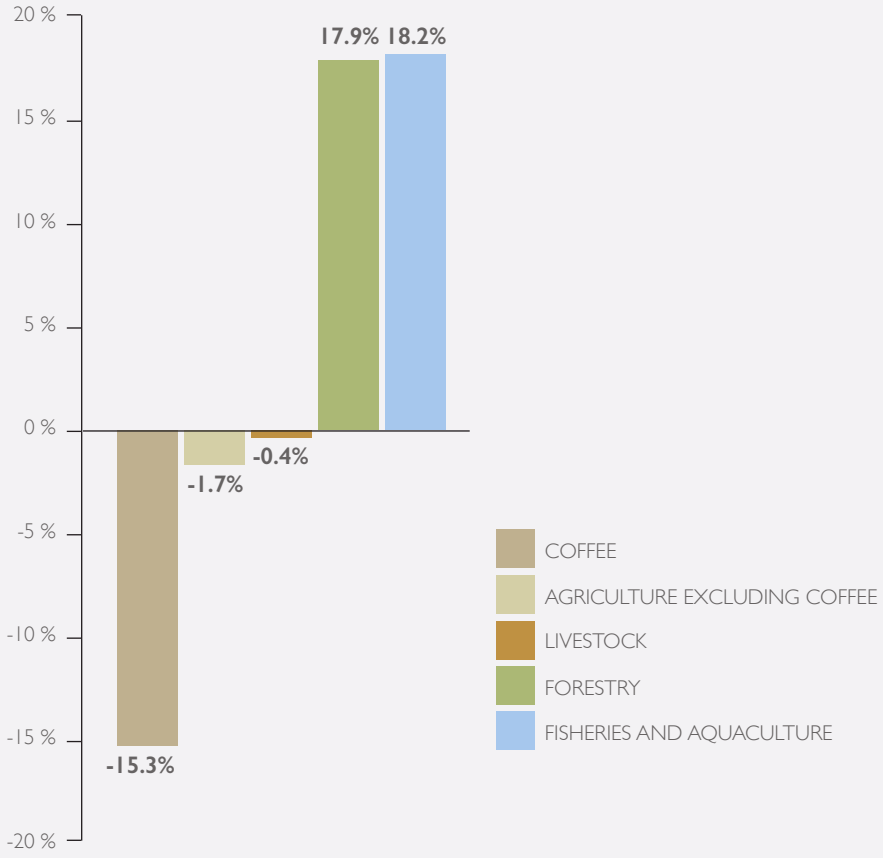
FIGURE 6: GROWTH OF COLOMBIA'S AGRICULTURAL GDP AND TOTAL GDP (2016–Q1 2023)



SOURCES: DANE, UPRA, Bancolombia.

7 Minagricultura and DANE
8 World Bank (2022), "Agriculture, forestry and fishing value added (% of GDP)."
9 Bancolombia (2023), Sector Agropecuario 4T-22.
10 Bancolombia (2023), Sector Agropecuario 1T-23.

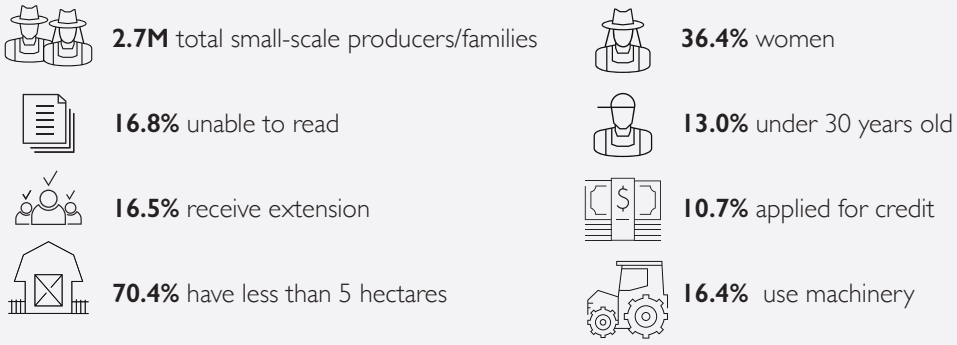
FIGURE 7: ANNUAL GROWTH IN COLOMBIA'S AGRICULTURAL GDP BY AGRICULTURAL CATEGORY (2022)



SOURCES: DANE, UPRA, Bancolombia.

Almost one-fourth of Colombia's population resides in rural areas. This ratio is in line with countries like Mexico and Peru, but above what is found in countries such as Argentina, Brazil, and Chile. Just under 15% of Colombia's labor force is engaged in agriculture, which places it between the highly industrial countries of the Southern Cone like Brazil and Argentina (both at around 7% of the labor force) and the lower-income economies of Central America and the Andean (between 25%-31% of the labor force).[11] Colombia's agriculture industry is dominated by smallholder farmers, who produce over 80% of the food consumed domestically. According to the most recent agriculture census conducted by Colombia's DANE (2014), there are roughly 2.7 million smallholder farmers in the country. **Figure 8** outlines some of the key characteristics of Colombia's smallholders.

FIGURE 8: SMALLHOLDER FARMERS IN COLOMBIA, AT A GLANCE



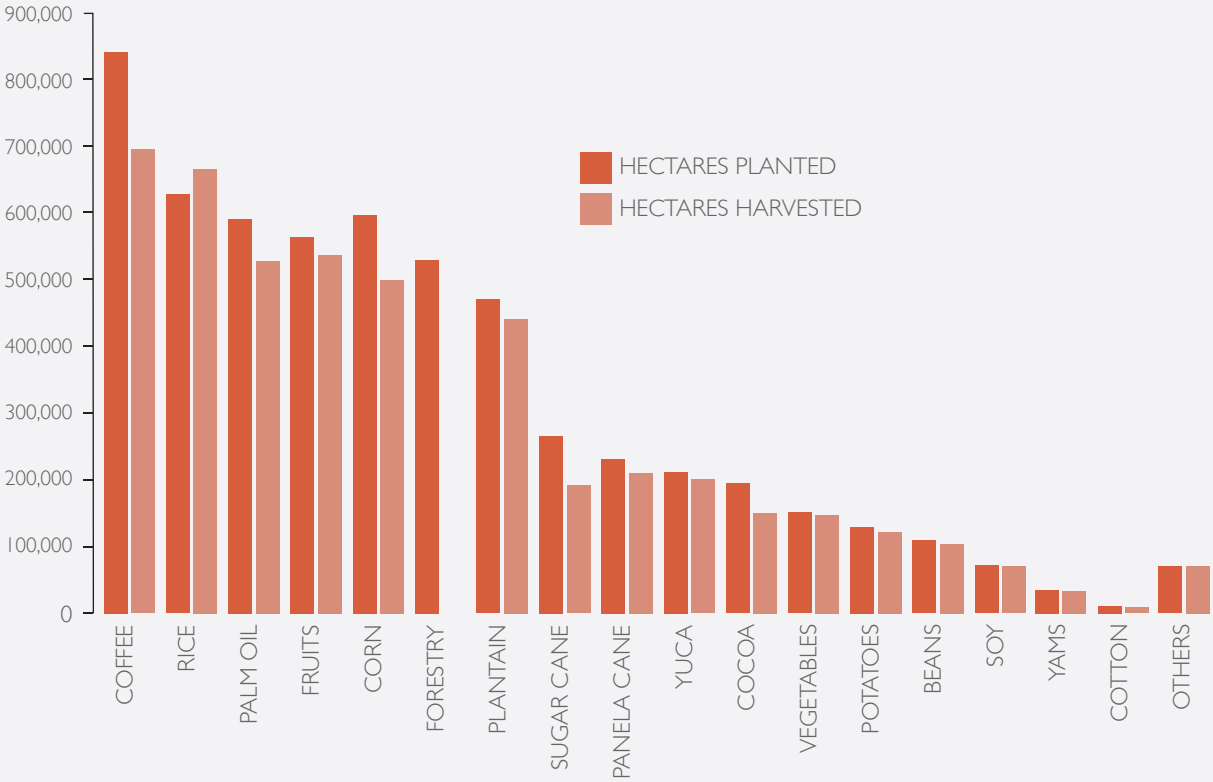
SOURCES: Minagricultura, DANE.

Colombia has around 48 million hectares of agricultural land, of which the vast majority (~40 million hectares) is meadows and pastures.[12] UPRA reports that, in 2021, Colombian farmers planted 5.7 million hectares of land and harvested 4.7 million hectares, resulting in a production of 33.4 million tons.[13] Colombia's top five crops in terms of area harvested are coffee, rice, palm oil, fruits, and corn (**see Figure 9**).

In terms of contribution to GDP, coffee remains the single most important crop, accounting for 11% of Colombia's agricultural GDP (see **Figure 10**). Although fisheries and aquaculture accounts for a small proportion of the overall market (only 3.4% of agricultural GDP), it is the fastest-growing category, expanding by 18.2% in 2022, a reflection of a rise in both domestic and international demand.[14]

11 ILOSTAT.
12 FAO Stat, Colombia.
13 Minagricultura and UPRA.
14 DANE, UPRA, and Bancolombia.

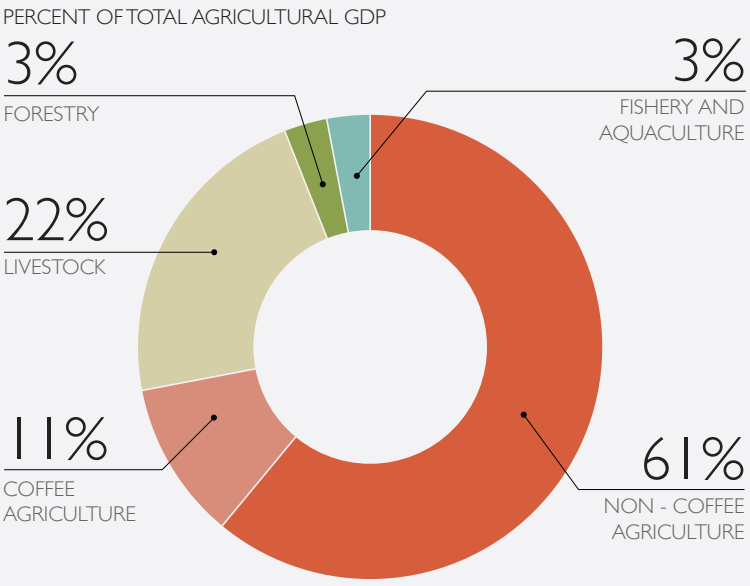
FIGURE 9: HECTARES PLANTED AND HARVESTED, BY CROP (2021)



SOURCE: UPRA.

Agricultural exports expanded by more than 22% in 2022, to reach US$11.5 billion, one-fifth of Colombia's total exports.[15] The increase in US dollars occurred despite the drop in the volume of some crops, notably coffee, which saw the number of sacks exported decrease from 12.5 million in 2021 to 11.1 million in 2022.[16] Coffee and flowers are Colombia's top two agricultural exports **(see Figure 11).**

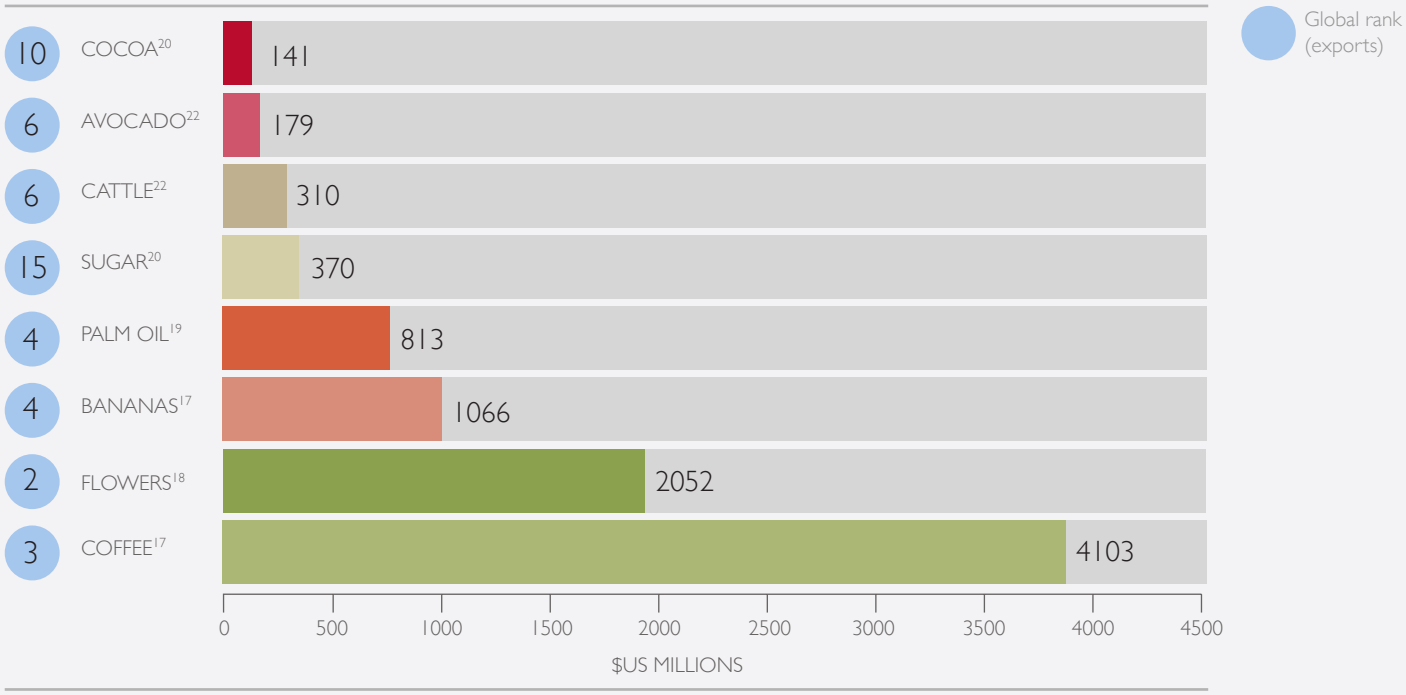
FIGURE 10: DISTRIBUTION OF AGRICULTURAL GDP BY CATEGORY (2022)



SOURCES: Minagricultura, DANE.

15 Mincit (2023), Informe de Exportaciones de Colombia, Diciembre 2022.
16 Federación Nacional de Cafeteros (2023), "Producción anual de café de Colombia cierra 2022 en 11,1 millones de sacos."

FIGURE 11: AGRICULTURAL EXPORTS BY CATEGORY (2021)



SOURCES: UPRA, OEC, [17] Reuters,[18] Solidaridad Network,[19] USDA,[20] Beef2Live,[21] Produce Pay.[22]

2.2 THE ROLE OF WOMEN IN AGRICULTURE

Of the 12.2 million people living in rural areas, 48.2% are women. Although official statistics state that only 30.6% of rural women are economically active, versus 74.7% of men, women play a significant role in rural economies, particularly in agriculture.[23] DANE estimates that the average rural woman engages in 14 hours and 1 minute of agricultural work per day, versus 11 hours and 25 minutes per day for the average rural man.[24] Nevertheless, rural women suffer from lower incomes, education, land ownership, and access to services when compared with not only rural men, but also urban women (see **Figure 12**).

17 OEC World, Coffee; OEC World, Bananas in Colombia.
18 Reuters (2020), "Colombia will seek to double flower exports to $3bln by 2030."
19 Solidaridad Network (2021), Barometer on Sustainable Palm Oil Production and Trade, Colombia 2020: Achieving a Sustainable Export of Palm Oil.
20 USDA (2023), Sugar: World Markets and Trade; USDA (2022), Colombia: The Colombian Cacao Industry.
21 Beef2Live (2023), Colombia.
22 Produce Pay (2023), "Colombian Avocado Growers Seek to Expand Global Export Market."
23 DANE (2022), Situación de las Mujeres Rurales en Colombia.
24 DANE (2022), Situación de las Mujeres Rurales en Colombia.

FIGURE 12: CHARACTERISTICS OF RURAL MEN VERSUS RURAL WOMEN (2022)

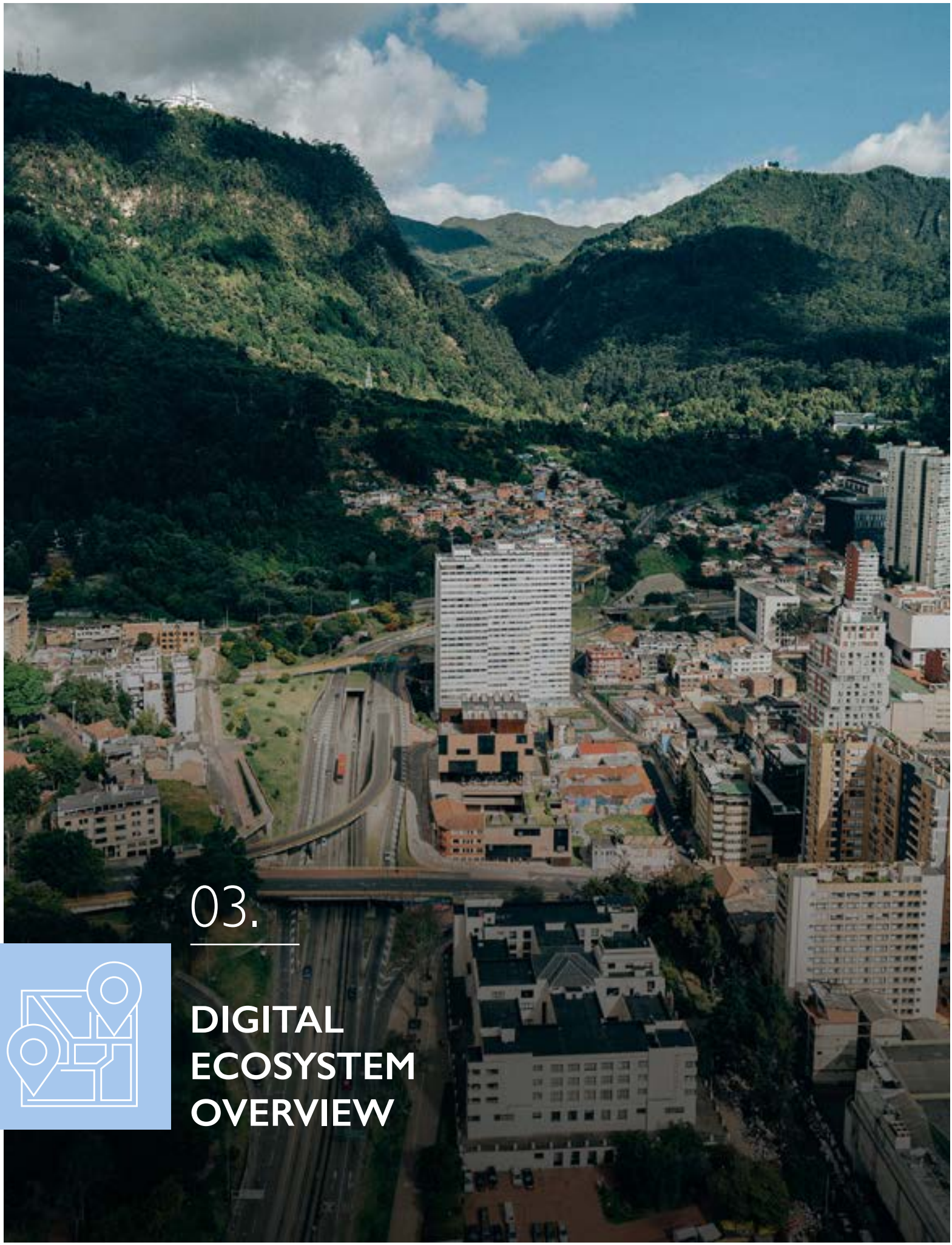
		
AVERAGE MONTHLY INCOME	US$179 (COP 701,424)	US$128 (COP 502,568)
WORKING HOURS PER DAY	11 hours, 25 minutes	14 hours, 1 minute
RECEIVING EXTENSION	191,876 farmers	57,469 farmers
ECONOMICALLY ACTIVE	74.7%	30.6%
UNEMPLOYMENT	6%	15%
MULTIDIMENSIONAL POVERTY	36.9%	37.3%
PARTICIPATE IN NON-REMUNERATED WORK	56.5%	93.0%
ACCESS TO FINANCIAL SERVICES	63.7%	64.4%
NUMBER OF CREDIT OPERATIONS	191,498	121,338
SIZE OF CREDIT REQUEST	US$886 (COP 3,473,566)	US$348 (COP 1,367,277)

SOURCES: DANE, Minagricultura[25]

The government, as well as numerous donors and international development agencies, has instituted a number of programs to support rural women. Minagricultura has established an entire division focused on rural women. These initiatives have helped close some of the gaps in access, but differences in level and depth of support remain. For instance, while the number of women accessing credit products has risen, loans granted to women remain significantly smaller than those granted to men (less than half the size, on average). [26]

The importance of agriculture to Colombia's economy continues to increase, with its share of the country's economy nearing 10%. After long neglecting agriculture, the government is now prioritizing agriculture sector development given the role it can play in expanding Colombia's exports and generating sustained economic growth and development. To achieve its full potential, however, Colombia's agricultural sector must become more productive and resilient to changes in climate. Innovation must take place, not only among the country's large agroindustrial farms, but also in smallholder farming communities where the bulk of agricultural production takes place. Digital tools can play an important role in driving the required innovation, particularly if the right underlying digital ecosystem and services are in place.

25 DANE (2022), Situación de las Mujeres Rurales en Colombia.
26 DANE (2022), Situación de las Mujeres Rurales en Colombia.



03.

DIGITAL ECOSYSTEM OVERVIEW

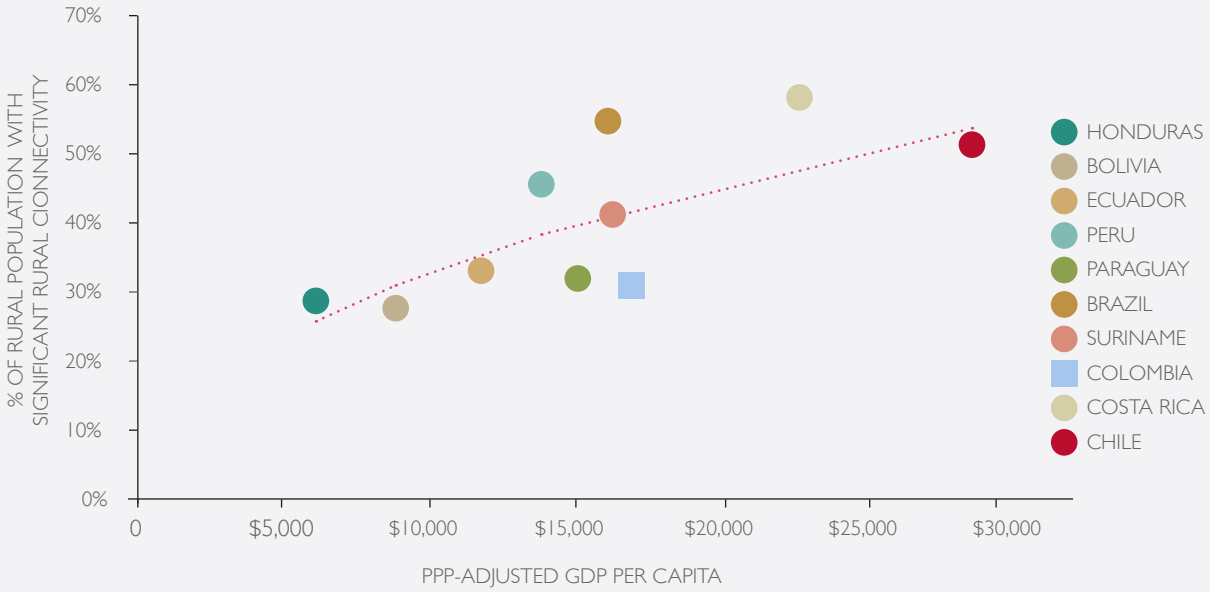
3. DIGITAL ECOSYSTEM OVERVIEW

A flourishing digital agriculture ecosystem depends on the extension of digital infrastructure, digital society and governance, and the digital economy to rural areas. In this section we leverage USAID's Digital Ecosystem Framework to analyze Colombia's digital ecosystem. The Digital Ecosystem Framework is organized around three separate, but overlapping, pillars: digital infrastructure and adoption; digital society, rights, and governance; and digital economy.[27]

3.1 DIGITAL INFRASTRUCTURE AND ADOPTION[28]

Although Colombia's overall connectivity levels are in line with those in other Latin American countries, Colombia's rural connectivity significantly lags that of its peers, creating a significant obstacle for the rollout of digital agriculture solutions. A vast and varied terrain along with 50 years of internal conflict have contributed to a widening infrastructure coverage gap. Based on Colombia's PPP-adjusted GDP per capita, The AgTech Network's analysis suggests that Colombia's rural connectivity level should be at least 10 percentage points higher than it is in 2023 (see **Figure 13**).

FIGURE 13: COLOMBIA'S SIGNIFICANT RURAL CONNECTIVITY (SRC) IN A LATIN AMERICAN CONTEXT



NOTE: Significant Rural Connectivity (SRC) is a measure developed by IICA, Microsoft, and the Inter-American Development Bank (IDB) to "assess people's real ability to access the Internet and to make full use of it, with the adequate frequency, speed and devices in keeping with current needs in rural areas." It leverages statistics on internet access, device availability, broadband service availability, and 4G coverage.

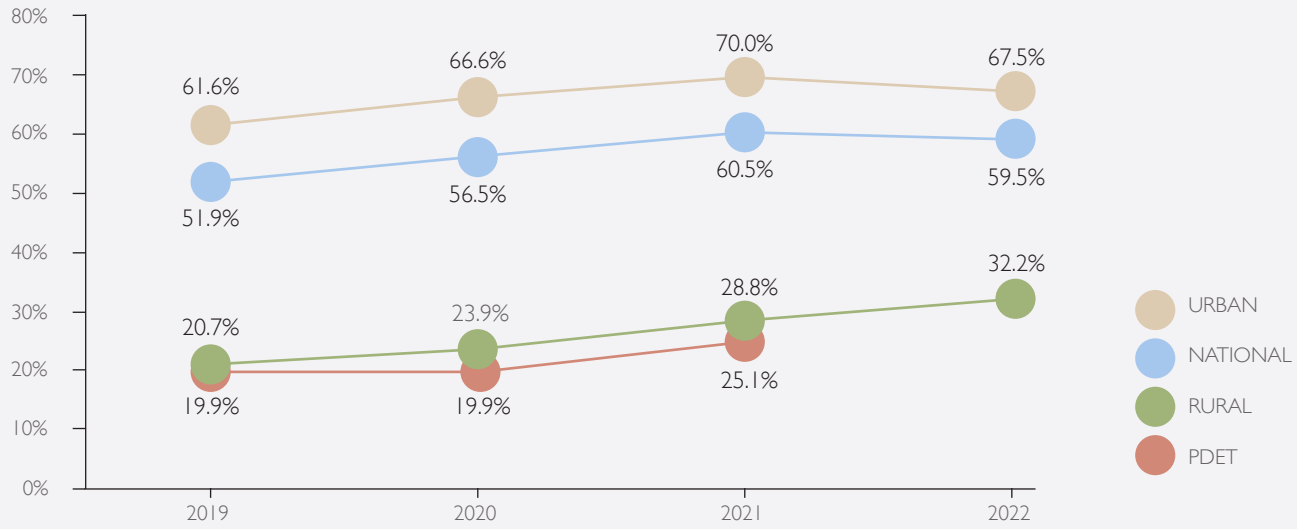
SOURCES: Bayer, CAF Development Bank of Latin America and the Caribbean, IICA, Microsoft, Syngenta, World Bank.

27 USAID and DAI (2022), Digital Ecosystem Framework.

28 "[Digital infrastructure and adoption] refers to the resources that make digital systems possible and how these resources are accessed and used by individuals and organizations. Infrastructure is assessed by understanding geographic network coverage, network performance, Internet bandwidth and spectrum allocation. Infrastructure directly affects how the Internet is used, who does and does not have access to the digital ecosystem, and why. This includes ownership and use of mobile phones and broadband, Internet affordability and digital literacy." USAID and DAI (2020), Digital Ecosystem Country Assessment (DECA): Colombia.

At year-end 2022, 32.2% of rural households in Colombia had access to internet services, compared with 67.5% of urban households (see **Figure 14**). [29]

FIGURE 14: PERCENTAGE OF COLOMBIAN HOMES WITH INTERNET ACCESS (2019–2022)

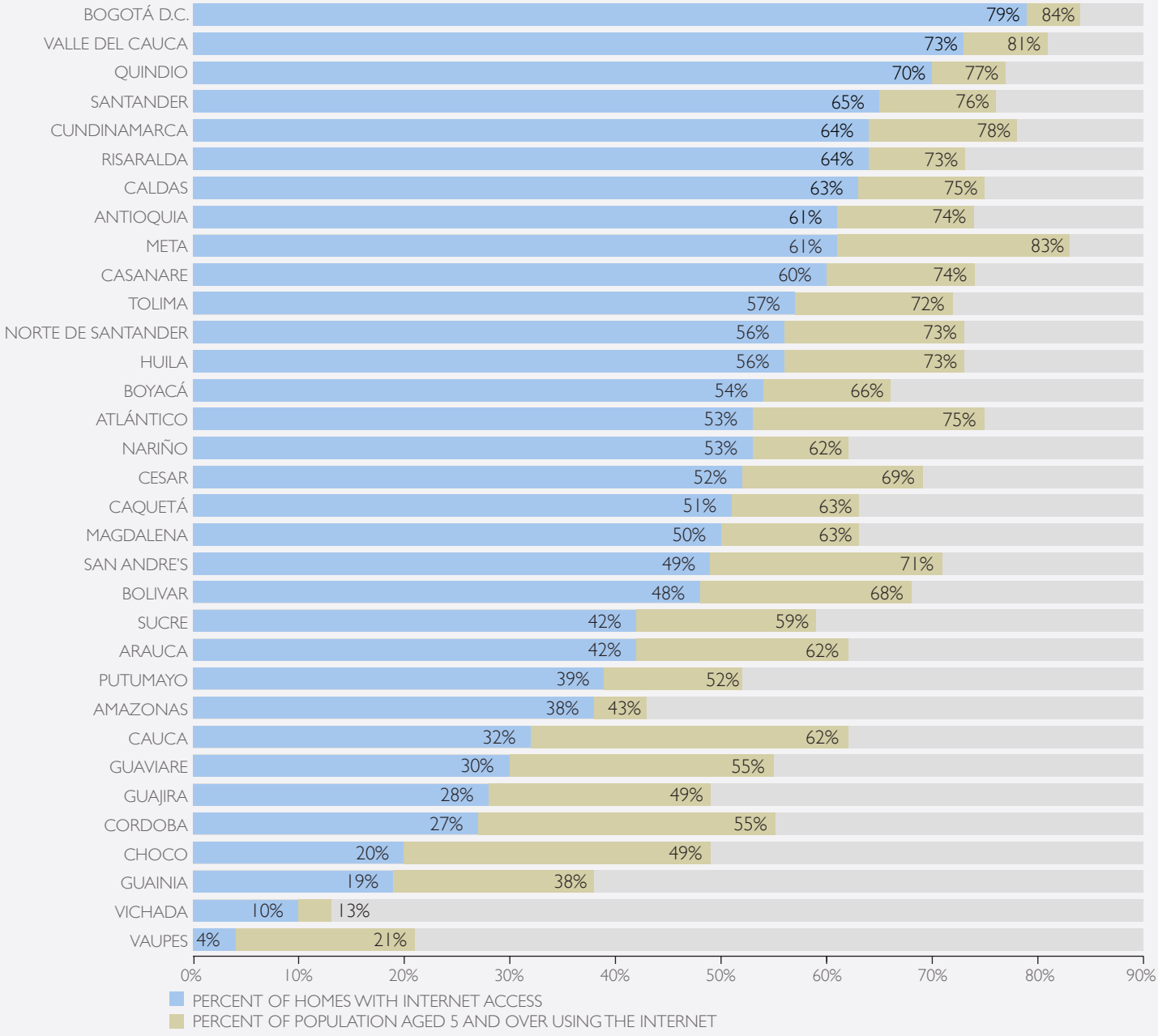


NOTE: The percentage of homes with internet access refers to the percentage of homes with at least one internet connection. Internet connections can be fixed broadband connections (e.g., fiber, DSL, fixed wireless, satellite) or mobile internet connections (e.g., 3G, 4G). PDET penetration figures are not yet available for 2022.
SOURCES: DANE Encuesta Nacional Calidad de Vida and ART.[30]

Urban and rural averages mask significant differences across departments (see **Figure 15**). In the capital of Bogotá, for example, nearly four of every five homes have internet connectivity. By contrast, there are four states where less than one in five households have internet access.

29 Household access to the internet via a fixed or mobile device. DANE (2023), Encuesta Nacional de Calidad de Vida, 2022.
30 ART (2022), Informe de Seguimiento a la Implementación de los PDET.

FIGURE 15: INTERNET CONNECTIVITY AND USAGE BY DEPARTMENT (2022)



NOTE: Percent of homes with internet access refers to the share of homes within each department with at least one internet connection. Percentage of population aged five and over using the internet refers to the share of the population in the department using the internet from any location (home, school, work, community centers).
SOURCES: DANE Encuesta Nacional Calidad de Vida (2022), DPL News.[31]

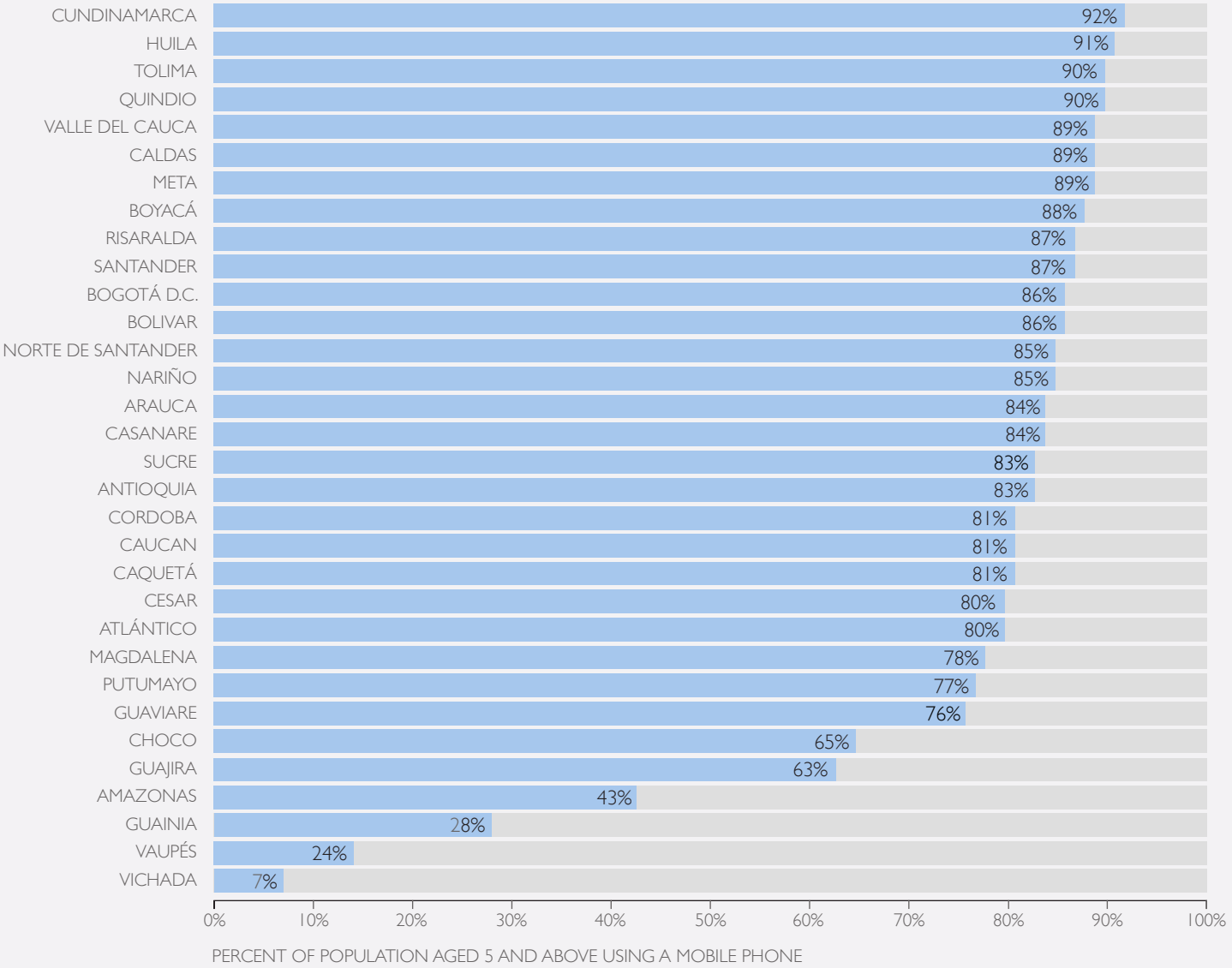
While cost is the leading factor behind many rural households' decision not to have internet at home, lack of network coverage also remains an important impediment in rural areas. Nearly one-fourth of rural households interviewed for the latest household ICT use survey in Colombia cited lack of network coverage as the reason for not having internet at home (versus only 2.2% of urban households). [32]

31 DPL News (2022), "Colombia requiere política integral de conectividad para acceso directo en hogares: OCDE."
32 DANE (2022), Encuesta de Tecnologías de la Información y las Comunicaciones en hogares, 2021.

