



# Landscaping the agritech ecosystem for smallholder farmers in Latin America and the Caribbean



## GSMA AgriTech Programme

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# Executive summary

Agriculture is an important source of employment in Latin America and the Caribbean, particularly in rural areas where 54.6 per cent of the labour force is engaged in agricultural production. The region is an important source of food globally, generating 13.6 per cent of total agricultural exports. Thanks to a wealth of natural resources and a vast and varied topography capable of producing a range of crops, Latin America is becoming known as the breadbasket of the world.

Although much of Latin America shares the same language and cultural heritage, the structure and scale of the agriculture sector vary significantly from country to country. Southern Cone countries are characterised by capital-intensive, highly-mechanised farming of export crops, while Central American and Andean countries rely much more on smallholder farming for crop production.

Several barriers have prevented the region's agriculture sector from achieving its full potential, including some of the world's lowest productivity levels, low financial inclusion and a lack of resilience to external shocks, such as those caused by climate change and the global COVID-19 pandemic. Recognising the positive impact that digital agriculture tools can have on productivity, incomes and resilience to climate change, agriculture-sector stakeholders throughout Latin America are implementing a range of tools aimed at easing pain points and benefiting those in the agricultural value chain, both on the supply and the demand side.

The GSMA AgriTech team examined 131 digital agriculture tools deployed throughout Latin America that are addressing the challenges of smallholder farmers. We looked at five use cases: **digital advisory, agri digital financial services (DFS), digital procurement, agri e-commerce and smart farming**. Several key trends emerged from this review:

- **Latin America's digital agriculture tools have failed to reach the scale of those in Asia and Africa.** Most digital agriculture services available in Latin America today are led by governments or NGOs and have between 1,000 and 5,000 users, making them difficult to sustain long term.
- **Smallholder farmers in Latin America are increasingly looking for holistic solutions** that address a range of farmer challenges, from knowledge gaps and low productivity to financial exclusion, climate change and poor access to markets.

- **New technologies, such as IoT sensors, drones, satellites, AI and big data, are increasingly underpinning digital agriculture tools in the region.** IoT sensors, drones and satellites are automating data collection, making the process more efficient and accurate for ecosystem players. Meanwhile, AI and big data analytics are enabling richer, more personalised and actionable data for smallholder farmers to increase production and decrease costs.
- **Blockchain is being used for agri DFS and digital procurement.** Heifer International, EthicHub, COOPSOL and other organisations are taking advantage of the transparency, security, speed and low-cost offered by blockchain to facilitate loans between lenders and smallholder farmers, provide traceability to crop buyers and support land registration.
- **Colombia has emerged as an agritech innovation hub for smallholder farmers in Latin America.** This has been due to a confluence of factors, including a strong (by regional standards) DFS ecosystem, an enabling regulatory environment, a robust start-up and investment culture, rising incomes and a relatively strong middle class. In Central American countries and Bolivia, where the opportunity for digital agriculture innovation is as strong due to the prevalence of smallholder farming, the sector has suffered from a less enabling and comparatively weaker environment.

The GSMA AgriTech team's research highlighted two opportunities in digital agriculture that could address farmers' low productivity and access to financial services in the short to medium term. These include:

- **Smart farming tools:** Over the last two years, smart farming pilots for smallholders in Latin America have shown promising results, with production increases as high as 50 to 80 per cent, and cost reductions of 20 to 40 per cent. Despite these benefits, few smart farming solutions have moved from the pilot phase to commercial viability. Implementation costs are the main barrier, including the cost of equipment (sensors, gateways, drones) and the cost of on-going connectivity (sensors powered by cellular data).
- **Using farmer data from digital agriculture tools to extend financing to smallholders:** Smallholder farmers in Latin America face significant gaps in short- and long-term financing, both for agricultural and non-agricultural financial needs. Access to credit from formal financial institutions requires an economic identity<sup>1</sup> that most smallholder farmers do not have, but mobile-based digital agriculture tools can generate digital financial footprints populated with farm and farmer data. This data can be used to perform credit risk assessments thus offering a pathway to financial inclusion for farmers. This offers huge potential to bridge the data gap in smallholder financing and open a pathway to financial inclusion. Digital tools that enable farmers to access markets, such as digital procurement solutions and e-commerce services, are especially useful in generating rich data sets, such as transactional data from the sale of crops.

This publication is the output of a project funded by IDB Lab for the benefit of smallholder farmers in Latin America and the Caribbean. The IDB Lab promotes agritech innovation and entrepreneurship ecosystems to support access to markets, services and agricultural assets for farmers. The study is part of this endeavour to better understand technological solutions and opportunities in agriculture that will allow IDB Lab to support strategies and investments with social and economic impact and expand the agritech ecosystem in the region. The report features innovations aimed at smallholder farming, particularly in countries of Central America and the Andean region, thus bridging the information gap left by much of the literature to date.

<sup>1</sup> An economic identity is a dynamic citizen profile that captures an individual's life events, assets and transaction history. For farmers, digitising the procurement of crops helps to establish an economic identity through transactional data from the sale of agricultural produce. In combination with other farm and farmer data, this data opens up full financial inclusion to farmers, including access to credit, savings and insurance products.



# 1 Introduction

By 2050, the world's population is slated to increase by more than two billion.<sup>2</sup> A growing population, combined with shifting consumption patterns driven by urbanisation and a growing middle class, mean that global agricultural production will need to be 50 per cent higher in 2050 than in 2012 to meet demand.<sup>3</sup> This increase in production must happen in the context of a changing climate and unsustainable pressure on land and other natural resources, such as fresh water.

To meet this challenge, agrifood systems will need to become more productive, cost efficient, transparent, sustainable and resilient to external shocks, such as those driven by climate change. Smallholder farmers, who manage 80 per cent of the world's arable land and 60 per cent of food production,<sup>4</sup> are especially vulnerable to these shocks. They will need to adopt new agricultural production processes while also grappling with limited access to agricultural information and assets, financing and markets.

Perhaps there has been no greater shock to the global food supply chain in recent years as the COVID-19 pandemic. Border closures, disruption of domestic and international logistics networks and declining demand, have all had a significant impact on agricultural supply chains, and potentially devastating implications for the roughly 500 million households globally that rely on agricultural production for their livelihoods.<sup>5</sup> COVID-19 has made it more urgent than ever to transform the ways current food systems operate to become more agile and resilient in the face of unforeseen events.

Agriculture sector growth is critical not only for supporting farmer livelihoods, but also for driving overall economic growth in rural areas. According to the World Bank, agriculture sector growth is two to three times more effective at reducing poverty than equivalent growth generated in other sectors like mining, manufacturing and services.<sup>6</sup> Two of the main vehicles for driving agriculture sector growth are higher productivity levels and greater financial inclusion.

In Latin America and the Caribbean, the agriculture sector has made important productivity gains over the last two decades. However, these gains have been uneven and largely concentrated in countries like Brazil and Uruguay, which are characterised by capital-intensive, large-scale farms that are among the world's leading producers of soy, sugar, grains, orange juice and beef. Countries like Bolivia, Guatemala, Nicaragua, Honduras, El Salvador and Peru report lower productivity levels, due in large part to the predominance of subsistence farming. The reported value-add per agricultural worker in these countries is

2 United Nations (2018), *World population set to grow another 2.2 billion by 2050: UN survey*.

3 ECLAC, FAO, IICA (2019), *The Outlook for Agriculture and Rural Development in the Americas: 2019-2020*.

4 FAO (2017), *The future of food and agriculture*.

5 Pshenichnaya, N. (2020), "Post COVID-19 business un-usual in agricultural value chains", GSMA Mobile for Development Blog.

6 Elsevier (2018), "Agriculture, structural transformation and poverty reduction: Eight new insights."

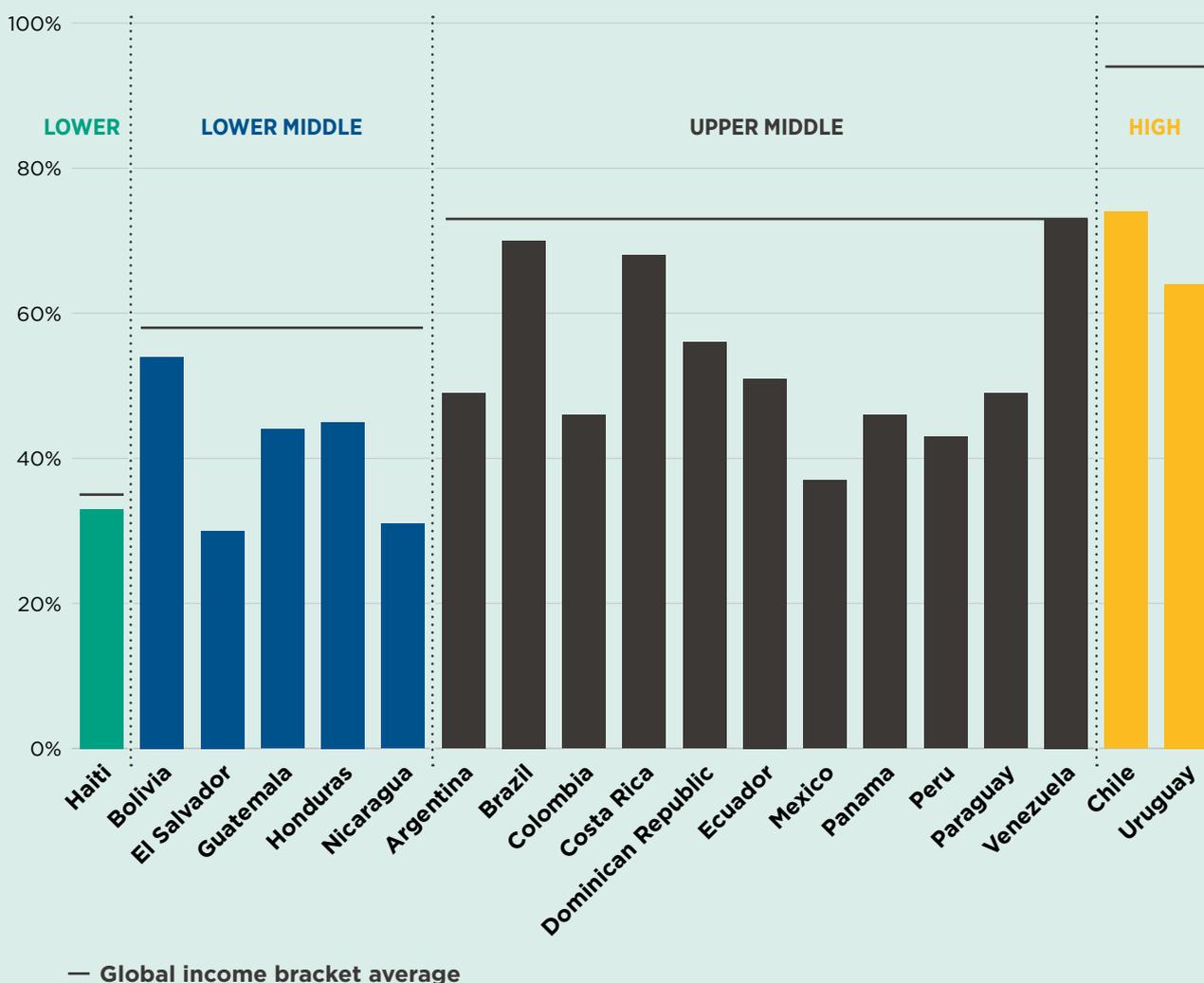
between one-seventh and one-fifth the levels in Brazil, and between one-fortieth and one-thirtieth the levels in the United States.<sup>7</sup>