Because of device sharing in the home, internet access in schools and places of work, and the rising availability of community access centers, the percentage of Colombians above five years old using the internet in rural areas is 52.6%, roughly 20 percentage points above the household penetration figure.[33] Interestingly, there is no measurable difference in either internet usage or device ownership between women and men in Colombia.

Although internet usage remains low in rural areas, the use of mobile phones is comparatively high, with roughly 83% of rural Colombians over five years of age using mobile services as of year-end 2022. Differences across states are less marked, with 22 departments enjoying rural mobile phone usage levels above 80% (see **Figure 16**). [34] We do note that mobile penetration in Guainía, Vaupés, and Vichada lies below 30% as of year-end 2022, suggesting that more targeted efforts will need to be pursued to reach rural communities in these areas.

FIGURE 16: MOBILE USAGE BY DEPARTMENT



SOURCE: DANE Encuesta Nacional Calidad de Vida (2022).

33 Household access to the internet via a fixed or mobile device. DANE (2023), Encuesta Nacional de Calidad de Vida, 2022.
34 Household access to the internet via a fixed or mobile device. DANE (2023), Encuesta Nacional de Calidad de Vida, 2022.

Colombia's government is keenly aware of the need to enhance rural connectivity and promote digitization to achieve its objective of driving economic growth and consolidating peace in post-conflict areas. Most of the government's initiatives to date have centered around community access, prioritizing the connection of public access points (such as schools, public parks, and other meeting places) that enable residents to connect anytime at no cost using their own devices. Two of the most notable projects include the Rural Digital Zones and the subsequent, much more ambitious, Digital Centers: Universal Access for Rural Zones, which expanded upon the earlier Rural Digital Zones project (see **Figure 17**).

FIGURE 17: GOVERNMENT RURAL COMMUNITY ACCESS INITIATIVES

	RURAL DIGITAL ZONES[35]	DIGITAL CENTERS: UNIVERSAL ACCESS FOR RURAL ZONES[36]
INSTALLATION	2019–2020	2021-ongoing
FUNDED THROUGH	18 months after installation	2031
INVESTMENT	US$16.6 million (COP 65.1 billion)	US$535 million (COP 2.1 trillion)
CENTERS PLANNED	1,550	14,745
MUNICIPALITIES	511	1,104, including all 170 PDET
DEPARTMENTS	31	32
TELCO PARTNERS	Inred	Claro (Region A, 7,468 centers) ETB (Region B, 7,277 centers)

SOURCE: Mintic.

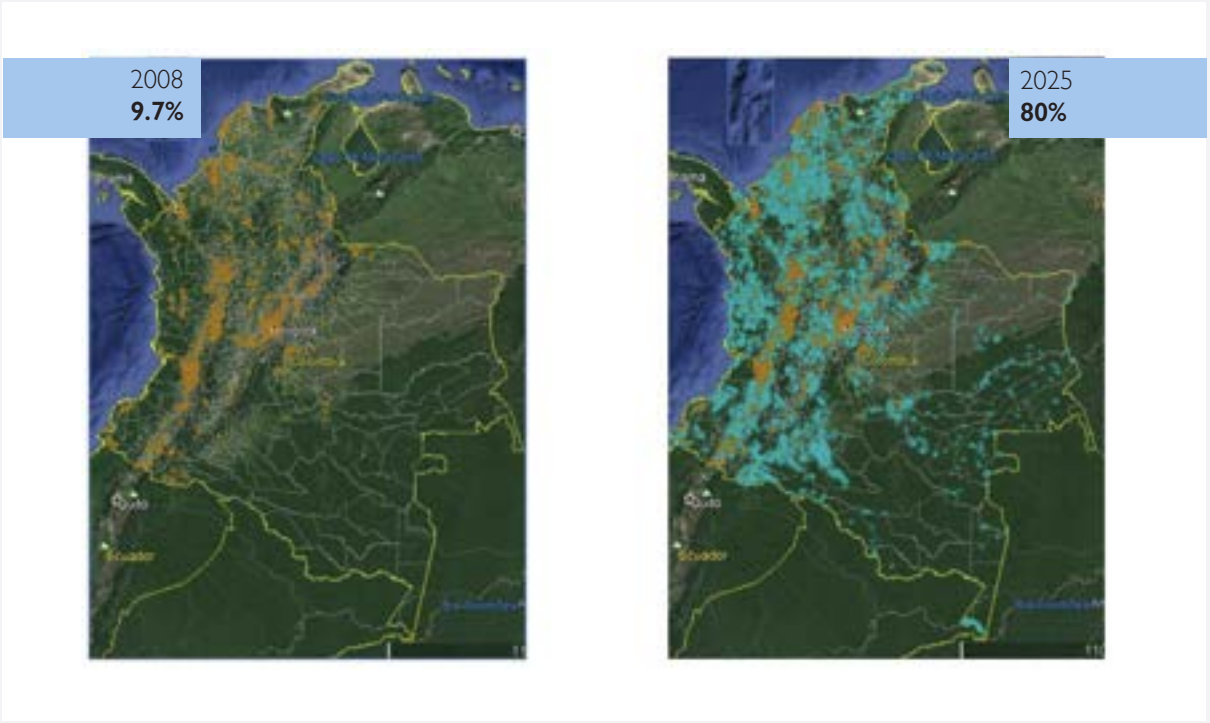
As of July 2023, over 5,900 digital centers have been installed, of which 5,400 are operational (see **Appendix 5** for location of digital centers in Colombia). [37] According to SIIPO, 366 community access centers have been installed in PDET regions, 57.2% of the ultimate goal (639 community centers in PDET regions). [38]

Colombia has also tried to incentivize the nation's telecommunications service providers to expand their networks into rural areas by making investment in these areas a condition for receiving spectrum. The three winners of the 2019 auction for 700MHz 4G spectrum (WOM, Claro, and Tigo), for example, are required to expand 4G to 3,658 rural sites and achieve 80% population coverage by May 2025 (see **Figure 18**).[39] In July 2023, IDB Lab announced that it extended a credit for COP 197.4 billion (US$50.4 million) to Tigo to expand its network to 915 rural zones that were previously unconnected. The credit will also help Tigo upgrade the network in 340 municipalities from 3G to 4G.[40]

In March 2023, the administration of President Gustavo Petro announced the ICT Connect 360 Plan (Plan Conecta TIC 360), which aims to "democratize" ICT services across all 32 departments and raise internet connectivity to 85% by 2026. [41] The ICT Connect 360 Plan prioritizes 10 departments—La Guajira, Chocó, Cauca, Nariño, Putumayo, Amazonas, Vaupés, Vichada, Guainía, and San Andrés y Providencia—benefiting 5.4 million people living in these areas.

35 Mintic (2022), Zonas Digitales.
36 Mineducación (2021), Proyecto Centros Digitales - MINTIC; Mintic (2023), Acceso Universal para Zonas Rurales – Centros Digitales.
37 Mintic (2023), Centros Digitales.
38 DNP SIIPO.
39 Mintic, Documento soporte y consulta pública: Desarrollo de 5G en Colombia.
40 DPL News (2023), "BID otorga crédito a Tigo Colombia para ampliar cobertura en zonas rurales."
41 Mintic (2023), "Con 'Conecta TIC 360' el Gobierno del Cambio conectará el 85% del país."

FIGURE 18: MOBILE COVERAGE IN RURAL AREAS, 2018 VERSUS 2025



SOURCE: Mintic.

The ICT Connect 360 Plan has a two-pronged approach to reach its objective of 85% connectivity by year-end 2026. The first is national, working with existing service providers to fill coverage gaps and increase the capacity and quality of existing coverage areas. The second is regional, involving leveraging alternative technologies and business models to develop hyper-localized strategies at the department and municipal level. The government of Colombia, through Mintic, is working with the Inter-American Development Bank (IDB), the CAF Development Bank of Latin America and the Caribbean, and the World Bank to develop department- and municipality-level implementation plans. [42] The regional approach would encourage more programs like Microsoft's Airband to proliferate in rural areas. Through Airband, Microsoft and its strategic partners offer holistic solutions to rural communities, including connectivity, education, and ICT skills development, as well as a full suite of products and services developed with the interests of the rural community in mind (telemedicine, education, agricultural services, etc.). Most of Airband's initiatives leverage TV white space, a cost-effective solution that has much greater propagation qualities than WiFi (~130x) and can work even in tough terrain (see **Airband Case Study**). [43]

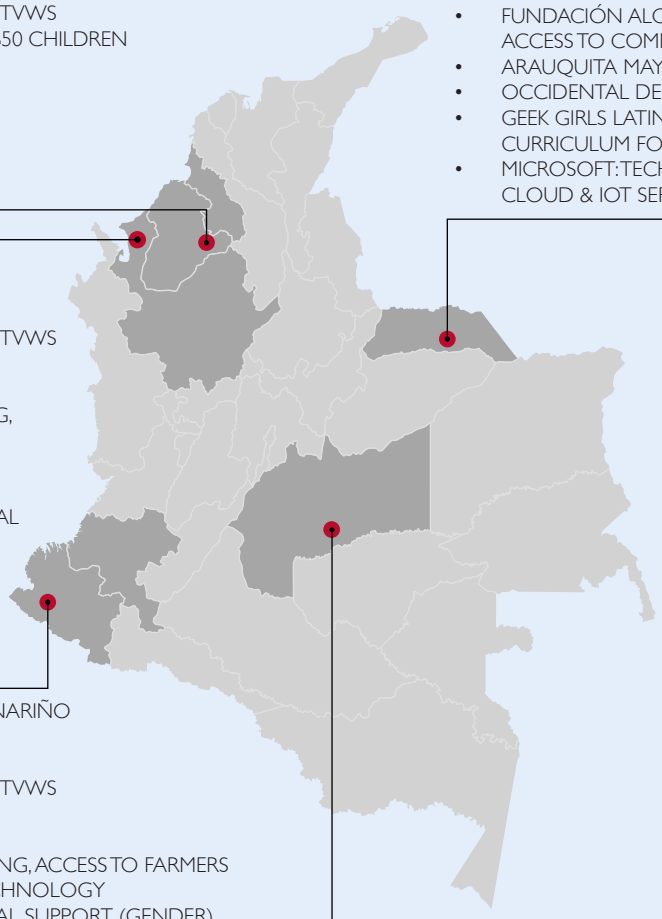
42 CAF Development Bank of Latin America and the Caribbean interview (March 2023).
43 Microsoft (2018), Connectivity strengthens livelihoods, promotes peace in Colombia.

CASE STUDY: AIRBAND

Airband is Microsoft's global initiative to bring internet access and digital services to previously unconnected rural areas. Launched in the United States in 2017, Airband projects have since been deployed in several other countries, including Brazil, Guatemala, Ghana, India, Colombia, Côte d'Ivoire, Kenya, Nigeria, Tanzania, and Uganda. USAID works with Microsoft on several Airband projects in Guatemala, Ghana, India, Colombia, and Kenya.[44]

In Colombia, Microsoft has worked with more than two dozen partners to develop Airband projects in eight different departments, investing over US$2.5 million in the process. Microsoft aims to reach over four million people in rural areas in Colombia by year-end 2025 through the Airband initiative, 10% of the global target.[45] It has worked in several key value chains, including coffee, cocoa, livestock, and cotton (see **Figure 19**).

FIGURE 19: SELECTED AIRBAND PROJECTS IN COLOMBIA (2018–2022)



LOCATION: OVEJAS, SUCRE
YEAR: 2022
VALUE CHAIN: N.A.
BROADBAND TECHNOLOGY: TVWS
BENEFICIARIES: 8 SCHOOLS, ~650 CHILDREN
PARTNERS:
- TELECARIBE: BROADBAND TECHNOLOGY
- MICROSOFT: TECHNICAL EXPERTISE, CLOUD & IOT SERVICES

LOCATION: GOLFO URABÁ
YEAR: 2022
VALUE CHAIN: COCOA
BROADBAND TECHNOLOGY: TVWS
BENEFICIARIES: N.A.
PARTNERS:
- GRUPO NUTRESA: FUNDING, ACCESS TO FARMERS
- ANDITEL: BROADBAND TECHNOLOGY
- USAID: FUNDING, TECHNICAL SUPPORT (GENDER)
- MICROSOFT: TECHNICAL EXPERTISE, CLOUD & IOT SERVICES

LOCATION: SAN LUÍS ROBLES, NARIÑO
YEAR: 2022
VALUE CHAIN: COCOA
BROADBAND TECHNOLOGY: TVWS
BENEFICIARIES: N.A.
PARTNERS:
- FUNDACIÓN LUKER: FUNDING, ACCESS TO FARMERS
- ANDITEL: BROADBAND TECHNOLOGY
- USAID: FUNDING, TECHNICAL SUPPORT (GENDER)
- MICROSOFT: TECHNICAL EXPERTISE, CLOUD & IOT SERVICES

LOCATION: ARAUQUITA, ARAUCA
YEAR: 2020
VALUE CHAIN: ENERGY
BROADBAND TECHNOLOGY: TVWS
BENEFICIARIES: N.A.
PARTNERS:
- FUNDACIÓN ALCARAVÁN: FUNDING, ACCESS TO COMMUNITIES
- ARAUQUITA MAYOR'S OFFICE
- OCCIDENTAL DE COLOMBIA: FUNDING
- GEEK GIRLS LATIN AMERICA: STEAM CURRICULUM FOR GIRLS
- MICROSOFT: TECHNICAL EXPERTISE, CLOUD & IOT SERVICES

LOCATION: MESETAS, META
YEAR: 2017-2018
VALUE CHAIN: COFFEE
BROADBAND TECHNOLOGY: TVWS
BENEFICIARIES: 8 FARMS, 2 SCHOOLS, ~500 PEOPLE
PARTNERS:
- LAVAZZA FOUNDATION: PROJECT DESIGN, FUNDING, ACCESS TO FARMERS
- ALO & PARTNERS: PROJECT MANAGEMENT, COORDINATION
- MAKAIA: DIGITAL SKILLS, CAPACITY BUILDING
- CARCAFE: COFFEE TECHNICIANS
- UNIVERSIDAD DE ANTIOQUIA: TELEMEDICINE
- MICROSOFT: TECHNICAL EXPERTISE, CLOUD & IOT SERVICES

NOTE: Highlighted departments are those with at least one Airband project. We elected to highlight projects in five out of the eight departments given their relevance to agriculture.
SOURCE: Microsoft Colombia.

44 USAID (2023), USAID/Microsoft Airband Initiative.
45 Microsoft (2023), "Microsoft Airband will expand internet access to nearly 40 million people across Latin America and Africa."

The full benefits of extending connectivity to rural areas will not be realized if increased connectivity is not met with a rise in the level of ICT skills development and digital literacy among rural populations. (See **Appendix 6** for Colombia's ICT skills in context.) Fundación Postobón, the foundation arm of Colombian beverage company Postobón, for example, found that 72% of the farmers participating in the organization's Hit Social program had difficulty using a mobile device, impeding farmers' ability to fully benefit from the technical and commercial support being provided by the company.[46] In May 2023, Fundación Postobón announced a two-year agreement with mobile operator WOM to provide digital literacy training and connectivity to 300 farmers from its Hit Social program in an effort to bridge the gap.[47]

There are many other initiatives that have emerged in recent years between different types of stakeholders that are also aiming to accelerate digital skills training in rural areas. Mintic teamed up with Agrosavia, UPRA, and ADR on the Commercial Digital Literacy for Extension Agents and Smallholder Farming Organizations initiative which provides monthly training on digital skills. [48] Additionally, there are a number of public-private partnerships: Agro+Mujeres+TIC, MásPorTIC, Colnodo, Tigo Digital Literacy, Emprende-WOM, and Red Emprende Rural, among others. (See **Appendix 7** for examples of digital literacy initiatives launched in Colombia.) Many of these initiatives target youth, women, and indigenous populations. Per a study conducted in 2022 by Bayer, CAF Development Bank of Latin America and the Caribbean, IICA, Microsoft, Syngenta, and the World Bank on rural connectivity in Latin America, enhancing digital skills among youth is one of the fastest ways to enhance digital skills in rural communities given the role youth play in transferring digital skills to other members of the household.[49]

3.2 DIGITAL SOCIETY, RIGHTS, AND GOVERNANCE[50]

In 2018, Colombia's government embarked on an ambitious digital transformation project which has as its main objective to "positively impact the lives of Colombian citizens and residents and increase Colombia's competitiveness in the world by increasing the value provided by the public sector through the digital transformation of the state." [51] The government has been making good progress on its digital transformation initiative. According to the most recent Digital Government Index (DGI) issued by the OECD, Colombia ranks third among all OECD countries on the DGI, behind only South Korea and Great Britain.[52]

Although Colombia's government continues to advance its e-government/digitalization initiatives, digitalization of the economy and Colombian society has been slower. The IMD ranked Colombia 60th of 64 countries in its Digital Competitiveness Ranking, behind countries like Argentina, Brazil, Chile, Mexico, and Peru.[53] One of the challenges for Colombia is the relative importance of SMBs to the economy. According to ITC, SMBs account for 99.6% of formal businesses, roughly 40% of Colombia's GDP and 65% of employment. SMBs tend to be slower to digitalize. In Colombia, they are also hampered by what many consider excessive bureaucracy.[54] Some organizations are looking to accelerate the digitalization of SMBs. IDB Lab, for example, is working to help rural and agricultural SMBs in Caquetá with their digital transformation.[55]

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46 Hit Social Postobón is an initiative led by Fundación Postobón aimed at supporting over 1,200 smallholder farmers that produce mango, guava, lulo (a Colombian fruit that looks like a small orange), and blackberry used in Postobón beverages. The Foundation helps farmers create associations and provides technical support, all while guaranteeing a market for the farmers' fruit. Fundación Postobón, "Hit Social Postobón"; Postobón (2023), "Nos unimos a WOM para impulsar la alfabetización digital en el país."

47 Postobón (2023), "Nos unimos a WOM para impulsar la alfabetización digital en el país."

48 USAID provided support for this initiative. Minagricultura (2022), Alfabetización Digital con Énfasis Comercial.

49 Bayer, CAF Development Bank of Latin America and the Caribbean, IICA, Microsoft, Syngenta, and World Bank (2022), Rural Connectivity in Latin America and the Caribbean.

50 "[Digital society, rights and governance] focuses on how digital technology intersects with government, civil society and the media. This intersection includes policies and regulations, the use of social media and social norms around technology, digital tools for accountability and openness and digital ID systems. Digital society and government also assesses risks associated with access to digital platforms and information and how they are managed. This includes data privacy, cybersecurity, censorship, disinformation, and misinformation." USAID and DAI (2020), Digital Ecosystem Country Assessment (DECA): Colombia.

51 Mintic, Gobierno Digital.

52 OECD (2021), Government at a Glance: Country Fact Sheet Colombia.

53 IMD, The IMD World Digital Competitiveness Ranking.

54 International Trade Center and Fenalco (2022), Promoting SME Competitiveness in Colombia.

55 DPL News (2023), "BID otorga crédito a Tigo Colombia para ampliar cobertura en zonas rurales.

3.2.1 DIGITAL LAND REGISTRIES

A key pillar of the 2016 peace accord was the restitution of land and the formalization of land titles that would reduce land-based disputes and encourage farmers in rural areas to make capital investments on their land to generate productivity improvements and fuel economic growth. Although the restitution of lands has been a priority for the last few administrations, the issue has taken even more prominence under the administration of President Gustavo Petro. In late 2022, his administration purchased three million hectares of land to distribute to rural farmers. [56] There have been some efforts to digitalize this process, including the USAID-funded Land and Rural Development Program. [57] The government has also relied on the use of blockchain to try to ease concerns around security and transparency.[58]

3.2.2 DATA SOVEREIGNTY, PRIVACY, AND CYBERSECURITY

Data sovereignty and cybersecurity are particularly relevant topics when it comes to the implementation of digital agriculture solutions. Service providers collect significant amounts of data on farmers and their farms. They often leverage that data to develop credit-scoring algorithms, fine-tune insurance policy frameworks, and develop insights that can be sold to agriculture ecosystem players, among others. Farmers in Colombia are generally distrustful of entities requesting data and want some level of guarantee that their data is being used responsibly. There are a number of different pieces of legislation that govern data sovereignty, privacy, and cybersecurity. These are outlined in **Figure 20**.[59]

FIGURE 20: LAWS GOVERNING DATA SOVEREIGNTY, PRIVACY, AND CYBERSECURITY

AGENDA	LAW # AND YEAR	RESPONSIBLE REGULATORY ENTITY
Digital government policy	Law 1712, 2014	Digital Government, Mintic
Data transparency and access to national public data	Law 1712, 2014	Secretary of Transparency
Privacy and data protection	Law 1581, 2012	Superintendency of Industry and Commerce
Cybersecurity	Law 1928, 2018	Mintic

SOURCE: Mintic.

3.3 DIGITAL ECONOMY[60]

Colombia has taken a leading role in Latin America in strengthening its digital economy. The government established the National Financial Inclusion Strategy in 2016 with the aim of increasing access to financial services products, particularly in rural areas. The government has taken several measures to promote financial inclusion, including lowering barriers to entry for alternative financial service providers (primarily fintechs) and encouraging citizens to have a bank account to receive government benefits (see **Figure 21**).

56 Latin American Post (2022), "The Main Project of Gustavo Petro: An Agrarian Reform Greater Than the Area of El Salvador."
57 USAID (2018), Colombia Land and Rural Development Program.
58 ANT (2018), Por primera vez el gobierno implementa alta tecnología para la protección de datos en materia de tierras.
59 Mintic (2022), Modelo de Gobernanza de la Infraestructura de Datos para el Estado Colombiano.
60 Digital economy looks at how people can use money digitally and how businesses are moving online. USAID and DAI (2020), Digital Ecosystem Country Assessment (DECA): Colombia.

FIGURE 21: GOVERNMENT-TO-PERSON (G2P) PAYMENT PROGRAMS

PLAN	DESCRIPTION	BENEFICIARIES
Familias en Acción[61] (Families in Action)	Supports families with young children living in poverty. Families receive a conditional monthly payment that must be used toward education and health. Additional benefits available to indigenous families.	1,862,103 beneficiaries in the sixth payment cycle of 2023.
Jóvenes en Acción[62] (Youth in Action)	Aims to support young people's technical and/or professional development. Open to young people ages 14–28 enrolled in a government-established priority field of study.	341,932 beneficiaries in the second payment cycle of 2023.
Colombia Mayor[63] (Older Colombia)	Benefits older citizens through a monthly payment of US$20 (citizens of Bogotá receive an additional benefit).	1.6 million beneficiaries in the sixth payment cycle of 2023.

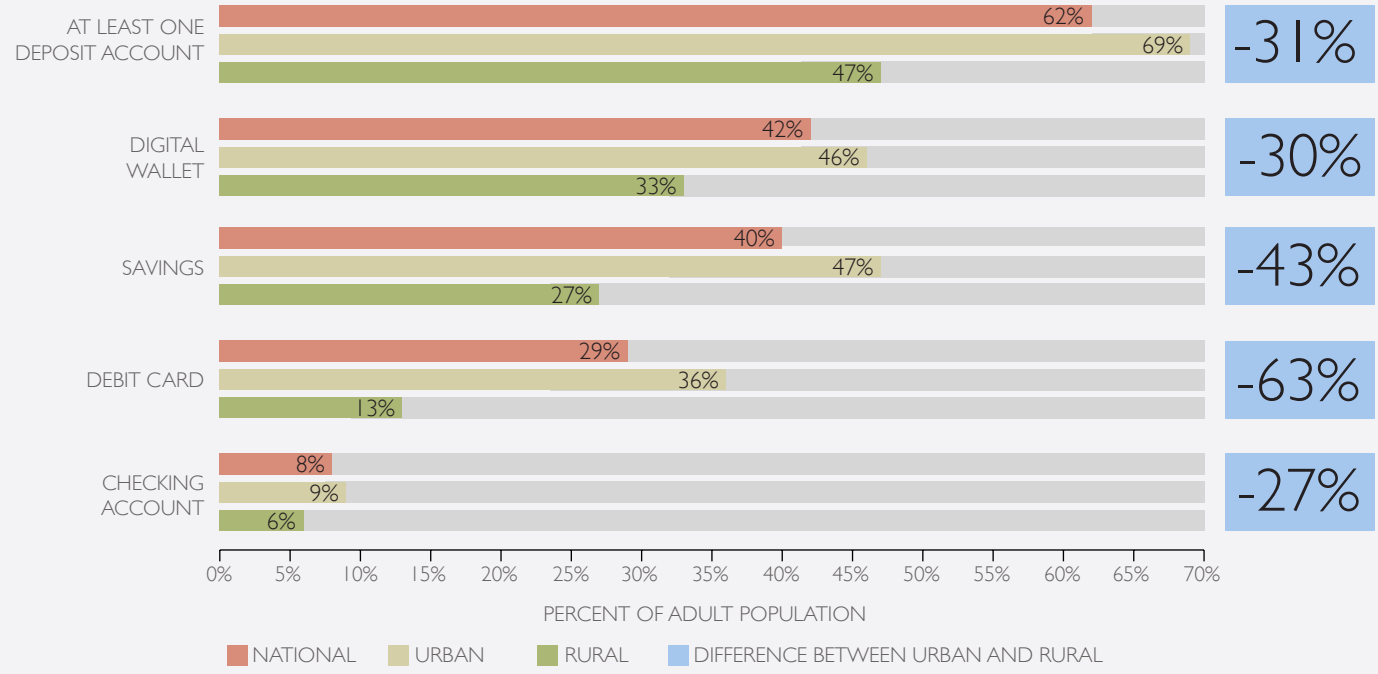
SOURCE: Prosperidad Social.

The biggest jump in the adoption of financial services products came in the wake of the COVID-19 pandemic, when governments throughout the world sought quick and efficient ways to disburse financial assistance to citizens in need. Colombia's government introduced Ingreso Solidario, a program through which payments equivalent to US$43 were disbursed monthly to roughly 3 million low-income Colombians, 1.2 million of whom were previously unbanked. [64] Twenty-three financial institutions participated in the program, including traditional banks, fintechs, and postal offices. Of households receiving Ingreso Solidario disbursement, 63% were led by women.[65]

According to Colombia's Banca de las Oportunidades, 62.0% of Colombians had at least one deposit account and 41.9% had a digital wallet as of mid-2022.[66] For most financial services products in Colombia, there is a 30–40% gap in adoption between urban and rural areas (see **Figure 22**).

61 Prosperidad Social, "Familias en Acción."
62 Prosperidad Social, "Jóvenes en Acción."
63 Prosperidad Social, "Colombia Mayor."
64 Better than Cash Alliance (2022), Colombia's Ingreso Solidario: Improving social protection through public-private collaboration and responsible digital payment practices as part of COVID-19 emergency response.
65 Better than Cash Alliance (2022), Colombia's Ingreso Solidario: Improving social protection through public-private collaboration and responsible digital payment practices as part of COVID-19 emergency response.
66 Banca de las Oportunidades (2022), Encuesta de demanda de inclusión Financiera.

FIGURE 22: FINANCIAL SERVICE ACCOUNT OWNERSHIP IN COLOMBIA, BY TYPE OF SERVICE AND AREA (2022)



SOURCE: Banca de las Oportunidades.

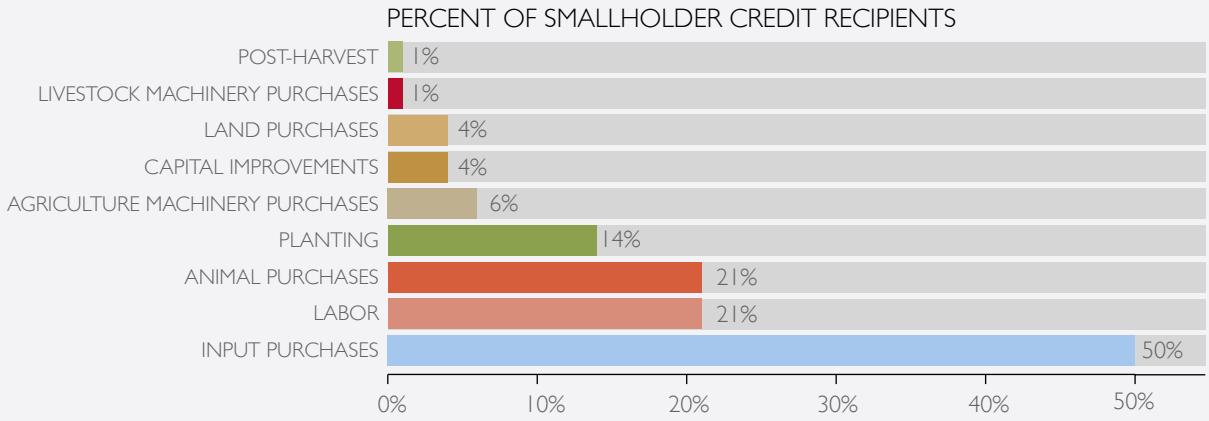
The differences between men and women in terms of account ownership in Colombia are less pronounced than the differences between urban and rural areas; in the case of digital wallets, for example, women have a higher rate of ownership (42.9%) than men (40.9%), a reflection of the large number of public and private digital banking initiatives that have been launched expressly for women. When it comes to more traditional banking products, like savings accounts and debit cards, the differences in account ownership between men and women are much starker, up to 16 percentage points.[67]

Per the Banca de las Oportunidades, less than 30% of Colombians applied for a credit product between 2021 and 2022.[68] In rural areas, that figure drops to 25%. In 2021, 479,000 loans to farmers were registered with government agency Finagro, a more than twofold increase from 2015 levels (214,000 farmers). Unsurprisingly, the two biggest farmer groups receiving loans are livestock and coffee farmers.[69]

The main reasons smallholders seek credit are short-term, operational reasons, including input purchases, labor, and animal purchases, as opposed to longer-term, more strategic reasons aimed at adding value to their enterprise, including land and machinery acquisitions and capital improvements (see **Figure 23**).

67 Banca de las Oportunidades (2022), Encuesta de demanda de inclusión Financiera.
68 Banca de las Oportunidades (2022), Encuesta de demanda de inclusión Financiera.
69 AsoBancaria (2022), Análisis de la inclusión financiera en áreas rurales en Colombia.

FIGURE 23: REASONS SMALLHOLDERS APPLY FOR CREDIT IN COLOMBIA

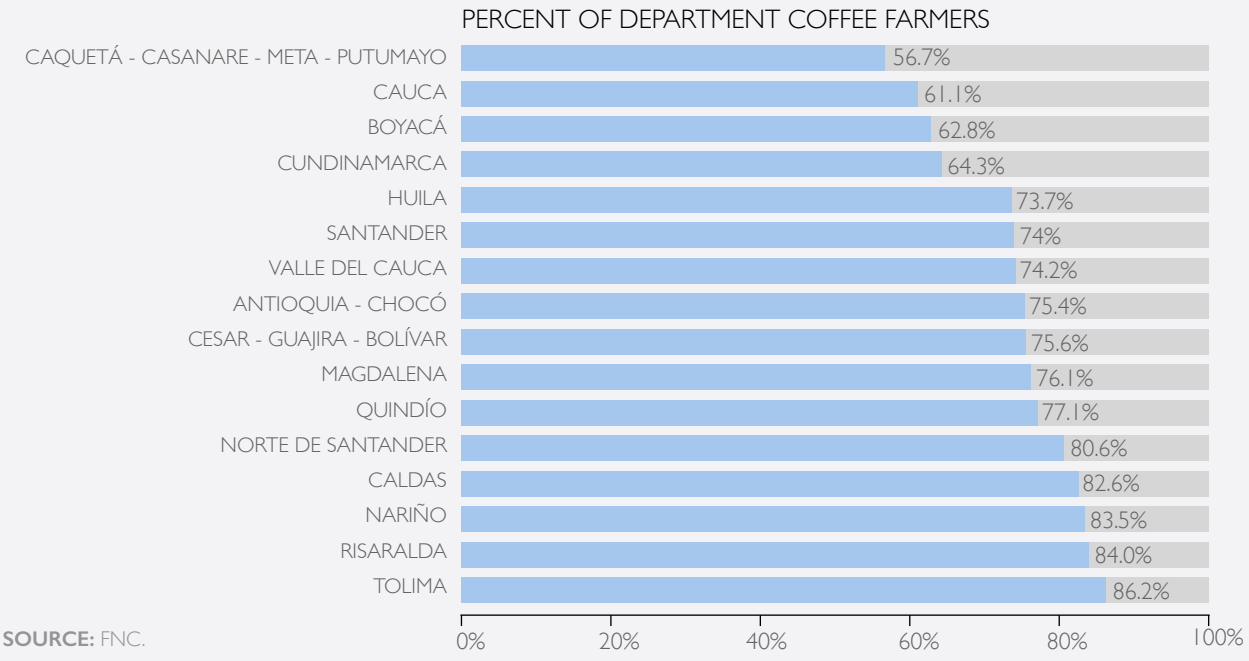


SOURCES: Minagricultura and DANE.[70]

Within the agriculture sector, one of the biggest financial inclusion initiatives was the introduction of the Cédula Cafetera Inteligente (Intelligent Coffee ID card) in 2006.[71] The traditional Cédula Cafetera was first introduced by the Federation of Coffee Growers (FNC) in 1931 as a form of ID for members of the federation. Beginning in 2006, coffee growers could choose the Intelligent ID card which, in addition to proving membership in the Federation, also gave cardholders the ability to receive payments via their card and withdraw money at any Banco de Bogotá location.[72] In 2014, the Cédula Cafetera Inteligente was linked to a bank account with access to preferential rates. The card can be used as a debit card at 260,000 locations around the country.

As of year-end 2022, over 386,000 coffee farmers (accounting for 74% of FNC members) had the Intelligent ID card, up from 298,000 (65% of FNC members) in 2015 (see **Figure 24**).[73] In 2022, COP 60.9 billion (US$15.5 million) in coffee purchases and COP 2.6 billion (US$656,000) in cash withdrawals were made using the Intelligent Coffee ID card.[74] The FNC also estimates that coffee farmers saved a total of COP 336 billion (US$84 million) from the preferential interest rates afforded them by having the Intelligent Coffee ID card.[75]

FIGURE 24: ADOPTION OF FNC INTELLIGENT ID CARD, BY DEPARTMENT (2022)



SOURCE: FNC.

70 Minagricultura and DANE (2016), 3er Censo Nacional Agropecuario.
71 Federación Nacional de Cafeteros, "Cédula Cafetera."
72 YouTube and Federación Nacional de Cafeteros (2022), "Don José nos enseña a usar la Cédula Cafetera 2022."
73 FNC (2023), Informe de Gestión, 2022.
74 FNC (2023), Informe de Gestión, 2022.
75 FNC (2023), Informe de Gestión, 2022.

04.

DIGITAL AGRICULTURE CONTEXT: THE ROLE OF DIFFERENT STAKEHOLDERS

4. DIGITAL AGRICULTURE CONTEXT: THE ROLE OF DIFFERENT STAKEHOLDERS

There is broad consensus among industry stakeholders that digital agriculture has the potential to transform rural communities by making them more resilient to climate events, linking them to markets and financial services, and making them more productive. For this reason, we see active engagement from a variety of different organizations, both domestic and international, in Colombia's digital agriculture sector.

In this section, we examine the role different stakeholders are playing in laying the foundation for digital agriculture innovation in Colombia. Specifically, we look at the activities of the Colombian government to spur innovation in digital agriculture, as well as the role played by research and academia, donors and foreign development agencies, incubators, accelerators, and innovation hubs, and investors.

4.1 GOVERNMENT PROGRAMS AIMED AT DIGITIZATION OF AGRICULTURE

Although the Colombian government has expressed an interest in digitizing agriculture as a means to accelerate economic development in rural areas, it has yet to formulate policy or even a cohesive strategy around digital agriculture in the country. Complicating matters is the fact that there is a new administration in place every four years, with a different set of priorities and objectives.

Because there is no overarching strategy governing digital agriculture in Colombia, we see numerous initiatives related to digital agriculture being implemented by different government agencies, from local mayoral or municipal offices to various ministries and federal agencies (see **Figure 25**). Not surprisingly, the bulk of government initiatives related to digital agriculture have been implemented by the Ministry of Agriculture (Minagricultura) and related agencies, including the Agency for Rural Development (Agencia del Desarrollo Rural [ADR]), the Planning Unit for Rural Agriculture (Unidad de Planificación Rural Agropecuaria [UPRA]), and the Corporation for Agriculture Sector Research (Agrosavia). Given the role technology plays in the development of digital agriculture solutions, the Ministry of Information Technology and Communications (Mintic) has also played an active role in the promotion of digital agriculture, particularly when it comes to testing the applicability of new technologies (such as IoT sensors, drones, AI, information systems, satellite, etc.). Through its incubator/accelerator, Apps.co, Mintic also provides technical and financial support to agtech and fintech startups looking to address challenges faced by agriculture sector players.

Given the potential for digital agriculture solutions to benefit the environment and help farmers mitigate the risks associated with climate change, the Ministry of the Environment (Minambiente) has also participated in selected digital agriculture initiatives. Other ministries that have worked on digital agriculture projects include the Ministry of Commerce, Industry and Tourism (Mincit), primarily through its innovation arm, Innova, and the Ministry of Science and Technology (Minciencias).

FIGURE 25: GOVERNMENT-LED DIGITAL AGRICULTURE INITIATIVES

INITIATIVE	IMPLEMENTING AGENCY	STATUS	DESCRIPTION
Mi Registro Rural[76] (My Rural Registry)	Minagricultura	active	Mi Registro Rural (My Rural Registry) is a digital registry that helps farmers more easily identify available government programs for which they may be eligible. This includes subsidy programs, insurance benefits, and financing programs, among others. Users receive text messages when new programs relevant to them become available. My Rural Registry is aimed at ~2 million farmers living in rural areas. In the future, data gathered through the registry can be used to provide targeted extension support to farmers.
Campo a un Clic[77] (The Field at One Click)	Minagricultura	active	Campo a un Clic is a COVID-era initiative aimed at helping smallholder farmers avoid income losses during the pandemic by identifying new buyers for their crops. The government established the platform to create linkages between smallholders and the more than two dozen agri e-commerce companies participating in the program.
AgroInsumos, AgroClima, AgroNegocios, and AgroTeConecta[78]	Minagricultura	inactive	Minagricultura introduced four digital advisory and marketplace mobile apps for farmers. AgroInsumos provides information about the price of inputs. AgroClima provides weather updates and alerts in different regions of the country. AgroNegocios is a digital marketplace that enables users to buy and sell crops, and AgroTeConecta provides the latest information about news and events related to the agriculture sector in Colombia. These services are currently not active.
SNUIRA, SIPRA, SIGRA, Información Estratégica, Evaluaciones Agropecuarias, Agronet	UPRA	active	One of UPRA's key objectives is to source, organize, and disseminate information relevant to agriculture and rural communities to interested players in the agriculture ecosystem. It has launched a number of digital sources of information to meet the sector's information needs.
Agro 4.0[79]	Mintic, iNNpulsa, government of Medellín	completed pilot	Mintic, in collaboration with C4IR.CO, conducted ten pilots looking to test the impact of new technologies such as IoT sensors, AI, and Big Data on the productivity levels of small and medium-sized farmers. The pilots were conducted in ten different municipalities with a focus on the coffee, cocoa, and avocado value chains. Mintic determined that the technologies tested are still too expensive for wide-scale adoption among small and medium-sized farmers.

76 Contexto Ganadero (2023), "'Mi registro rural,' nueva herramienta de Minagricultura para llegar a los productores."
77 Minagricultura (2023), El Campo a Un Clic.
78 Agronet, Aplicaciones Móviles.
79 Mintic (2021), "Agro 4.0, el Programa del MinTIC y del C4IR.CO que busca mejorar la productividad del sector agropecuario con la implementación de tecnologías avanzadas."

INITIATIVE	IMPLEMENTING AGENCY	STATUS	DESCRIPTION
Dr. Agro, HornillApp, Linkata, Rice ClimaRemote, AlimenTro, DieTro, Más Bienestar, AHoRA, MaPa	Agrosavia	active	Agrosavia has deployed a number of digital tools to support farmers working in different value chains, including panela cane (HornillApp), livestock (AlimenTro, DieTro, Más Bienestar), banana and plantain (AHoRa), and rice (Rice ClimaRemote). Agrosavia has also designed tools that provide training to technical assistants (Linkata) and support farmers as they adopt new crop systems that increase their adaptation to climate change and climatic variability (MaPa).
Soluciones Digitales para el Campo (Digital Solutions for the Field)[80]	Minagricultura, ADR	active	Soluciones Digitales para el Campo is an initiative led by ADR with the support of Minagricultura and the Technological University of Pereira. The objective of this program is to extend digital advisory services to at least 150,000 small and medium-sized farmers in Colombia. To date, however, the initiative has mostly focused on registering farmers rather than delivering advisory services. As of early June 2023, 378,000 farmers had registered on the platform, of which 93,579 are located in PDET regions.
El Campo Innova	Minagricultura, ICA	active	El Campo Innova is a forum created by Minagricultura with the support of the Colombian Agricultural Institute (ICA) that brings together different stakeholders in the agriculture sector to share best practices. The initiative has a special focus on agronomic extension. To date, El Campo Innova has hosted two conferences. It also has a mobile app available to farmers that enables them to register their information to receive targeted extension support.
Sumercé	RAP-E	active	Su Mercado de la Región Central (Sumercé) started as an initiative led by RAP-E to collect accurate information about farmers living in the Central region of Colombia. RAP-E is an association of departments that includes Bogotá, Boyacá, Cundinamarca, Huila, Meta, and Tolima. It now enables participating farmers to sell their crops via an online marketplace. [81]

SOURCES: Minagricultura, Mintic, ICA, Agrosavia, Apps.co, ADR, iNNpulsa.

A review of the government initiatives makes it clear that digital extension is a clear priority for the Colombian government, as is building an accurate registry of smallholder farmers in the country. My Digital Registry, Digital Solutions for the Field, and El Campo Innova all focus on capturing data on farmers so that more targeted services, including advisory and governmental support, can be delivered to farmers.

80 UTP, "Soluciones Digitales para el Campo."
81 Sumercé and RAP-E (2021), "El sistema de información 'Sumercé' inicia pilotos en los seis territorios de la región central."

4.2 ROLE OF RESEARCH AND ACADEMIA INSTITUTIONS IN DIGITAL AGRICULTURE

One of Colombia's main assets as a potential Latin American hub for digital agriculture innovation is the presence of numerous academic institutions and research organizations, including one of the leading research organizations focused on agriculture in the Global South, the Alliance Biodiversity and the International Center for Tropical Agriculture (CIAT), part of the global CGIAR network.

The Alliance Biodiversity and CIAT, in particular, is behind some of the most ambitious digital agriculture initiatives in Colombia, including Climate-Smart Initiatives for Climate Change Adaptation and Sustainability in Prioritized Value Chains (CSICAP), a US$100-million initiative aimed at providing climate-smart agronomic advisory to farmers working in eight different value chains (see **CSICAP Case Study**).

CASE STUDY: CSICAP

ABOUT:
Climate-smart initiatives for climate change adaptation and sustainability in prioritized agricultural production systems (CSICAP) is an ambitious program conceived by CIAT that contributes to the government's goal of strengthening rural economies while helping to meet global climate commitments.[82] Through the use of technology, CSICAP seeks to reduce the vulnerability of agricultural systems to climate events and to increase the competitiveness of small-scale producers in Colombia. By helping farmers adopt climate adaptation strategies, CSICAP hopes to develop a more predictable and adequate food supply while also contributing to a reduction in carbon emissions. One of the project's key objectives is to implement a digital agriculture extension platform that will guide farmers through the implementation of climate-smart adaptation and mitigation measures. The project has a special emphasis on female farmers to ensure that they are not left behind.

GEOGRAPHIC FOCUS:
22 departments in Colombia

VALUE CHAINS:
Banana and plantain, coffee, corn, livestock, rice, panela cane, potato, sugar cane

EXPECTED BENEFITS:
The project aims to directly benefit 195,871 smallholders and their families (619,691 people in total), as well as to indirectly benefit 347,996 smallholder farmers. As a result of the adoption of climate-smart practices through the program, CSICAP plans to reduce carbon emissions by 9,152,034 tCO2e in the 22 departments where the program will operate.

FUNDING:
Total funding for the project is US$99.9 million, of which the Green Climate Fund is providing US$73.3 million (US$48.3-million grant and US$25.0-million loan). Each participating farmer group is also contributing funding to the project.

PARTNERSHIPS:
CSICAP is a project four years in the making, due to both its ambitious nature and the need to build an extensive network of partnerships to effectively address the needs of farmers working across eight different value chains in Colombia. CIAT, which is part of the CGIAR network of agriculture research institutions worldwide, brings extensive experience working in similar initiatives in the Global South (see **Figure 26**).

82 Green Climate Fund (2022), Funding Proposal: Climate-smart initiatives for climate change adaptation and sustainability in prioritized agricultural production systems.

FIGURE 26: CSICAP PARTNERSHIPS

SOURCES: CGIAR, Alliance Biodiversity and CIAT, Green Climate Fund.

WHAT'S NEXT?:
The project is facing some administrative hurdles and the start of the project has been delayed.

From the KIIs we heard that Colombia's universities are an under-utilized asset when it comes to the rollout of digital agriculture solutions. Whereas universities in Brazil and Argentina play a significant role in research and development around digital agriculture solutions, universities in Colombia have played a less prominent role. Nevertheless, we note that things are starting to change. Universities like Universidad de Ibagué (RiceClimaRemote), Universidad de Rosario (SiembraCo), Universidad de San Buenaventura Cali (Agrosmart), and Universidad de Caldas (Lunagro) are among those that have started looking more closely at how they can contribute to digital agriculture development. Universidad Tecnológica de Pereira (UTP) is actively involved with the ADR in the project to bring extension services to 150,000 smallholder farmers throughout Colombia (see **Figure 25**).

4.3 NGOS, DONORS, AND FOREIGN DEVELOPMENT AGENCIES SUPPORTING DIGITAL AGRICULTURE

Digital agriculture solutions aimed at smallholder farmers often struggle to attract capital given questions about their financial sustainability over time. As a result, much of the funding for digital agriculture solutions to date has come from governments, agribusinesses, NGOs, and donors that have a vested interest in digital agriculture solutions beyond their ability to generate a profit. NGOs and donors, in particular, are driven by an interest in promoting climate-smart agricultural practices, improving the livelihoods of rural populations, supporting underrepresented groups like women, youth, and ethnic populations, and ensuring a reliable food supply (see **Figure 27**). In the specific case of Colombia, NGOs, donors, and foreign development agencies are also driven by a need to safeguard the peace process by improving security and ensuring that rural populations can enjoy economic prosperity without having to resort to growing illicit crops.

FIGURE 27:
NGOS AND DONORS ACTIVE IN DIGITAL AGRICULTURE INITIATIVES IN COLOMBIA

YOUTH AND EDUCATION	GENDER	CLIMATE	AGRICULTURE AND RURAL DEVELOPMENT	FINANCIAL INCLUSION
MásPorTIC	Fundación delamujer	RARE Solidaridad Nature Conservancy InsuResilience Grameen Foundation Mercy Corps Rabo Foundation Fundación Natura Sparkassenstifung for International Cooperation	Fundación Bancolombia[83] Fundación Luker Fundación Postobón Solidaridad Fundación Monomeros Fundación Local Partners Grameen Foundation Fundación Nutresa	Mastercard Fundación Bancolombia InsuResilience Sparkassenstifung for International Cooperation

SOURCES: NGOs, donors, The AgTech Network.

There are many foreign development agencies active in Colombia's agricultural sector that have supported the development of digital agriculture solutions. Japan's government is behind the CIAT-led IoT pilot looking at increasing rice productivity, e-kakashi. Canada's government has backed a number of rural development and financial inclusion projects, including the DECISIÓN credit-scoring tool that is now operated by government agency Finagro. Germany's government, through GIZ, has funded the INCAS project to support over 9,000 smallholder farmers working in the coffee, cocoa, banana, palm oil, and rubber value chains. INCAS seeks to create international agricultural supply chains that are sustainable, fair, and deforestation free. To do so, farmers have access to Solidaridad's digital agriculture tools Extension Solution, Agrolearning, and Agropréstamo (see **Figure 28**).

83 Agronegocios (2023), "Fundación Bancolombia promoverá 120 iniciativas para impulsar el campo Colombiano."

FIGURE 28: GIZ Project INCAS and INCAS+ Global

KEY INITIATIVE: Sustainable Agriculture Supply Chains and Standards (Project INCAS – for Iniciativa Cadenas Agrícolas Sostenibles) and Project INCAS Global+

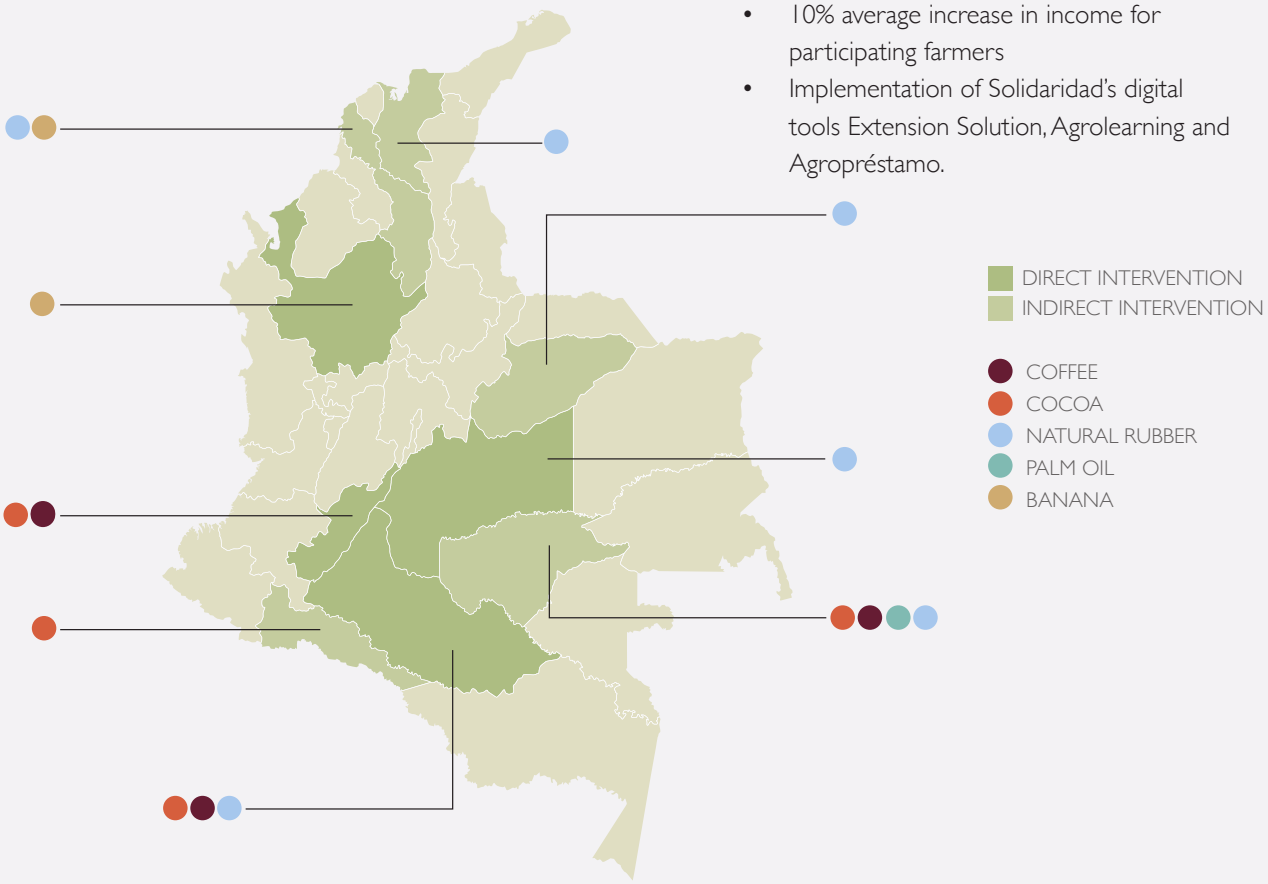
DATES:	Project INCAS 2019- Project INCAS Global+ 2020-
VALUE CHAINS	coffee, cocoa, banana, palm oil, rubber
GEOGRAPHIC FOCUS	Meta, Caquetá
FARMERS SUPPORTED	9,100
IMPLEMENTATION PARTNER	Solidaridad

PROJECT OBJECTIVES:

- International agriculture supply chains that are sustainable, fair and deforestation free
- Living income for local producers
- Leveraging digital solutions to support evaluation, training, traceability

PROJECT HIGHLIGHTS

- 10% average increase in income for participating farmers
- Implementation of Solidaridad's digital tools Extension Solution, Agrolearning and Agropréstamo.



SOURCES: GIZ, Solidaridad, INA.[84]

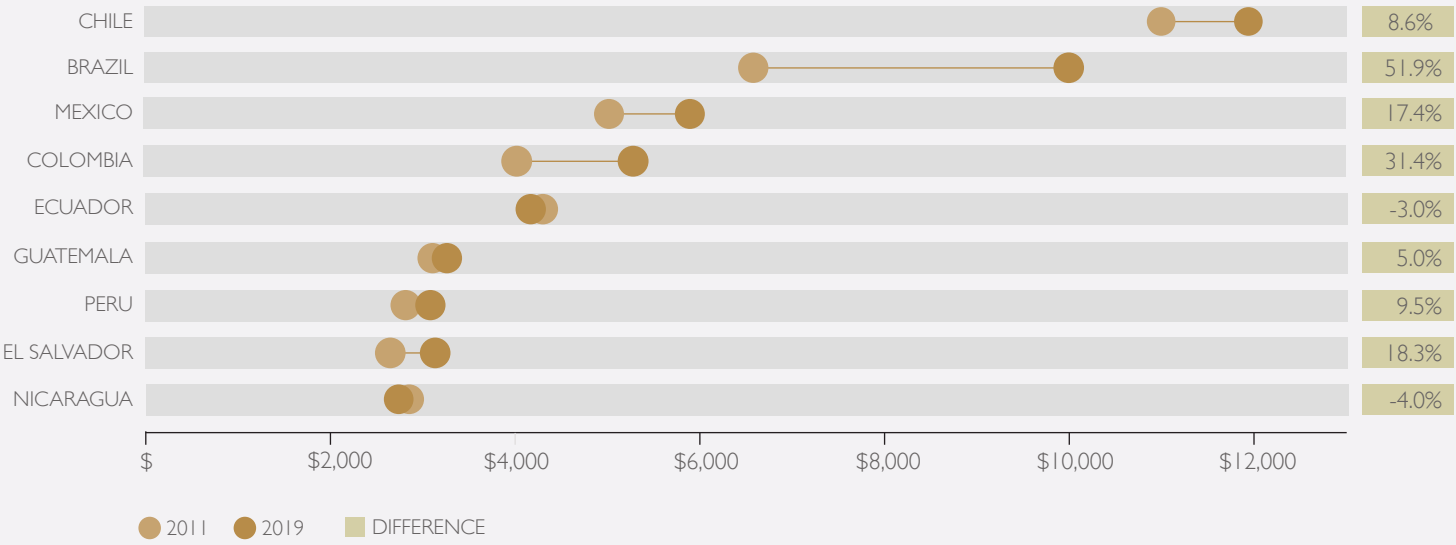
The UK government has supported the development of digital insurance products aimed at smallholder farmers. It also issued an Agri-Tech Catalyst Challenge Fund in 2019 that culminated in the funding of 7 different agtech projects in the cocoa, coffee, banana, and tilapia value chains in 17 different departments throughout Colombia.[85] The US government, through USAID, has supported the development of dozens of digital financial services services through its RED–Rural Finance project[86] and has backed the development of digital agriculture tools as part of initiatives like StartPath Empodera (AgrodatAi, IncluirTec)[87] and The Cacao Effect,[88] among others.

84 INA, "Project INCAS and INCAS Global+ strengthening sustainable supply chain through digital tools."
85 Gov.uk (2019), "UK Prosperity Fund Agri-Tech Catalyst Projects in Colombia."
86 USAID (2020), RED-Rural Finance Initiative.
87 USAID and Mastercard, StartPath Empodera.
88 USAID (2023), The Cacao Effect.

4.4 INCUBATORS, ACCELERATORS, AND INNOVATION HUBS SUPPORTING DIGITAL AGRICULTURE INNOVATION

Argentina and Brazil have long been considered the leading hubs for agtech innovation in Latin America. Brazil, in particular, has emerged as a global agroindustrial powerhouse, thanks in large part to its adoption of innovative digital solutions. Not only does Brazil enjoy one of the highest agricultural productivity levels in Latin America, it also has made some of the most significant gains over the last ten years (see **Figure 29**).[89]

FIGURE 29: FARMER PER CAPITA PRODUCTIVITY (PFP) (2010 VERSUS 2019)



SOURCES: OPSAa, IICA, World Bank.

Brazil's success is due in large part to the collaboration between Embrapa, the agriculture research corporation division of the Ministry of Agriculture, local universities, and a vibrant startup ecosystem centered around Piracicaba, considered the Silicon Valley of Latin America's agtech industry.[90] The Agtech Garage, headquartered in Piracicaba, links over 1,000 organizations, including agroindustrial companies, startups, technology companies, investors, research, and academia.[91]

89 OPSA and IICA (June 2023), Atlas for Agriculture in the Americas.
90 GSMA and IDB Lab (2020), Landscaping the agritech ecosystem for smallholder farmers in Latin America and the Caribbean.
91 The AgTech Garage.

Agtech innovation in Brazil, like in Argentina, is focused on large-scale farming given the makeup of the agricultural industry in those countries. This creates an opening for Colombia to become a regional innovation hub focused on solutions addressing the challenges faced by smallholder farmers and the ecosystem partners that work alongside them. Colombia is ideally suited to fill this role given its size as the third-largest economy in Latin America and its location, strategically situated between agtech hubs in North America (the US) and South America (Argentina/ Brazil). It is perhaps the largest agricultural market in Latin America centered around the smallholder farmer.

In the past, Colombia's ability to step into this role has been hampered by what many startups considered to be excessive red tape. The last few Colombian administrations, however, have gone to great lengths to make it easier for startups to do business by eliminating barriers to entry and attempting to reduce bureaucracy. The government has also set up a number of initiatives to provide early funding and technical support to startups. These include government backed Apps.co, iNNpulsa, Startco, the Bogotá Chamber of Commerce's Innovalab, and Medellín's rutaN. As a result, Colombia's startup ecosystem rankings have increased, to 3rd in Latin America and 40th globally. [92]

StartupBlink estimates that there are 1,324 Colombian startups, of which 207 are focused on fintech and 97 are focused on agtech and foodtech (see **Figure 30**). Colombia is now home to two unicorns, the largest of which, on-demand delivery app Rappi, has raised over US$2.3 billion over 15 rounds of financing.[93]

FIGURE 30: COLOMBIA'S STARTUP ENVIRONMENT AT A GLANCE

TOTAL STARTUPS	% AGTECH/ FOODTECH	% FINTECH	UNICORNS	ACCELERATORS
1,324	7.3%	15.6%	2	2

SOURCE: StartupBlink.

The last few years have seen the emergence of more agtech-focused innovation hubs, like Medellín-based AgStar spin-off AgCenter. We note as well that Colombian startups are increasingly being selected in international calls for startups. The Inter-American Institute for Cooperation on Agriculture (IICA) had a call for 15 startups to attend Digital Agriculture Week 2023. Four startups from Colombia were selected (AgrodatAi, Incluirtec, SiembraCo, and Visualiti), more than from any other country.[94]

92 StartupBlink, "The Startup Ecosystem of Colombia."
93 StartupBlink, "The Startup Ecosystem of Colombia."
94 IICA (2023), "Fifteen Agtechs Offering Digital Agriculture Solutions for the Americas Will Attend Digital Agriculture Week 2023 in Costa Rica."

FIGURE 31: SELECTED INNOVATION HUBS, ACCELERATORS, AND INCUBATORS IN COLOMBIA

ORGANIZATION / INITIATIVE	DESCRIPTION	SELECTED DIGITAL AGRICULTURE INNOVATORS SUPPORTED
agcenter Hub agrifoodtech	Medellín-based innovation hub supporting agrifoodtech startups in Colombia through networking, open innovation, acceleration, and investment.	Tu Plaza, Petalli, Bloomspal Network
ruta n MEDELLÍN	Medellín-based innovation hub that supports innovations leveraging science and technology.	Agro 4.0, MásPorTIC
INNpulsa Colombia	Innpulsa is a government agency focused on entrepreneurship and innovation. Innpulsa and Mintic created Apps.co to promote ICT-based innovation.	Agrapp, Kanpo, Agrosmart, Comproagro
STARTCO	Platform that connects startups to investors. During Startco 2023, 350 startups from around the world applied, with 30 of those ultimately selected.	AgrodatAi
IICA	Costa Rica-based Inter-American Institute for Cooperation on Agriculture (IICA) is a multilateral agency supporting agriculture in its 34-member states, including Colombia. In 2023, IICA issued a call for participation in its Digital Agriculture Week. AgrodatAi and Incluirtec were the Colombian companies selected.	AgrodatAi, Incluirtec, SiembraCo, Visualiti, Bloomspal Network
mastercard USAID FROM THE AMERICAN PEOPLE	StartPath Empodera is a program sponsored by USAID and MasterCard to promote female entrepreneurs working throughout Latin America.	AgrodatAi, IncluirTec

SOURCES: Hubs, The AgTech Network.

4.5 KEY INVESTORS IN DIGITAL AGRICULTURE

As the maturity of the digital agriculture ecosystem in Colombia increases and the provision of digital agriculture tools shifts from public to private entities, the need for capital increases. According to many of the digital agriculture startup companies interviewed for this assessment, accessing capital has been complicated in the last three years, initially because of the pandemic and more recently because of a complicated international context of rising inflation, the war in Ukraine, and disrupted supply chains.

The bulk of funding to date has been early-stage, pre-seed financing for sums well below US$1 million. Digital agriculture marketplace Frubana is a notable exception, having raised more than US$270 million in capital since its founding in 2018 through 8 different financing rounds.[95]

Among the leading investors in digital agriculture innovation in Colombia are companies such as The Yield Lab, which has long been active in agtech in countries like Argentina and Brazil, as well as Glocal Managers and impact investor Acumen (see **Figure 32**).

FIGURE 32: SELECTED VENTURE CAPITAL FIRMS INVESTING IN AGTECH IN COLOMBIA

ORGANIZATION / INITIATIVE	DESCRIPTION	SELECTED DIGITAL AGRICULTURE INNOVATORS SUPPORTED
THE YIELD LAB	Venture capital firm that supports early-stage agriculture sector startups through acceleration opportunities, mentorship, and investment.	Bloomspal Network, Croper.com, SIOMA
	Impact investor focusing on early-stage innovations that tackle the problems generated by poverty.	Acceso, IncluirTec, Siembraviva
GLOCAL	Global accelerator and investor focused on the agtech sector.	Agrapp
Village Capital	Impact investor focused on early-stage startups. Village Capital launched Impulsando Agtech y Foodtech en la Region Andina in 2020. It also partnered with Argidius for the Colombian Ecosystem Builders Program which identifies and trains 10 Entrepreneur Support Organizations (ESOs) such as incubators, accelerators, etc., to help drive innovation.	IncluirTec
MR PINK VC	Argentina-based venture capital focused on seed round investments in Colombia, Argentina, Peru, Uruguay, and Chile.	Tu Plaza
Rockstart	Founded in 2011 as an accelerator with offices in Amsterdam and Copenhagen. Opened Bogotá office in 2017. Strong focus on tech startups, including agtech.	Agrapp, SiembraCo, IncluirTec
500	Venture capital firm with assets of $2.5 billion focused on technology startups.	Agrapp

SOURCES: Organizations, The AgTech Network.

95 Crunchbase, "Frubana"

05.

DIGITAL AGRICULTURE SERVICE LANDSCAPING AND EVOLVING TRENDS

5. DIGITAL AGRICULTURE SERVICE LANDSCAPING AND EVOLVING TRENDS

Digital agriculture solutions can transform rural communities by helping smallholder farmers more quickly and cost-effectively gain access to information, financial services, markets for their crops, and assets that enable them to become more productive and improve their incomes. Digital agriculture solutions can also help rural communities build resilience against climate change by giving farmers the tools they need to optimize the use of natural resources and inputs, reduce their carbon footprint, and adopt climate-smart practices. Given the potential of digital agriculture solutions to positively impact rural communities, it is no surprise that agriculture sector stakeholders, ranging from government agencies to agribusinesses and farmer groups to NGOs to established technology companies and startups, are investing millions to develop digital agriculture solutions throughout Colombia.

This section examines the digital agriculture landscape in Colombia by taking a closer look at the different types of solutions available in the market and the ecosystem players behind them. We highlight solutions that focus on bridging the gender divide and helping build climate adaptation. We also take a look at the solutions implemented in PDET regions.

5.1 DIGITAL AGRICULTURE USE-CASE FRAMEWORK

During the course of our research, The AgTech Network identified over 150 different digital agriculture solutions implemented in the Colombian market addressing various challenges faced by smallholder farmers and other relevant stakeholders in the agricultural supply chain (see **Appendix 1**). For the purposes of this analysis, The AgTech Network has segmented these solutions into five distinct use cases as outlined in **Figure 33** and discussed in more depth in the following sections.

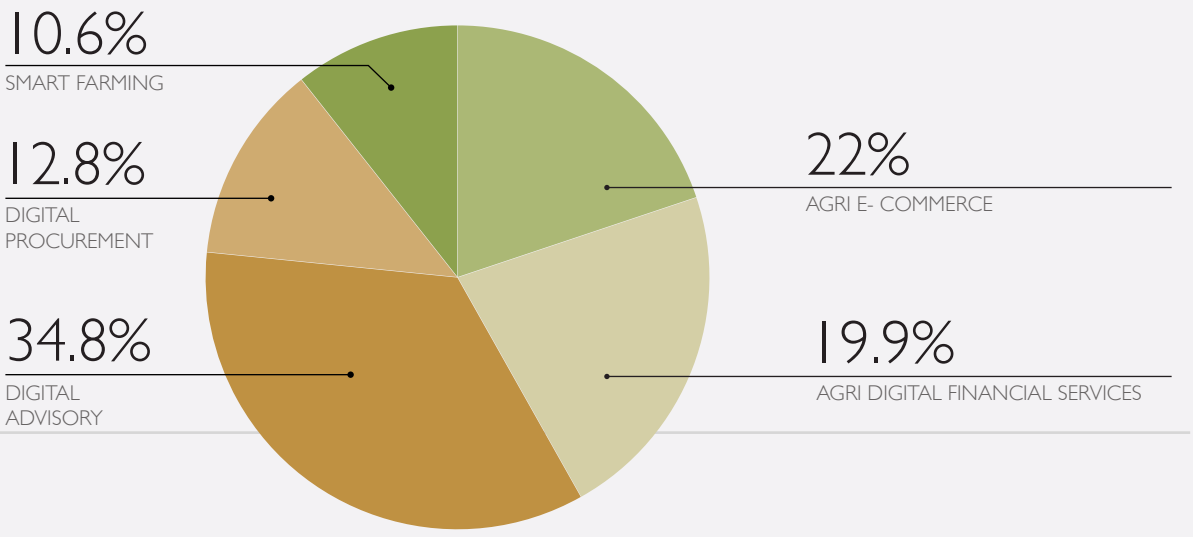
FIGURE 33: DIGITAL AGRICULTURE USE CASES

ACCESS TO INFORMATION	ACCESS TO FINANCE	ACCESS TO MARKETS		ACCESS TO ASSETS
				
DIGITAL ADVISORY AND EXTENSION	AGRI DIGITAL FINANCIAL SERVICES	DIGITAL PROCUREMENT / FARM MANAGEMENT	AGRI E-COMMERCE / MARKETPLACES	SMART FARMING
Digital advisory and extension refers to use of digital solutions, including IVR, text messaging, applications like WhatsApp, and dedicated apps to provide agronomic information, best practices, and advice to smallholder farmers. The aim of digital advisory and extension services is to more cost-effectively reach a wider number of farmers with insights that can help them improve agricultural production processes, leading to higher productivity and reduced losses.	Agri digital financial services refers to the provision of financial services (e.g., payments, credit, insurance) through digital channels. The aim of agri digital financial services is to give farmers access to financial resources that can help them invest in their farms and reduce the risk of one-time climatic events so that they can exit the cycle of poverty.	Digital procurement refers to digital solutions implemented in the last mile that transition agricultural processes from paper to digital. The digitization of farmer and farm records enables agribusinesses to increase operational efficiency and transparency. It also supports farmers in their efforts to comply with increasingly stringent traceability and certification requirements. By establishing a digital footprint, farmers can gain access to other (e.g., financial) services.	Agri e-commerce and marketplaces refers to online platforms that facilitate the buying and selling of crops and inputs. The aim of agri e-commerce platforms is to identify new markets for smallholder farmers, most often domestically, but increasingly also internationally.	Smart farming refers to the use of data collected from sensors, drones, satellites, and other agricultural assets to provide smallholder farmers with recommendations around the optimization of resources (water, inputs, feed, etc.). The aim of smart farming solutions is often to increase productivity and lower the cost of production.

SOURCES: GSMA AgriTech, USAID, The AgTech Network.

Given that digital advisory services were among the first digital agriculture services to become available, it is not surprising that they account for one-third of all digital agriculture services identified in Colombia, more than any other use case. Agri e-commerce and digital financial services each account for roughly one-fifth of total solutions in Colombia (see **Figure 34**).