Regional variations in Latin America and the Caribbean are not limited to productivity—they also extend to financial inclusion. Across the region, just over half (55 per cent) of adults in 2017 had an account with a bank,

other financial institution or a mobile money account.<sup>8</sup> However, in Chile, almost three-quarters of the adult population had an account compared to roughly a third in Nicaragua and Haiti.<sup>9</sup> Low levels of financial inclusion, in Nicaragua and elsewhere, prevent farmers from accessing the capital they need to purchase assets and upgrade equipment to reduce productivity gaps and increase their incomes.

Figure 1

### Account ownership at a financial institution or through a mobile money provider in selected countries in Latin America and the Caribbean, age 15+, 2017



Source: World Bank Findex

7 IICA (2018), *Atlas for Agriculture in the Americas*.  
 8 World Bank (2017), *Global Findex*.  
 9 Ibid.

Account penetration figures in Latin America are well below what the region's income levels would suggest, and well below African and Asian countries with similar income levels. Ghana, a lower-middle income country in Africa with a PPP-adjusted gross domestic product (GDP) per capita of \$4,997, had an account ownership rate of 58 per cent in 2017.<sup>10</sup> Meanwhile, Nicaragua, which has a higher PPP-adjusted GDP per capita level of \$6,004, had an account ownership rate of just 31 per cent in 2017.<sup>11</sup> This disparity is due primarily to more limited adoption of mobile money services in Latin America. Kenya, considered a first mover in the roll-out of mobile money services, enjoyed an account ownership rate of 82 per cent in 2017 despite having a PPP-adjusted GDP per capita of only \$4,046.<sup>12</sup>

The need to improve productivity has prompted the rise of agritech innovation hubs in the Southern Cone,<sup>13</sup> particularly in Brazil. Embrapa, Brazil's Agricultural Research Corporation, a division of the Ministry of Agriculture, has been a key driver in Brazil's transformation into a leading global exporter of agricultural products. The city of Piracicaba in the State of São Paulo is known as Latin America's Silicon Valley of agriculture and is home to the Agtech Garage, which brings together 350 agritech start-ups under the guidance of several of the largest agriculture ecosystem players in the world.

Much of the innovation coming out of the Southern Cone has been focused on large-scale farming, and has not necessarily been applicable to smallholder farmers, which account for the bulk of production in Central America, and in Colombia, Bolivia, Ecuador and Peru. Agritech innovation that focuses on meeting the needs of smallholders has been hampered by lack of access to finance.

Some regional organisations, such as the Inter-American Institute for Cooperation in Agriculture (IICA), Sustainable Agriculture, Food and Environment Platform (SAFE) and the Consultative Group on International Agricultural Research (CGIAR), as well as country-based groups such as the International Center for Tropical Agriculture (CIAT, part of CGIAR) and Colombia's National Learning Service (SENA), have taken the lead in supporting innovations aimed at smallholders. These groups, based near research or university centres, are working alongside donors and non-governmental organisations (NGOs) such as the European Union, USAID, IDB Lab, Solidaridad, Heifer International, Grameen Foundation and Lutheran World Relief, to disrupt the digital space for the benefit of smallholders.

Impact investors outside the Southern Cone have also emerged, including Acumen (South America), Grassroots Capital (Central America) and Pomona Impact (Central America). In contrast to Africa and Asia, the region's leading MNOs have played a less prominent role in the roll-out of agritech innovations, although Telefónica's Wayra<sup>14</sup> has been involved in financing some early agritechs, including Celotor and Agruppa.

10 Ibid.; World Bank Data (2019), "[GDP per capita, PPP \(current international \\$\) - Ghana](#)".

11 Ibid.; World Bank Data (2019), "[GDP per capita, PPP \(current international \\$\) - Nicaragua](#)".

12 Ibid.; World Bank Data (2019), "[GDP per capita, PPP \(current international \\$\) - Kenya](#)".

13 The Southern Cone region includes Argentina, Brazil, Chile, Paraguay and Uruguay.

14 Wayra, which is part of Telefónica's Connected Open Innovation area, helps to link technological disrupters with Telefónica to generate joint business opportunities. Wayra operates seven hubs in Europe and Latin America that reach the entrepreneurial ecosystems of 10 countries, including Argentina, Brazil, Chile, Colombia, Germany, Mexico, Peru, Spain, the United Kingdom and Venezuela. One of Wayra's key objectives is to help local entrepreneurs in these ecosystems achieve global scale. Telefónica Connected Open Innovation has a portfolio of over 500 active start-ups, 20 per cent of which are doing business with Telefónica. Available at: <https://www.wayra.com/wayra-hubs>

Figure 2

## Sources of funding and advisory for digital innovations aimed at smallholders in Latin America and the Caribbean

	Research groups & universities	Multinational agencies	Governments	NGOs & foundations	Multilateral investment funds	Impact investors	Incubators & accelerators	Technology companies
International	<ul style="list-style-type: none"> <li>CGIAR</li> </ul>	<ul style="list-style-type: none"> <li>FAO</li> </ul>	<ul style="list-style-type: none"> <li>EU</li> <li>USAID</li> <li>Taiwan ICDF</li> <li>Switzerland</li> <li>Canada</li> <li>USDA FAS</li> </ul>	<ul style="list-style-type: none"> <li>Lutheran World Relief</li> <li>Grameen Foundation</li> <li>Solidaridad</li> <li>Mercy Corps</li> <li>Mastercard Foundation</li> </ul>	<ul style="list-style-type: none"> <li>IDB Lab</li> <li>World Bank</li> <li>Desjardins</li> </ul>	<ul style="list-style-type: none"> <li>Oikocredit</li> <li>Rabobank</li> </ul>	<ul style="list-style-type: none"> <li>Wayra</li> <li>The Yield Lab</li> <li>Softbank</li> <li>Heifer International</li> </ul>	<ul style="list-style-type: none"> <li>IBM</li> </ul>
Regional	<ul style="list-style-type: none"> <li>Universidad de los Andes</li> <li>CIAT</li> <li>Tecnoparque</li> <li>CARDI</li> <li>SENA</li> </ul>		<ul style="list-style-type: none"> <li>APPS.CO</li> <li>Innóvate Perú</li> <li>Start-Up Chile</li> </ul>	<ul style="list-style-type: none"> <li>Acceso</li> </ul>		<ul style="list-style-type: none"> <li>Acumen</li> <li>Grassroots Capital</li> </ul>	<ul style="list-style-type: none"> <li>SP Ventures</li> <li>NXTP Ventures</li> </ul>	

Source: GSMA, organisations

This report shines a light on digital agriculture solutions deployed in the Latin America and Caribbean region. While much of the literature to date has focused on agritech innovations that address the challenges and opportunities of large-scale farmers in larger countries, such as Argentina and Brazil, this report features innovations that address the pain points of smallholder farmers, especially low productivity, financial exclusion and the impacts of climate change.

The report begins with an overview of global digital disruption trends in agriculture that are relevant to Latin America and the Caribbean. It then provides an

assessment of the agriculture sector in Latin America and the Caribbean, highlighting the importance of agriculture to the region’s economy and employment. Based on a detailed review of 131 digital agriculture tools aimed at smallholder farmers in Latin America and the Caribbean, the report provides a market mapping and landscape analysis of the most prominent cases of digital disruption, and highlights some of the major trends observed in five digital agriculture use cases. Drawing on lessons from digital tools employed to date, the report concludes with recommendations for future engagement that could deliver long-term, sustainable economic and social benefits.

### Methodology

The GSMA AgriTech team relied on a combination of primary and secondary research. Analysts conducted in-depth interviews with roughly 40 industry stakeholders, including agritechs, agribusinesses, MNOs, donors and investors. The team identified stakeholders behind the digital disruptions that are benefiting smallholder farmers throughout the region. Because of the travel restrictions imposed by the COVID-19 pandemic, interviews were conducted remotely using web-based platforms or telephone. The team conducted interviews with stakeholders in 10 different countries in the region, including Argentina, Brazil, Chile, Colombia, Costa Rica, Guatemala, Honduras, Mexico, Nicaragua and Peru, as well as with agritechs and donors based in Europe, India and the United States that

are developing digital agriculture tools in Latin America. In addition, the team participated in several virtual events focused on agritech innovation in Latin America.