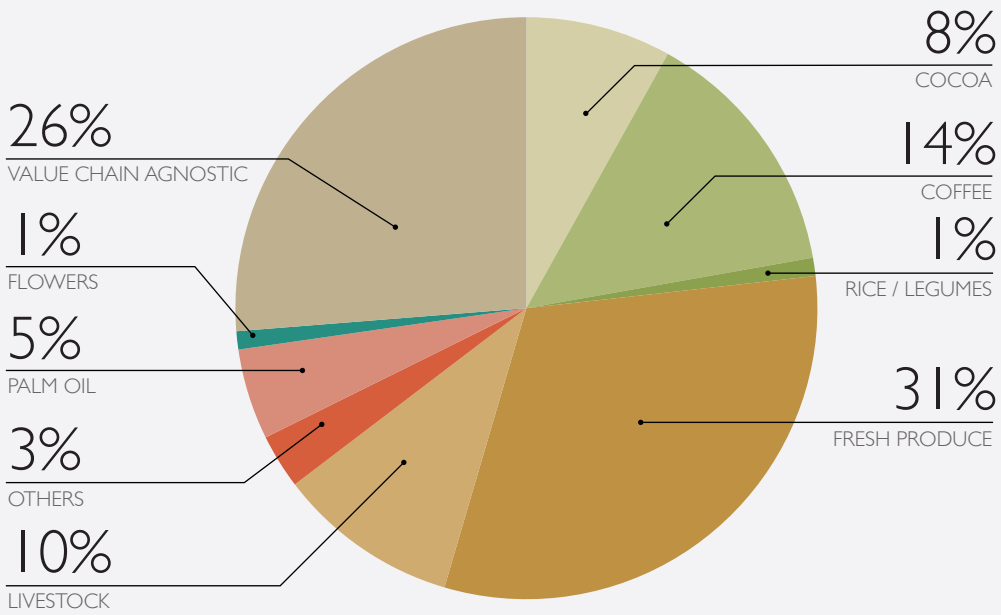
FIGURE 34: DISTRIBUTION OF DIGITAL AGRICULTURE SOLUTIONS IN COLOMBIA BY USE CASE



SOURCE: The AgTech Network.

From a value chain perspective, most tools are designed around Colombia's most important export crops: coffee, cocoa, and palm oil. Fresh produce accounts for over 30% of all tools, mostly because virtually all agri e-commerce tools are built around the movement of fruits and vegetables from rural areas to urban centers (**see Figure 35**).

FIGURE 35: DISTRIBUTION OF DIGITAL AGRICULTURE SOLUTIONS IN COLOMBIA BY VALUE CHAIN



SOURCE: The AgTech Network.

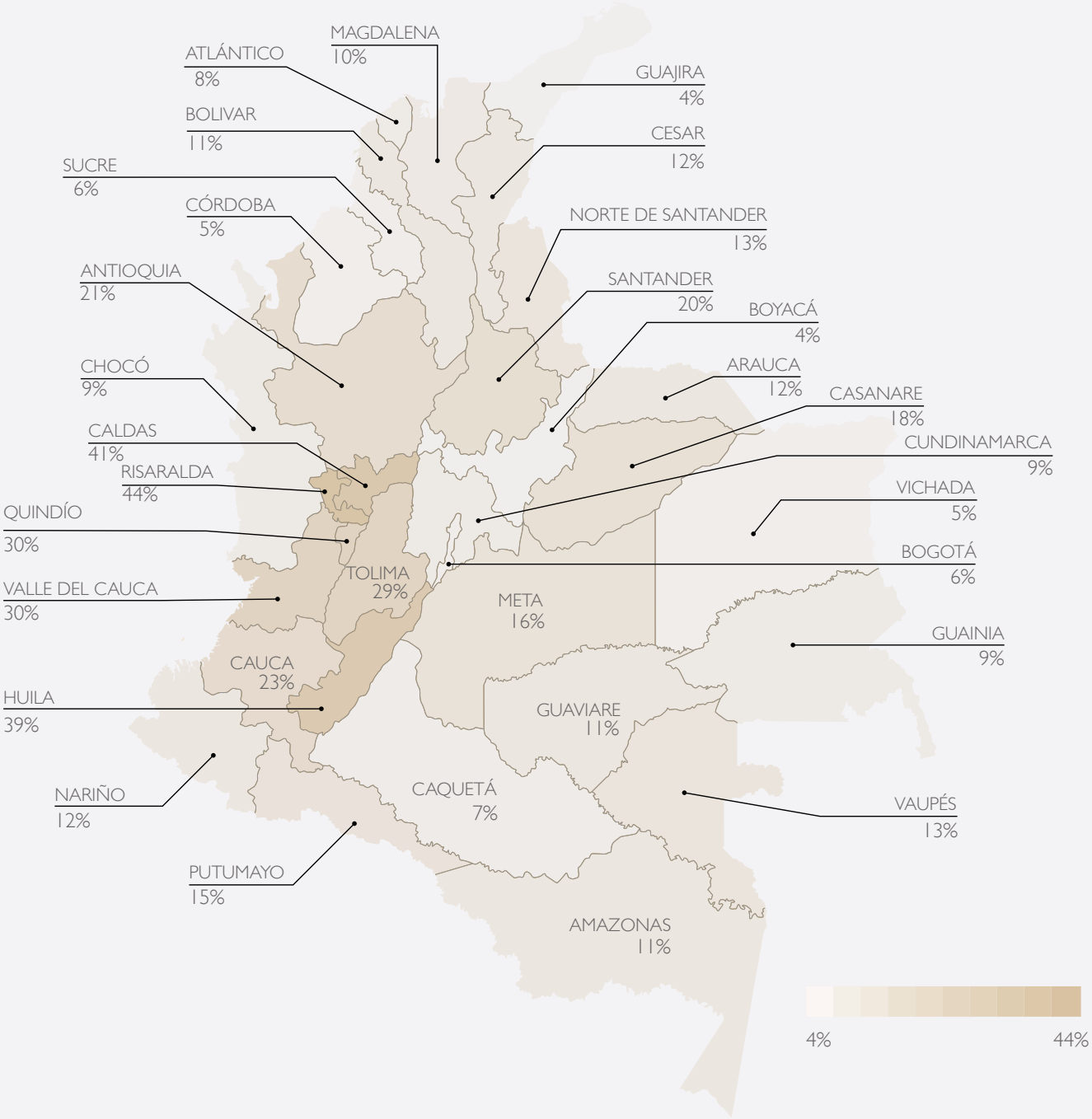
5.1.1 DIGITAL ADVISORY AND EXTENSION

According to Article 24 of Law 1876 passed in 2017, agricultural extension is a basic right afforded to farmers in Colombia. Farmers are eligible to receive services that "diagnose, recommend, update, educate, assist, generate competencies and empower farmers to incorporate the latest knowledge, best practices, technologies and behaviors to help farmers increase their food security, their competitiveness and their resilience."[96] Each municipality is charged with developing an agricultural extension plan for smallholder farmers, cooperatives, and farmer groups living in their communities and ensuring coordination with departmental-level plans. (See **Appendix 8** for main types of agricultural extension provided to smallholders in Colombia.) In order to provide extension services, organizations must be registered as an Entity that Provides Agricultural Extension (EPSEA). There are no limitations on the type of company that can become an EPSEA.[97]

Despite the priority placed by the government on extension, data from Colombian statistics agency DANE suggests that less than 17% of smallholder farmers enjoy access to agricultural extension services. In some departments, less than 10% of smallholder farmers enjoy access (see **Figure 36**).[98]

96 ADR (2023), Extensión Agropecuaria; Minagricultura (2017), Ley 1876.
97 ADR (2023), Extensión Agropecuaria; Minagricultura (2017), Ley 1876.
98 Minagricultura and DANE (2016), 3er Censo Nacional Agropecuario.

FIGURE 36:
SHARE OF SMALLHOLDERS RECEIVING EXTENSION SUPPORT IN COLOMBIA, BY DEPARTMENT



SOURCES: Minagricultura, DANE.

Although digital advisory and extension solutions cannot replace in-person extension, they can be a valuable complement, enabling organizations to more quickly and cost-effectively reach a larger share of smallholder farmers. This is particularly true in countries like Colombia, where it can take hours to reach remote rural areas from some municipal and departmental capitals.

Key enablers for the rollout of digital advisory and extension services include network coverage in rural areas, device ownership, and access to farmer databases (see **Figure 37**).

FIGURE 37: KEY ENABLERS: DIGITAL ADVISORY AND EXTENSION SERVICES

NETWORK CONNECTIVITY

Digital advisory and extension services generally require the user to have access to a mobile network. Although many have offline capabilities, the ability to receive timely recommendations, upload queries, and access information is dependent on having network access. While simpler text-based services can function on 2G networks, newer app-based solutions would benefit from 3G+ network coverage.

FARMER DATABASES

The successful deployment of digital agriculture solutions requires access to up-to-date farmer databases that include farmer phone numbers. Farmer databases are generally more widely available in more structured, formalized value chains. In the case of Colombia that would include coffee, cocoa, livestock, and palm oil. The government has several ongoing programs seeking to develop farmer databases.

DEVICE OWNERSHIP

Digital advisory and extension services require users to have a mobile device. While text-based solutions can be accessed from a feature phone, the newer solutions relying on WhatsApp and proprietary applications require the use of a smartphone device as well as basic data access.

AVAILABILITY OF LOCALIZED CONTENT

Digital advisory services depend on low-cost and timely access to localized content. Some of the most widely used digital advisory services in Colombia source information from as many as 120-150 different sources. Of particular relevance are databases with weather data, pricing data, best practices, pest and disease alerts, and fertilizer/pesticide recommendations. The more localized the data, the more useful it is to the smallholder accessing it.

WHATSAPP ADOPTION

Increasingly, digital agriculture service providers are relying on WhatsApp to deliver agricultural advisory and extension to smallholder farmers because it is an application that is familiar to farmers. According to a survey by Colombia's CRC, 98% of Colombia's smartphone users have WhatsApp. This same study also found that users are increasingly relying on WhatsApp for their voice and messaging needs.

ENGAGED LOCAL ACTORS

Colombia's agricultural extension approach is a highly localized one, depending on active engagement from municipalities and local actors. The presence of local government agencies, NGOs, agribusinesses, and other entities with deep knowledge of local agricultural sector dynamics can be critical to the success of digital agriculture deployments

SOURCES: The AgTech Network, GSMA, CRC.[99]

The AgTech Network identified over 40 digital advisory services in Colombia, not including the dozens of WhatsApp groups that have formed in recent years that enable farmers to exchange information and best practices. Most of these services fall into one of three categories (see **Figure 38**). The first is the provision of weather and climate intelligence to help farmers make better decisions about when to plant and harvest. This category also includes services that provide weather alerts to help farmers take action in the face of adverse climate events. The second category includes services that provide farmers with information that helps them mitigate the effects of pests and diseases. These services can also help farmers optimize the use of fertilizers and pesticides to achieve the best results. The final category includes services that provide general advisory and best practices. AgrodatAi and Comunidad Virtual Ganadera are among the most widely used services in this category.

99 CRC (2022), El rol de los servicios OTT: 2021; CRC (2023), El rol de los servicios OTT: 2022.

FIGURE 38: SELECTED DIGITAL ADVISORY AND EXTENSION SERVICES IN COLOMBIA, BY CATEGORY

CLIMATE AND WEATHER ADVISORY

SOLUTION: Melisa
IMPLEMENTED BY: CIAT
YEAR: n.a.
STATUS: Active
VALUE CHAINS: Corn and rice
DELIVERY: Chatbot (WhatsApp, Facebook, Telegram)
DESCRIPTION: Melisa provides climatic forecast data to corn and rice farmers to help them make decisions at different stages in the agricultural cycle.

SOLUTION: Agroclima
IMPLEMENTED BY: Cenicafé, FNC
YEAR: n.a.
STATUS: Being revamped
VALUE CHAIN(S): Coffee
DELIVERY: Web
DESCRIPTION: Agroclima provides coffee farmers with weather forecasting information as well as alerts about potential climate-related risks.

SOLUTION: Boletín Semanal
IMPLEMENTED BY: IDEAM
YEAR: 2014
STATUS: Active
VALUE CHAIN(S): Various
DELIVERY: Web
DESCRIPTION: IDEAM publishes weekly bulletins with weather and climate-related information and forecasts.

PEST AND DISEASE MITIGATION / INPUT MANAGEMENT

SOLUTION: Dr. Agro
IMPLEMENTED BY: Agrosavia
YEAR: 2014
STATUS: Active
VALUE CHAIN(S): Cotton, mango, tomato, potato, rubber
DELIVERY: Mobile app
DESCRIPTION: Dr. Agro helps smallholder farmers and extension officers identify pests, diseases, and nutritional deficits impacting their crops. The application provides users with mitigation recommendations, including what mix of fertilizers and pesticides to use.

SOLUTION: Tumaini
IMPLEMENTED BY: CIAT
YEAR: 2017
STATUS: Active
VALUE CHAIN(S): Banana
DELIVERY: Mobile app
DESCRIPTION: Tumaini is a mobile application that helps banana farmers combat five common diseases and one pest. Users can upload an image of the affected plant; Tumaini leverages AI to scan the image, then provides a diagnosis and a plan of action. CGIAR claims the application has an accuracy rate of ~90%.

SOLUTION: Manejo Agronómico
IMPLEMENTED BY: Cenicafé
YEAR: n.a.
STATUS: Active
VALUE CHAIN(S): Coffee
DELIVERY: Mobile app
DESCRIPTION: Manejo Agronómico is a mobile app that gives coffee farmers in Colombia the tools they need to identify pests, diseases, and other nutritional deficiencies in their coffee crops. Farmers can enter information about their location, the symptoms noticed, and the part of the plant impacted, among other information.

SOLUTION: Asohofrucol
IMPLEMENTED BY: Asohofrucol, ICA
YEAR: 2022
STATUS: Active
VALUE CHAIN(S): Fresh produce
DELIVERY: WhatsApp groups
DESCRIPTION: Asohofrucol teamed with ICA to provide fresh produce farmers with more effective tools to combat pests and diseases. They created a series of WhatsApp groups to provide farmers with specific recommendations.

GENERAL ADVISORY AND BEST PRACTICES

SOLUTION: Mundo Cacao
IMPLEMENTED BY: Nutresa
YEAR: n.a.
STATUS: Active
VALUE CHAIN(S): Cocoa
DELIVERY: Mobile app
DESCRIPTION: Mundo Cacao is an application that enables Nutresa to communicate directly with its smallholder farmer partners to share best practices and information about the company.

SOLUTIONS: AlimenTro, DieTro
IMPLEMENTED BY: Agrosavia
YEAR: n.a.
STATUS: Active
VALUE CHAIN(S): Livestock
DELIVERY: Mobile app
DESCRIPTION: AlimenTro provides livestock farmers with advice on how to optimize pastures for increased meat and milk production and recommendations to reduce carbon emissions. DieTro is a complementary application that provides recommendations on what to feed dairy cows for increased production.

SOLUTION: Un Mensaje por el Campo
IMPLEMENTED BY: RARE, PxD
YEAR: 2021
STATUS: Active
VALUE CHAIN(S): Cocoa, coffee, plantain, citrus
DELIVERY: SMS, WhatsApp
DESCRIPTION: Un Mensaje por el Campo provides best practices around regenerative agriculture and reducing carbon emission. Focuses on soil health, composting, cover cropping, integrated pest management, erosion prevention, optimized pruning, and agroforestry.

SOLUTION: Cultivo Red
IMPLEMENTED BY: MásPorTIC
YEAR: n.a.
STATUS: Active
VALUE CHAIN(S): Various
DELIVERY: WhatsApp groups
DESCRIPTION: MásPorTIC creates farmer groups with common interests that share best practices and other general advisory through the Cultivo Red service.

SOLUTION: AgrodatAi
IMPLEMENTED BY: AgrodatAi
YEAR: 2019
STATUS: Active
VALUE CHAIN(S): Various
DELIVERY: SMS, WhatsApp, web, mobile app
DESCRIPTION: Through an AI-powered chatbot called Don Tulio, AgrodatAi provides general advisory and best practices to smallholder farmers nationwide. Provides information on pricing, climate, financial services, and general agricultural practices.

SOLUTION: Coffee Club
IMPLEMENTED BY: Yara
YEAR: 2021
STATUS: Active
VALUE CHAIN(S): Coffee
DELIVERY: Mobile app, WhatsApp
DESCRIPTION: Coffee Club enables farmers to access climate information for the location of their farm, pricing information (updated daily), articles sharing best practices, and a personalized nutrition plan for their coffee plants. The application also enables users to submit queries which are answered by agronomists with expertise in the coffee sector.

SOLUTION:
Comunidad Virtual Ganadera
IMPLEMENTED BY: Fedegan
YEAR: n.a.
STATUS: Active
VALUE CHAIN(S): Livestock
DELIVERY: WhatsApp groups
DESCRIPTION: Comunidad Virtual Ganadera is a service made available to Colombian livestock farmers by the federation of livestock farmers (Fedegan). The service is made up of ~5,400 WhatsApp groups that include over 250,000 livestock farmers. Focus on sustainable best practices for meat and dairy livestock farmers.

SOLUTION: Más Calidad
IMPLEMENTED BY: Cenicafé
YEAR: 2022
STATUS: Active
VALUE CHAIN(S): Coffee
DELIVERY: Mobile app
DESCRIPTION: Más Calidad is a digital tool that helps coffee farmers monitor the post-harvest process. The app provides farmers with best practices on post-harvest so that they can maximize the value of their coffee crop.

SOLUTION: App del Café
IMPLEMENTED BY: FNC
YEAR: n.a.
STATUS: Active
VALUE CHAIN(S): Coffee
DELIVERY: Mobile app
DESCRIPTION: App del Café is a service aimed at coffee farmers and coffee buyers/collectors. The app provides reference pricing at different locations as well as future prices and estimates for the evolution in pricing. The app can also connect farmers to buyers/collectors, thereby serving as an online marketplace.

SOURCES: Yara,[100] CGIAR,[101] Agrosavia,[102] Companies, The AgTech Network.

100 Yara interview (March 2023); Yara Colombia, "Coffee Club"
101 CGIAR, "Tumaini: an AI-powered mobile app for pests and diseases."
102 Agrosavia interview (April 2023); Agrosavia, "Dr. Agro: Un Aliado para el campo Colombiano."

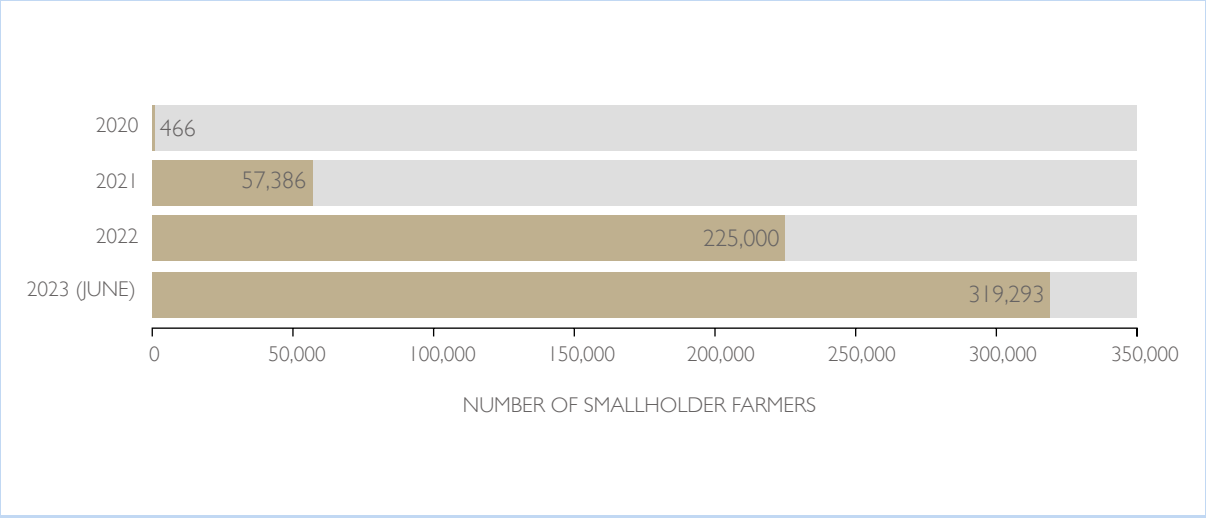
Nearly half of the services identified are led by government agencies, research organizations, and academia that have been working to extend extension support to the more than 80% of smallholders who have historically been excluded from agricultural extension programs. These include services introduced by Minagricultura (e.g., AgroInsumos), services introduced by government research group Agrosavia (e.g., Dr. Agro, AlimenTro, DieTro, HornillApp, Más Bienestar, MaPa), and services led by the international research organization CIAT/CGIAR (e.g., Tumaini, Aclímate, Fenalcheck).

In recent years, we have seen greater participation from private sector stakeholders in the deployment of digital agriculture and extension services to help farmers adopt best practices and stay informed. Yara, an input supplier, has introduced several services, including Coffee Club, CheckIT, and TankMixIT, to help farmers optimize input use on their farms. Grupo Nutresa, one of Colombia's largest cocoa companies, launched Mundo Cacao to share information and best practices with its cocoa farmers. Palm oil federation Fedepalma launched SISPA Móvil to share its newsletter with members, while the Federación Nacional de Cafeteros (FNC) has launched several apps, including App del Café and Más Calidad. Agtech company AgrodatAi works with several agribusinesses to offer extension support to more than 300,000 smallholder farmers throughout the country (see **AgrodatAi Case Study**).

CASE STUDY: AGRODATAI

ABOUT: AgrodatAi is a Colombian agtech startup that provides digital advisory services for 340 different agricultural activities to smallholder farmers nationwide. The company was founded in 2019 and now serves 319,293 farmers,[103] making it the largest digital advisory service in Colombia. **Figure 39** outlines the rapid growth of AgrodatAI user base in the recent years.[104] AgrodatAi has made the greatest inroads in the livestock value chain. Livestock farmers account for roughly one-third of all farmers on the AgrodatAi platform.[105]

FIGURE 39: AGRODATAI USER EVOLUTION (2020–JUNE 2023)



SOURCES: AgrodatAi, OECD.[106]

SOLUTION: AgrodatAi provides digital advisory to farmers via three different channels: web, a mobile application, and a chatbot branded as "Don Tulio, your agricultural advisor" that works over WhatsApp and SMS and is powered by AI and machine learning. Farmers enter their location, the crop(s) grown, and their cellular number. With that information, AgrodatAi sends personalized data on the best windows to plant or harvest, the optimal time to vaccinate cattle, locations offering the best prices for different crops, and local weather, among others.

103 AgrodatAi interview (March 2023).
104 AgrodatAi interview (March 2023).
105 Don Tulio Informa (April 2023).
106 OECD (2022), Connection and empowerment of Colombian agricultural producers through innovative digital solutions.

AgrodatAi has various versions of Don Tulio to reflect the language and dress of farmers working in different regions in Colombia. Early advisory focused on weather. However, AgrodatAi found over time that farmers were much more interested in what they called "pocketbook issues," including pricing and access to financial services products. [107] The content is derived from roughly 120 public, third-party, and proprietary databases.

BUSINESS MODEL: AgrodatAi is free to smallholder farmers. AgrodatAi's customers are agribusinesses, NGOs, financial services companies, agro input and equipment suppliers, government agencies, and other organizations that maintain commercial relationships with large groups of farmers.

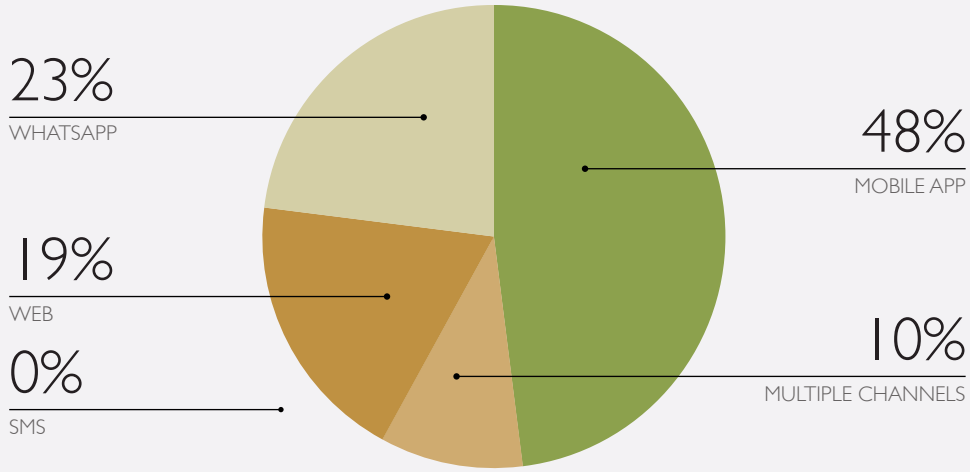
PARTNERSHIPS: AgrodatAi has received funding and technical support from Startco, the Bogotá Chamber of Commerce (CCB), Startpath Empodera (Mastercard and USAID), and CAF Development Bank of Latin America and the Caribbean.

WHAT'S NEXT?: AgrodatAi claims that its greatest asset lies with the trust it has developed with over 300,000 smallholder farmers throughout Colombia (~10% of all smallholder farmers in the country). AgrodatAi is now leveraging this asset to provide additional services to smallholder farmers, including access to credit, access to agricultural insurance products, and access to inputs, to provide a holistic end-to-end solution. As of June 2023, AgrodatAi had formed relationships with six financial services companies to extend credit to over 9,400 farmers. AgrodatAi is also seeking to leverage data from its 300,000 users to provide anonymized insights to its enterprise and NGO customers.

There is great variability in the scope and sophistication of the digital advisory services offered in Colombia. Some services are very narrowly focused on a specific crop or agricultural process. Agrosavia's HornillApp, for example, is designed to give panela cane farmers step-by-step instructions to build the oven needed to process the panela cane. Others, by contrast, cover a wide variety of crops and processes. AgrodatAi, for example, provides advisory for 340 different agricultural activities through its solution.[108] Some services, like PxD's Un Mensaje por el Campo (Message for the Field), which was subsequently transitioned to RARE, rely on SMS and, more recently, WhatsApp to disseminate information and best practices. Others, like AgrodatAi, leverage AI and WhatsApp chatbots to cater recommendations to individual farmers. In contrast to Africa and Asia where there is a greater reliance on SMS and IVR for the delivery of agronomic advisory, in Colombia solutions overwhelmingly rely on data-enabled delivery channels (see **Figure 40**). Digital agriculture service providers have found that, despite the gap in mobile versus internet usage (82% versus 52% in rural areas), the usage of WhatsApp (98% of mobile internet users) still outstrips the use of SMS (see **Section 3.1**).

107 AgrodatAi interview (March 2023).
108 AgrodatAi interview (March 2023).

FIGURE 40: DISTRIBUTION OF DIGITAL ADVISORY SERVICES BY DELIVERY CHANNEL



NOTE: The distribution presented in this chart reflects the distribution among digital advisory services identified by The AgTech Network through this assessment, not the distribution of all digital advisory services available in Colombia. Based on insights gathered from our KIIs, the distribution would likely skew more heavily toward WhatsApp if all solutions were accounted for given the prevalence of WhatsApp use among different farmer groups and cooperatives.

SOURCE: The AgTech Network.

Farmers and other ecosystem players have reported numerous benefits from the use of digital advisory services, including reduced crop losses from pests and diseases, increased productivity from the implementation of best practices, more efficient use of natural resources, and increased preparedness against adverse climate events, among others. Aclímate is a digital advisory tool launched by CIAT in partnership with rice association Fedearroz and cereal and legume association Fedalce. CIAT leveraged large datasets to provide highly localized recommendations to rice farmers in different parts of Colombia. Based on their analysis, CIAT could identify the main factors impacting yield in the different regions of Colombia at different stages of the agricultural cycle. In Saldaña, a municipality in the department of Huila, for example, CIAT found that the amount of accumulated solar energy in irrigated rice had the greatest impact on yields; in Villavicencio, the capital of the department of Meta, it was the frequency of rainfall over 10mm during the vegetative state that had the greatest impact.[109] Armed with these insights, CIAT's Aclímate could provide targeted recommendations to farmers. CIAT estimates that, in the year after implementation, improved decision-making by farmers armed with Aclímate's advisory helped save over US$3.6 million.[110]

5.1.2 AGRI DIGITAL FINANCIAL SERVICES (DFS)

Agri DFS can play an instrumental role in lifting rural communities out of poverty by giving smallholder farmers access to credit to invest in their farms and to insurance to better manage their risk against potentially catastrophic climate events. Crowdsourcing fintech Agroune estimates that there are 2.3 million farmers who are unable to access credit products each year.[111] Similarly, Colombian financial service provider Bancamia estimates that 79% of its rural customers live in areas vulnerable to severe climate events.[112] Insurance, however, is a relatively new concept among rural communities. As a result, less than 1% of smallholder farmers had agricultural insurance protection in 2022.[113]

109 Open Data's Impact, USAID, GovLab, fhi360, mobile Solutions, Technical Assistance and Research (2017), Aclímate Colombia: Open Data to Improve Agricultural Resiliency.
110 Open Data's Impact, USAID, GovLab, fhi360, mobile Solutions, Technical Assistance and Research (2017), Aclímate Colombia: Open Data to Improve Agricultural Resiliency.
111 Agroune, "Nuestra Historia."
112 World Bank (2015), Expanding Rural Finance to Colombia's Impoverished Farmer
113 MiCRO (2022), "Campo Seguro with Seguros Bolívar and Fundación delamujer."

Key enablers for the rollout of Agri DFS include network coverage in rural areas, mobile money adoption, an enabling regulatory environment, and a robust fintech startup ecosystem (see **Figure 41**).

FIGURE 41: KEY ENABLERS FOR AGRI DFS

NETWORK CONNECTIVITY

Agri digital financial services generally require access to a mobile network. This enables digital payments to be delivered (e.g., G2P disbursements, insurance payments, etc.), credit applications to be uploaded, submitted, and subsequently monitored, and financial services companies to remain in communication with smallholder farmers receiving financial services products.

MOBILE MONEY ADOPTION AND DIGITAL PAYMENTS ECOSYSTEM

Agri digital financial services adoption is closely linked to mobile money adoption and the development of a digital payments ecosystem that discourages cash-outs upon the receipt of funds. Also critical is a robust rural agent network that has agents accessible from most communities. According to CGAP, as of 2016 every municipality in Colombia has at least one agent.

ENABLING REGULATORY ENVIRONMENT

For digital financial services to flourish, it is necessary to have an enabling regulatory environment that lowers the barriers to digital transactions (e.g., lowers or eliminates transaction fees, transfer minimums, etc.) and levels the playing field between traditional financial services companies and startup fintechs.

ROBUST FINTECH ECOSYSTEM

The presence of a robust fintech ecosystem helps to drive innovation in the provision of financial services products and accelerates the migration toward digital products. Competition from fintech startups also pushes established players to innovate, leading to better and lower-cost products on the market.

SOURCES: The AgTech Network, GSMA AgriTech, CGAP.[114]

The AgTech Network identified over two dozen digital financial services in the Colombian market, most of which have come online in the last three years (see **Figure 42**). Most services fall into one of four different categories. The first includes mobile payments and encompasses offers from some of the leading digital mobile wallets in Colombia, such as Daviplata (Davivienda), Nequi (Bancolombia), and Movii. Agribusinesses and other ecosystem players look to mobile payments to enhance security and transparency associated with their payments to farmers. The second category encompasses credit and loan products, including credit-scoring tools that leverage farmer and farm data to generate algorithms that can determine a farmer's creditworthiness. Finagro's DECISIÓN is an example of this type of tool. The third category encompasses crowdfunding solutions that extend loans to smallholder farmers using capital raised online through individual investors. Agrapp is perhaps the best-known example of this type of solution. The final, and perhaps fastest growing, category encompasses insurance products, typically parametric insurance products, that protect farmers against potentially catastrophic events. Global players such as MiCRO and Blue Marble each have several products available in Colombia in partnership with local insurance companies and banks.

114 CGAP (2023), "How Did Bancolombia Create a Successful Rural Agent Network at Scale."

FIGURE 42: SELECTED AGRI DFS IN COLOMBIA, BY CATEGORY

CREDIT AND LOANS

SOLUTION: DECISIÓN
IMPLEMENTED BY: Finagro
YEAR: 2018
STATUS: Active
VALUE CHAIN(S): Various
DESCRIPTION: The agri digital financial tool DECISIÓN was developed as part of the PASAC! project funded by the Canadian government and carried out with Desjardins (DID) and Financière Agricole du Quebec Développement International (FADQDI). The tool leverages an algorithm developed to assess the creditworthiness of smallholder farmer credit applicants. DECISIÓN is now managed by Finagro.

SOLUTION: Crédito Agropecuario
IMPLEMENTED BY: crezcamos
YEAR: n.a.
STATUS: Active
VALUE CHAIN(S): Various
DESCRIPTION: crezcamos offers eight different credit options under its Crédito Agropecuario product offering, including agricultural production, livestock production, maintenance, climate adaptation, and machinery purchases, among others. Credit is available for 6 to 120 months. To qualify farmers must have experience in agriculture and have been growing their crop a minimum of one year.

SOLUTION: Hola Préstamo
IMPLEMENTED BY: 4Told
YEAR: n.a.
STATUS: Active
VALUE CHAIN(S): Palm oil
DESCRIPTION: Hola Préstamo is a credit-management tool developed by 4Told leveraging data from small businesses and farmers. Digital tools like QR codes and electronic wallets aid in the disbursement, monitoring, and collection of the loan. Initially available to palm oil farmers.

SOLUTION: IncluirTec
IMPLEMENTED BY: IncluirTec
YEAR: 2016
STATUS: Active
VALUE CHAIN(S): Various
DESCRIPTION: IncluirTec has developed a platform that enables financial institutions and microlending companies to more accurately assess the risk associated with extending a loan to a small or medium-sized farmer. The tool leverages demographic data as well as data on specific crops to assess risk.

SOLUTION: Agrapp
IMPLEMENTED BY: Agrapp
YEAR: n.a.
STATUS: Pre-launch
VALUE CHAIN(S): Various
DESCRIPTION: Agrapp is working on a new credit product that leverages data collected from satellite images to assess the credit risk associated with extending credit to an individual loan applicant. By leveraging satellite technology, Agrapp is hoping to lower the cost of credit origination, thereby making credit much more accessible to smallholder farmers.

SOLUTION: Agropréstamo
IMPLEMENTED BY: Solidaridad
YEAR: 2022
STATUS: Active
VALUE CHAIN(S): Palm oil, cocoa
DESCRIPTION: Tool that integrates the credit profile of a small-scale farmer applicant with his/her agronomic practices, collateral, and household-level cashflow repayment capacity. Management of credit cycle (granting, portfolio follow-up, and recovery) using biometric tools. Agropréstamo offer mobile wallets as well as prepaid cards.

CROWDFUNDING

SOLUTION: Agrapp
IMPLEMENTED BY: Agrapp
YEAR: 2018
STATUS: Active
VALUE CHAIN(S):
Exotic fruits
DESCRIPTION: Agrapp links smallholder farmers looking for credit to individual investors looking for impact investment opportunities by supporting projects in 11 different departments throughout Colombia. In addition to financing, Agrapp provides farmers on its platforms with agronomic advisory and access to markets.

SOLUTION: Agroune
IMPLEMENTED BY: Agroune
YEAR: 2019
STATUS: Active
VALUE CHAIN(S):
Exotic fruits, aromatics
DESCRIPTION: Agroune links smallholder farmers looking for credit to individual investors looking for impact investment opportunities by supporting low-, medium-, and high-risk projects in five different departments in Colombia.

SOLUTION: Mariana
IMPLEMENTED BY: Finagro
YEAR: n.a.
STATUS: Pre-launch
VALUE CHAIN(S):
Not yet defined
DESCRIPTION: Mariana is being conceived as a digital marketplace for credit products. Farmers can upload their credit request onto the Mariana platform. Banks can then review the request and reach out to the farmer if interested. The goal of the platform is to lower origination costs for financial institutions while reaching more farmers.

SOLUTION: Sosty
IMPLEMENTED BY: Sosty
YEAR: 2020
STATUS: Active
VALUE CHAIN(S): Livestock
DESCRIPTION: Sosty links livestock farmers looking to implement regenerative farming practices with like-minded investors. Farmers are carefully vetted to ensure they are implementing regenerative practices and are not causing deforestation. In the future, Sosty hopes to leverage the data collected to help farmers benefit from international carbon markets.