Primary research was corroborated with internal and external secondary sources, both qualitative and quantitative. This includes internal sources like mobile industry data from GSMA Intelligence (GSMAi); an extensive library of GSMA reports, toolkits and market assessments; and the GSMA AgriTech Services tracker that aggregates industry data for over 700 agritech services deployed worldwide. External sources for this report include industry-recognised data sources, such as the World Bank, FAOSTAT, ILOSTAT, Global Findex Data and IICA, among others.



# 2 Digital innovation in agriculture: Global trends

Digital agriculture solutions have the potential not only to transform current food systems by making them more productive, cost efficient, transparent and agile; they also have the power to transform rural communities by improving farmer livelihoods and strengthening resilience to climate change. These tools also benefit the environment by giving users the ability to optimise their use of natural resources, implement sustainable practices, reduce waste and adapt to climate change.

For digital services to take root, an enabling environment of favourable regulation, entrepreneurship and ICT skills is required, as is capital to transform business concepts and trials into commercially viable, scalable business solutions. This section presents the spectrum of digital agriculture use cases that have emerged around the world, and the major trends observed in each of these use cases. The trends are derived from the GSMA's Digital Agriculture Maps 2020 State of the Sector in Low and Middle-Income Countries report, a tool to help practitioners understand emerging opportunities in digital agriculture, and support strategies and investments with social and commercial impact.<sup>15</sup> This section also presents some of the enabling factors that influence how these global trends are adapted to the Latin American context.

Hundreds of digital solutions have been introduced worldwide over the last 10 years to meet the challenges faced by different actors in agricultural value chains. Digital innovation in agriculture is wide

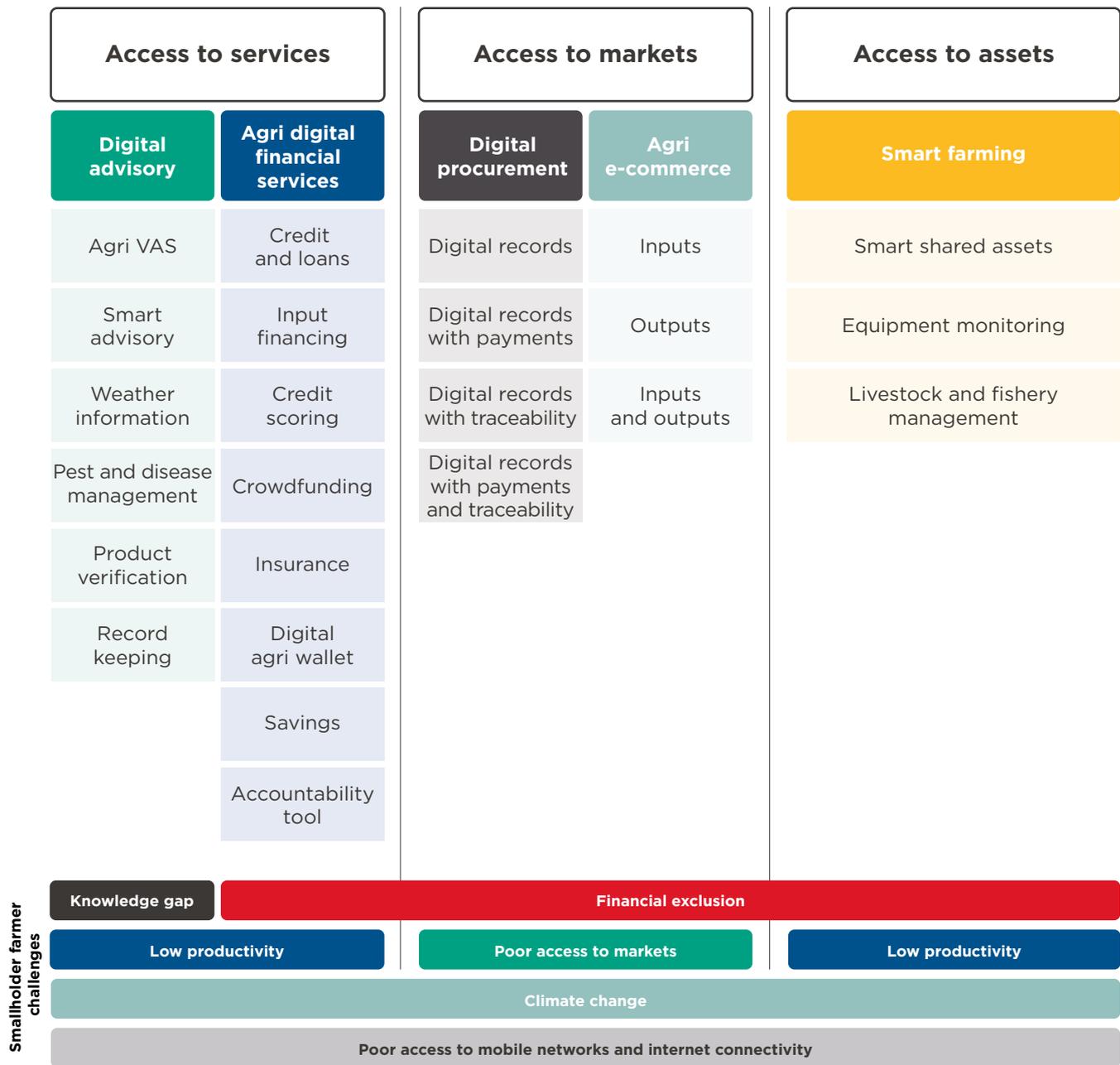
ranging, from low-tech solutions that rely on SMS, USSD and voice, to high-tech holistic tools that use satellites, drones, sensors, blockchain, artificial intelligence (AI) and big data analytics.

The GSMA maintains a tracker of over 700 digital agriculture solutions across low- and middle-income countries (LMIC) globally, segmented into three broad categories: access to services, access to markets and access to assets. These categories are further divided into five use cases and 24 sub-use cases that address challenges in the agriculture sector.<sup>16</sup> A particular use case, such as digital advisory services, can be supported with either low-tech or high-tech technologies, or even a combination of the two. Likewise, a specific technology solution can support multiple use cases. Satellites and drones are being leveraged to support smart farming solutions, as well as digital procurement and agri digital financial services (DFS) like credit scoring and insurance. For a full breakdown of digital agriculture use cases and their definitions, please refer to the Appendix.

<sup>15</sup> GSMA (2020), [Digital Agriculture Maps: 2020 State of the Sector in Low and Middle-Income Countries](#).  
<sup>16</sup> Ibid.

Figure 3

### Digital agriculture use cases and sub-use cases



Source: GSMA

## 2.1 Digital advisory



Digital advisory<sup>17</sup> services were among the first digital agriculture solutions aimed at smallholder farmers to emerge worldwide, primarily because many of the early services (e.g. market information and best practice guidelines) did not require a 3G connection. As a result, digital advisory services account for most commercially available digital agriculture tools—around 42 per cent according to the GSMA's latest estimates.<sup>18</sup> Sub-Saharan Africa and South Asia have emerged as innovation hubs for the development of various types of digital advisory services, in part due to the sheer number of farmers, but also because of the ubiquity

of mobile devices and the donors, impact investors and agritech companies actively promoting the use of digital technologies in these regions. In Latin America, digital advisory services also make up the largest proportion of digital agriculture interventions, with over 40 different services identified (see Section 4.1.1).

In the 2020 Digital Agriculture Maps report,<sup>19</sup> the GSMA AgriTech team identified several trends underlying the deployment and growth of digital advisory services throughout the world.

### TREND #1

Digital advisory services are provided by an array of ecosystem players

Many types of entities are engaged in the provision of digital agriculture advisory services, from government agencies and NGOs to agribusinesses, cooperatives, agritech companies, VAS providers and mobile network operators (MNOs). This is also the case in Latin America where digital advisory services are provided by governments, NGOs, agribusinesses and

agritechs (see Section 4.1.3). The business model employed depends largely on the objectives of the organisation providing the service. In most cases, the service is free for the farmer, with the cost of the service picked up by the government, an NGO, cooperative or agribusiness.

### TREND #2

Digital advisory services are expanding to address more pain points for farmers

As digital advisory services have become smarter, they have expanded beyond market prices, nutrition information and basic weather data to address the specific pain points of farmers. New digital tools are

enabling farmers to better manage pest and disease outbreaks, verify the authenticity of products such as seeds and fertilisers, keep digital records and, most recently, respond to challenges introduced by COVID-19.

<sup>17</sup> See the Appendix for a more detailed definition of digital advisory.

<sup>18</sup> GSMA (2020), *Digital Agriculture Maps: 2020 State of the Sector in Low and Middle-Income Countries*.

<sup>19</sup> Ibid.

**TREND #3**

Digital advisory services are becoming smarter with highly localised and granular insights

The growing availability of data, combined with the emergence of data analytics tools, such as AI, big data and machine learning, are making it possible for digital advisory services to provide farmers with more targeted insights and recommendations. In the early generation of services, general information on market prices, weather, nutrition and best practices were disseminated to a vast network of farmers using voice (e.g. IVR), text (e.g. Costa Rica’s Agromensajes), generic apps (e.g. WhatsApp) or specialised apps (e.g. Myanmar’s Site Pyo and Colombia’s Kanpo).

By integrating insights collected from a variety of sources, including satellite and drone imagery, hyper-local weather forecasts and on-field farm sensors, the quality of advisory services has improved. Large data sets can now be translated into specific recommendations on what crops to plant in a certain field, the most appropriate inputs for specific locations, the amount of fertiliser or pesticide to use, when to irrigate and optimal harvesting times. As more and more farmers begin to use smartphones, insights can be delivered through media-rich formats like video, making it easier for the farmer to understand the advisory and act on it.