INSURANCE

SOLUTION: Café Seguro
IMPLEMENTED BY: Seguros Bolívar
YEAR: 2018
STATUS: Active
VALUE CHAIN(S): Coffee
DESCRIPTION: Café Seguro is a parametric insurance product developed by Blue Marble and provided to ~10,000 coffee farmers in the department of Caldas, Huila, Valle del Cauca and Nariño. The product was developed in partnership with Nespresso and Seguros Bolívar.

SOLUTION: Inversión Protegida
IMPLEMENTED BY: SBS Seguros
YEAR: 2019
STATUS: Active
VALUE CHAIN(S): Various
DESCRIPTION: Bancamía teamed up with SBS Seguros, MiCRO, and InsuResilience to offer a parametric insurance product in Colombia to low-income smallholder farmers and entrepreneurs. The insurance covers against catastrophic events including excessive rain, earthquakes, and droughts.

SOLUTION: Mi Siembra Segura
IMPLEMENTED BY: SBS Seguros
YEAR: 2021
STATUS: Active
VALUE CHAIN(S): Various
DESCRIPTION: Parametric insurance created as part of the UNDP Rapid Response Facility (RRF2) Program. Targets smallholder farmers, particularly those of indigenous or Afro-Colombian descent. Initially available in select municipalities in La Guajira and Sucre. Payments are triggered by excessive rain or drought.

INSURANCE

SOLUTION: Campo Seguro
IMPLEMENTED BY: Seguros Bolívar
YEAR: 2022
STATUS: Active
VALUE CHAIN(S): Various
DESCRIPTION: Fundación delamujer teamed up with Seguros Bolívar to introduce two types of insurance products for smallholder farmers. The first is an insurance that protects the home against fire. The second is a parametric insurance powered by MiCRO that covers agricultural activity in the face of excessive rain, drought, or earthquakes.

SOLUTION: Seguros de Lluvia
IMPLEMENTED BY: crezcamos
YEAR: n.a.
STATUS: Active
VALUE CHAIN(S): Various
DESCRIPTION: Parametric insurance product offered to smallholder farmers in 410 municipalities throughout the country. Covers agricultural activities against excessive rain and drought.

SOLUTION: Seguro Paramétrico
IMPLEMENTED BY: Banco Agrario
YEAR: 2022
STATUS: Active
VALUE CHAIN(S): Various
DESCRIPTION: This parametric insurance product was launched in partnership with Cardif Seguros Generales and is available nationwide. Payments are triggered by excessive rain, drought, or flooding.

SOLUTION: Tranquilidad Rural
IMPLEMENTED BY: Interactuar
YEAR: 2023
STATUS: Active
VALUE CHAIN(S): Various
DESCRIPTION: Interactuar teamed with Seguros Bolívar, Blue Marble and Marsh McLennan to introduce a parametric insurance product that protects farmers against excess rain or drought. The product launched with nearly 6,000 smallholders covered.

SOURCES: Organizations, The AgTech Network.

Demand for insurance has increased in recent years given the devastating impact of the last La Niña cycle (see **Figure 52**). Adoption has also been aided by government subsidies on agricultural insurance products. Government subsidies can range from 30% to 90% of the cost of the premium, with an additional bonus (5–10% of the premium) given to those policies that meet certain conditions established by Finagro. There is an additional bonus (5% of the premium) given to individuals from underrepresented groups in the lowest income category, including youth (under 28 years of age), women, indigenous populations, and farmers living in PDET regions (see **Figure 43**). The Colombian government has set a disbursement cap of COP 100 billion (US$21.5 million) for agricultural insurance incentives in 2023.[115]

115 Finagro (2023), Incentivo al seguro agropecuario.

FIGURE 43: GOVERNMENT INCENTIVES FOR AGRICULTURAL INSURANCE (2023)

FARMER SIZE	SUBSIDY	2023 BUDGET ALLOCATION
MEDIUM-SIZED FARMER (INCOME NOT TO EXCEED COP 52 MILLION [US$13,000])	30%	COP 9.5 million**
If policy meets Finagro conditions	+10% bonus	
SMALL-SIZED FARMER	80%	COP 71.25 million**
If policy meets Finagro conditions	+10% bonus	
SMALL-SIZED FARMER (LOW INCOME)	90%	
If policy meets Finagro conditions	+5% bonus*	
Youth (18–28 years of age)		
NARP (Black, Afro-Colombian, Raizal, Palenquera)		
In PDET or ZOMAC regions		
Participating in special ADR program		

* Can only claim one bonus (for a maximum incentive of 95%) even if falling under more than one criterion.
** Excludes Finagro bonus. An additional COP 14.25 million is set aside to pay out bonuses associated with policies that meet Finagro's conditions.

SOURCE: Finagro.

These new parametric insurance products are having a significant impact on farmer communities. At the end of 2022, Seguros Bolívar and Blue Marble announced insurance payments totalling ~US$3 million to the ~6,500 farmers insured by Café Seguro as a result of the challenging weather conditions experienced during the year.[116] Not only did the payouts help farmers weather their losses, they also instilled trust in insurance products among farmers who may have been previously skeptical. According to Seguros Bolívar, the introduction of parametric insurance has enabled the number of smallholders insured by them to expand from 5,000 to over 25,000 in just a couple of years.[117]

Most agri DFS in Colombia are offered by financial service providers, including traditional financial service providers and fintech companies. Often these services are offered in partnership with agribusinesses (such as Nespresso, SKN Caribecafé, Cargill, Oleoflores) or NGOs (such as Fundación delamujer) that have relationships with farmer groups interested in financial services. Increasingly we are seeing other types of digital agriculture solutions providers (such as agri e-commerce, digital advisory, or digital procurement) enter the digital financial space, often in response to customer demand. Croper.com and AgrodatAI, for example, are agri e-commerce and digital advisory solutions, respectively, that have integrated credit and insurance products into their portfolios over the last 12 months.

> ***"If we had not received the payment or assistance from Café Seguro in this moment, we would be resorting to bank loans because the farm plantation cannot miss the fertilizer and the daily payments that we must make."***
>
> *- Insured coffee farmer, Café Seguro*

116 Blue Marble interview (March 2022); Blue Marble (2022), LinkedIn post.
117 Contexto Ganadero, "Seguros Bolívar y Fundación delamujer lanzan Campo Seguro."

CASE STUDY: MICROINSURANCE CATASTROPHE RISK ORGANIZATION (MICRO)

ABOUT: MiCRO was founded in 2011 by Mercy Corps and Fonkoze in the wake of a catastrophic earthquake in Haiti to "strengthen the resilience of vulnerable populations" through the creation of a risk management solution available to small-scale farmers and micro entrepreneurs.[118] In 2013, Mercy Corps teamed with the Swiss Agency for Development and Cooperation (SDC) and Swiss Re to introduce a risk management solution in Central America in partnership with local microfinance institutions and insurance companies. In later years, the InterAmerican Development Bank (IDB) and Climate Adaptation Platform managed by KfW joined the initiative.[119] MiCRO entered the Colombian market in 2019 with its first parametric insurance product. It has since signed partnerships with a number of local organizations, bringing the total number of Colombian farmers insured to over 20,000.

SOLUTION: MiCRO developed a parametric insurance product based on a proprietary platform that assesses the potential risk from natural disasters in the area of intervention. MiCRO relies on satellite information as well as data collected on the ground to detect both the occurrence and severity of events covered by its insurance, such as excessive rain, earthquakes, drought, etc.

BUSINESS MODEL: MiCRO works primarily through local aggregators such as banks, microfinance institutions, cooperatives, and associations who in turn provide parametric insurance to their customers.

PARTNERSHIPS: MiCRO has teamed with a wide variety of partners in Colombia to offer parametric insurance to smallholder farmers in the country. These include insurance companies like SBS Seguros and Seguros Bolívar, microlending institutions like Bancamía, and local foundations like Fundación delamujer (see **Figure 44**).

FIGURE 44: MiCRO partnerships in Colombia

PRODUCT	DATE LAUNCHED	PARTNERS	INSURES AGAINST
Inversión Protegida[120]	October 2019	Bancamía, SBS Seguros	Excess rain, drought, earthquakes
Mi Siembra Segura[121]	December 2021	UNDP, SBS Seguros	Excess rain, drought
Campo Seguro[122]	March 2022	Seguros Bolívar, Fundación delamujer	Fire damage to household, drought, excessive rain, earthquakes

SOURCE: MiCRO.

WHAT'S NEXT?: MiCRO has ambitious goals for the various products launched to date. For example, it believes the addressable market for its Inversión Protegida product is around one million smallholder farmers and micro entrepreneurs, though it hopes to reach 100,000 in three years. It also has set a target of 30,000 for its Campo Seguro plan.[123] In addition to expanding its reach in Colombia by expanding the client base of its existing products as well as forging new partnerships to launch new products, it is also eyeing expansion into other Latin American countries, like Mexico.

118 MiCRO, "Sobre Nosotros."
119 MiCRO, "Sobre Nosotros."
120 MiCRO (2019), "Seguro Innovador Basado en Índices Lanzado En Colombia Para Proteger A Las Familias Vulnerables y De Bajos Ingresos Contra las Pérdidas Financieras Graves."
121 MiCRO (2021), "Mi Siembra Segura: Seguro Paramétrico Para la Ruralidad Colombiana, con PNUD."
122 MiCRO (2022), "Campo Seguro con Seguros Bolívar y Fundación delamujer."
123 MiCRO (2019), "Seguro Innovador Basado en Índices Lanzado En Colombia Para Proteger A Las Familias Vulnerables y De Bajos Ingresos Contra las Pérdidas Financieras Graves"; MiCRO (2022), "Campo Seguro con Seguros Bolívar y Fundación delamujer."

5.1.3 DIGITAL PROCUREMENT AND FARM MANAGEMENT

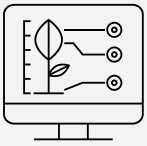
Digital procurement and farm management solutions can help agribusinesses and smallholder farmers improve on-farm performance by migrating records from paper to digital. This digitization of farm data also enables farmers to meet certification and traceability requirements for export crops like palm oil, coffee, and cocoa. Western Europe and North America are increasingly requiring agricultural imports to meet strict certification requirements.

Key enablers for the rollout of digital procurement solutions include mobile connectivity and access to internet, the availability of export crops that require certification or traceability, and corporate sustainability initiatives adopted by agribusinesses (see **Figure 45**).

FIGURE 45: Key enablers: Digital procurement

NETWORK CONNECTIVITY

Digital procurement and farm management solutions benefit from network connectivity and internet access. Though many of these solutions have an offline mode which enables users to enter data, attach pictures, and access information, the user must eventually have access to the internet to sync the data with the platform for effective farm management, certification, or traceability purposes.



IMPORTANCE OF CROPS REQUIRING CERTIFICATION AND TRACEABILITY

The need to meet certification requirements (e.g., USDA, Fairtrade, Rainforest Alliance, RSPO) is driving many agribusinesses and farmer groups to adopt digital procurement solutions. This is true of export crops like coffee, cocoa, palm oil, and many fruits and vegetables. It is also increasingly true of crops consumed domestically, like livestock.

CORPORATE SUSTAINABILITY COMMITMENTS

It is becoming increasingly common for agribusinesses to make sustainability commitments to their shareholders and their customers. This requires them to collect and monitor data from the farmers they work with, an incentive for them to adopt digital procurement solutions.

DIGITAL LITERACY

Digital literacy is a critical prerequisite for the adoption of digital procurement and farm management solutions. Digital procurement solutions often require either farmers, agronomists, or extension agents to input data into a mobile device (smartphone or tablet). Users must also be able to upload photos and scan and upload documents, among other functionalities.

SOURCES: GSMA AgriTech, The AgTech Network.

The AgTech Network identified over a dozen digital procurement solutions active in Colombia, most offered by agribusinesses and value chain associations (see **Figure 46**). Some agribusinesses and value chain associations leverage third-party platforms. Solidaridad's Extension Solution, for example, is used by Henkel, Cenipalma, Fedepalma, Fedecacao, and Colcocoa, among others. Others, like Olam and ECOM, have developed proprietary solutions globally that they then customize for their Colombian operations. Still others, like Asohofrucol, Postobón, Fundación Luker, Fedepalma, and the Federación Nacional de Cafeteros, work with local developers to design platforms that meet their own requirements or enlist the support of local agtech startups. Interestingly, we did not see a strong presence from some of the world's largest agtechs working in the digital procurement space (e.g., companies like Cropin, Farmforce, and SourceTrace).

FIGURE 46: SELECTED DIGITAL PROCUREMENT AND FARM MANAGEMENT SERVICES IN COLOMBIA

DIGITAL PROCUREMENT / FARM MANAGEMENT

Olam

SOLUTION: OFIS
IMPLEMENTED BY: Olam
YEAR: 2018
STATUS: Active
VALUE CHAIN(S): Coffee
DESCRIPTION: Olam Farmer Information System (OFIS) is a digital procurement platform used by Olam field agents worldwide to collect data on farms and farmer activities, store GPS location data, track input delivery and usage, manage training, track financing, and track crop purchases. There are over half a million farmers registered on the OFIS platform across 30 countries worldwide.

Solidaridad

SOLUTION: Extension Solution
IMPLEMENTED BY: Colcocoa / Solidaridad
YEAR: 2020
STATUS: Active
VALUE CHAIN(S): Cocoa
DESCRIPTION: Solidaridad's digital procurement tool Extension Solution has been implemented by Colcocoa as part of a Swisscontact program called Cacao+Sostenible. The project aims to increase productivity among cocoa farmers living in Antioquia, in the municipalities of Maceo, Caracolí, Puerto Berrío, San Roque, and Yolombó.

1849 ECOM

SOLUTION: SMS/Integrity
IMPLEMENTED BY: ECOM
YEAR: n.a.
STATUS: Active
VALUE CHAIN(S): Coffee
DESCRIPTION: ECOM Sustainability Services (SMS) is a suite of services available to farmers in 26 countries where ECOM is present. Integrity, which falls under the SMS umbrella, is a platform that enables field staff to collect data on farms and farmer activities. ~8,000 Colombian farmers are on the platform.

FUNDACIÓN LUKER

SOLUTION: Farm Management
IMPLEMENTED BY: Fundación Luker
YEAR: 2020
STATUS: Active
VALUE CHAIN(S): Cocoa
DESCRIPTION: As part of the Cacao Effect initiative which seeks to increase productivity among cocoa farmers, Fundación Luker developed a digital farm management tool that extension agents use to collect data at the farm and farmer levels. The tool can be used by agents offline (key given the remote location of many cocoa farms) and later synced when agents are back within reach of a network.

DIGITAL PROCUREMENT / FARM MANAGEMENT

SOLUTION: Trazabilidad Bovina
IMPLEMENTED BY: Grupo Nutresa
YEAR: n.a.
STATUS: Active
VALUE CHAIN(S): Livestock, dairy
DESCRIPTION: Grupo Nutresa developed the Trazabilidad Bovina mobile application to monitor its cattle and ensure that it is complying with traceability objectives.

SOLUTION: Dimitra
IMPLEMENTED BY: Agrosavia
YEAR: 2022
STATUS: Active
VALUE CHAIN(S): Livestock
DESCRIPTION: Dimitra maintains a farm management platform that leverages data collected from the satellite and the farm to measure pasture health. Farmers receive a recommendation on how to improve pasture health while optimizing the use of inputs. Dimitra has teamed with Agrosavia to build a nationwide repository of livestock data that can be leveraged to help farmers improve the management of their cattle.

SOLUTION: Control Ganadero
IMPLEMENTED BY: Apptank
YEAR: 2012
STATUS: Active
VALUE CHAIN(S): Livestock
DESCRIPTION: Control Ganadero is farm management tool that enables cattle farmers to better manage their animals for increased productivity and traceability. The mobile app is available for free to small farmers (less than 20 animals) while larger farmers pay a fee. The service was launched in Colombia but is now available in Mexico, Venezuela, Argentina, Ecuador, Peru, Bolivia, and Spain among others.

SOURCES: Companies, The AgTech Network.

CASE STUDY: HENKEL AND SOLIDARIDAD'S EXTENSION SOLUTION

ABOUT: Henkel is a global industrial and consumer goods company headquartered in Germany. For several of its brands, including Dial and Nature Box, Henkel sources palm oil from multiple countries, such as Colombia, Ghana, Honduras, and Indonesia.[124] In 2012, Henkel teamed up with Solidaridad to ensure that the palm oil it is sourcing from these countries is sustainably produced. Colombia has been a particularly appealing source of palm oil because 99.5% of palm oil production as of 2020 takes place on land not related to deforestation.[125] In 2023, Dial announced a new three-year partnership with Solidaridad in Colombia aimed at creating 35,000 acres of land for the production of RSPO-certified palm oil to be used in the production of hand soaps for the US market. The grant also supports the training of 520 farmers on sustainable agricultural practices through the use of the Agrolearning digital tool.

SOLUTION: Solidaridad developed a digital procurement tool called Extension Solution to support smallholder palm oil farmers in Colombia. The tool provides recommendations to farmers on steps they can take to increase productivity and reduce their environmental impact. The data collected by the tool also aids in the documentation required during the RSPO certification process.

BUSINESS MODEL: Solidaridad received a grant from Henkel for its on-the-ground support in Colombia, which included financial support for the design, development, and maintenance of the Extension Solution application. Extension Solution has been expanded to support corporate partners in other value chains (soy, cocoa, coffee) across ten countries.

PARTNERSHIPS: Henkel works with Solidaridad in all countries from which it sources palm oil.

WHAT'S NEXT?: Solidaridad has been able to leverage Extension Solution beyond its initial objective of improving farmer productivity and incomes by implementing best practices and supporting smallholder farmers in the certification process. The data collected from Extension Solution is now also being used within the Agropréstamo app, which integrates the credit profile of small-scale farmer applicants with their agronomic practices, collateral, and household-level cashflow repayment capacity. The tool enables the efficient management of the whole credit cycle (granting, portfolio follow-up, and recovery) using biometric tools in customer knowledge processes, correspondent bank models, and electronic wallets. Agropréstamo will offer mobile wallets and prepaid cards specifically designed for palm oil producers to manage their credit.

124 Sustainable Palm Oil Choice (2021), "Henkel improves livelihood of 34,000 oil palm farmers."
125 Henkel (2023), "Henkel and Solidaridad have worked together for almost a decade, to enhance a more sustainable palm oil supply chain."

5.1.4 AGRI E-COMMERCE

Agri e-commerce platforms or marketplaces make it easier for smallholder farmers in rural areas to sell their crops directly to buyers in cities or international markets. They also enable smallholder farmers to acquire inputs and machinery needed to make them more productive. By eliminating intermediaries, agri e-commerce platforms enable farmers to keep a larger share of the sales price or pay a lower price for inputs, contributing positively to a smallholder farmers' bottom line.

Key enablers for the development of a vibrant agri e-commerce market include mobile network connectivity, a digital payments ecosystem, solid logistical networks, an enabling regulatory framework that supports digital commerce, evolving food consumption and lifestyle preferences accelerated by the COVID-19 pandemic, and a robust agtech investment ecosystem.

FIGURE 47: KEY ENABLERS FOR AGRI E-COMMERCE

NETWORK CONNECTIVITY

Agri e-commerce platforms are online platforms that enable buyers and sellers of agricultural machinery, inputs and crops to connect. Some platforms allow for the final negotiations and financial transactions to take place offline, but the initial linkage typically requires network connectivity and Internet access.

MOBILE MONEY ADOPTION AND DIGITAL PAYMENTS ECOSYSTEM

Although many of the agri e-commerce platforms in Colombia allow for buyers to pay sellers off the platform in cash, agri e-commerce platforms can have a much bigger impact if transactions take place online. Access to digital payments capabilities is a major driver for agri e-commerce adoption.

LOGISTICS

Agri e-commerce platforms rely on the efficient movement of goods from rural to urban areas (in the case of fresh produce and other crops) or from urban to rural areas (in the case of inputs, machinery). Poor transportation infrastructure and logistics networks can severely hamper the ability of agri e-commerce platforms to succeed.

ENABLING REGULATORY ENVIRONMENT

Legislation that supports e-commerce is critical for agri e-commerce solutions to flourish. Colombia passed e-commerce legislation back in 1999. The government has also taken several steps to encourage the development of an agri e-commerce ecosystem, most recently through its *Campo a un Clic* initiative.

EVOLVING CONSUMER BEHAVIORS, ACCELERATED POST-COVID

Even prior to the COVID-19 pandemic, there had been a trend toward the purchase of goods on services online, including fresh produce and other crops. Consumers are increasingly interested in knowing where their food is sourced from so they can purchase the freshest, highest quality produce all while benefiting the smallholder farmer. The COVID-19 pandemic accelerated this trend.

ROBUST AGTECH STARTUP ECOSYSTEM

Most agri e-commerce providers will be agritech startups which will depend on external capital and the technical support provided by incubators, accelerators, and innovation hubs. A robust ecosystem that supports this type of innovation can be an important catalyst for the implementation of agri e-commerce solutions.

SOURCES: The AgTech Network, GSMA.

The AgTech Network identified more than 30 agri e-commerce companies in Colombia, most of them agtech startups. The success of e-commerce startups such as Rappi and Frubana has encouraged many others to join the fray. As the market gets increasingly crowded, it has become more important for agri e-commerce companies to develop a niche. Frubana, for example, initially focused on meeting the fresh produce needs of restaurants in Colombia. It later expanded to meet all of restaurants' needs, from fresh produce, to meat, to pantry staples, and even restaurant equipment. Croper.com initially developed a platform enabling smallholders to acquire inputs. Its platform expanded to include other services, including financial ones like credit and insurance. Koshcampo is an agri e-commerce platform focusing on delivering kosher food to mostly urban consumers. TuPlaza's platform focuses on providing fresh produce to corner stores (see **TuPlaza Case Study**).

FIGURE 48: SELECTED AGRI E-COMMERCE PLATFORMS IN COLOMBIA

AGRI E-COMMERCE

SOLUTION: Frubana
IMPLEMENTED BY: Frubana
YEAR: 2018
STATUS: Active
VALUE CHAIN(S): Fresh produce, general grocery, restaurant equipment
DESCRIPTION: Frubana is an agri e-commerce platform founded in Colombia with a presence in Bogotá, Medellín, and Barranquilla. It targets restaurants, initially providing them with fresh produce and later adding meats, general grocery, and even restaurant equipment and machinery. Leveraging a successful model in Colombia, it has since expanded to Mexico and Brazil.

SOLUTION: TuPlaza
IMPLEMENTED BY: TuPlaza
YEAR: 2020
STATUS: Active
VALUE CHAIN(S): Fresh produce
DESCRIPTION: TuPlaza was founded in Cali in 2020. The founders saw an opportunity to deliver fresh produce to small grocers, supermarkets, and restaurants during COVID. TuPlaza operates in Cali and Bogotá. In the near term, it is planning to work with smallholder farmers to provide them with inputs and financing.

SOLUTION: Croper.com
IMPLEMENTED BY: Croper.com
YEAR: n.a.
STATUS: Active
VALUE CHAIN(S):
Fertilizers, machinery, financial services
DESCRIPTION: Croper.com is a marketplace that links smallholder farmers to sellers of inputs, machinery, and other equipment. Smallholder farmers are able to find the items they need at the best price, helping their bottom line. Croper.com has recently expanded to include financial services, including credit and insurance.

SOLUTION: Comproagro
IMPLEMENTED BY: Comproagro
YEAR: 2014
STATUS: Active
VALUE CHAIN(S): Fresh produce
DESCRIPTION: Comproagro was founded in Toca, Boyacá by a farming family looking to improve the livelihoods of farmers in their community. Comproagro has over 35,000 farmers on its platform. Farmers can post the crops they have for sale on the platform and buyers can contact them to arrange purchase. Comproagro receives a share of the transaction as well as revenue from advertising on the site.

SOLUTION: GoFruver
IMPLEMENTED BY: Agrosmart
YEAR: n.a.
STATUS: Active
VALUE CHAIN(S):
Fresh produce, meats, fish
DESCRIPTION: Cali-based Agrosmart Co. created GoFruver as an e-commerce platform to deliver fruits, vegetables, meats, and fish from smallholders to urban centers.

SOLUTION: Agromovil
IMPLEMENTED BY: Agromovil
YEAR: 2020
STATUS: Active
VALUE CHAIN(S): Fresh produce
DESCRIPTION: Agromovil developed a simple platform that allows farmers to register in less than five minutes and post their crop for sale. In Colombia, Agromovil's platform has over 100 different products sourced from around 150 different communities. Agromovil works with several partners in Colombia, including local credit union Comultrasan and mobile operator WOM, which provides devices to support connectivity.

AGRI E-COMMERCE

SOLUTION: Asohofrucol WhatsApp Groups
IMPLEMENTED BY: Asohofrucol
YEAR: 2022
STATUS: Active
VALUE CHAIN(S): Fresh produce
DESCRIPTION: Within the PNFH (funded by the FNFH), Asohofrucol has established WhatsApp groups that help members of 366 different fruit and vegetable associations around Colombia sell their fresh produce to buyers that have established commercial partnerships with Asohofrucol. These 366 associations comprise over 10,000 fruit and vegetable farmers.

SOLUTION: RUMECA
IMPLEMENTED BY: RUMECA
YEAR: n.a.
STATUS: Active
VALUE CHAIN(S): Fresh produce
DESCRIPTION: Ruta del Mercado Campesino (RUMECA) is an e-commerce platform that links smallholder farmers to buyers of fresh produce including restaurants, supermarkets, and small retail stores. Smallholder farmers can upload information about the products they have for sale onto the RUMECA mobile app. RUMECA is present in 39 municipalities, many of them PDET.

SOLUTION: Waruwa
IMPLEMENTED BY: Waruwa
YEAR: n.a.
STATUS: Active
VALUE CHAIN(S): Fresh produce
DESCRIPTION: Waruwa is an e-commerce platform that links smallholder farmers, transportation providers, and buyers. Waruwa purchases directly from smallholder farmers, linking them to transportation providers if they cannot deliver their produce to Waruwa's collection points. Smallholders are paid digitally. Corporate buyers purchase directly from Waruwa with their produce delivered on-site.

SOURCES: Organizations, The AgTech Network.

Most of the agri e-commerce companies in Colombia focus on linking smallholders to buyers in urban areas. A select few link users to buyers in international markets. Bloomspal, for example, enables international buyers to purchase flowers from smallholders in Colombia. Beyco does the same with coffee.

CASE STUDY: TUPLAZA

ABOUT: TuPlaza is a Cali-based agri e-commerce platform that was founded in May 2020, in the early days of the pandemic, to help reduce friction points in the movement of fresh produce from rural areas to cities. In addition to Cali, TuPlaza is also present in Bogotá.

SOLUTION: TuPlaza manages three different platforms. The first is a client-facing e-commerce platform that enables both enterprise customers (supermarkets, restaurants, other retail) and individual consumers to purchase fresh produce sourced from smallholder farmers in Colombia. TuPlaza is able to guarantee delivery in less than 24 hours of receiving the order. The second platform is a micro-forecasting tool that clients can use to better understand demand for each individual product in each individual store. Forecasting is done at a very micro-level (week or day) so that business customers know exactly what they are going to need and where. A third digital tool, which is under development, tracks farmer performance (monthly sales by product, timeliness, productivity, etc.). This information will initially ensure that TuPlaza can guarantee a steady supply of fresh produce to their clients. Over the longer term, however, it will also enable TuPlaza to have the necessary information to understand the creditworthiness of each farmer, data it can then use to offer loans. Although TuPlaza had originally also built a platform to interact with smallholder farmers for the provision of digital advisory/extension, it has since migrated to WhatsApp, a platform that is being used by farmers and does not require extensive training.

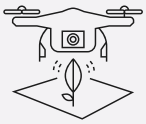
BUSINESS MODEL: TuPlaza's business model is mostly B2B, though consumers are able to buy through the platform. TuPlaza buys crops from smallholder farmers in rural areas and sells those products at a mark-up to supermarkets, restaurants, and other retailers. The company specializes in smaller supermarkets. By eliminating intermediaries, TuPlaza can provide smallholder farmers a higher price than they would otherwise make through the sale of their produce. In the future, TuPlaza plans to monetize the sale of inputs to smallholder farmers (through a mark-up model), as well as monetize insights from its micro-forecasting tool and farmer databases.

PARTNERSHIPS: One of TuPlaza's earliest partnerships was with Rappi, the first Colombian tech startup to reach unicorn status. Rappi has a special promotion on its website called "del campo a tu casa" (from the field to your home), which provides customers with fresh produce sourced by TuPlaza. TuPlaza's other B2B clients include Treinta, Muncher, D1, and Makro.

WHAT'S NEXT?: TuPlaza has been working on reducing friction points along the storage and distribution of crops through the digitization of the distribution process. By doing so, it hopes to reduce the capital required to scale the business. TuPlaza is also in the process of raising capital to expand its operations in Colombia, primarily through the addition of financial services products and inputs. Being able to provide a full suite of services and products to smallholders is key to its ability to identify new smallholders from whom to source crops. TuPlaza is also planning to build a new platform to analyze and monetize insights from its data. TuPlaza is also interested in expanding its operations to other Latin American countries.

By eliminating intermediaries, agri e-commerce platforms can help smallholder farmers keep more money in their pockets. Croper.com states that through access to inputs and machinery through the Croper.com platform, smallholders are able to increase their productivity by as much as 30%. Smallholders' ability to compare prices on the platform for the products that they need can also translate into savings of up to 50%.[126]

126 Yahoo! Finanzas (2022), "Alianza de Microsoft, Croper y Managro conectará a productores in Colombia."



5.1.5 SMART FARMING

Although smart farming solutions that leverage sensors, drones, satellites, and other agricultural assets have been widely used in the context of large-scale farming for many years, these types of solutions are relatively nascent in the context of smallholder farming. This is largely due to the cost of the solutions, which can range from a few hundred dollars for a sensor to thousands of dollars for automated irrigation systems, connected greenhouses, or cold storage solutions. The GSMA has identified three main sub-use cases applicable to smallholder farmers within the broader smart farming use case that we reference here. [127] These include equipment monitoring, which involves the use of smart farming solutions to remotely monitor and control agricultural assets (like an irrigation system) with the aim of increasing productivity and reducing waste (water, fertilizers, etc.). Data collected from sensors in the ground, around the plant, or in a greenhouse or cold storage facility can be combined with data from external sources (e.g., weather stations) to then feed recommendations to the farmer on what actions to take (irrigate, apply inputs, change the temperature in the cold storage facility, etc.). In more sophisticated examples, the farmer doesn't even have to take action; the recommended action is automated through the smart farming solution itself. Most of the smart farming solutions in the context of smallholder farming in Colombia fall into this sub-use case.

A second sub-use case is related to the monitoring of livestock or aquaculture through the use of sensors and other smart farming equipment placed around an animal (a collar on a cow, for example), in a livestock pen, or in an aquaculture pond. As in the previous sub-use case, data collected from these sensors is combined with external data to offer recommendations to prevent animal illness and death, optimize feeding, and maximize reproduction. We found very few digital agriculture solutions falling into this sub-use case. One notable example is Celotor, which through the use of sensors placed around the necks of cows can detect when a cow goes into oestrus, enabling the farmer to identify the perfect time for insemination. Control Ganadero recently introduced smart collars that can be scanned using a mobile device to provide the farmer with relevant information about the animal scanned. The third and final sub-use case involves the sharing economy for agricultural assets (such as tractors or drones), whereby farmers can leverage a mobile application and mobile payment to book an asset for use on their farm. There are many well-publicized examples of this sub-use case in Africa and Asia (Hello Tractor, Trotro Tractor, Tun Yat), but we did not identify any such services available in Colombia.

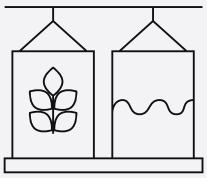
Key enablers for the rollout of smart farming services include mobile network coverage and internet access in rural areas, availability of lower-power wide-area (LPWA) networks, low import duties for the import of sensors, drones, or other relevant infrastructure (or low-cost domestic manufacturing/assembly capabilities), and the presence of value chains suitable for the application of smart farming solutions (see **Figure 49**).

127 GSMA (2022), Assessment of smart farming solutions for smallholders in low and middle-income countries.

FIGURE 49: KEY ENABLERS: SMART FARMING SOLUTIONS

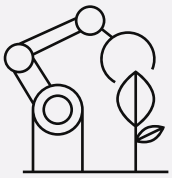
NETWORK CONNECTIVITY

Smart farming services, more so than other digital agriculture solutions, tend to require continuous access to a mobile network given the use of sensors and other "always-on" technology. The cost of deploying an IoT-based smart farming solution over a traditional cellular network can be prohibitive, so the availability of low-power, wide-area (LPWA) networks is a critical enabler for the deployment of smart farming solutions.



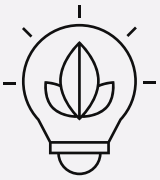
PRESENCE OF VALUE CHAINS SUITABLE FOR SMART FARMING SOLUTIONS

Smart farming solutions are generally better suited for value chains that require irrigation, would benefit from greenhouses, packhouses or cold storage or that require more continuous monitoring. Livestock, aquaculture and fresh produce are among the value chains that have benefited most from early smart farming innovations. All three value chains are relevant to the Colombian context.



LOW IMPORT BARRIERS AND/OR LOCAL MANUFACTURING/ASSEMBLY

Many smart farming solutions require the use of sensors, gateways, drones, or other technology that may not be available in Colombia. Low import duties and quick, damage-free processing through customs are key for solution providers importing technology from abroad. Robust local manufacturing or assembly capabilities can also reduce the barrier to entry by reducing costs and accelerating time to market.



ROBUST AGTECH STARTUP ECOSYSTEM

Most smart farming service providers will be agritech start-ups which will depend on external capital and the technical support provided by incubators, accelerators and innovation hubs. A robust ecosystem that supports this type of innovation can be an important catalyst for the implementation of smart farming solutions.

SOURCES: GSMA AgriTech, The AgTech Network.

Most of the smart farming deployments The AgTech Network identified in Colombia were pilot projects led by research organizations, the government, or multilateral organizations. Few of these smart farming pilot projects graduated to commercial service availability given the high cost of deployment. Commercial smart farming solutions identified in Colombia were mainly aimed at larger agribusinesses, such as Farmapp's smart farming solution for large-scale flower farmers and Sioma's solution aimed at large banana and palm oil companies. These services are led by agtech startups based in Colombia. Local Colombian startup Agromel and UK-based Inspira Farms were among the few smart farming solution providers identified that focus on the challenges faced by smallholder farmers (see **Figure 50**).

FIGURE 50: SELECTED SMART FARMING SERVICES IN COLOMBIA

REMOTE CROP OR LIVESTOCK MONITORING

SOLUTION: AgroMEL
IMPLEMENTED BY: GIS Data Center
YEAR: 2013
STATUS: Active
VALUE CHAIN(S): Various
DESCRIPTION: AgroMEL leverages data collected from satellites and sensors on the ground (and soon connected greenhouses) to provide farmers across various value chains with specific recommendations on irrigation, pesticide use, and other activities to maximize productivity. AgroMEL works primarily in the Nariño area of Colombia.

SOLUTION: Inspira Farms
IMPLEMENTED BY: Inspira Farms
YEAR: 2012
STATUS: Active
VALUE CHAIN(S):
Fresh produce, flowers
DESCRIPTION: Inspira Farms has been active in Africa since 2012 and entered Colombia in 2019 through a partnership with BASF and Asobosque. Inspira Farms provides connected packhouses, cooling units, freezing units, and storage units that can be managed remotely through an application.

SOLUTION: Smart Agro 4.0
IMPLEMENTED BY: Telefónica, FAO
YEAR: 2019
STATUS: Completed pilot
VALUE CHAIN(S): Potatoes, coffee
DESCRIPTION: Telefónica teamed with FAO to work with 79 farmers in Boyacá (potatoes) and Nariño (coffee) on the deployment of an IoT-based smart farming solution. Sensors installed in the ground took measurements on the soil quality which were then sent to an agronomist who provided farmers with recommendations on irrigation and fertilizer use.

SOLUTION: e-kakashi
IMPLEMENTED BY: CIAT
YEAR: 2019
STATUS: Completed pilot
VALUE CHAIN(S): Rice
DESCRIPTION: e-kakashi is an initiative implemented by CIAT with the backing of the IDB Lab, the Japanese government, and Softbank. It leverages IoT technology, big data, and AI to provide rice farmers in Cauca and Valle del Cauca with recommendations on the more efficient use of water in their rice fields. The goal of the service is to reduce the environmental impact of rice production.

REMOTE CROP OR LIVESTOCK MONITORING

SOLUTION: Visualiti
IMPLEMENTED BY: Visualiti
YEAR: n.a.
STATUS: Active
VALUE CHAIN(S): Various
DESCRIPTION: Visualiti is a technology company that works with small and medium-sized farmers in Colombia to provide hardware (IoT sensors, irrigation systems, monitoring capsules) and software that enables farmers to improve on farm practices and optimize resources.

SOLUTION: Libelium Waspmote Plug & Plan
IMPLEMENTED BY: Tecnoparque/SENA
YEAR: 2014
STATUS: Completed pilot
VALUE CHAIN(S): Banana
DESCRIPTION: SENA and Tecnoparque tested Libelium's IoT sensors on banana plantations. Sensors measured everything from soil radiation, soil moisture, and soil temperature to trunk diameter, fruit diameter, precipitation, and ammonia to monitor the health of the banana plants. The solution enables farmers to monitor their crops while meeting certification requirements.

SOLUTION: UBEES
IMPLEMENTED BY: Nespresso
YEAR: 2020
STATUS: Active
VALUE CHAIN(S): Coffee, honey
DESCRIPTION: Nespresso teamed with UBEES to encourage coffee farmers to adopt beekeeping. IoT sensors are placed near the beehives to monitor activity and alert the farmer to potential problems. Bees increase pollination in the coffee crop (thereby increasing fruit production) while also producing honey that farmers can sell for additional income.

SOURCES: Organizations, The AgTech Network.

CASE STUDY: INSPIRA FARMS AND BASF

ABOUT: German agro-industrial company BASF developed a program called SumoTech aimed at supporting small-scale farmers to develop sustainable farming practices.[128] SumoTech supports local communities through knowledge transfer, the implementation of technology, and identification of new markets. In Colombia, SumoTech works with Asobosque, a group of 390 mostly fruit and vegetable smallholder families living in Pasca, Cundinamarca, around 70 km away from Bogotá. The farmers in this area grow mostly potatoes, onions, peas, berries, and exotic fruits. One of the main challenges they face is intermediation, which means farmers keep a very small share of the final sale price of the fruits and vegetables produced on their farms. In order to help them generate more value and keep a larger share of the sales price, BASF enlisted Inspira Farms to build a 60m2 packhouse and cold storage solution in Pasca, Cundinamarca.[129]

SOLUTION: Inspira Farms's packhouse and cold storage units enable farmers to add value to their production process by lengthening the shelf life of their produce and reducing waste. These units have sensors that enable farmers to monitor them remotely, adjusting temperature as needed and responding to alerts (e.g., if the cold storage's door was left ajar).

FIGURE 51: INSPIRA FARMS PACKHOUSE AND COLD STORAGE UNIT IN COLOMBIA

SOURCE: Inspira Farms.

BUSINESS MODEL: Although the smallholder farmers are the ones benefiting from the use of the packhouse and the cold storage unit, BASF is funding the unit as part of its SumoTech initiative. Inspira Farms has a number of plans that allow customers to pay up front (most suitable for large agribusinesses) or to put a 20% deposit and pay the remaining balance over the span of up to 60 months.[130]

PARTNERSHIPS: Inspira Farms is working with BASF and Asobosque, a farming group of 390 families located in Pasca, Cundinamarca.

WHAT'S NEXT?: Inspira Farms has historically worked primarily in Africa where it maintains a presence in more than a dozen countries. In Latin America it has made inroads in Colombia, Guatemala, and Mexico and hopes to expand further into the region.

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128 BASF, "Proyecto SumoTech: Cosechando sueños, transformando vidas."
129 Inspira Farms (2019), "Inspira Farms arrives in South America."
130 GSMA (2022), Assessment of smart farming solutions for smallholders in low and middle-income countries.

Productivity improvements observed from many of the smart farming pilots deployed in Colombia were promising. AgroMEL's smart farming solution, for example, helped Fenalce farmers increase their productivity from 6.0 tons per hectare to 7.86 tons per hectare.[131] UBEES's smart beehive solution generated an additional $950 in annual income for coffee farmers through the sale of honey.[132] The FAO/Telefónica Smart Agro 4.0 smart farming pilot that took place in Ventaquemada with 38 families saw a significant increase in the quality of potatoes grown, a 50% increase in productivity, and a 22% decrease in water and input usage.[133] The impact on the participating farmers' bottom line was significant. The cost of the solution, however, remains out of reach for a wide-scale deployment in small-scale farming (over US$3,000 for the first five years).[134]

5.2 DIGITALLY ENABLED SOLUTIONS ADDRESSING CLIMATE CHANGE

Climate adaptation and mitigation are an important focus of many of the digital agriculture solutions being implemented in Colombia, particularly those led by government agencies and NGOs. The negative impact of severe weather associated with the La Niña phenomenon of the last few years has brought climate adaptation and mitigation to the forefront for governments, NGOs, donors, and investors (see **Figure 52**).

FIGURE 52: IMPACT OF LA NIÑA ON DIFFERENT VALUE CHAINS IN COLOMBIA (2021–2022)[135]

VALUE CHAIN	IMPACT
ALL	Excessive rain makes application of fertilizer less effective, leading to decreased quality of production and reduced overall production.
VARIOUS	Damaged roads from heavy rains delays transport, leading to crop losses, particularly of perishable foods.
COFFEE	Excessive rain led to lower production: ~11 million sacks versus 14 million. Record insurance payments were issued to coffee farmers in 2022.
BANANA	La Niña exacerbated the impact of the black sigatoka pest among banana plants.
RICE	Delays in planting alongside rivers and other bodies of water given excessive flooding.
LIVESTOCK/DAIRY	Damage to pastures led to decreased milk production and increased cattle deaths.

SOURCE: Portafolio.

A number of solutions have been introduced to support climate adaptation. Among the most widespread is parametric or index-based insurance that protects smallholder farmers against adverse weather events, most notably excess rain and drought. Some insurance policies also cover earthquakes. Among these are several products launched by MiCRO in partnership with different financial services companies in Colombia, as well as products from Blue Marble, Banco Agrario, and crezcamos, among others. Insurance is often distributed via an intermediary who benefits from increased climate resilience of its smallholder farmer partners, and it is included in a wider portfolio of supporting services like agronomic advisory, credit, and access to markets.

131 GIS Data Center interview (March 2023).
132 Nespresso (2021), "The beans and the bees."
133 GSMA (2022), Assessment of smart farming solutions for smallholders in low and middle-income countries.
134 GSMA (2022), Assessment of smart farming solutions for smallholders in low and middle-income countries.
135 Portafolio (2022), "Fenómeno de la niña ya golpea el agro nacional.

Some of the most ambitious digital agriculture projects in Colombia support climate adaptation through the provision of weather advisory. Services like Agricultura Específica por Sitio, AClímate, and Agroclima provide smallholder farmers with vital information about expected weather events so that farmers can make decisions about when to plant, fertilize, and harvest their crops to maximize their yields and reduce their risk.

Digital advisory can also support climate mitigation by sharing best practices on climate-smart farming techniques that can conserve natural resources and reduce the negative impacts of farming on the environment. Yara's Coffee Club digital advisory service, for example, shares best practices on the use of natural shade to help smallholders mitigate their carbon footprint while maximizing the quality and quantity of their coffee crop. Solidaridad's Carbon Farming Academy, available over the Agrolearning platform, provides advisory on agroforestry systems and carbon reduction. RARE's Un Mensaje por el Campo provides advisory on soil health, composting, cover cropping, integrated pest management, erosion prevention, optimized pruning, and agroforestry.

Smart farming solutions can also have an impact on climate mitigation by conserving natural resources and minimizing the negative impact of fertilizers and pesticides on the environment. Both the e-kakashi smart farming initiative launched by CIAT and the Smart Agro 4.0 pilot launched by Telefonica and FAO sought to significantly reduce water usage and minimize input use.

More recently, we've noted significant interest in a new type of solution aimed at climate mitigation by smallholder farmers through their participation in international carbon markets. Farmers apply climate-smart agroforestry systems; in return, they receive annual payments from international carbon markets for the carbon removal generated by the trees on their farms. Although Solidaridad's implementation of the ACORN platform is perhaps the best known in Colombia, there are other similar initiatives that aim to provide smallholder farmers with an additional source of income from the carbon captured on their farms, including Sosty (see **ACORN Case Study**).

CASE STUDY: AGROFORESTRY CARBON REMOVAL UNITS FOR THE ORGANIC RESTORATION OF NATURE (ACORN)

CARBON CREDIT INITIATIVE IN COLOMBIA[136]

ABOUT: Solidaridad began working with coffee farmers in Risaralda, Colombia, in 2018 on ASOMBRATE, an initiative to implement agroforestry systems. Through grant funding, Solidaridad aids farmers with the selection of shade trees for their coffee farms. It also provides training to field technicians and smallholder farmers on agroforestry systems and enables the provision of inputs from community-based tree nurseries. In 2020, Solidaridad teamed with Rabobank's ACORN to provide farmers with a monetary incentive to reward them for agroforestry practices. Through linkages to international carbon markets, ACORN can provide farmers with carbon credits in exchange for the carbon capture attributed to the trees on their farms. The objectives from the collaboration with ACORN were to (1) improve the quality and productivity of farm output; (2) diversify and increase the income of coffee farmers whose annual income averages US$3,000 to US$4,000 per year; (3) support climate resilience through the implementation of agroforestry systems; and (4) reduce deforestation and biodiversity loss.

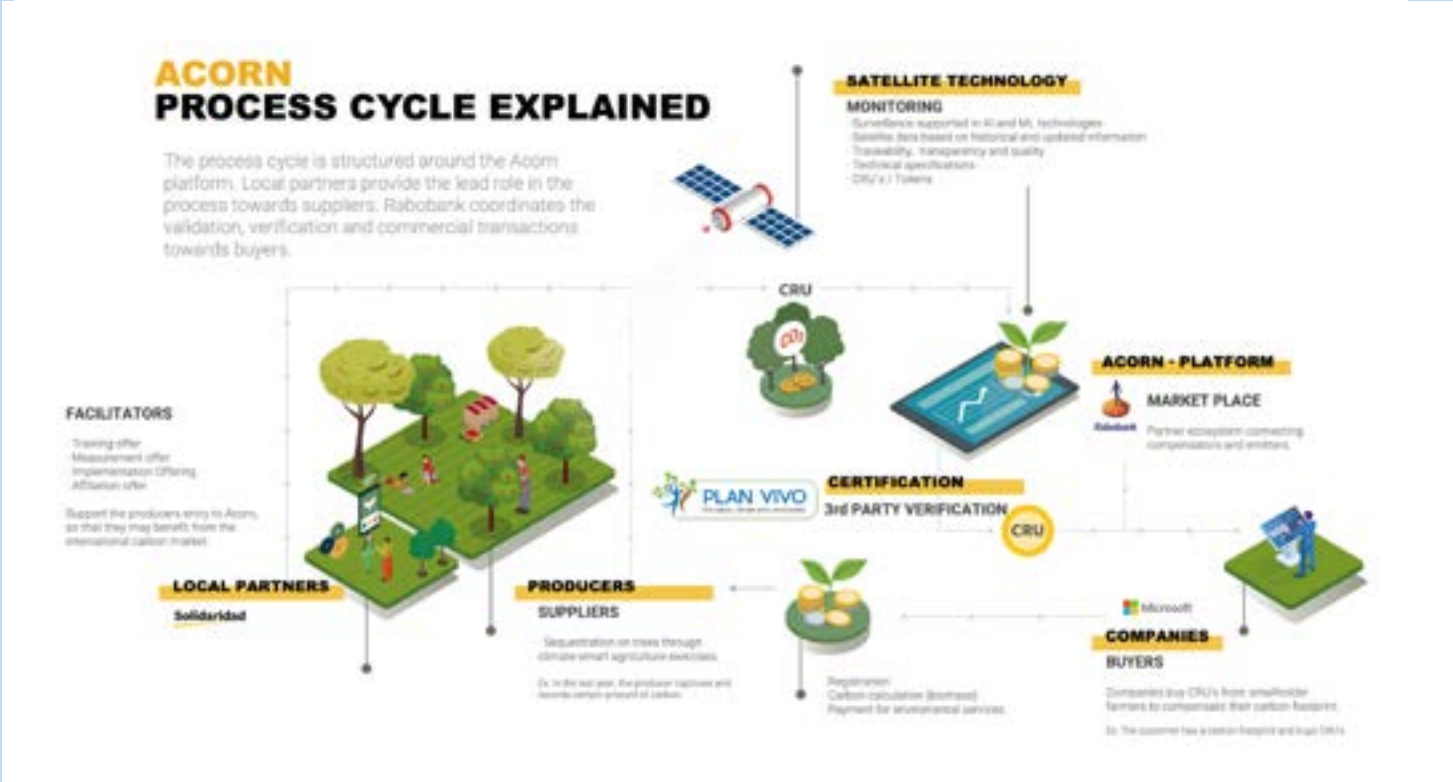
SOLUTION: ACORN measures, certifies, and monetizes the biomass growth of trees planted on smallholder farms. The growth is then converted to Carbon Removal Units (CRUs), which are then sold on voluntary carbon markets (VCMs) or as insetting units within supply chains.[137] The platform aims to be fully transparent, with purchasers of the carbon credits having visibility of the carbon capture at the farm level. Over the span of 20 years, and barring the impact of climate events, Solidaridad estimates that farmers will see a 20% improvement in the productivity of their coffee farms through the implementation of agroforestry practices.[138]

136 ACORN Rabobank (2023), Solidaridad Latin America Colombia.
137 ACORN Rabobank (2023), "About Us."
138 Solidaridad (2022), Solidaridad Colombia, Risaralda.

BUSINESS MODEL: Smallholder farmers receive 80% of the funds generated through the sale of CRUs. Solidaridad receives 10% of total sales as a fee for implementing the program in Colombia and providing agroforestry advisory and support. Rabobank receives 10% for the technical operation of the platform. ACORN manages a minimum price of 20 EUR per CRU, but sales reached 31 EUR per CRU in 2022, exceeding expectations. To date, Microsoft has been the purchaser of all CRUs coming from ACORN's initiative with Solidaridad in Colombia.

PARTNERSHIPS: ACORN is supported in Colombia by Solidaridad (implementation partner) and Microsoft (purchaser of CRUs). Plan Vivo provides certification and Rabobank provides technical support (see **Figure 53**).

FIGURE 53: ACORN MODEL IN COLOMBIA



SOURCES: ACORN, Solidaridad.

WHAT'S NEXT?: To date, Solidaridad and ACORN have registered 16,000 coffee and cocoa farmers working on 32,300 hectares of land. Solidaridad has identified an additional 34,000 smallholder farmers that can be supported by the program by 2026. It is expanding beyond coffee and cocoa to include other agroforestry systems. During interviews we identified several other digital agriculture providers that had been evaluating the opportunity of entering the voluntary carbon markets through their own platforms. The option of teaming with ACORN and Solidaridad was extremely appealing to these organizations given that they could plug into a proven platform with long-term payments.

5.3 DIGITAL AGRICULTURE INNOVATION IN PDET REGIONS

To date, most digital agriculture innovations have emerged out of Bogotá, Medellín, and, to a lesser extent, Cali (if not imported from abroad), and have subsequently expanded to those rural areas that are most populated and where there is more network connectivity. We were only able to identify one digital agriculture services startup founded in PDET. Sioma is a smart farming digital agriculture service provider working mainly in the banana and palm oil value chains. To date, however, it has worked primarily with large agricultural companies, not smallholder farmers, due to the cost of its solution.

Because many PDET regions are so remote and often lack network connectivity and internet access, the adoption of digital agriculture solutions in these regions has been more limited. Many of the barriers that digital agriculture service providers face when deploying a solution are compounded in PDET regions. Some of the main challenges faced by digital agriculture service providers venturing into PDET regions are outlined below:

1. **SIGNIFICANT DISTANCES FROM URBAN CENTERS.** It can take up to a day by road to reach several PDET regions, which has a number of implications for the provision of digital agriculture services. It can be difficult to get staff out to the regions to provide training and onboarding of new users, as well as technical staff for troubleshooting.

2. **HIGHER LEVELS OF POVERTY.** PDET regions have 28.7% multidimensional poverty, well above the Colombian average. As mentioned by several of the organizations interviewed, living in poverty causes farmers to be focused on their day-to-day needs and less open to learning about new ways of doing things or adopting digital agriculture tools, despite the benefits these may bring.

3. **HIGHER LEVELS OF ILLITERACY.** Fewer Colombians in PDET regions complete elementary education. Illiteracy rates are twice the Colombian average. Gaps in digital literacy are also greater, making onboarding for new digital services tougher.

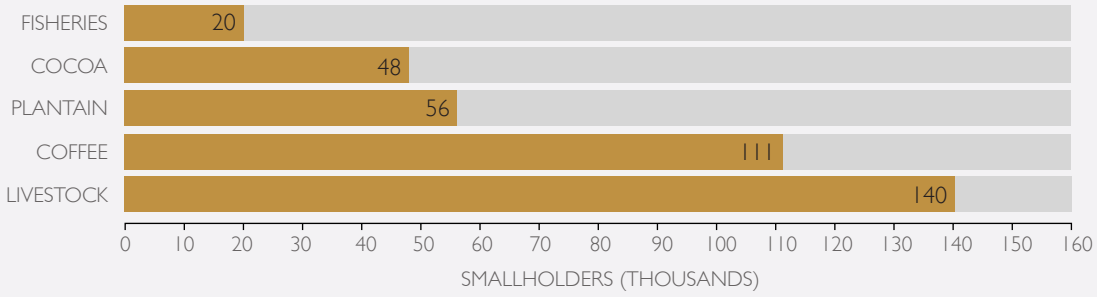
4. **MORE VIOLENCE AND ISSUES OF SECURITY.** Given the historical conflict in these areas and the prevalence of illicit activities, violence is more commonplace in PDET regions, leading to greater security concerns. This makes it difficult for digital agriculture providers to send staff into the regions for training, onboarding, and technical support.

5. **POOR NETWORK CONNECTIVITY.** Given the distance and lack of institutional support received by PDET regions during the period of conflict, operators have been slow to expand network and internet access to PDET regions.

6. **GREATER MARGINALIZATION OF WOMEN.** We often heard from those interviewed that women living in PDET regions face more challenges than their counterparts in other rural areas of the country. These challenges include less access to mobile devices and internet services, difficulty accessing agronomic advisory, and greater obstacles when trying to access loans and other financial services products, among others.

Not surprisingly, the digital agriculture tools designed for the value chains most active in PDET regions are the ones that have seen the highest adoption levels. Solutions focused on the coffee, livestock, and cocoa value chains are seeing the most adoption in PDET areas, particularly when the services are supported by the relevant value chain associations and their research arms (see **Figure 54**).

FIGURE 54: SMALLHOLDER FARMERS BY VALUE CHAIN IN PDET REGIONS



SOURCE: FAO.[139]

Although many services based on apps and WhatsApp groups are available to farmers in PDET if they download the application and have internet access, other solutions were developed with a strong PDET focus. Agri e-commerce company RUMECA for instance, sources produce from several PDET municipalities.[140] The Cacao Effect is an initiative that leverages digital advisory and digital procurement solutions to help farmers increase their productivity. Many of the more than 900 farmers supported by the initiative are located in PDET regions. Fedepalma was part of a USAID-led initiative that supported palm oil farmers living in Tumaco, in part through the digitization of information. They also leveraged SIG tools to assist farmers with traceability, something that is becoming increasingly important in the palm oil value chain. **Figure 55** outlines some of the services identified that are available in PDET.

FIGURE 55: DIGITAL AGRICULTURE ADVISORY SERVICES AVAILABLE IN PDET REGIONS

139 FAO (2022), Plan Maestro de Estructuración PDET, una nueva herramienta al servicio de los municipios más afectados por la violencia.

140 RUMECA.

ORGANIZATION	VALUE CHAIN	DIGITAL SOLUTION AVAILABLE	PDET AREAS OF INTERVENTION
AgrodatAi	all, but a strong focus on livestock	digital advisory	Where mobile service is available
Luker	cocoa	digital advisory, digital procurement	Antioquia (Apartado, Caucasia, Cáceres, Necoclí, Turbo, San Pedro de Urabá, Zaragoza), Córdoba (Montelíbano, Puerto Libertador), Huila (Algecieras), Nariño (Tumaco)
Fedepalma	palm oil	digital advisory, digital procurement	Nariño (Tumaco), Catatumbo
RUMECA	fruits, vegetables	agri e-commerce	César (Valledupar), Magdalena (Santa Marta), Arauca, Antioquia (Urabá), Guaviare (San José del Guaviare), Nariño (Tumaco), Caquetá (Florencia), Tolima
Asohofrucol	fruits, vegetables	digital procurement	not available
Nutresa	cocoa	digital procurement	not available
Federación Nacional de Cafeteros	coffee	DFS, digital procurement, digital advisory	not available
Control Ganadero	livestock	digital advisory, farm management	not available

Sources: Organizations, The AgTech Network.

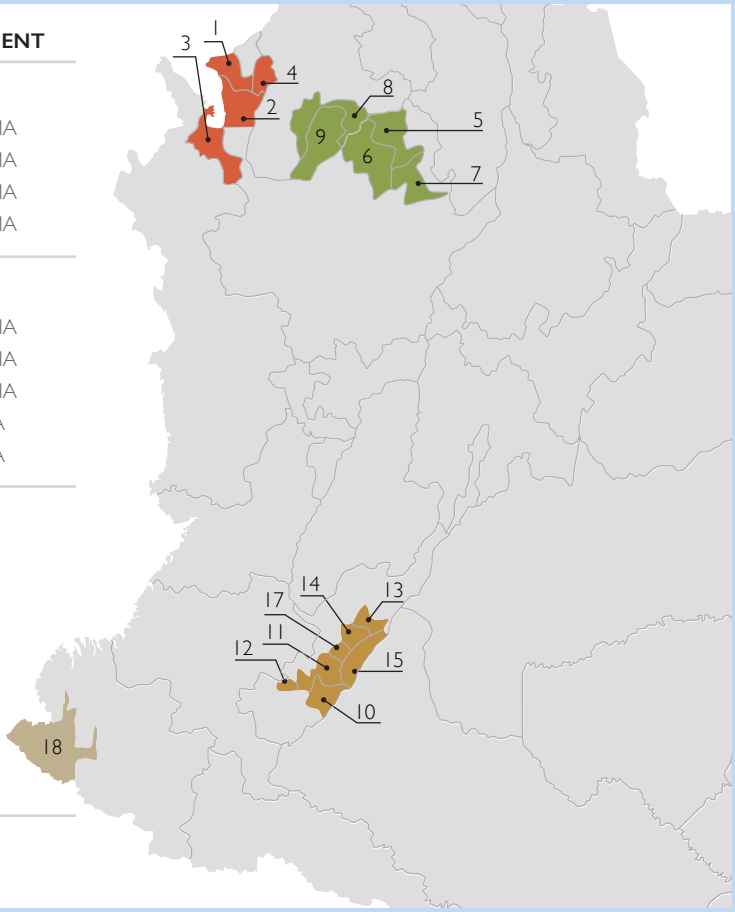
Unsurprisingly, there is significant engagement in PDET regions coming from donors and foreign development agencies committed to maintaining the peace in post-conflict areas. These organizations are working in tandem with value chain associations in the region, local nonprofits, and government agencies to ensure that farmers in PDET areas are not left behind by the digitalization of the agricultural sector. Though not exclusive to agriculture, mobile wallet Movii, for example, is currently running a campaign in PDET regions to sign on 25,000 new mobile wallet users in the region. Fundación Luker has been working with USAID on The Cacao Effect initiative in PDET regions. This initiative seeks to help cacao farmers improve their livelihoods through increased productivity, membership in associations, and education (see **The Cacao Effect Case Study**).

CASE STUDY: THE CACAO EFFECT[141]

ABOUT: The Cacao Effect is a five-year project initiative under the USAID's Private Sector Collaboration Pathway program (formerly known as Global Development Alliance). The project was launched in 2019 in collaboration with cocoa company Luker Chocolate and its foundation arm Fundación Luker. The project is a US$36-million initiative that seeks to increase the productivity of the cocoa value chain while improving the livelihoods of smallholder farmers. The partners established three main goals: (1) increase productivity in all 18 municipalities where Luker operates; (2) help farmers strengthen their associations and provide education; and (3) improve the competencies in the communities of Tumaco and Necoclí. The Cacao Effect has a strong focus on PDET regions which account for more than half of the municipalities in which Luker operates (see **Figure 56**).

FIGURE 56: THE CACAO EFFECT FOOTPRINT

ZONE	DEPARTMENT
URABÁ	
1 NECOCLÍ	ANTIOQUIA
2 APARTADÓ	ANTIOQUIA
3 TURBO	ANTIOQUIA
4 SAN PEDRO	ANTIOQUIA
BAJO CAUCA	
5 CAUCASIA	ANTIOQUIA
6 CÁCERES	ANTIOQUIA
7 ZARAGOSA	ANTIOQUIA
8 MONTELÍBANO	CÓRDOBA
9 PUERTO LIBERTADOR	CÓRDOBA
HUILA	
10 GARZÓN	HUILA
11 GIGANTE	HUILA
12 EL AGRADO	HUILA
13 RIVERA	HUILA
14 CAMPOALEGRE	HUILA
15 EL PITAL	HUILA
16 ALGECIRAS	HUILA
17 HOBO	HUILA
NARIÑO	
18 TUMACO	NARIÑO



SOURCES: USAID, Fundación Luker.

SOLUTION: To support the high-level objectives of The Cacao Effect, Fundación Luker developed a number of digital agriculture solutions with the help of local programmers. One of the solutions is designed to collect farmer data at specific points of time, a way to take stock of the impact of the various initiatives undertaken. Data collected from this tool is used largely for internal reporting purposes. A second tool developed by Fundación Luker aims to capture a fuller picture of smallholder cocoa farmers working with Luker Chocolate. The most recent digital tool developed by Fundación Luker is a digital advisory solution introduced during the pandemic aimed at providing agronomic advisory to smallholder farmers.

141 USAID (2022), The Cacao Effect, Annual Implementation Plan 2022.

PARTNERSHIPS: The Cacao Effect is a partnership between several different parties each with its own area of expertise (see **Figure 57**).

FIGURE 57: THE CACAO EFFECT PARTNERS

SOURCES: USAID, Fundación Luker.

WHAT'S NEXT:? The project is set to end in early 2024. Fundación Luker and Luker Chocolate would like the project to continue beyond 2024 given some of its successes to date, including increased productivity, increased association, and increased education of youth and farmers living in the two target communities (see **Figure 58**).

FIGURE 58: EXPECTED PRODUCTIVITY IMPROVEMENTS OF THE CACAO EFFECT

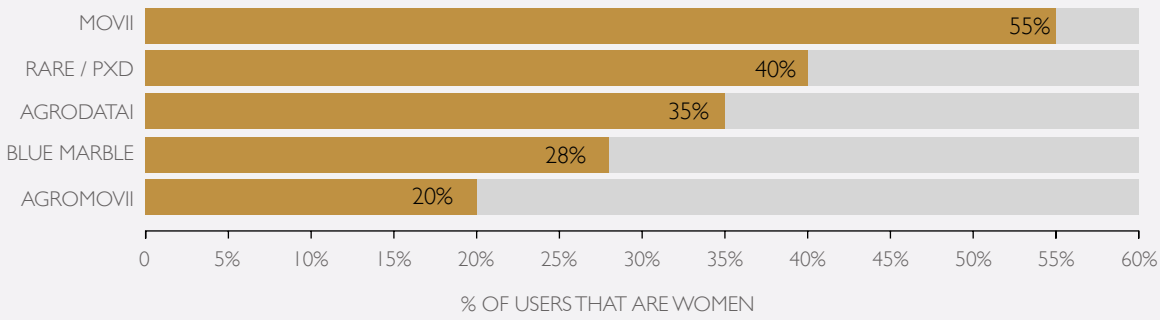
	PLANTED HECTARES	RECULTIVATED HECTARES	FARMERS PROVIDED WITH TECHNICAL ASSISTANCE	PRODUCTIVITY (KG/HA)
2021	474	1,063	935	547
2022	80	120	762	762
2024	470	990	2,470	971

SOURCE: USAID.

5.4 GENDER AND INCLUSIVITY IN DIGITAL AGRICULTURE

To date the push for gender inclusion in digital agriculture has come largely from external sources, including the Colombian government, NGOs, foreign development agencies, and other donors. Funding and technical support to digital agriculture service providers are often predicated on meeting certain minimum requirements for adoption among women, youth, or ethnic minorities. More than 50% of Movii's digital wallet customers are women (see **Figure 59**). This is because Movii has been active in several of the government digital payment initiatives aimed at transferring money to female heads of household. Roughly 40% of RARE's digital agriculture advisory service users are women. This is due in large part to the UK government's focus on gender inclusion in its interventions in Colombia and its decision to add gender metrics to its project milestones. Where these external forces are not present, we note that adoption of digital agriculture solutions among women is much lower (below 10–20% in many instances). Service providers also note differences across regions. Whereas adoption levels might be 25–35% nationwide, when it comes to PDET regions the ratio can drop below 20%.

FIGURE 59:
SHARE OF WOMEN USERS FOR VARIOUS DIGITAL AGRICULTURE SOLUTIONS IN COLOMBIA



SOURCES: KIIs, The AgTech Network.

Some of the key strategies employed to increase adoption among women include:

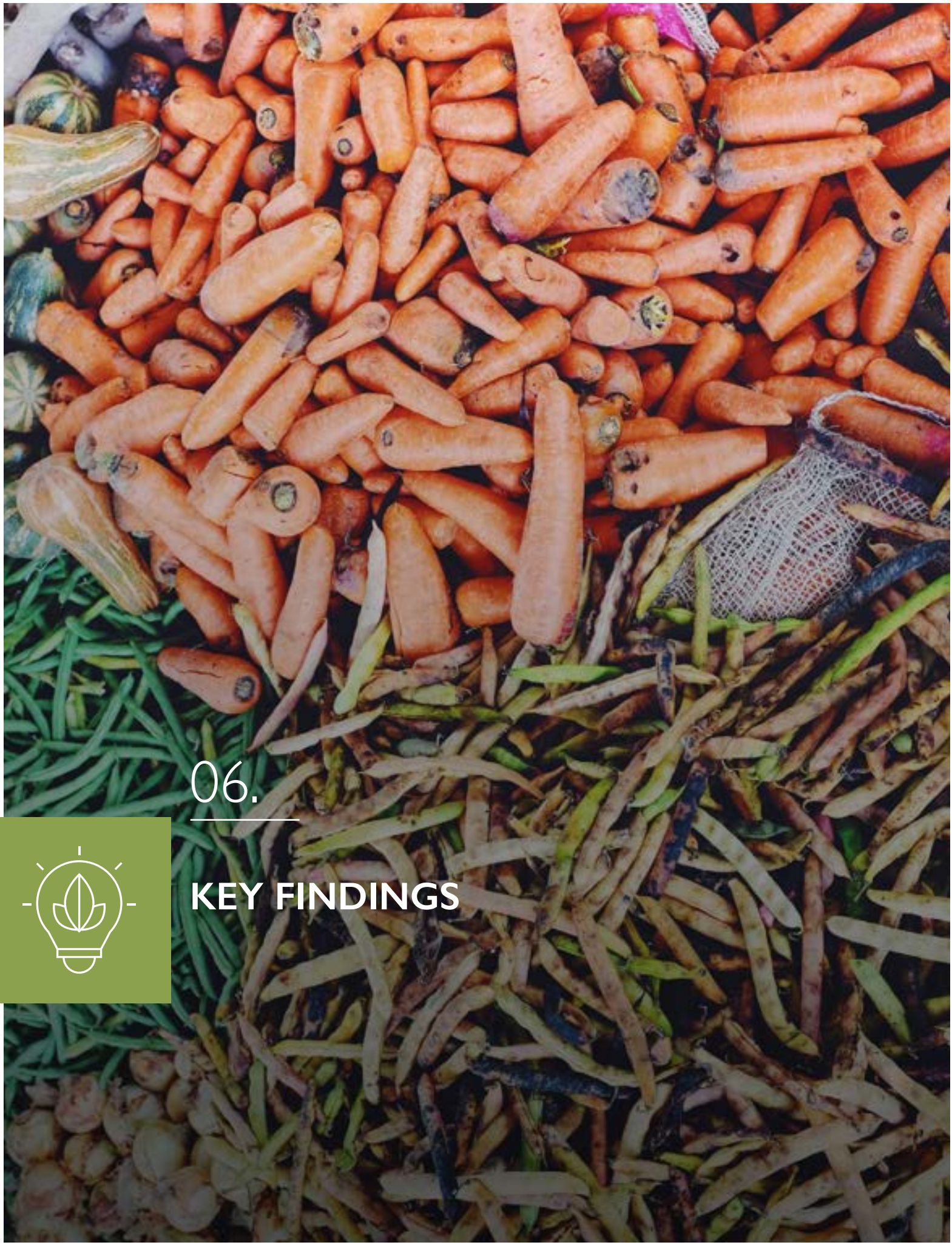
- **IDENTIFY WOMEN COMMUNITY LEADERS THAT CAN BE EARLY ADOPTERS.** Several of the agtech companies we interviewed provide monetary incentives to community leaders who successfully sign on new users.
- **INCLUDE CONTENT THAT IS OF PARTICULAR INTEREST TO WOMEN.** In addition to traditional agronomic advisory, digital agriculture service providers that include content that is of specific relevance to rural women tend to do better. This can be content related to those agricultural activities where more women participate, as well as content related to maintaining the household, caring for children, and starting a business, among other topics.
- **LEVERAGE KNOW-HOW OF ORGANIZATIONS ACTIVE WITH RURAL WOMEN.** There are several nonprofit organizations active in Colombia that have expertise working with rural women. These include Fundación delamujer, which has offices throughout Colombia, and Fundación Mujeres de Éxito, among others.

- **OFFER PREFERENTIAL RATES TO FEMALE FARMERS.** In an effort to increase adoption among female farmers, some digital agriculture service providers, particularly agri DFS companies implementing government initiatives, offer preferential rates to female farmers. This can take the form of a five- to ten-percentage-point break on interest rates or insurance subsidies to account for the uncompensated work taking place in the home.

These strategies are yielding positive results. For example, in PDET regions where there are numerous programs aimed at supporting female farmers, women account for 37.5% of all credit applications for the Crédito Fomento Agropecuario program, compared with 35.9% outside of PDET regions.[142]

While we noted quite a large number of initiatives promoting gender inclusion, we identified far fewer initiatives with a specific ethnic lens. We did note that there were a handful of agri DFS initiatives aimed at ethnic minorities. Finagro, for example, offers a bonus equivalent to 5% of the insurance premium to applicants that fall into the NARP category (black, Afro-Colombian, Raizal, or Palenqueras) (**see Figure 43**).[143] We also identified a number of financial services products (mostly credit and insurance) focused on regions where the population of ethnic minorities is higher (along the coast, for example) or aimed at specific ethnic groups. SBS Seguros, for example, offers a MiCRO parametric insurance product called Mi Siembra Segura that is specifically aimed at indigenous people and Afro-Colombians living in La Guajira and Sucre. This product is backed by the UNDP Rapid Response Facility (RRF2) Program.[144] Though not always agriculture-specific, USAID teamed with various financial services products through the Rural Finance initiative to develop credit products aimed at ethnic minorities living in rural areas.