Figure 4

**Differences between advisory and smart advisory services**

Advisory	Smart advisory
General information	Targeted insights and recommendations
Targeting individual pain points	Targeting multiple pain points
SMS, WhatsApp, Android or iOS app	Video tutorials, chat boxes, individualised alerts and recommendations
Limited amounts of data	Large volumes of data

Source: GSMA

**TREND #4**

Digital agriculture advisory is evolving into more holistic offerings

Organisations are increasingly bundling agricultural advisory with other digital services to farmers, most notably digital procurement and agri DFS. Smallholders prefer a one-stop shop that connects them to the various services they need to run their farms efficiently. By integrating several solutions in a single tool, organisations can avoid confusion, facilitate adoption and add more value. Zimbabwe’s

Econet Wireless, for example, has a package called ZFU EcoFarmer Combo that bundles advisory with membership in the Zimbabwe Farmers’ Union, weather-indexed insurance and funeral cover.<sup>20</sup> Tools like Colombia’s Control Ganadero also offer users a range of services, including digital records, hyper-local weather information, transportation insurance and links to veterinarians and livestock buyers and sellers.

20 Econfarmer (2020), “ZFU EcoFarmer Combo”.

## 2.2 Agri digital financial services



Agricultural DFS are a subcategory of DFS that includes services provided directly to smallholder farmers, such as digital agricultural payments, as well as derivative services that support agricultural credit (e.g. input financing), savings (e.g. digital wallets designed to support specific agriculture sector activities) and insurance. Agri DFS also include solutions that enable access to derivative services through data analytics, such as credit-scoring solutions provided by third-party companies, as well as those provided by agribusinesses that have developed in-house solutions to extend financing to the farmers they procure from.<sup>21</sup> Of the 150 agri DFS available

to smallholder farmers worldwide, nearly three-quarters can be found in Sub-Saharan Africa and 15 per cent in Kenya alone.<sup>22</sup> This is the result of the wide proliferation of mobile money services in the region.

In Sub-Saharan Africa, mobile money providers (MMPs) dominate the agri DFS ecosystem while in other parts of the world, including Latin America, banks and fintechs are behind the majority of agri DFS initiatives (see Section 4.2.1).

An analysis of global agri DFS deployments revealed several key trends, which are outlined below.<sup>23</sup>

### TREND #1

Many agri DFS use data collected from agritech tools to support other digital agriculture use cases

The emergence of rich data sets with farmer information, transaction data from the sale of crops and payment information, among others, are helping solution providers better understand a farmer's financial footprint. This makes it more viable for MNOs,

MMPs, fintech companies and traditional financial service providers (FSPs) to extend products to smallholder farmers in remote areas, such as insurance, credit and loans.

### TREND #2

Insurance is the primary sub-use case for agri DFS, accounting for approximately a third of all services available globally

The shift from indemnity- to index-based insurance to protect against the impact of unexpected events, combined with the growing use of mobile phones to deliver services to smallholder farmers, have unlocked new opportunities to provide digital insurance products worldwide.<sup>24</sup> Insurance providers have typically collaborated with extension agencies, agro-dealers, seed companies, government agencies and

MNOs to promote, market and distribute their digital insurance products. In Latin America, the GSMA AgriTech team has uncovered fewer digital insurance tools, but one is the livestock transportation insurance tool, SEGUGAN, which Control Ganadero launched in 2019 in coordination with Colombia's Federation of Cattle Ranchers (FEDUGAN).

<sup>21</sup> GSMA (2020), [Digital Agriculture Maps: 2020 State of the Sector in Low and Middle-Income Countries](#).

<sup>22</sup> Ibid.

<sup>23</sup> Ibid.

<sup>24</sup> GSMA (2020), [Agricultural insurance for smallholder farmers: Digital innovations for scale](#).

**TREND #3**

## Crowdfunding is the fastest growing sub-use case of agri DFS globally

Crowdfunding is still an emerging agri DFS sub-use case, with the first services coming online in 2014–15. Since then, the number of crowdfunding services has increased exponentially, becoming the second largest sub-use case in agri DFS for smallholders after insurance.<sup>25</sup> Blockchain is a key enabler of

crowdfunding as it improves transparency and security for both investors and farmers. It also facilitates the transfer of funds from investors, many of whom are based in urban areas or internationally, to farmers in remote rural areas.



25 GSMV (2020), [Digital Agriculture Maps: 2020 State of the Sector in Low and Middle-Income Countries](#).

## 2.3 Digital procurement



There has been a rapid increase in the number of digital procurement and farm management tools developed in recent years, with approximately half of all tools in use today coming online in the last four years. Sub-Saharan Africa accounts for 55 of 111 digital procurement tools being tracked by GSMA's AgriTech team, with Kenya, Nigeria and Ghana each having

more than eight tools in service as of January 2020. Indonesia leads all markets with the deployment of 12 digital procurement tools as of January 2020.<sup>26</sup> In Latin America, the AgriTech team has identified over two dozen digital procurement tools in use as of mid-2020 (see Section 4.3.1).

### TREND #1

Payment functionality is being added to digital procurement tools, primarily in countries where mobile money is prevalent

Throughout the world, but especially in Sub-Saharan Africa, agritech companies and other organisations active in digital procurement have been able to successfully leverage the infrastructure of MMPs to integrate payments in their digital procurement tools. This has allowed agribusinesses to minimise the risk of theft and fraud while also creating more transparent

processes. Farmers also benefit from having digital profiles, which can help them create economic identities and gain access to financial products like savings, credit and insurance. Connected Farmer, which uses Vodafone's M-Pesa mobile money solution, is currently offered by five agribusinesses that work with over 30,000 farmers in Sub-Saharan Africa.<sup>27</sup>

### TREND #2

Consumer demand for food safety and sustainability is driving digital procurement tools to incorporate traceability

Digital record keeping combined with traceability is the most prevalent sub-use case under the digital procurement use case, accounting for 41 per cent of all digital procurement tools available worldwide as of January 2020.<sup>28</sup> In part, this is because the United States and European Union, both major importers of agricultural products, have tightened regulations on food imports in recent years, making traceability a priority for agribusinesses exporting crops to these markets. Consumers in both developed and emerging

economies are also increasingly interested in knowing where their food comes from, especially since the onset of the COVID-19 pandemic. Governments, NGOs and agribusinesses are also pushing for the use of digital tools with traceability to support sustainability efforts. As part of its new certification standards, for example, the Rainforest Alliance is requiring cocoa exporters to digitise 30 per cent of farmer data by the end of 2020, with a target of 60 per cent by 2024.<sup>29</sup>

<sup>26</sup> GSMA (2020), *Digital Agriculture Maps: 2020 State of the Sector in Low and Middle-Income Countries*.

<sup>27</sup> TechnoServe: [www.technoserve.org/our-work/projects/connected-farmer-alliance/](http://www.technoserve.org/our-work/projects/connected-farmer-alliance/)

<sup>28</sup> GSMA (2020), *Digital Agriculture Maps: 2020 State of the Sector in Low and Middle-Income Countries*.

<sup>29</sup> The Rainforest Alliance

**TREND #3**

Digital procurement tools are mainly offered as Software-as-a-Service (SaaS) solutions

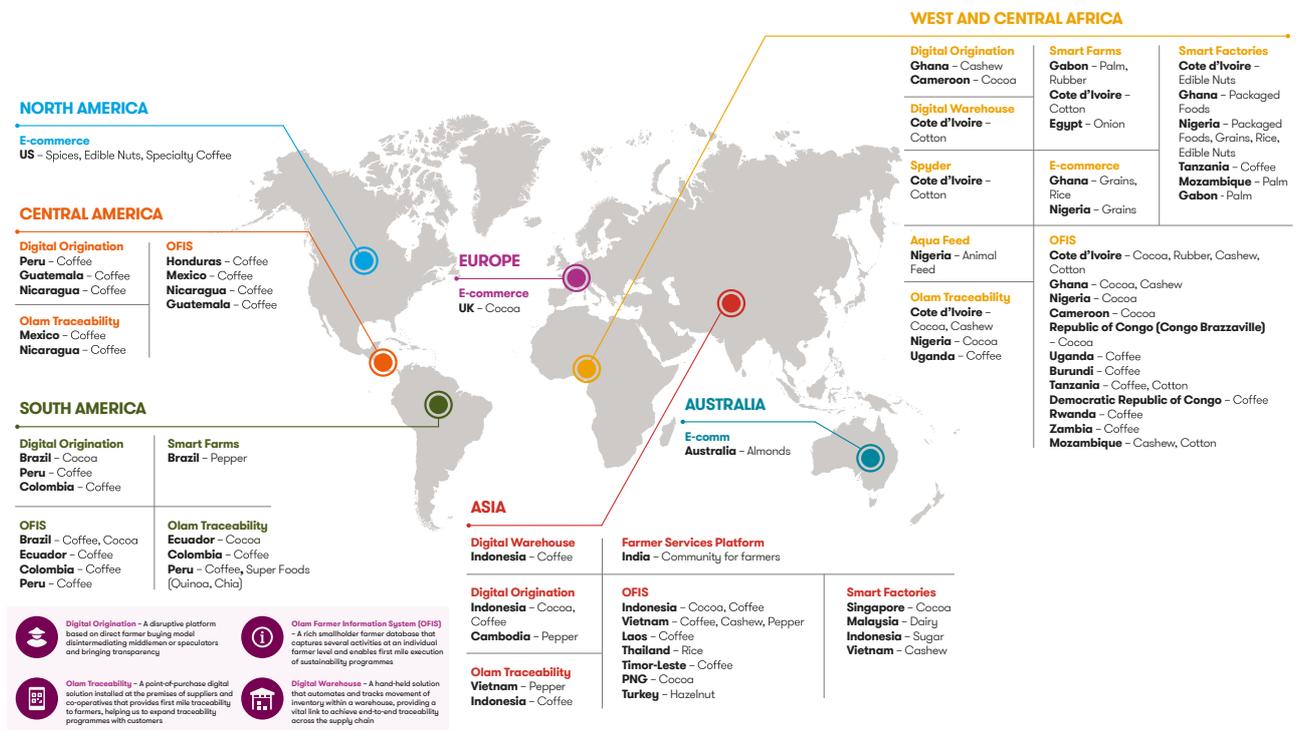
Given the complexity and cost of building tools that integrate digital payment capabilities, generate digital transaction records and enable crop traceability, the majority of digital procurement tools tracked by the GSMA are being provided as SaaS solutions by companies that specialise in the provision of such services. Agritech companies, such as SourceTrace, Cropin, Farmforce, Agritask and TaroWorks (a wholly owned subsidiary of Grameen Foundation), have scaled by building solutions that can be applied across different geographies and in various languages for a variety of value chains and different types of organisations and user requirements. Although many of these agritech companies got their start in Europe and Asia, they have since expanded their presence to Latin America. Outside of Farmforce and TaroWorks, however, these agritech companies have focused

their attention on large-scale farmers rather than smallholders. In most cases, digital procurement solutions are offered through a business-to-business-to-consumer (B2B2C) model.