142 DANE (2021), Situación de las Mujeres Rurales en Colombia.
143 "Raizal" refers to individuals of Afro-Caribbean descent. "Palanquera" refers to individuals from an area called Palenque in Colombia which refers to the first enclave in Colombia with freed slaves.
144 MiCRO (2021), "Mi Siembra Segura: Parametric Insurance to Protect Vulnerable Rural Communities in Colombia, with UNDP."



06.

KEY FINDINGS

6. KEY FINDINGS

Many of the organizations interviewed for this assessment are optimistic about the opportunities for digital agriculture development in Colombia. This section discusses some of the key enablers facilitating the deployment of digital agriculture solutions in the country, as well as some of the key barriers facing organizations deploying digital agriculture solutions in the country. This section also identifies some of the leading business models behind the deployment of digital agriculture solutions in the country and some of the key factors leading to sustainability and scale.

6.1 KEY ENABLERS OF DIGITAL AGRICULTURE INNOVATION

Section 5 outlines some of the key enablers for each of the five different use cases analyzed in this assessment. **Figure 60** provides a summary of these enablers, many of which apply to a wide variety of use cases.

FIGURE 60: ENABLERS FOR DIGITAL AGRICULTURE INNOVATION IN COLOMBIA

CONNECTIVITY / ACCESS	POLICY/ GOVERNMENT	ECOSYSTEM	OTHER
Mobile coverage and internet service availability	National Digital Agriculture policy	Vibrant start-up and investment ecosystem	Presence of value chains more suitable for digitalization (e.g., coffee, cocoa, livestock, palm oil)
Mobile device / smartphone ownership	Availability of centralized, validated, up-to-date farmer databases	Strong support from NGOs and donors	High digital literacy levels (among farmers, extension officers, agronomists)
Availability of LPWA IoT networks	Government subsidies and incentives	Formalization of the sector (presence of farmer groups, associations, cooperatives)	Rising middle class
	Enabling mobile money regulatory environment and large agent network		

SOURCE: The AgTech Network.

6.2 KEY BARRIERS TO FURTHER SCALE AND ADOPTION OF DIGITAL AGRICULTURE SOLUTIONS

Digital agriculture solutions providers have encountered a number of challenges when deploying their solutions in the market. The leading challenges observed during our research are outlined below.

CHALLENGE 1: LIMITED NETWORK CONNECTIVITY IN RURAL AREAS

The leading barrier digital agriculture service providers face when deploying their solutions in rural areas is lack of connectivity. Even when there is connectivity, it is often not meaningful connectivity (4G+) that can support a wide variety of applications and services. Every organization interviewed for this assessment cited connectivity as a significant barrier. Digital advisory service provider AgrodatAi stated that adoption levels by region are closely linked to connectivity.[145] Apptank's Control Ganadero has seen increased adoption in Mexico compared to Colombia, in large part because of higher connectivity levels in Mexico's rural areas than those in Colombia's rural areas.[146] Fundación Luker cited poor connectivity in specific PDET areas where it operates (e.g., Huila). Agronomists are unable to access the network while out in the field; even when they return to the department capital, it often takes several tries before they can upload the information gathered onto the server.[147]

Digital services providers have employed a number of strategies to address these challenges. Many have developed an offline option to allow usage when not in range of a network. For instance, Finagro's DECISIÓN digital financial tool allows agents to input information on the app and take pictures while offline. When the agent is within range of a network, the information is uploaded onto the DECISIÓN platform.[148]

Many also have incorporated a text option to relay information to farmers. AgrodatAi, for example, has four channels to interact with its farmers, including a web interface, an application, SMS, and a chatbot that functions over WhatsApp and text messaging.

Lastly, some solution providers have joined forces with alternative network access providers to extend the reach of networks beyond that of traditional telecommunications service providers. Cocoa companies Luker[149] and Nutresa, for example, are both working with Microsoft to extend the latter's Airband solution to the rural communities where their smallholders live and work. This option, however, is out of reach for most solution providers given the cost of extending infrastructure to rural areas.

145 AgrodatAi interview (March 2023).
146 Control Ganadero interview (March 2023)
147 Fundación Luker interview (April 2023).
148 Finagro interview (April 2023).
149 YouTube and Fundación Luker (2022), Microsoft y el Efecto Cacao.

CHALLENGE 2: LIMITED ACCESS TO DEVICES AND DATA SERVICES

In addition to limited access to networks, limited access to devices and data services can also be a significant challenge to digital agriculture service adoption. While the digital agriculture service providers interviewed for this assessment reported the rising use of mobile devices among the smallholder farmers they work with, many of these devices are feature phones that are incompatible with WhatsApp and other app-based delivery modes. Agtech startup Agromovil estimates that only 45% of the farmers they work with have access to a mobile device.[150]

Data services are also considered to be expensive by many smallholder farmers. Some digital agriculture service providers are getting around this by teaming up with NGOs that subsidize the cost of devices and data services. Others, like Agromovil, are teaming up with mobile service providers to provide access to smallholder farmers. Mobile operator WOM provided Agromovil with 9,700 SIM cards with six months of data connectivity included that Agromovil can provide to its customers.[151] Agromovil benefits by eliminating a barrier to entry for users of its marketplace, while mobile operator WOM benefits from accessing customers who are difficult to reach.

CHALLENGE 3: LIMITED DIGITAL LITERACY AMONG FARMERS

For many organizations deploying digital agriculture solutions benefiting smallholders, the lack of digital literacy among farmers, particularly older farmers, has been a significant barrier. Value chain associations Asohofrucol and Fedepalma have both found it challenging to get farmers to adopt digital technologies.[152] Fundación Postobón, the foundation arm of Colombian beverage company Postobón, for example, found that 72% of the farmers participating in the organization's Hit Social program had difficulty using a mobile device, impeding farmers' ability to fully benefit from the technical and commercial support being provided by the company. [153]

Agribusinesses are implementing a number of strategies to address the lack of digital skills and literacy among smallholders. Often they are teaming with NGOs, foreign development agencies, or government groups to extend training to farmers. Fundación Luker, for example, works closely with Fundación Manuel Mejía, a nonprofit with significant experience in training and education in rural communities, particularly coffee and cocoa farming communities.[154] AgrodatAi, for example, worked with USAID to extend digital training to some of its farmers.[155] Several have cited SENA as a helpful partner in this regard. Some organizations, like MásPorTIC, have emerged precisely to support digital skills development in rural areas through camps and courses aimed at young people. Microsoft works with partners to provide digital training in partnership with local schools as part of its Airband initiative.

Digital agriculture solutions providers have also adapted to work with the platforms already familiar to farmers, particularly WhatsApp. Many digital agriculture suppliers that launched their own apps ended up replacing them with WhatsApp-based solutions to improve their adoption among farmers. However, in this approach, the addressable market is limited to farmers with smartphones and within coverage of a 3G or 4G network.

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150 Agromovil interview (March 2023).
151 Agromovil interview (March 2023).
152 Asohofrucol interview (March 2023); Fedepalma interview (April 2023).
153 Hit Social Postobón is an initiative led by Fundación Postobón aimed at supporting over 1,300 smallholder farmers that produce mango, guava, lulo (a Colombian fruit that looks like a small orange) and blackberry used in Postobón beverages. The Foundation helps farmers create associations and provides technical support, all while guaranteeing a market for the farmers' fruit. Fundación Postobón, "Hit Social Postobón"; Postobón (2023), "Nos unimos a WOM para impulsar la alfabetización digital en el país."
154 Fundación Luker interview (April 2023).
155 AgrodatAi interview (March 2023).

CHALLENGE 4: LIMITED DIGITAL LITERACY AMONG AGRONOMISTS, EXTENSION OFFICERS, AND AGENTS

Many of the digital agriculture solutions providers and agribusinesses interviewed for this assessment have found it difficult to find staff with digital skills and training in the latest digital technologies like sensors, drones, AI, and digital entrepreneurship. The focus of many university agronomy programs resides in the decades-old study of soil, pests, diseases, and traditional agricultural practices. The few students with digital training are snatched up by larger agroindustrial companies, leaving few to work with startups and NGOs working on challenges facing smallholder farmers. Through KIIs, we heard that many agronomists, particularly those from older generations, fear that new digital solutions will replace them, making them more resistant to implementing digital tools in their day-to-day activities.

Digital agriculture solutions providers are working to address this challenge by forming closer bonds with universities in Colombia so that they can adjust their curriculum to more closely align to the requirements of these new startups. Startup executives from AgrodatAi and Croper.com are engaging with university programs and leading seminars, all in the effort to ensure the supply and quality of agronomists, extension officers, and agents meets demand. Asohofrucol, the fresh produce association, has teamed up with several universities to provide digital training and certification to students studying agronomy. Universities benefit from the on-the-ground training and certification received by the students, and Asohofrucol benefits from having future agronomists aligned with Asohofrucol practices.[156]

CHALLENGE 5: LACK OF CENTRALIZED, EASY-TO-ACCESS, UP-TO-DATE FARMER DATABASES AND FARMER DATA

The cost of deployment of digital agriculture solutions is often closely tied to the availability of centralized, accessible, and up-to-date farmer data. If a digital agriculture provider first has to collect farmer data, the solution can become far too expensive. PxD, a provider of digital agriculture solutions, has reduced its cost per user from $43 in 2016 to $1.58 in early 2022 in countries such as India in part because of its ability to access farmer data from government agencies.[157] In Colombia, the data required to introduce the service was not available to PxD from one easy-to-identify source, making the cost significantly higher, as PxD had to identify local sources and often travel from farmer to farmer to collect the data. This made scaling the service more difficult.

Despite several governmental initiatives to build up-to-date farmer databases (see **Section 3.4**), many of the digital agriculture service providers consulted for this assessment continue to struggle to access reliable farmer databases. They therefore seek to build partnerships with agribusinesses, value chain associations, or farmer groups that have farmer relationships. As digital agriculture service providers themselves scale, they too can become valuable partners for others (e.g., financial service providers) to access farmer groups.

CHALLENGE 6: LACK OF FARMER TRUST

One of the main challenges faced by organizations looking to provide digital services to smallholder farmers is a lack of trust. Farmers are generally skeptical of any organization looking to collect data from them, believing that the data is being used to collect more taxes. This is especially true in post-conflict regions, like the PDET regions, where farmers seek to keep a low profile to avoid being caught up in the crosshairs between organizations pursuing illicit activities and the government. Some of the organizations interviewed for this study that had worked in other emerging markets stated that the farmer trust issues that they'd encountered in Colombia were much more pronounced than those they encountered in places like India and Africa.

156 Asohofrucol interview (April 2014).
157 PxD interview (March 2023); PxD, "Our Learning"; PxD (2023), Annual Report 2022.

It can take years to develop farmer trust, time digital agriculture service providers—which often have just a few years to demonstrate the viability of their offers—simply do not have. For this reason, they often seek out partnerships with organizations that have been working in the field for years and have earned that trust. Agromovil, for example, worked through on-the-ground partners Comultrasan and the Avocado Association to generate trust with potential clients.[158] During our research, organizations like Solidaridad and Interactuar were often mentioned as trusted partners given their work in challenging parts of the country. Nonprofit organization RARE, for example, has a strong focus on climate and helping smallholders implement regenerative agriculture practices through traditional and digital advisory. The department of Meta was particularly compelling as an intervention site because of its high deforestation rates (second in Colombia), high carbon emissions (second in Colombia), and the impact of agriculture on emissions (more than 85% of total emissions).[159] Perhaps as important, it was also able to find a partner with deep knowledge of the local culture and agricultural sector dynamics.

CHALLENGE 7: SECURITY CONCERNS

Although Colombia has come a long way, some areas are still marked by violence and security concerns that cause many digital agriculture service providers to conduct security assessments before beginning an implementation. This is particularly true of PDET regions. Some of the organizations interviewed for this study described pulling out of specific areas because of security concerns or having to shift their strategy in response to security concerns. The area of Tumaco was mentioned by a few organizations as an area of particular concern. Partnering with organizations familiar with these regions can help mitigate some of the risks faced by digital agriculture service providers.

CHALLENGE 8: SHIFTING GOVERNMENT PRIORITIES AND PERSONNEL

Many of the organizations interviewed for this assessment stated that it was difficult to move initiatives forward without institutional support given the importance of the state in Colombian culture. For this reason, a change in administration every four years, with the related changes in priorities and personnel, can cause significant disruption to digital agriculture initiatives. In one instance, negotiations became "tense" following the transition and funding was frozen. In another, an agtech startup was in negotiations with a potential commercial partner about leveraging their data to introduce a new financial service product aimed at smallholders. When a new administration took control, those discussions began anew. By the same token, some ambitious government initiatives around creating farmer databases and introducing digital agronomic advisory initiated in the previous administration have been shelved or redirected under the new administration.

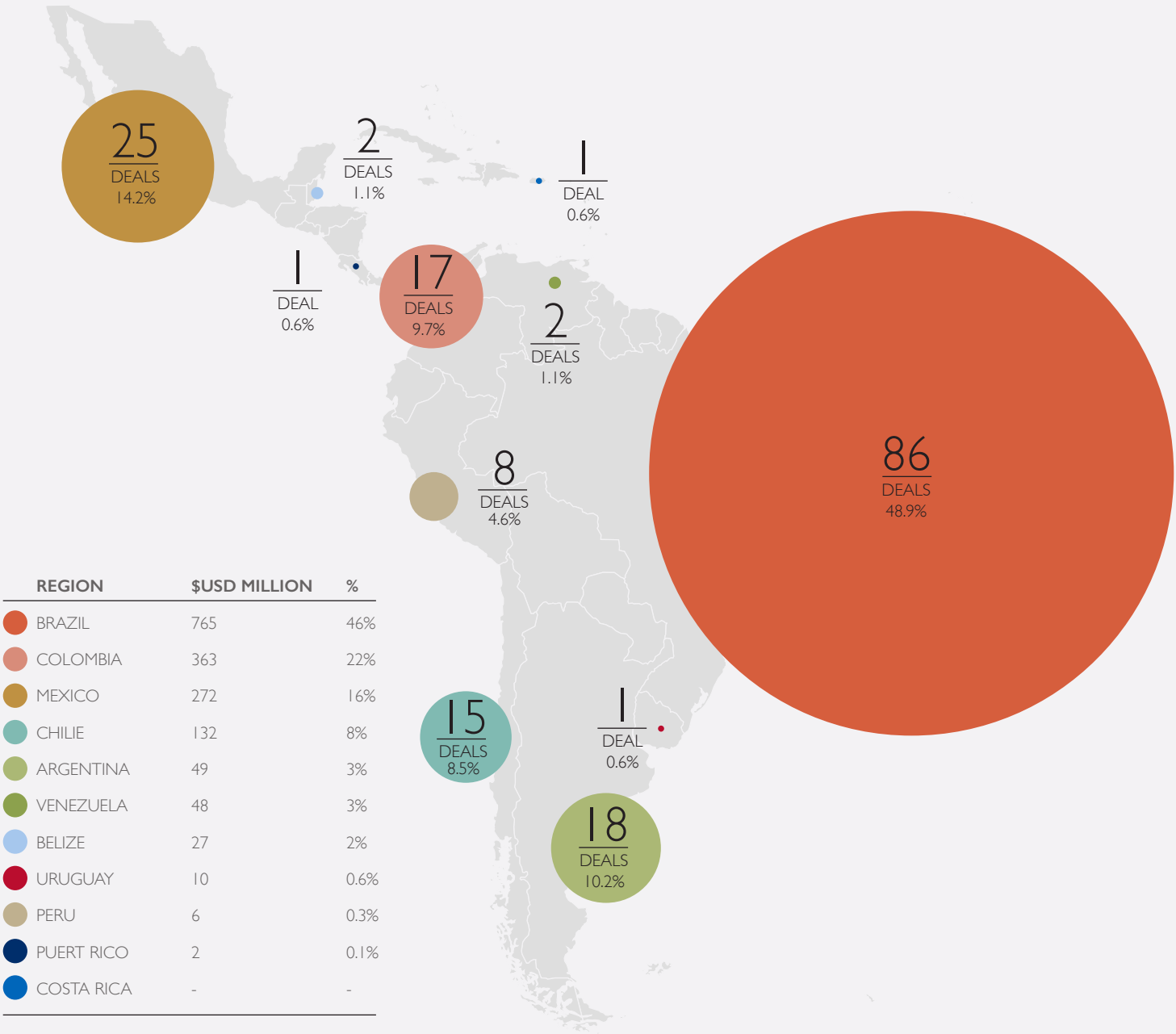
CHALLENGE 9: DIFFICULTY ACCESSING CAPITAL

For many of the startups interviewed during this assessment, accessing capital has been a challenge, particularly in the macroeconomic context of the last few years. The COVID-19 pandemic, rising inflation, the war in Ukraine, and a change in administration at the local level have all contributed to a more complicated environment for raising capital in 2020 to 2022. Several of those interviewed, like TuPlaza, had hoped to raise funding in 2022 but had to postpone until 2023.

The environment does seem to be improving, however. According to AgFunder, Colombia ranked second in terms of agrifoodtech investments in 2022 (see **Figure 61**).[160] Though much of this investment flowed toward marketplaces and solutions aimed at the restaurant industry, there does appear to be rising interest in DFS and those aimed at environmental conservation.

158 Agromovil interview (March 2023).
159 RARE interview (March 2023).
160 AgFunder, AgFunder News, and SP Ventures (2023), Latin America AgriFoodTech: Investment Report 2023.

FIGURE 61: INVESTMENTS BY COUNTRY (2022)



REGION	$USD MILLION	%
BRAZIL	765	46%
COLOMBIA	363	22%
MEXICO	272	16%
CHILIE	132	8%
ARGENTINA	49	3%
VENEZUELA	48	3%
BELIZE	27	2%
URUGUAY	10	0.6%
PERU	6	0.3%
PUERT RICO	2	0.1%
COSTA RICA	-	-

SOURCE: AgFunder.

The nine challenges outlined above are common to all five use cases. There are some challenges that are specific to particular use cases, notably agri DFS and smart farming. These are outlined in **Figure 62.**

FIGURE 62: KEY CHALLENGES SPECIFIC TO AGRI DFS AND SMART FARMING USE CASES

AGRI DFS	
Frequent change of SIM card	For the fintechs interviewed, one of the biggest challenges faced over the years has been the frequent changing of SIM cards on the part of smallholder farmers. Smallholder farmers do not appear to have an attachment to their phone numbers and frequently change SIM cards for a variety of reasons. This makes it difficult to keep track of users for payments or collection. Blue Marble, for example, was unable to locate a number of farmers owed insurance payments because they had changed SIM numbers and had not updated their information on the platform. Mobile wallet Movii also struggled to maintain contact with users who switched SIMs. Movii introduced a self-service mechanism on the platform that enables users to update their phone number when changing their SIM.
Enabling mobile payment ecosystem	Despite the introduction of many digital payment platforms in recent years to facilitate the payment of government benefits, smallholder farmers still maintain a strong preference for cash. Even when organizations convince smallholder farmers to accept digital payments, these farmers' inability to use digital means to pay for goods and services in their own communities mean that the benefits of digital payments are limited, as smallholders simply cash out upon receipt of their payment. Financial service providers' efforts to create mobile payment ecosystems have been hampered by the high fees retailers must pay when accepting digital and the lack of interoperability across different banking systems.
Excessive bureaucracy	Smallholder farmers often have to fill out cumbersome paperwork to receive agri DFS, like the SARLAFT. Having to fill out this paperwork prevents many from signing up for financial services, forcing many agri digital service providers to set up teams to help farmers with the paperwork required to receive the service.
SMART FARMING	
Difficulty importing equipment	Digital agriculture service providers that rely on the importation of technology (e.g., sensors, gateways, drones) often struggle with the bureaucracy and cost associated with bringing the technology into the country. Technology is often damaged as it passes through customs, causing further delays and increasing costs.
High cost of technology	For most providers of smart farming solutions, the cost of the solution (sensors, gateways, etc.) has proven too high for smallholder farmers. Telefónica estimated that its smart farming solution built around IoT sensors had a total cost of US$3,000 over the first five years of implementation.

SOURCE: The AgTech Network.

6.3 BUSINESS SUSTAINABILITY OF DIGITAL AGRICULTURE SOLUTIONS AND EMERGING REVENUE MODELS

A review of digital agriculture services deployed in Colombia reveals the implementation of various different monetization models (see **Figure 63**). These models are not mutually exclusive. Some organizations, particularly those pursuing various market segments, might employ one monetization model for one segment and another monetization for another segment. Agrifintech Agrapp, for example, has several monetization models in place. It charges a spread on the interest rates between what the farmers pay for their credit and what investors receive; it generates revenue from services provided to farmers (agronomic extension, reports that can be used for certification and traceability); and it receives a commission from linking farmers of exotic fruits to exporters that they have developed relationships with. Going forward, Agrapp plans to leverage their credit-scoring methodology to offer farmers other financial services products (e.g., credit cards), which can also be monetized.[161]

FIGURE 63: DIGITAL AGRICULTURE MONETIZATION MODELS IN COLOMBIA

MODEL	TARGET MARKET	DESCRIPTION	EXAMPLES
Farmer-pays	smallholders	Farmer pays directly to access the service; either a one-time payment or subscription fee.	Blue Marble, Agrapp
Cooperative or value chain association pays	smallholders, cooperatives	Farmer pays annual dues to the cooperative, which grants access to a digital solution.	Fedepalma, Asohofrucol, Agromovil
Freemium	smallholders, agribusinesses	Basic version of the service is available free to smallholders. A premium version is available for a fee, typically aimed at larger farms.	Control Ganadero
Subsidy or incentive	smallholders	Smallholders access the service for free. A third party (e.g., agribusiness, NGO, government) picks up the tab.	Blue Marble
Agribusiness pays	smallholders, agribusinesses	Agribusinesses pay for the service which benefits both the agribusiness and their smallholder partners.	AgrodatAi, Blue Marble, Olam, Yara, Agromovil
Insights	smallholders, agribusinesses, input suppliers, governments, NGOs, donors, retailers	Organization sells anonymized farmer data collected through their platform to third parties interested in understanding farmer behavior or output.	TuPlaza, Agrapp
Advertising	smallholders, input suppliers, equipment vendors	Organization sells advertising on the platform aimed at smallholders to providers of inputs (seeds, fertilizers) or equipment targeting smallholders.	Croper.com, Comproagro
Commission	smallholders, retailers, restaurants, bank	Organization charges a commission (or mark-up) on transactions that take place over its platform or that it facilitates.	Agrapp, TuPlaza, Waruwa

SOURCE: Agtechs, The AgTech Network.

161 Agrapp interview (April 2023).

Through a thorough review of different digital agriculture service deployments in Colombia, The AgTech Network was able to identify some common threads among those solutions that were better able to scale.

1. **FOCUS ON B2B OR B2B2C BUSINESS MODELS, RATHER THAN B2C BUSINESS MODELS.** Most service providers interviewed agree that smallholder farmers are generally unwilling to pay for digital agriculture solutions, even when these solutions are proven to improve productivity and income. Identifying client groups that have a vested interest in smallholder adoption of digital services is key to the ability of many digital agriculture service providers to achieve scale. Agribusinesses and value chain associations looking to digitize activities along the agricultural cycle to improve efficiencies and meet traceability requirements, and financial service providers looking to extend services to rural communities, are often ideal targets for digital agriculture services. AgrodatAi, for example, has been able to grow its farmer base to over 300,000 thanks to a model that targets agribusinesses and other B2B clients for growth.
2. **LEVERAGE FARMER GROUPS, AGRIBUSINESSES, AND LARGER AGTECH STARTUPS TO GAIN ACCESS TO FARMER DATA.** In the absence of government farmer registries with up-to-date information, digital agriculture solutions providers must often develop partnerships with agribusinesses, value chain associations, cooperatives, and other farmer groups in order to identify potential new users. A few of the digital agriculture service providers interviewed attempted to recruit farmers on a one-on-one basis. This proved time-consuming, costly, and, in most cases, unsustainable. More successful were those solutions providers that identified partners on the ground with established relationships with thousands of farmers. Blue Marble microinsurance company, for example, partnered with Nespresso and Seguros Bolívar to provide insurance to coffee farmers. CIAT is working through eight different value chain associations to deploy digital advisory services to farmers in their respective value chains.
3. **LEVERAGE PARTNERSHIPS WHEN ENTERING NEW GEOGRAPHIES OR CUSTOMER SEGMENTS.** Each of Colombia's regions is characterized by a unique set of attributes that make it difficult to apply a one-size-fits-all strategy to the entire territory. It often takes months or years to establish relationships with local government officials and industry stakeholders and to build trust with local smallholder farmers. To accelerate entry into new regions, digital agriculture service providers in Colombia have found it essential to team with organizations that know the local area well. RARE, for example, opted to focus its digital advisory service activities on the Meta region of Colombia not only because of its contribution to Colombia's carbon emissions but also because its local partner had expertise in this geography. This is particularly true of PDET regions, which have long been isolated and where building trust is an even bigger challenge.
4. **LEVERAGE SUBSIDY AND INCENTIVE PROGRAMS.** The government offers various incentives to smallholders to encourage them to use inputs in their production cycle, to seek credit, and to acquire insurance products. Agri digital financial service providers leverage these incentives to offset the cost of their services to smallholder farmers. The cost of parametric insurance for smallholder farmers was completely offset by Blue Marble and Seguros Bolivar's parametric insurance programs, which leveraged government insurance subsidies available to smallholder farmers, as well as fair trade premiums paid by the cooperatives.
5. **PIVOT QUICKLY IN RESPONSE TO SMALLHOLDER FARMER FEEDBACK.** Based on our review of various digital agriculture solutions, it appears that digital agriculture service providers that are able to adjust quickly to smallholder farmer feedback tend to perform better than those that don't. AgrodatAi launched its digital advisory service with a focus on climate but heard from farmers that there was a greater interest in pocketbook issues, such as pricing and market data. So AgrodatAi shifted focus. Most recently, it heard from farmers that what they needed most was access to credit, so AgrodatAi teamed with six financial service institutions to offer credit to farmers. Similarly, agrifintech Agrapp has continuously evolved in response to client feedback. It started out as a technology company providing an IoT-based solution aimed at improving productivity. They quickly realized that financing, not productivity, was the biggest challenge faced by farmers, so they shifted their focus to a crowdfunding platform. To support credit recipients with agronomic advisory, Agrapp built a mobile application for use by farmers. Digital literacy among credit recipients was low, so they shifted to a WhatsApp-based model that has seen much higher adoption.[162]

162 Agrapp interview (April 2023).

6. **FOCUS ON THE SOLUTION, NOT THE TECHNOLOGY.** Early providers of smart farming solutions tended to focus on the technology itself and the "wow factor" behind the use of sensors, drones, connected greenhouses, and other state-of-the-art technology. Smallholder farmers that are struggling to make a living are far less interested in the technology and much more interested in how the technology can help them. Shifting the pitch from the state-of-the-art nature of the technology to the benefits from the use of the technology is key.
7. **LOOK FOR OPPORTUNITIES TO MEET ADDITIONAL FARMER NEEDS WITHIN THE SOLUTION OFFERED.** We heard through KIIs that smallholder farmers do not want to download different applications and learn about different platforms for each of their needs (information, financing, access to markets, etc.). Digital agriculture service providers that can meet multiple needs are more likely to see higher adoption than those that are very narrowly focused. We've noted that many agri DFS, agri e-commerce, digital procurement, and smart farming providers, for example, have introduced digital advisory services as they've found that this improves the quality of the crops. Agrapp, for example, started providing digital advisory to its exotic fruit farmers to improve the quality of the fruit it received, the price it was able to garner from its buyers, and therefore the ability of the farmer to repay the initial loan. We noted through the interviews conducted that there is particularly strong demand for agri DFS, with several providers having waiting lists of 10,000 farmers or more seeking loans to support their farming activities. This speaks to the decision of digital agriculture providers like AgrodatAi and Croper.com, among others, to introduce agri DFS to their portfolio in recent years.

07.

RECOMMENDATIONS TO ECOSYSTEM STAKEHOLDERS

7. RECOMMENDATIONS TO ECOSYSTEM STAKEHOLDERS

In this section, The Agtech Network provides a series of recommendations to different ecosystem players active in the digital agriculture ecosystem. It also outlines specific recommendations for USAID to support the development of digital agriculture solutions at scale in the Colombian market.

RECOMMENDATIONS FOR COLOMBIA'S GOVERNMENT

1. **DEVELOP A DIGITAL AGRICULTURE STRATEGY.** The broader digital agriculture ecosystem would benefit from clearer direction from the government about its priorities for digital agriculture in Colombia, as well as the roles of each individual government ministry and agency. We've noted that governments in other countries like India and Kenya have put in place digital agriculture strategies that outline their vision for digital agriculture and the role of different stakeholders. The FAO has developed guidelines to assist governments in developing National e-Agriculture Strategies,[163] while CAF Development Bank of Latin America and the Caribbean has worked on similar initiatives in Latin America.
2. **DEVELOP PLAN TO EXTEND NETWORK CONNECTIVITY AND INTERNET ACCESS TO RURAL AREAS.** Lack of network availability and internet access in rural areas remains the leading bottleneck for the scaling of digital agriculture solutions in Colombia. Colombia's rural connectivity lags that of its Latin American peers, suggesting that there is much work to be done to increase connectivity levels in the country. Government initiatives that incentivize mobile network providers to expand into rural areas are a good first step. Community-based access models, like those being explored by the government through a partnership with CAF Development Bank of Latin America and the Caribbean, the World Bank, and the IDB, should also be explored further, as should initiatives that leverage different technologies (such as TV white space) to cost-effectively reach rural areas, like Microsoft's Airband.
3. **FOSTER DEVELOPMENT OF THE DFS ECOSYSTEM IN RURAL COLOMBIA.** The Colombian government has made great strides in creating an enabling environment for DFS in the country. Despite these efforts, there is more that can be done. Fintechs, for example, are pushing for open banking and real-time-payments legislation that would create more choice for consumers by leveling the playing field between fintechs and traditional financial services companies. The government should also pass legislation that allows fintechs to participate in some of the preferential credit and insurance programs that Finagro offers that have historically been open to only traditional financial service providers.
4. **BUILD ROBUST, CENTRALIZED, UP-TO-DATE REPOSITORY OF AGRICULTURE SECTOR DATA, INCLUDING FARMER REGISTRIES.** The Colombian government has made several efforts to centralize insights and data on the agriculture sector through agencies like UPRA and initiatives like SNUIRA and Agronet. Despite these efforts, and the vast amounts of data available across numerous government agencies, KIIs suggest that industry stakeholders still find it exceedingly difficult to gain access to the information they need to make decisions, often visiting multiple government agencies (both local and federal) before they find the information they need (if at all). In recent years, both the federal government

163 FAO (2017), National e-agriculture strategy.

and regional governmental organizations (e.g., RAP-E) have launched a number of initiatives aimed at creating up-to-date farmer registries for the provision of digital agronomic advisory. Farmer groups like Asohofrucol have formed closer relationships with DANE to ensure the data collected becomes part of the official registry. Nevertheless, awareness of these initiatives is extremely limited. Colombia's agriculture sector would greatly benefit from the creation of an up-to-date database of agriculture-sector data easily accessible to all ecosystem players. The database should be built upon a mutually agreed methodology that takes into account the perspective of different actors, including farmers. If possible, these should provide interoperability with global information systems, like the Digital Integration of Agricultural Supply Chains (DIASCA) initiative currently championed by a number of organizations, including Solidaridad.[164] Generating awareness of the data is just as important as aggregating the data itself. Dissemination campaigns should be created to ensure all ecosystem actors are aware of these important resources.

RECOMMENDATIONS FOR DONORS, NGOS AND FOREIGN DEVELOPMENT AGENCIES

1. **FACILITATE NETWORKING AND SHARING OF BEST PRACTICES.** One of the most striking findings of our research was how little information-sharing took place in Colombia with respect to digital agriculture innovation. There is very limited cross-sector collaboration, and most new undertakings occur in silos. There are a number of new initiatives being developed in Colombia that seek to create spaces for collaboration, networking, and sharing of best practices. Among these are AgCenter, the only agriculture-focused innovation hub in Colombia; AgStar, a space that brings together individuals and organizations with an interest in the agtech ecosystem; and an agtech group created by a few industry executives and interested parties that would like to promote innovation and the development of agriculture projects centered around technology. These spaces should incorporate the work being undertaken by groups, such as IICA and CGIAR, which are constantly testing new digital solutions for implementation in Latin America. CAF Development Bank of Latin America and the Caribbean is currently setting up a digital transformation laboratory that will test new solutions for implementation in Latin American member countries. Agriculture will be an important vertical for the Laboratory.[165]
2. **ENCOURAGE ENTREPRENEURSHIP IN AGRICULTURE.** Colombia's agriculture sector lacks some of the entrepreneurial drive evident in other agriculture markets in Latin America, notably Brazil and Argentina, where it is not uncommon for startup ventures to emerge from agricultural programs at local universities. University agricultural programs should add entrepreneurship to their curriculum and not offer only scientific study. Students should be encouraged to translate promising projects developed at university into entrepreneurial ventures upon graduation. Grants could be made available to encourage development of the most promising projects and ideas into viable business opportunities. iNNpulsa, for example, issued a call for 65 female entrepreneurs under the Núcleo E Fondo Emprende Mujer Rural in March 2023. [166] Entrepreneurship should also be added to the training offered to smallholder farmers to encourage innovation and entrepreneurship in the field. This would have the added benefit of encouraging more young people to stay engaged in agriculture, seeing agriculture as a potential business venture as opposed to just a way of life.
3. **FACILITATE ESSENTIAL SKILLS TRAINING, INCLUDING DIGITAL AND FINANCIAL LITERACY PROGRAMS.** Agribusinesses, farmer groups, NGOs, and agtech companies need to spend significant time training their users on basic digital skills and financial literacy. This detracts vital resources from marketing and sales and the day-to-day operation of the business. Providing rural communities with digital skills training and financial literacy training will support the growth of digital agriculture solutions in Colombia.

164 INA, "Towards interoperability of digital traceability systems in global agricultural supply chains."
165 CAF Development Bank of Latin America and the Caribbean interview (March 2021).
166 iNNpulsa (2023), "'Núcleo E Fondo Emprende Mujer Rural' abre convocatoria para apoyar a 65 negocios de mujeres rurales."

4. **CONTINUE INCLUDING GENDER TARGETS IN INTERVENTIONS.** Digital agriculture service adoption among women farmers was much higher in those initiatives where donors/funders instituted targets related to gender or applied a gender-inclusive approach. Without these outside mandates, projects are reaching much lower levels of adoption among women, which risks further marginalizing women and excluding them from opportunities to improve their livelihoods and incomes.[167] To ensure that women are not left behind, NGOs, government entities, foreign development agencies, and impact investors should continue to include mandates for the inclusion of women in digital agriculture initiatives in the short term and require that their implementation partners apply a gender lens to interventions. These entities can also identify best practices for the inclusion of women (trainings led by women, content specific to women, special incentives for women, etc.) and seek partnerships with organizations with a successful track record in working with rural women (e.g., Fundación delamujer, which has 227 offices throughout Colombia covering 91% of the territory).[168]

5. **SEEK PARTNERSHIPS WHEN ENTERING REMOTE/PDET REGIONS.** Most organizations agreed that entering remote regions and PDET regions is difficult if done alone given the many challenges of operating in these regions (security challenges, geographic distance, lack of connectivity, lack of trust, local politics, etc.). When looking to operate in these regions, digital agriculture service providers should leverage the expertise of organizations that have been operating on the ground for some time, understand the nuances of the various municipalities in PDET, and have gained the trust of local smallholders.

6. **SUPPORT THE DEVELOPMENT OF A VOLUNTARY CARBON MARKET SUPPORTING SMALLHOLDER FARMERS IN COLOMBIA.** We noted significant interest in the income-generating opportunity available to smallholder farmers from the sale of carbon captured by the trees on their farms on domestic or international carbon markets. The number of farmers registered with Solidaridad on the ACORN platform rose from 6,000 to 16,000 in just a matter of months, with another 34,000 expected to come online by 2026. Several agribusinesses and value chain associations, particularly those in the coffee, cocoa, palm oil, rice, and livestock industries, are exploring ways to generate extra income for their smallholder farmers through engagement in carbon markets. In addition to the extra income for smallholder farmers, participation in voluntary carbon markets requires that farmers adopt and maintain climate-smart agricultural practices that not only strengthen smallholders' climate resilience over time, but also have environmental benefits for the country as a whole. Given all these benefits, donors, NGOs, and international development agencies should support agribusinesses, value chain associations, and farmer group efforts to participate in the voluntary carbon markets.