In some cases, agribusinesses and commodity traders have developed their own digital procurement solutions in-house to maintain control of their own assets and fully customise the solution to their needs. Olam International, for example, built a series of last-mile digital procurement tools to better capture farmer information, manage payments to farmers and implement traceability and sustainability initiatives. These include Olam’s Digital Origination, Olam Traceability, Olam Farmer Information System (OFIS) and Digital Warehouse tools, which are deployed worldwide.<sup>30</sup>

Figure 5

**Olam’s global footprint of digital procurement tools**



Source: Olam

30 Olam (May 2019), *Olam Insights*, Volume I.

## 2.4 Agri e-commerce



Agri e-commerce services in LMICs are still in early stages of development. Most platforms either facilitate the movement of agricultural produce from smallholder farmers in rural areas to buyers in urban areas or enable the sale of agricultural inputs to farmers living outside urban centres. Although some of the first platforms came online in 2008–09, the vast majority of agri e-commerce services engaging smallholder farmers in LMICs have emerged in the last five years, with countries like Kenya, India and Uganda seeing the most

activity. Together, these three countries account for roughly a third of all e-commerce platforms in service as of January 2020.<sup>31</sup> In Latin America, Colombia has emerged as an agri e-commerce leader, with over a dozen agri e-commerce platforms available in that country alone as of mid-2020 (see Section 4.4.1).

A review and evaluation of over 120 agri e-commerce companies in developing countries revealed several key global trends in agri e-commerce.

### TREND #1

The most successful agri e-commerce businesses invest in more than just a digital platform

Global research into e-commerce models indicates that over the last few years, a growing number of e-commerce platforms have expanded beyond just linking buyers (consumers, businesses, hotels and restaurants) with sellers (farmers). As part of a strategy to add value, although sometimes purely out of necessity, most agri e-commerce businesses have taken on additional functions that were typically the domain of middlemen, agribusinesses or banks. These include farmer acquisition,

marketing and customer care at one end of the spectrum, to pre-financing, payments, logistics, quality control and warehousing at the other.<sup>32</sup> By taking on additional functions, either directly or through partnerships, an agri e-commerce business can have greater control over the entire supply chain and increase its chances of seeing the measurable improvements in efficiency it needs to succeed. However, greater complexity requires more capital and, often, greater risk.

### TREND #2

The proliferation of agri e-commerce depends on several enabling factors

Whether an agri e-commerce service can scale and become sustainable depends on a country's infrastructure, including telecommunications, logistics networks and financial services. A recent GSMA AgriTech study of emerging business models in agri e-commerce<sup>33</sup> identified seven key market enablers. The three most important are mobile internet penetration and connectivity to enable buyers to access online services; a well-established logistics network, including national infrastructure such as roads, address systems and haulage services to move produce from one place to another; and accessible digital payment solutions, such as mobile money and payment banks in areas where traditional banking service penetration is relatively low.

Other enabling factors include agriculture sector readiness, which requires being technically equipped for e-commerce with access to relevant devices and digital skills. Familiarity with other, non-agriculture specific e-commerce services also increases the likelihood that consumers will use agri e-commerce. Urbanisation also acts as a catalyst for consumers with busy urban lifestyles to shift to agri e-commerce, while rising incomes lead to changes in food consumption and lifestyle patterns. E-commerce is therefore becoming a particularly appealing way to cater to growing middle-class interest in ethically sourced local produce, as well as fresh and organic food.

31 GSMA (2020), [Digital Agriculture Maps: 2020 State of the Sector in Low and Middle-Income Countries](#).

32 GSMA (2019), [E-commerce in agriculture: new business models for smallholders' inclusion into the formal economy](#).

33 Ibid.

**TREND #3**

## Most agri e-commerce companies have yet to achieve scale

The vast majority of agri e-commerce tools have a limited presence (a single metropolitan area) and have yet to extend their farmer base beyond a few thousand. This is the case in Latin America where all but a handful of agri e-commerce businesses serve a single metropolitan area (see Section 4.4.3). One of the key challenges agri e-commerce businesses face, particularly in Sub-Saharan Africa which is home to roughly half of all agri e-commerce businesses in LMIC countries, is achieving the scale required to operate independently of donor funding. This is due to poor logistics infrastructure in many of the operating markets.

There is evidence that the COVID-19 pandemic is accelerating demand for agri e-commerce services, not only in high-income countries but in LMICs as well. The imposition of lockdowns, as well as limitations placed on the movement of people and goods, have underscored the importance of technology for agile food delivery. In India, for example, the number of daily orders on agri e-commerce sites has increased significantly since the pandemic began.<sup>34</sup>



34 GSMA (2020), [Digital Agriculture Maps: 2020 State of the Sector in Low and Middle-Income Countries](#).

## 2.5 Smart farming



Smart farming refers to the use of sensors, drones, satellites and other farm assets to generate and transmit data about a specific crop, animal or practice to support agricultural activities. Smart farming solutions rely on connectivity between IoT-enabled devices to optimise production processes and growing conditions while also minimising costs and saving resources (see Appendix).<sup>35</sup> Smart farming tools are among the latest to emerge in the digital agriculture ecosystem, primarily because of the high cost associated with deploying sensors and the absence of IoT networks in rural areas.

To date, at a global level, the GSMA has identified 38 smart farming solutions deployed for the benefit of smallholder farmers in developing countries, roughly half of which are in Sub-Saharan Africa. Latin America has been slower to implement smart farming solutions for smallholder farmers. Most interventions to date have been small-scale pilots that have yet to be commercialised (see Section 4.5.1). The following section highlights some of the main trends observed in an in-depth review of 38 solutions identified globally.<sup>36</sup>

### TREND #1

The vast majority of smart farming solutions for smallholder farmers are based on the shared asset use case

Although slower to arrive on the scene than other smart farming solutions, shared smart asset tools now make up nearly two-thirds of all smart farming solutions available worldwide. These tools give farmers the ability to access productivity-enhancing equipment like tractors or drones through a shared economy model that promotes efficiencies. They also enable

asset owners to earn extra income on equipment that might otherwise sit idle. Equipment is often outfitted with monitoring devices that allow owners to keep track of their assets. Farmers can reserve timeslots to use the equipment, either offline or with an app interface, much like they would reserve a car service using Uber or accommodations using Airbnb.

### TREND #2

Livestock and aquaculture have benefited from smart farming innovations

The use of sensors is particularly well suited to livestock and aquaculture operations, and an entire sub-use case has emerged dedicated to these two value chains. Sensors are widely used with cattle and poultry to increase production. Sensors applied to cattle collars or harnesses can detect when a cow is going into oestrus to ensure timely insemination, and sensors can also measure bird activity and health and reduce the incidence of disease. In the case of farmed fish, sensors placed in ponds or tanks can

measure temperature, fish movement and health to mitigate the potential impact of diseases. Sensors can also be linked to dispensers that automatically release food into the water, automating processes that would otherwise need to be performed manually. Given the importance of livestock and aquaculture to Southeast Asian and South Asian markets, most of the innovations in this use case have emerged in countries like India and Indonesia.

<sup>35</sup> GSMA (2020), [Digital Agriculture Maps: 2020 State of the Sector in Low and Middle-Income Countries](#).

<sup>36</sup> Ibid.

**TREND #3**

Pay-as-you-go models are enabling smallholder farmers to access smart farming tools previously only available to larger farms

Given the high cost associated with mechanised equipment and other assets, such as sensors and drones, service providers are turning to pay-as-you-go (PAYG) models to make the tools accessible to smallholder farmers. For example, farmers can gain access to a smart irrigation system and make

payments over 18 to 36 months, often using mobile money services. Examples of companies leveraging PAYG models to supply cost-sensitive farmers with smart farming assets include Kenya’s SunCulture and Vietnam’s MimosaTek.

Figure 6

**SunCulture’s PAYG payment plans for smart irrigation systems, 2019**

Rainmaker2 with ClimateSmart Direct™



PAYG payment plan	Price
Deposit	\$72
Monthly installments	\$28
Duration	18 months
Total	\$578
<b>Cash payment</b>	<b>\$454</b>

Rainmaker2 with ClimateSmart™ Battery



PAYG payment plan	Price with TV	Price without TV
Deposit	\$90	\$81
Monthly installments	\$35	\$35
Duration	36 months	30 months
Total	\$1,364	\$1,142
<b>Cash payment</b>	<b>\$1,107</b>	<b>\$880</b>

Source: SunCulture

## 2.6 Enabling factors driving the adoption of digital agriculture solutions by smallholder farmers in Latin America and the Caribbean

Several elements need to be in place for digital agricultural solutions to take hold and scale in a country. At the most basic level, farmers and other agritech tool users must have a mobile device that can access a mobile network, preferably one that supports mobile internet services. Digital literacy is also a prerequisite for the use of virtually all digital agriculture services described in Sections 2.1 to 2.5.