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167 GSMA (2022), Reaching and Empowering Women with Digital Solutions in the Agricultural Last Mile.
168 Contexto Ganadero, "Seguros Bolívar y Fundación delamujer lanzan Campo Seguro."

RECOMMENDATIONS FOR DIGITAL AGRICULTURE SERVICE PROVIDERS

1. **ADAPT STRATEGIES TO LOCAL CONTEXT.** What works well in Africa, India, or other Latin American countries may not translate to Colombia due to local particularities of the market. Further, what works in one part of Colombia may not work in another given the presence of different agribusinesses, a lower level of association among farmers, a higher incidence of crime, or a different level of involvement from local government agencies. Prior to launching any digital agriculture service, it is important to do a thorough review of the local operating environment.
2. **ENSURE THE USER IS AT THE CENTER OF PRODUCT DESIGN.** Human Centered Design (HCD), or user-centered design, refers to the design of products and services that places user needs and preferences at the center. It is the first of nine pillars established in the Principles for Digital Development now supported by 317 donors and development agencies worldwide.[169] HCD ensures that users are engaged at every step of product or service design, from early stages of identifying challenges that need to be solved to product and service ideation to product development, product launch, and subsequent scaling.[170] Our research has found that solutions that employed HCD tended to outperform those that did not employ this methodology. CGIAR, for example, stated that, of all the digital agriculture solutions launched a few years ago, only those that had leveraged HCD were still in service three years later. Those providing digital agriculture services must keep the user at the center of product design and development. Continuous user interaction is key, as companies also need to be able to pivot on the basis of evolving needs and consumer demand.

169 Principles for Digital Development, "Endorsers."
170 GSMA (2020), Digital Agriculture Maps.


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APPENDICES

APPENDICES

APPENDIX 1: LIST OF STAKEHOLDERS INTERVIEWED

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SANTIAGO HENAO, AGCENTER

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APPENDIX 2: DIGITAL AGRICULTURE SOLUTIONS IDENTIFIED IN COLOMBIA

The status of the solutions presented in the table below reflects The AgTech Network's best assessment based on KIIs and a review of websites and other secondary sources at the time of publication.

SOLUTION	PROVIDER(S)	USE CASE(S)	STATUS	VALUE CHAINS
Acceso	Acceso	digital procurement	active	various
acércate	acércate	agri e-commerce	active	fresh produce
Aclímate	CIAT	digital advisory	inactive	rice, cereals, legumes
ACORN	Rabobank Solidaridad	digital procurement, agri DFS	active	coffee, cocoa
Agri-track	Environment Systems	smart farming	active	various
Agricultura Específica por Sitio (AEPS)	CIAT	digital advisory	active (though no longer in use in some value chains)	citrus, avocado, mango, plantain, sugar cane
Agro 4.0	Mintic, Corpohass, Agrosavia, ICA	smart farming	completed pilot	coffee, cocoa, avocado
Agroclima	Cenicafé	digital advisory	in redesign	coffee
AgroClima	Minagricultura	digital advisory	inactive	various
AgrodatAi	AgrodatAi	digital advisory, agri DFS	active	various
AgroInsumos	Minagricultura	digital advisory	inactive	various
Agrapp Credit Measurement Tool	Agrapp	agri DFS	in development / pre-launch	various
Agrolearning	Solidaridad	digital advisory	active	various
AgroMEL	GIS Data Center	smart farming	active	various
Agromovil	Agromovil	agri e-commerce	active	fresh produce
AgroNegocios	Minagricultura	agri e-commerce	inactive	various
Agronet	Minagricultura	digital advisory	in redesign	various
Agropréstamo	Solidaridad	agri DFS	active	palm oil, cocoa, coffee
AgroSecurity	AgroSecurity	agri DFS	active	various
Agrosmart	Agrosmart	digital advisory, smart farming	active	coconut
AgroTeConecta	Minagricultura	digital advisory	inactive	various
Agroune	Agroune	agri DFS	active	exotic fruits
Agruppa	Agruppa	agri e-commerce	inactive	fresh produce

SOLUTION	PROVIDER(S)	USE CASE(S)	STATUS	VALUE CHAINS
AHoRa	Agrosavia	digital advisory	active	banana, plantain
AlimenTro	Agrosavia	digital advisory	active	livestock
App del Café	FNC	digital advisory	active	coffee
Asohofrucol-FNFH WhatsApp groups	Asohofrucol-FNFH	digital advisory, agri e-commerce	active	fresh produce
Bees for Coffee	Nestlé Nespresso, UBEES, World Bank	smart farming	active	apiary
Beyco	Progreso Foundation	agri e-commerce	active	coffee
Bico	Banco Agrario	agri DFS	active	various
Bloomspal	Bloomspal	agri e-commerce	active	flowers
Boletín Semanal	IDEAM	digital advisory	active	various
Cacao+Sostenible	Swisscontact, Movii	agri DFS	active	cocoa
Café Paga	NKG Caribecafé, Movii, Mastercard, Fundación Capital	agri DFS	inactive	coffee
Café Seguro	Blue Marble, Seguros Bolívar, Nespresso	agri DFS	active	coffee
Campo Seguro	Seguros Bolívar, MiCRO, Fundación delamujer	agri DFS	active	various
Cargill Delivery (WhatsApp delivery)	Cargill	agri e-commerce	unknown	inputs
Cédula Cafetera Inteligente	FNC	agri DFS	active	coffee
Celotor	Celotor	smart farming	active	livestock
CEPAL-DNP (dept. of Huila)	CEPAL, DNP, Huila government	digital advisory	active	fresh produce, bees, fish
CEPAL-DNP (dept. of Risaralda)	CEPAL, DNP, Risaralda government	digital advisory	active	plantain, cocoa, avocado
CheckIT	Yara	digital advisory	active	various
Coffee Club	Yara	digital advisory	active	coffee
COLCO	Catapult, Fedecacao, UK government	digital advisory, smart farming	in development	cocoa
Colombia es Cacao	Fedecacao, Croper.com	agri e-commerce, digital procurement	active	cocoa
Comproagro	Comproagro	agri e-commerce	active	fresh produce
Comunidad Virtual Ganadera	Fedegan	digital advisory	active	livestock

SOLUTION	PROVIDER(S)	USE CASE(S)	STATUS	VALUE CHAINS
Control Ganadero	Apptank	digital advisory, farm management	active	livestock
Cosecha Más	Agrapp	agri DFS, digital advisory	active	exotic fruits
Crédito Agropecuario	crezcamos	agri DFS	active	various
croper.com	croper.com	agri e-commerce	active	inputs
CSICAP	CIAT, Federations, Green Climate Fund,	digital advisory	in development	banana, plantain, coffee, corn, livestock, rice, panela cane, potato, sugar cane
Cultivando Futuro	Cultivando Futuro	digital advisory	inactive	various
CultivoRed	MásPorTIC	digital advisory	active	various
DECISIÓN	Finagro	agri DFS	active	various
DieTro	Agrosavia	digital advisory	active	livestock
Digitalization of Small-Scale Agriculture	CIAT, Visualiti, Fontagro	smart farming	completed pilot	coffee, corn, beans
Dimitra	Dimitra, Agrosavia	farm management	active	livestock
Dr. Agro	Agrosavia	digital advisory	active	cotton, mango, tomato, potato, rubber
e-kakashi	CIAT	smart farming	inactive	rice
El Campo Innova	Minagricultura, ICA	digital advisory	in development / pre-launch	various
Establecimiento	Agrapp	agri DFS	active	exotic fruits
Extension Solution	Solidaridad	digital advisory	active	various
Farmapp	Farmapp	smart farming	active	flowers
Fedepalma weather station	Fedepalma	digital advisory	in development / pre-launch	palm oil
Fenalcheck	Fenalce, Minagricultura, CIAT	digital advisory	active	maize
FincaYa!	FincaYa!	agri e-commerce	active	fresh produce
Frubana	Frubana	agri e-commerce	active	fresh produce
Fruktal	Fruktal	agri e-commerce	inactive	fresh produce
Fruvi	Fruvi	agri e-commerce	active	fresh produce
Fundación Luker survey tool	Fundación Luker	farm management	active	cocoa

SOLUTION	PROVIDER(S)	USE CASE(S)	STATUS	VALUE CHAINS
Fundación Luker farm management tool	Fundación Luker	farm management	active	cocoa
Fundación Luker digital extension	Fundación Luker	digital advisory	active	cocoa
Galapp	Galapp	digital procurement	active	fresh produce
GoFruver	GoFruver	agri e-commerce	active	fresh produce, livestock
Gramor	Gramor	agri e-commerce, agri DFS	active	various
Hit Social	Postobón	digital procurement	active	fruits
Hola Préstamo	4Told Fintech	agri DFS	inactive	palm oil
HornillApp	Agrosavia	digital advisory	active	panela cane
IncluirTec	IncluirTec	agri DFS	active	various
Indicadores de Rendimiento	FNC	digital procurement	active	coffee
Inspira Farms	Inspira Farms	smart farming	active	fresh produce, flowers
Inversión Protegida	SBS Seguros, MiCRO, Bancamía	agri DFS	active	various
Jokr (which acquired Plaz)	Joker (Plaz)	agri e-commerce	inactive	fresh produce
Kanpo	Kanpo	digital advisory, agri e-commerce	in redesign	coffee, cocoa, fresh produce
Koshcampo	Koshcampo	agri e-commerce	active	fresh produce
La Mayorista	La Mayorista	agri e-commerce	active	fresh produce
Linkata	Agrosavia	digital advisory	active	various
Lunagro	Universidad de Caldas	digital advisory	inactive	various
Manejo Agronómico	Cenicafé	digital advisory	active	coffee
MaPa	Agrosavia	digital advisory	active	various
Mariana	Finagro	agri DFS	in development / pre-launch	not yet determined
Más Bienestar	Agrosavia	digital procurement	active	livestock
Más Calidad	Cenicafé	digital advisory	active	coffee
Melisa	CIAT	digital advisory	active	corn
Mercavíva	Mercavíva	agri e-commerce	active	fresh produce
Mi Siembra Segura	UNDP, MiCRO	agri DFS	active	various

SOLUTION	PROVIDER(S)	USE CASE(S)	STATUS	VALUE CHAINS
Movicuenta	Banco Agrario	agri DFS	active	various
Mucho	Mucho	agri e-commerce	active	fresh produce
Mundo Cacao	Nutresa	digital advisory	active	cocoa
Ofercampo	Ofercampo	agri e-commerce	active	fresh produce
OFIS	Olam	digital procurement	active	coffee
Olam Traceability	Olam	digital procurement	active	coffee
Phaxsi Solutions	Phaxsi Solutions	smart farming	unknown	various
Plagapp	Plagapp	digital advisory	inactive	various
Plan Vivo	Solidaridad, Microsoft ACORN, Rabo	digital procurement	active	coffee, cocoa
Plaza en Vivo	Plaza en Vivo	agri e-commerce	active	fresh produce
PlusPlus	Federación Campesina del Cauca, Solidaridad	agri DFS	active	coffee
Raíces	Raíces	agri e-commerce	inactive	fresh produce
RiceClimaRemote	Agrosavia, UNIBAGUÉ	smart farming	pilot	rice
RUMECA	RUMECA	agri e-commerce	active	fresh produce
Satelligence	Solidaridad, Satelligence, Fedepalma	farm management	active	palm oil
Segugan	Apptank, Fedegan	agri DFS	in redesign	livestock
Seguro Agrícola	TúPrimero, Croper.com	agri DFS	active	various
Seguro Avícola	TúPrimero, Croper.com	agri DFS	active	livestock
Seguro Bovino y Bufalino	TúPrimero, Croper.com	agri DFS	active	livestock
Seguro Climático	MAPFRE	agri DFS	active	various
Seguro Equino	TúPrimero, Croper.com	agri DFS	active	livestock
Seguro Paramétrico	Banco Agrario, Cardif Seguros Generales	agri DFS	active	various
Seguro Porcícola	TúPrimero, Croper.com	agri DFS	active	livestock
Seguros de Lluvia	crezcamos	agri DFS	active	various

SOLUTION	PROVIDER(S)	USE CASE(S)	STATUS	VALUE CHAINS
Servicio de Diagnóstico y Monitoreo	Yara	digital advisory	active	palm oil, livestock, coffee
SiembraCo	SiembraCo	agri e-commerce, digital advisory, agri DFS	active	fresh produce
SiembraViva	SiembraViva	agri e-commerce, digital procurement	inactive	fresh produce
Sioma	Sioma	smart farming	active	banana, plantain, palm oil
SIGRA	UPRA	digital advisory	active	various
SIPRA	UPRA	digital advisory	active	various
SIRIA	Fenalce	digital advisory	active	maize
SISPA Móvil+	Fedepalma	digital advisory	in redesign	palm oil
Smart Agro 4.0	Telefónica, FAO	smart farming	completed pilot	potato, coffee
SMS/Integrity	ECOM	digital procurement	active	coffee
SNUIRA	UPRA	digital advisory	active	various
Sosty	Sosty	agri DFS	active	livestock
Sumercé	RAP-E	agri e-commerce	active	various
TankMix IT	Yara	digital advisory	active	various
Tranquilidad Rural	Interactuar, Seguros Bolívar, Blue Marble	agri DFS	active	various
Trazabilidad Bovina	Nutresa	farm management	active	livestock
Tumaini	CIAT	digital advisory	active	banana
TuPlaza	TuPlaza	agri e-commerce	active	fresh produce
Un Mensaje Por el Campo	RARE, PxD	digital advisory	active	coffee, cocoa, plantain, citrus
Visualiti	Visualiti	smart farming	active	various
Vive	Vive Agro	agri e-commerce	active	fresh produce
Waruwa	Waruwa	agri e-commerce	active	fresh produce
Waspmote Plug & Sense	Libelium, Red Tecnoparque, SENA	smart farming	completed pilot	banana

APPENDIX 3: ADDITIONAL RESOURCES

MACRO INDICATORS

- DANE, Demografía y Población.
- World Bank Data, Colombia.
- ILO, ILOSTAT.

FOOD AND AGRICULTURE:

- FAO FAOSTAT, Food and agriculture indicators.
- World Bank (2021), Agriculture, forestry and fishing value added (% of GDP).
- Bancolombia (2023), Sector agropecuario.
- Mincit (2023), Informe de Exportaciones de Colombia, Diciembre 2022.
- Minagricultura, DANE (2016), 3er Censo Nacional Agropecuario.
- OPSAa, IICA, Atlas for Agriculture in the Americas.

USAID RESOURCES:

- USAID, DAI (2022), Digital Ecosystem Framework.
- USAID (2020), Digital Ecosystem Country Assessment (DECA) Colombia.
- USAID, Bill and Melinda Gates Foundation, DAI, Development Gateway, Athena Infonomics, Farmer-Centric Data Governance: Towards a New Paradigm.
- USAID (2022), Localization: Catalyzing and Supporting Local Change.
- USAID (2022), Country Development Cooperation Strategy.
- USAID (2018), Colombia Land and Rural Development Program.
- USAID (2020), RED-Rural Finance Initiative.
- USAID, Mastercard, StartPath Empodera.
- USAID (2023), The Cacao Effect.

DIGITAL INFRASTRUCTURE AND SERVICES IN COLOMBIA:

- Andi (2020), Colombia un país digital.
- DANE (2023), Encuesta Nacional de Calidad de Vida, 2022
- DANE (2022), Encuesta de Tecnologías de la Información y las Comunicaciones en hogares, 2021
- Bayer, CAF Development Bank of Latin America and the Caribbean, IICA, Microsoft, Syngenta, World Bank (2022), Rural Connectivity in Latin America and the Caribbean

- Mintic, Indicadores.
- ITU, ICT Indicators.
- Mintic, Conecta TIC.
- CRC (2023), El rol de los servicios OTT: 2022.

DIGITAL FINANCIAL SERVICES IN COLOMBIA:

- UNDP Insurance and Risk Finance Facility (2023), Inclusive insurance and risk financing in Colombia: Snapshot and way forward 2023.
- Banca de las Oportunidades (2022), Encuesta de demanda de inclusión Financiera.
- AsoBancaria (2022), Análisis de la inclusión financiera en áreas rurales en Colombia.
- Better than Cash Alliance (2022), Colombia's Ingreso Solidario: Improving social protection through public-private collaboration and responsible digital payment practices as part of COVID-19 emergency response.

DIGITAL AGRICULTURE FRAMEWORKS AND TRENDS:

- CAF Development Bank of Latin America and the Caribbean (2020), Estrategia para la transformación digital de los sectores productivos en América Latina.
- AgFunder, AgFunder News, SP Ventures (2023), Latin America AgriFoodTech: Investment Report 2023.
- ADR, Soluciones Digitales para el Campo.
- GSMA, IDB Lab (2020), Landscaping the agritech ecosystem for smallholder farmers in Latin America and the Caribbean.
- GSMA (2022), Assessment of smart farming solutions for smallholders in low and middle-income countries.

GENDER AND INCLUSIVITY:

- DANE, Minagricultura (2023), Situación de las Mujeres Rurales en Colombia, 3era Edición.

PDET REGIONS:

- BAPP (2022), Informe de Seguimiento a la Implementación de los PDET.
- ART, FAO, Plan Maestro de Estructuración.
- ART, Municipios PDET Subregiones.

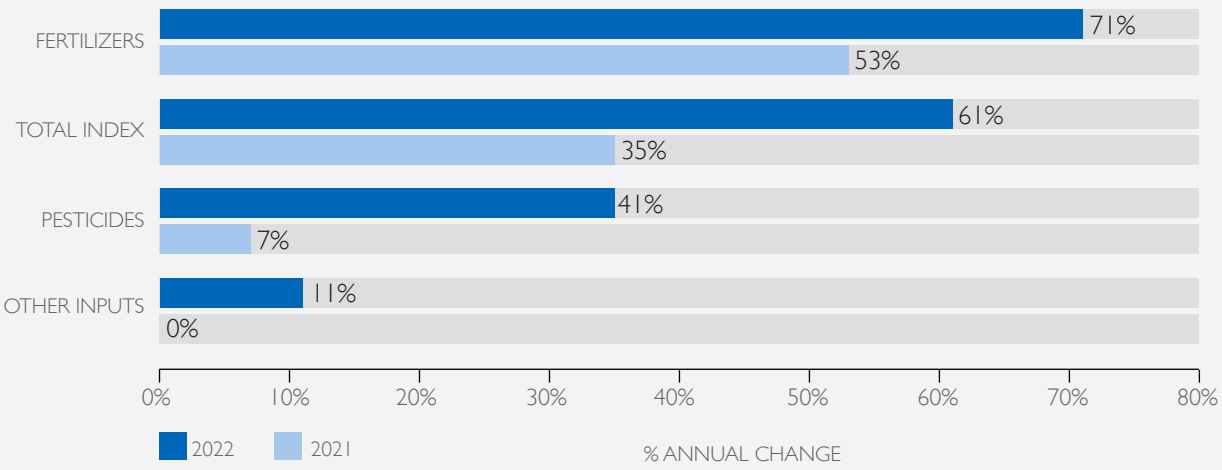
CLIMATE

- IDEAM, Climate Data.

APPENDIX 4: IMPACT OF THE WAR IN UKRAINE ON INPUT PRICES IN COLOMBIA

One of the main global political events impacting Colombia's agriculture industry has been the recent war in Ukraine. Roughly 20% of Colombia's fertilizer comes from Ukraine, which means that fertilizer prices in Colombia, as elsewhere, have risen steadily since the onset of the war (see **Figure 4-1**).

FIGURE 4-1: ANNUALIZED CHANGE IN INPUT PRICES DURING THE 12 MONTHS LEADING UP TO SEPTEMBER 2022 AND SEPTEMBER 2021



SOURCES: UPRA, La República.[171]

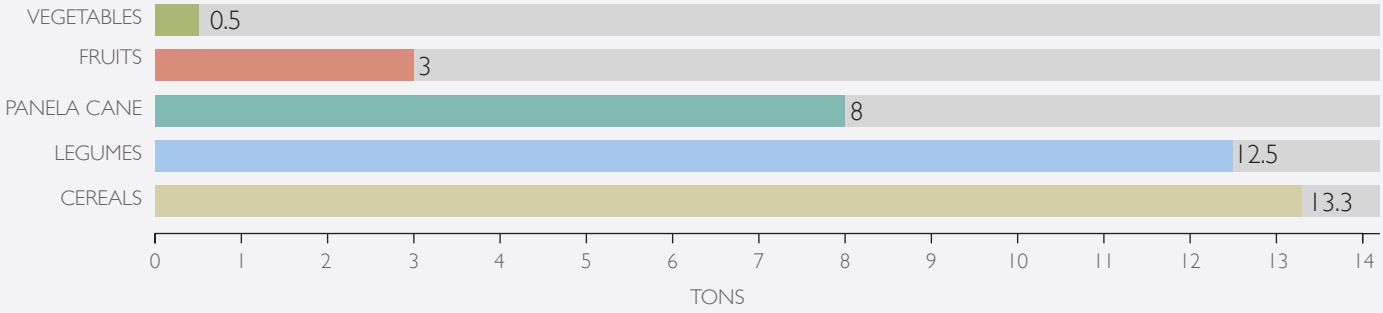
A study by the National University concluded that around 250,000 smallholder farmers were in need of relief from the rising price of inputs. In response, Colombia's government passed Law 2183 in 2022, creating the Fund for Access to Agricultural Inputs, which provides smallholder farmers with a subsidy on the purchase of inputs (see **Figure 4-2**).

FIGURE 4-2: HIGHLIGHTS OF THE FUND FOR ACCESS TO AGRICULTURAL INPUTS, COLOMBIA

WHAT IS IT?	Subsidy of up to 20% on the cost of inputs
FUNDS AVAILABLE	Up to COL80,000m (US$17.2m)
TIMEFRAME	November 17, 2022 – March 31, 2023
PARTNERS	Banco Agrario Mayoral offices Agricultural input stores (over 11,000 nationwide)
GEOGRAPHIC COVERAGE	Nationwide
VALUE CHAINS ELIGIBLE	19 agricultural value chains 5 livestock value chains

171 La República (2022), "Alza de precios de insumos para el agro llegó a 29.4%, con fertilizantes de líderes."

FIGURE 4-3: MAXIMUM PRODUCTION ALLOWED (IN TONS) TO PARTICIPATE IN SUBSIDY, BY VALUE CHAIN



SOURCES: Minagricultura, La República.[172]

"The increase in price for fertilizers and other inputs used in the production of potatoes is between 25 and 30%. It is much more expensive and difficult to achieve profitability. The cost of growing one hectare of potatoes has increased from COL22m to COL34m in just one year."

- Fedepapa

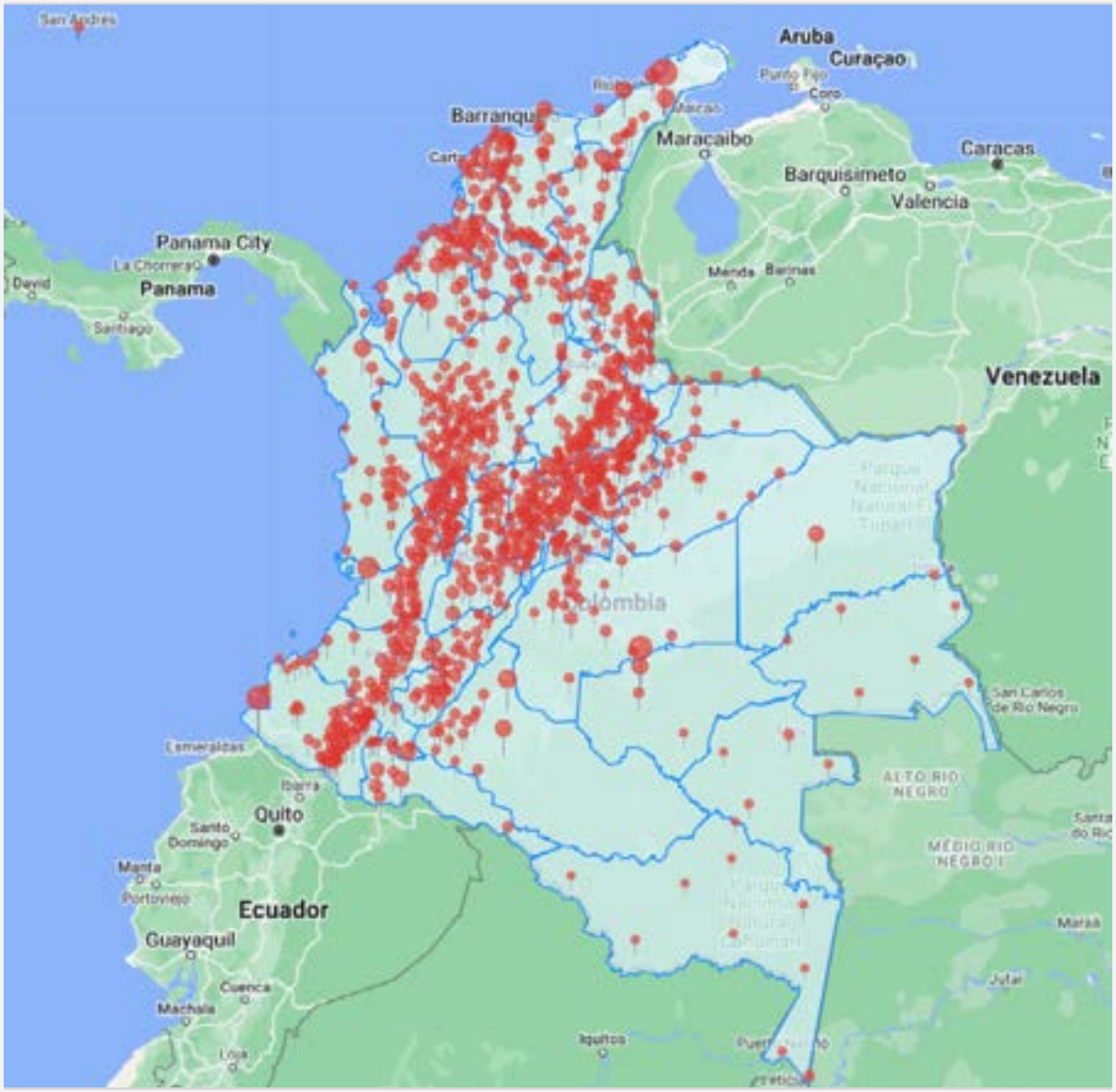
"The price of the balanced and concentrated fertilizers has increased around 200% in the last year and a half. The price of maize has also increased significantly. Although international prices have stabilized, the inputs needed to produce milk in Colombia continue to increase at 20%."

- Fedegan

172 La República (2022), "Alza de precios de insumos para el agro llegó a 29.4%, con fertilizantes de líderes."

APPENDIX 5: COLOMBIA'S DIGITAL CENTERS

FIGURE 5-1: MAP OF COLOMBIA'S DIGITAL CENTERS AS OF JULY 2023

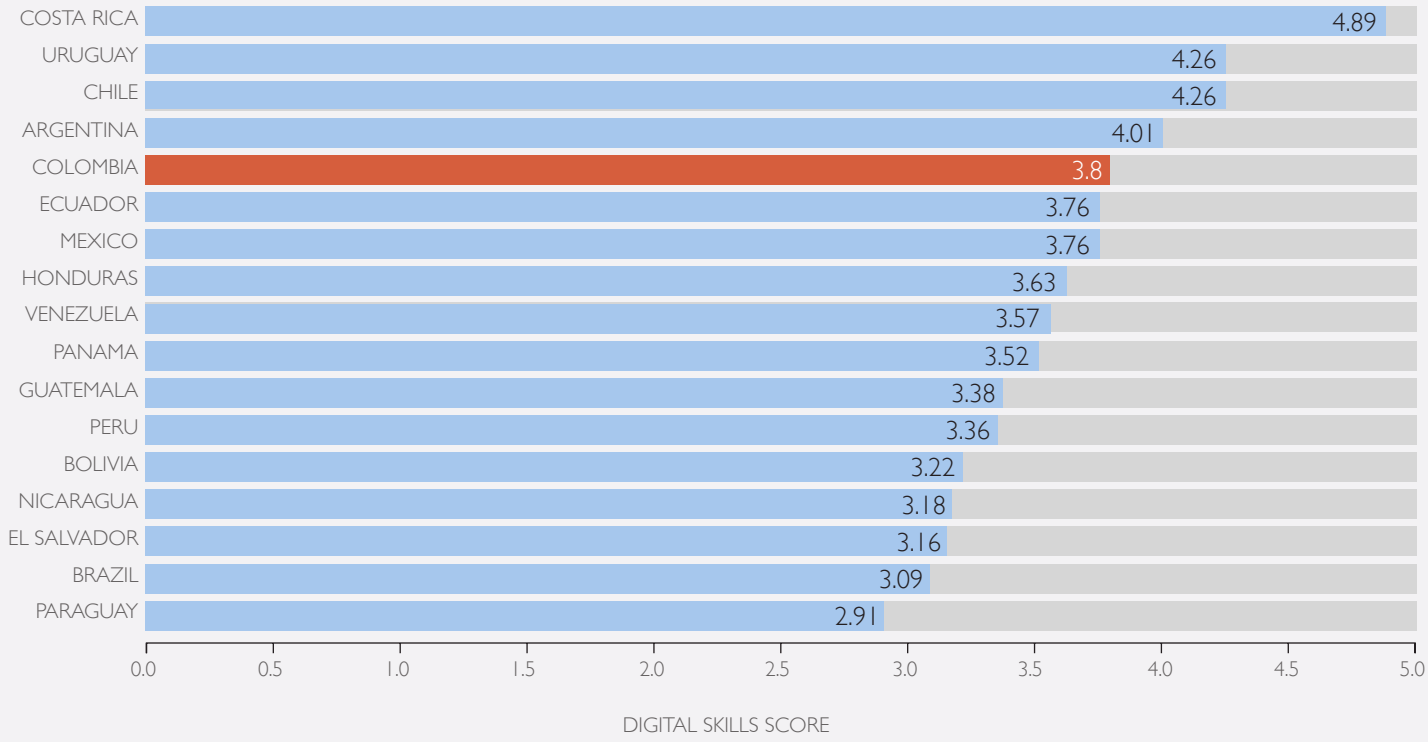


SOURCE: Mintic.[173]

173 Mintic (2023), Centros Digitales.

APPENDIX 6: DIGITAL SKILLS

FIGURE 6-1: DIGITAL SKILLS IN SELECTED LATIN AMERICAN COUNTRIES



NOTE: The digital skills score measures the extent to which digital skills (computer, basic coding, digital reading) have been adopted by the economically active population, with a score of 0 suggesting "not at all" and a score of 7 suggesting "to a great extent."[174]

SOURCES: Google, World Bank, World Economic Forum Global Competitiveness Index. [175]

174 Google (2019), The Digital Sprinters: Driving Growth in Emerging Markets.
175 World Bank (2019), GCI 4.0: Digital Skills Among Population.

APPENDIX 7: SELECTED DIGITAL LITERACY TRAINING INITIATIVES IN COLOMBIA

FIGURE 7-1: SELECTED DIGITAL LITERACY TRAINING INITIATIVES IN COLOMBIA

AGRO + MUJERES + TIC	
PARTNERS	Universidad Autónoma de Manizales Manizales Mayor's office
BENEFICIARIES	~40 rural women and youth
REGIONS	Caldas
DESCRIPTION	Agro + Mujeres + TIC will provide leadership, entrepreneurship, and digital skills training to ~40 rural women and youth in Manizales. The initiative will support three rural enterprises emerging from the training.

HIT SOCIAL POSTOBÓN	
PARTNERS	Postobón (beverage company) WOM (mobile operator)
BENEFICIARIES	~300 fruit farmers participating in Hit Social Postobón
REGIONS	Bolívar, Santander, Tolima, Huila
DESCRIPTION	WOM will provide digital literacy training and connectivity to ~300 fruit farmers participating in Postobón's Hit Social program. Training will center around the use of devices, the use of mobile services and applications (like WhatsApp), the use of social networking, digital marketing, and entrepreneurship. WOM Is also installing 50 network access points in community centers supporting Hit Social farmers.

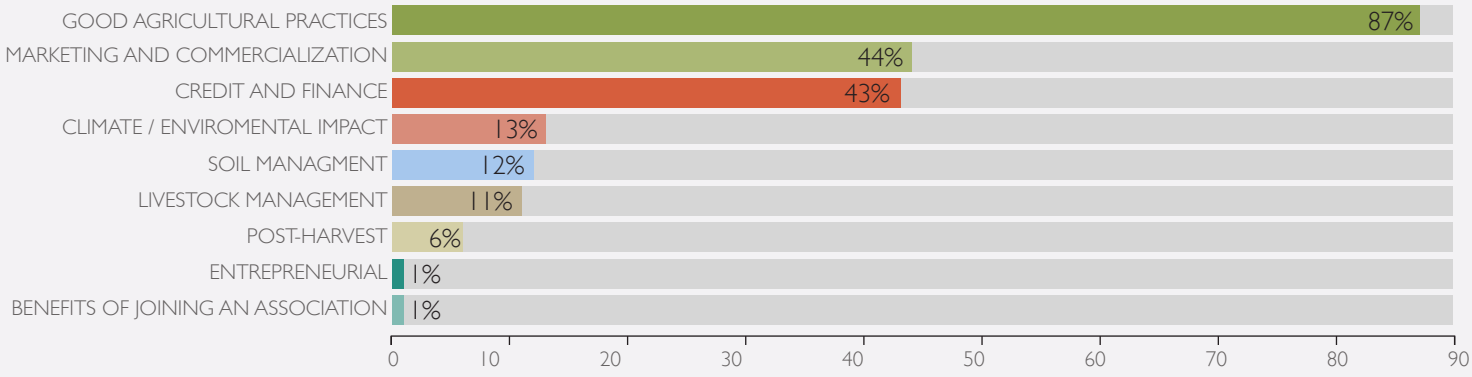
1-2-3 POR TIC, CULTIVO RED	
PARTNERS	MásPorTIC Fundación Bancolombia Fundación Loma Alta
BENEFICIARIES	~300 rural farmers ~60 youth
REGIONS	Antioquia, Cundinamarca, Norte de Santander, Santander, Tolima, Nariño, Bolívar, Arauca, Huila, Putumayo, Chocó, Caldas, Atlántico, Boyocá, Santander, Caquetá
DESCRIPTION	MásPorTIC offers camps through rural schools to provide digital literacy and entrepreneurship to young people. It also provides digital literacy and ICT training to ~300 farmers through the Cultivo Red digital tool.

RED EMPRENDE RURAL	
PARTNERS	Bayer Solidaridad
BENEFICIARIES	~500 small-scale farmers in Colombia and Costa Rica
REGIONS	Boyocá
DESCRIPTION	The pandemic disproportionately impacted employment among women, youth and people in rural areas. To address this, Bayer and Solidaridad teamed up to offer entrepreneurial skills training to smallholder farmers in Costa Rica and Colombia. Skills training is targeted at women and youth. Early programs in Colombia focused on association building and entrepreneurship in dairy farming.

SOURCES: MásPorTIC, Postobón, World Economic Forum, Bayer, Solidaridad. [176]

APPENDIX 8: AGRICULTURAL EXTENSION SERVICES IN COLOMBIA

FIGURE 8-1:
LEADING TYPES OF AGRICULTURAL EXTENSION SUPPORT RECEIVED BY FARMERS IN COLOMBIA



SOURCES: Minagricultura, DANE. [177]

176 World Economic Forum, "Agro+Mujer+TIC."
177 Minagricultura and DANE (2016), 3er Censo Nacional Agropecuario.