This section presents some of the key enablers influencing the pace of adoption of different digital agriculture solutions in countries across Latin America and the Caribbean. These enablers were identified through conversations with over 40 digital agriculture ecosystem players either based or working in Latin America and the Caribbean.

Figure 7

### Enablers driving the adoption of digital agriculture solutions by smallholder farmers in Latin America and the Caribbean



Source: GSMA

**ENABLER #1**

Coverage for mobile internet services is nearly ubiquitous in Latin America, but there are gaps between urban and rural areas

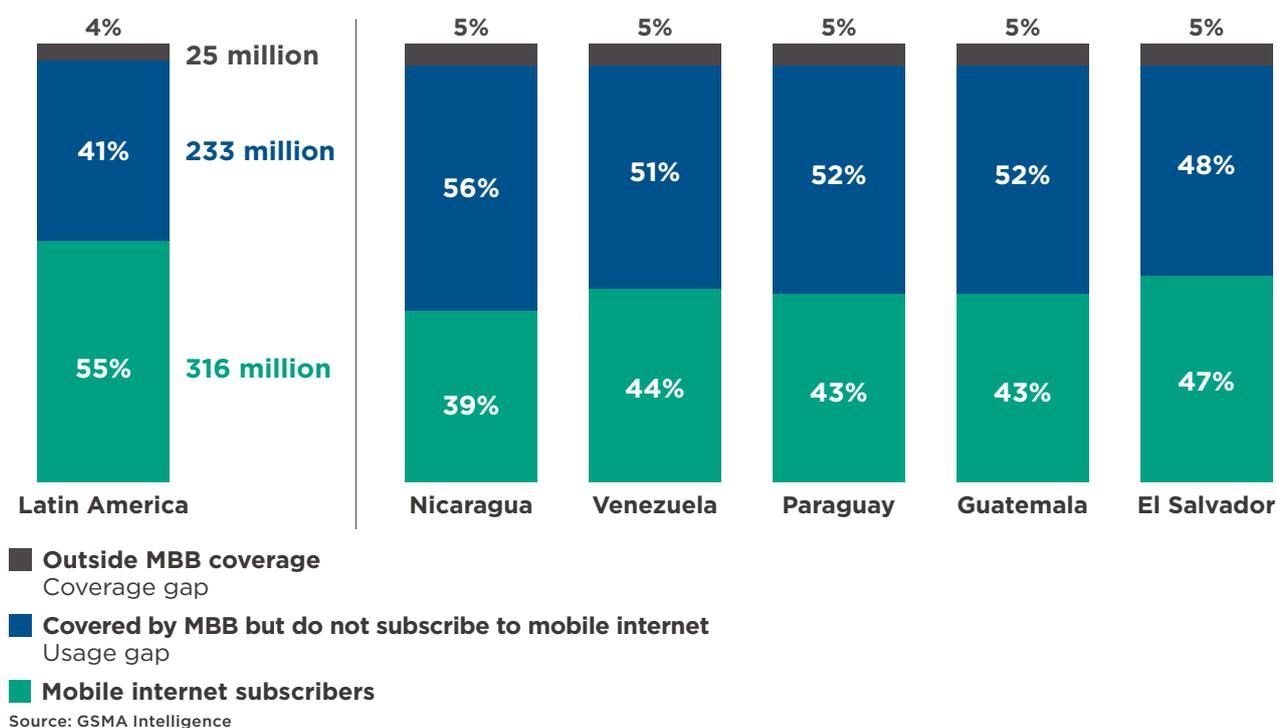


Network connectivity is essential for the successful implementation of most digital agriculture tools although some, like selected digital advisory, agri DFS and digital procurement tools, have the capacity to work offline when a service user is outside the reach of a mobile network. Even in these cases, however, a user must be able to access the network periodically, either through a mobile network or a Wi-Fi hotspot, to download the latest insights or to upload information.

In Latin America, all but four per cent of the population (an estimated 24 million people) lives within the coverage area of a mobile broadband (MBB) network.<sup>37</sup> The bulk of the population living outside of MBB network coverage are in rural areas where agriculture is the main source of employment. This explains why network coverage is still cited as an obstacle by agriculture ecosystem players interviewed for this study, particularly in countries of Central America, Colombia and Mexico.

Figure 8

**The mobile internet adoption gap in Latin America, % of population, Q1 2020**



For tools that require an internet connection, including some advisory services, agri DFS, digital procurement tools, and all e-commerce and mobile-enabled (2G/3G/4G) smart farming solutions, affordability can be a barrier to adoption. In Latin America, an estimated 233 million people live within MBB coverage areas but do not subscribe to mobile internet services.<sup>38</sup> The affordability gap is especially acute in rural areas.

According to the International Telecommunication Union (ITU), the internet penetration gap between urban and rural areas was 28 percentage points in 2018.<sup>39</sup> In some countries, such as El Salvador, Bolivia and Peru, the gap between urban and rural internet penetration is even wider, suggesting that connectivity may need to be addressed before digital solutions can be offered in some regions.<sup>40</sup>

37 GSMA Intelligence  
 38 GSMA Intelligence  
 39 ITU, as found in ECLAC, FAO and IICA (2019), *The Outlook for Agriculture and Rural Development in the Americas: 2019-2020*.  
 40 Ibid.

**ENABLER #2**

Smartphone penetration in Latin America is the highest of all developing regions

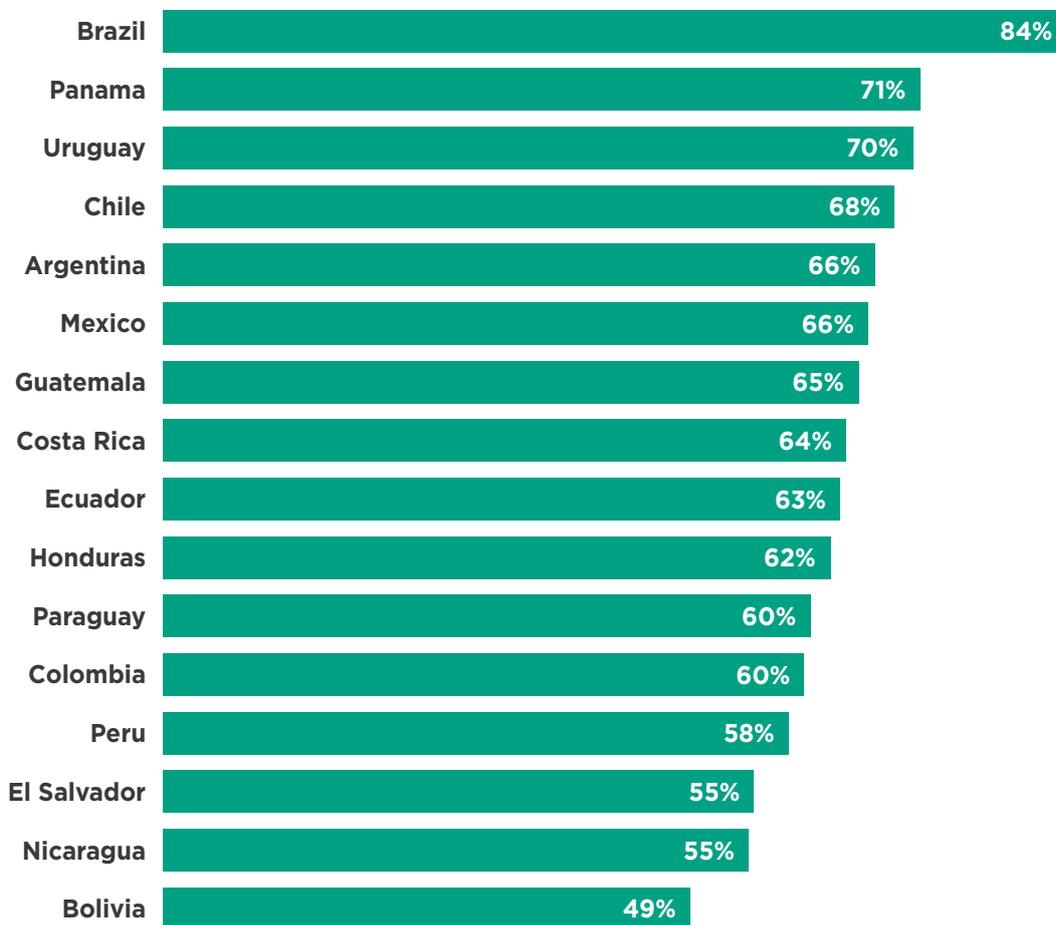


Some newer digital tools, such as next-generation smart advisory, digital procurement and agri digital financial tools (especially versions designed for field officers/agents), as well as e-commerce platforms, require users to have access to a smartphone, tablet or digital reader. The proliferation of low-cost (e.g. under \$30) smartphones throughout Latin America

has helped smartphone penetration reach levels well above those seen in Sub-Saharan Africa and South Asia. Brazil enjoys the highest smartphone penetration in Latin America at 84.1 per cent as of Q1 2020.<sup>41</sup> Bolivia has one of the lowest penetration rates at 49.1 per cent.<sup>42</sup> Most countries in the region lie somewhere between 55 and 65 per cent penetration.

Figure 9

**Smartphone penetration in selected Latin American countries, Q1 2020**



Source: GSMA Intelligence

41 GSMA Intelligence  
42 GSMA Intelligence

**ENABLER #3**

Mobile money services are available in Latin America and the Caribbean, but have not been widely adopted outside Paraguay, Haiti and Honduras, limiting the potential of agritech tools



A robust mobile money ecosystem is a key enabler for the adoption of many digital agriculture use cases (see Appendix), including agri DFS, digital procurement and agri e-commerce. Globally, there are nearly 300 live mobile money deployments in 95 countries.<sup>43</sup> In Latin America and the Caribbean, there are currently only 27 live mobile money services and 13 million active accounts, less than four per cent of the active mobile money account base worldwide. There is also a far less robust agent network in rural areas to support transactions critical to the success of mobile money services (e.g. cash-in, cash-out, airtime top-up).

Mobile money adoption in Latin America and the Caribbean has been held back by a regulatory environment that, until very recently, has made it difficult for non-bank-led initiatives to take root. In countries like Brazil, competition from banks has been especially strong. Interestingly, Latin America and the Caribbean was the only region to record a decline in both the number of active mobile money accounts and the overall volume of transactions in 2019, although the value of transactions still increased. According to the GSMA Mobile Money programme, the total volume of mobile money transactions in Latin America fell by nearly 25 per cent in 2019 due to the exit of a few major players. In Sub-Saharan Africa and South Asia, by contrast, transaction volumes in 2019 increased by nearly 20 per cent.<sup>44</sup>

Figure 10

**State of mobile money services in Latin America and the Caribbean, December 2019**

Live mobile money services	Registered mobile money accounts	Active mobile money accounts	Volume of transactions	Value of transactions
27 (9.3%)	26 million (2.5%)	13 million (-1.6%)	601 million (-24.2%)	\$16.5 billion (1.4%)

Percentages = Latin America's share of the global total  
Source: GSMA Mobile Money

The mobile money ecosystem is strongest in some of the least developed markets in the region. Paraguay, Haiti and Honduras are considered leaders in mobile money development in Latin America due to the earlier introduction of mobile money services. In Colombia, a favourable regulatory environment has led several market players to offer mobile money services (see

Figure 11), and payments have been integrated with several agritech tools for digital procurement, agri DFS and e-commerce. In Central America, however, a cultural distrust of non-cash transactions continues to stand in the way of payment integration despite the growing availability of mobile money solutions.

43 GSMA (2020), [2019 State of the Industry Report on Mobile Money](#).  
44 Ibid.

Figure 11

### Map of mobile money providers in Latin America and the Caribbean, October 2020



Source: Mobile money providers, GSMA

**ENABLER #4**

A growing middle class is changing consumption patterns



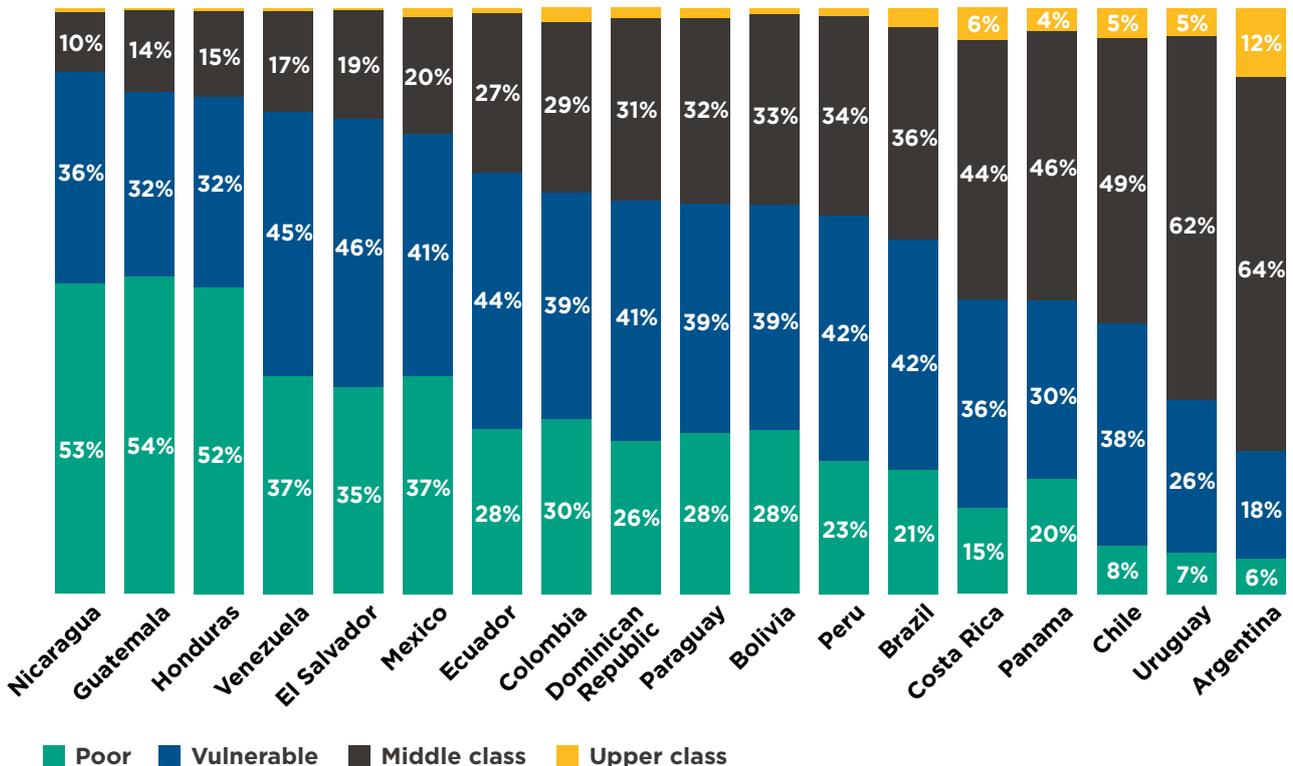
An expanding middle class is an enabler for several digital agriculture use cases, most directly e-commerce. Higher income levels combined with busier lifestyles drive demand for direct-to-consumer services, such as online food shopping. Higher incomes are also closely correlated with an increase in demand for healthier, safer and ethically sourced food as well as organic products with certification and traceability credentials. Just as importantly, a growing middle class drives entrepreneurship, a key enabler of digital innovation and disruption.

According to the Inter-American Development Bank (IDB), the middle class in Latin America and the Caribbean expanded by 87 million people between

2002 and 2014 and accounted for 32 per cent of the region’s total population.<sup>45</sup> This expansion has been driven by economic growth and rising education levels, but it has been uneven across the region. In fact, Latin America is the most unequal region in the world with eight of the 20 most economically unequal countries.<sup>46</sup> In Argentina, the middle class represents 64 per cent of the population, while in Nicaragua it accounts for only 10 per cent of the population, with the poor and vulnerable making up almost 90 per cent of the population. Many middle-class households in Latin America find themselves in a very vulnerable position given low savings rates. This puts them at considerable risk of falling back into poverty in the context of the COVID-19 pandemic.

Figure 12

**Income distribution by country, countries in Latin America and the Caribbean, 2017**



Poor: <\$5.00 per day Vulnerable: \$5-\$12.40 per day Middle class: \$12.40-\$62.00 per day Upper class: >\$62.00 per day  
Source: IDB

45 IDB (2017), *Social Pulse in Latin America and the Caribbean. Family Legacy: Breaking the Mold or Repeating Patterns.*  
46 CSIS (2020), *Covid-19 exposes Latin America's inequality.*

**ENABLER #5**

## Investment in agritech is increasing



A vibrant agritech ecosystem relies on the ability of start-ups to access both short-term and long-term capital. According to the Association for Private Capital Investment in Latin America (LAVCA), the agritech sector is one of the most undercapitalised sectors in the region, accounting for roughly one per cent of total venture capital (VC) volume.<sup>47</sup> Over the last few years, however, the volume of investment has grown exponentially. According to Finistere Ventures, there were 35 agritech investment deals in Latin America in 2018, with a combined value of \$120 million. This is a more than ten-fold increase from 2012.<sup>48</sup>

There are now over 20 investment vehicles in Latin America supporting agritech investment, including SP Ventures, Glocal Managers, NXTP Ventures (formerly NXTP Labs) and The Yield Lab. Although most attention and investment were initially focused in Argentina

and Brazil, where 75 per cent of the region's agritech companies are based,<sup>49</sup> recent deals suggest that these and other investors are starting to look at a second tier markets, including Colombia, Peru and Central America.

Latin America has also seen the emergence of a few large-scale corporate-backed funds in recent years. In 2019, for example, Softbank announced the creation of the \$5 billion Softbank Innovation Fund,<sup>50</sup> the largest tech fund in Latin America. Softbank has vowed to invest primarily in Latin American tech start-ups focused on e-commerce, DFS and healthcare.

New investment vehicles are also helping to drive innovation and growth in Andean and Central American countries. Pomona Impact and Grassroots Capital are two such vehicles, with the latter focused specifically on solutions that benefit smallholder farmers.

**ENABLER #6**

## Latin America is a leading producer of crops that are well suited to digitisation



Latin America is a leading producer of coffee (55.4 per cent of global production),<sup>51</sup> and several fruits and vegetables like bananas (80 per cent of the world's exports)<sup>52</sup> that are structured in highly formal value chains. These value chains offer attractive transactional

volume economics, predictable business-to-person (B2P) payment streams and fewer actors. Formal value chains are also characterised by long-established relationships between agribusinesses, cooperatives and farmers, which make digitisation initiatives easier to implement.

**ENABLER #7**

## An enabling regulatory environment is key to the success of many digital interventions



Governments and regulatory bodies can play an important role in the success and scalability of digital agriculture solutions, mainly through enacting enabling regulation that facilitates the entry of MMPs, promotes e-commerce, enables the deployment of IoT networks and allows for the use of drones and satellite technology for agricultural use.

Governments can also act as incubators or accelerators by promoting entrepreneurship and digital innovation. In Colombia, the Ministry of Technology Information and Communications (MinTIC)

began the Apps.co initiative to foster entrepreneurship and encourage the development of apps. Agritechs like Kanpo, Plaz, Agromarket and Comproagro got their start under the guidance of Apps.co (see Figures 20 and 33). Start-Up Chile, the original government-backed incubator in the region, has supported nearly 2,000 start-ups, including crowdlending agritech Wuabi (see Figure 27) while enjoying a 17-fold return on its investment.<sup>53</sup> Innóvate Perú developed StartUp Peru and is behind several of the agritechs profiled in this study, including AgriCredit.

47 LAVCA (2017), [A Record Year for Agtech in Latin America](#).

48 Finistere Ventures (2018), [2018 Agtech Review](#).

49 IDB Lab (2019), [Agtech Innovation Map in Latin America and the Caribbean](#).

50 Softbank (2019), [Softbank Group Corp. Announced Launch of New \\$5 Billion Technology Growth Fund for Latin America](#).

51 IICA (2018), [Atlas for Agriculture in the Americas](#).

52 FAO (2019), [Bananas and Major Tropical Fruits in Latin America and the Caribbean](#).

53 The Next Web (2020), [Tech in Latin America: An Entrepreneur's Guide to April's Start-up News](#).

## DEEP DIVE

### Agricultural and rural reform in post-conflict Colombia

After ending a 52-year war in 2016, the Colombian government made agricultural and rural reform a central pillar of its post-conflict strategy. The decades-long conflict led to the displacement of over 6.9 million Colombians and the abandonment of large swathes of land.<sup>54</sup> Farmers living in remote Revolutionary Armed Forces of Colombia (FARC)-controlled rural areas were cut off from formal markets and turned to coca farming to make a living. Without oversight, the expansion of coca farming led to significant deforestation and other environmental damage. Colombia's post-conflict strategy calls for relocating much of the displaced population to land more suitable for agricultural development while also providing financial support and training for up to 15 years as an incentive.

The government's post-conflict rural initiatives have attracted the attention of numerous outside donors, including governments, NGOs and private entities.

USAID, for example, developed the Cacao for Peace initiative in 2017 to promote the expansion of the cocoa industry in Colombia. The effort, which brings together many public and private sector actors, aims to increase coordination and modernise practices to improve cocoa yields. Cocoa production areas are concentrated in the regions most affected by post-conflict resettlement.

In the coffee value chain, Nespresso joined forces with the Federación Nacional de Cafeteros (FNC) to launch the Caquetá post-conflict project.<sup>55</sup> This project supports the development of sustainable coffee programmes for the benefit of displaced farmers in one of the regions most affected by war. The government's decision to support these initiatives has driven significant investment in Colombia's agricultural sector while also encouraging technological innovation.

Outside the Southern Cone where agritech innovation is geared towards large-scale farming, Colombia offers the most fertile environment for agritech innovation for smallholder farmers. Colombia benefits from the confluence of several enabling factors, including a strong (by regional standards), DFS ecosystem, an enabling regulatory environment, a robust start-up and investment ecosystem, rising incomes and a relatively strong middle class. Peru and Ecuador are also beginning to see more agritech innovation, with Peru in particular seeing more investment vehicles and

government support through initiatives like Innóvate Perú and StartUp Perú.

Digital agriculture innovation faces more challenges in Central American countries and Bolivia where the enabling environment is comparatively weaker. The exception is DFS, which are relatively established by regional standards. The needs of smallholder farmers in these countries are significant given higher poverty rates and the more acute effects of climate change.

54 CIAT (2017–2018), [Boosting agriculture as key to lasting peace in Colombia](#).

55 Nespresso (24 November 2017), ["Nespresso announces investment in post-conflict Colombian coffee."](#)

# 3 Agriculture in Latin America and the Caribbean

Latin America and the Caribbean is a vast and heterogeneous region characterised by a wealth of natural resources, including a third of the world's freshwater resources and some of the highest quality soil for agricultural production. Although much of the region shares the same language and cultural heritage, the structure and scale of the agriculture sector varies significantly from country to country.

The Southern Cone is characterised by capital-intensive, highly-mechanised farming of export crops, such as soybean, coffee and sugar, as well as large farms dedicated to the rearing of livestock. Central America and the Andean region, by contrast, are characterised by greater reliance on smallholder farming for crop production, as well as a variety of crops ranging from coffee and cocoa to fish, flowers and a broad range of fruits and vegetables.

The contribution of the agriculture, forestry and fishing sector to Latin America and the Caribbean's total GDP stands at 4.9 per cent.<sup>56</sup> However, this average masks some important differences in the region. At one extreme are some of the largest economies in the region where the share of GDP from agriculture

is below five per cent, in line with what is seen in high-income European countries like Spain (2.7 per cent) and Romania (4.1 per cent). This includes Mexico (3.4 per cent), Brazil (4.4 per cent) and Chile (3.6 per cent).<sup>57</sup> At the other extreme are several Central American, Caribbean and Andean countries where the contribution of agriculture to GDP is over 10 per cent. Haiti reports the highest contribution from agriculture in the region, at 19.5 per cent of GDP in 2019.<sup>58</sup> The ratios in these countries are similar to those reported in countries like Indonesia (12.7 per cent), India (16.0 per cent), Cameroon (15.4 per cent) and Ghana (17.3 per cent).<sup>59</sup> For most countries in the region, the share of GDP from agriculture, forestry and fishing has been declining over the last decade. The drop has been particularly sharp in Guyana, Guatemala and Ecuador.<sup>60</sup>

56 World Bank Data (2019), "Agriculture, forestry, and fishing, value added (% of GDP)".

57 Ibid.

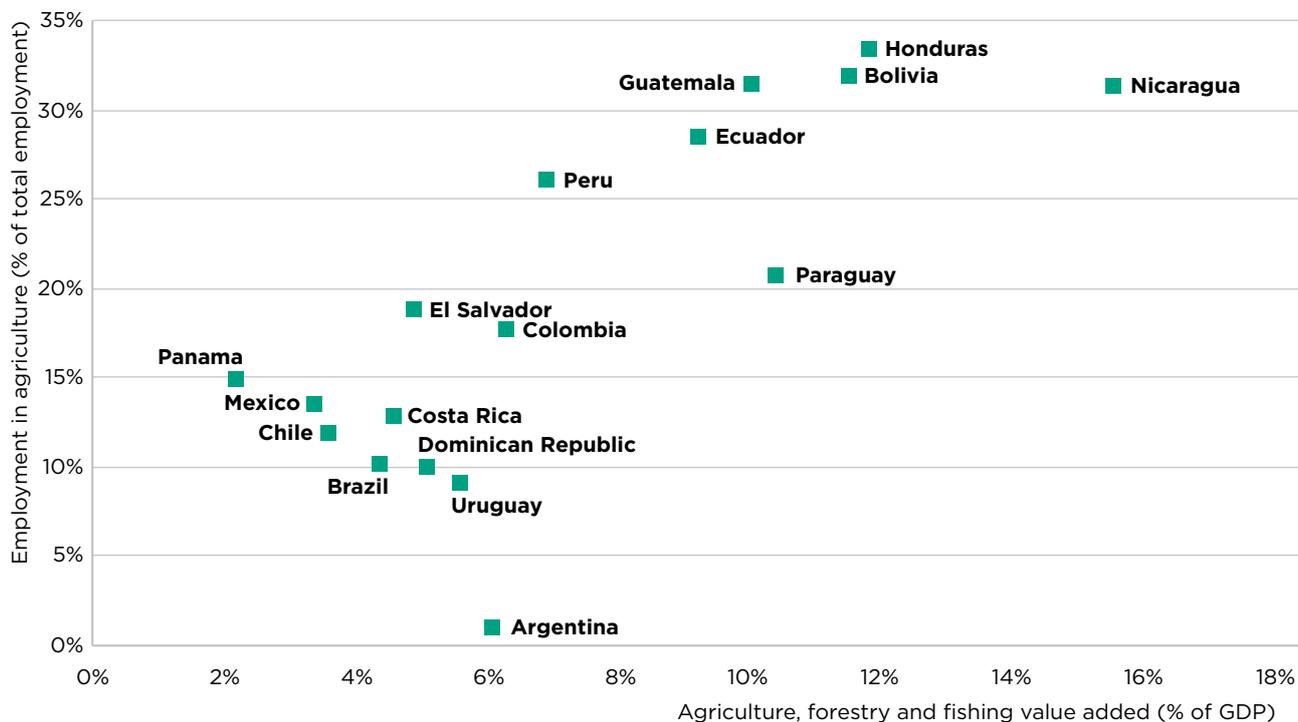
58 Ibid.

59 Ibid.

60 OECD and FAO (2019), *OECD-FAO Agricultural Outlook, 2019-2028*.

Figure 13

### Relevance of agriculture in select countries in Latin America and the Caribbean



Sources: ILO is the source for employment in agriculture as a percentage of total employment. Data is for 2017. The World Bank is the source for agriculture, forestry and fishing value added as a percentage of GDP. Data is for 2019.

Agriculture is an important source of employment in Latin America and the Caribbean, with 14.0 per cent of the region’s labour force engaged in agricultural activities.<sup>61</sup> Agriculture is particularly important to rural areas as it is the main source of employment. According to the IICA, 54.6 per cent of the rural labour force in Latin America and the Caribbean is engaged in agricultural production, and this figure tops 70 per cent in countries like Bolivia and Peru.<sup>62</sup> Agriculture’s contribution to overall employment is especially high in countries like Bolivia, Guatemala, Honduras and

Nicaragua, where the percentage of the labour force employed in agriculture rises to almost one-third.<sup>63</sup> These countries are characterised by the prevalence of smallholder farmers engaged in labour-intensive crops like coffee and fruits and vegetables. In Southern Cone countries like Argentina, Brazil and Uruguay by contrast, the share of the labour force engaged in agriculture is below 10 per cent, largely the result of the highly mechanised, intensive crop production and livestock rearing characteristic of the agriculture sector in that region.<sup>64</sup>

61 IICA (2018), *Atlas for Agriculture in the Americas*.  
 62 Ibid.  
 63 ILO (2019), *2018 Labour Overview of Latin America and the Caribbean*.  
 64 Rabobank (2015), *Latin America: Agricultural Perspectives*.

### 3.1 The importance of smallholder farmers to Latin America’s agriculture sector

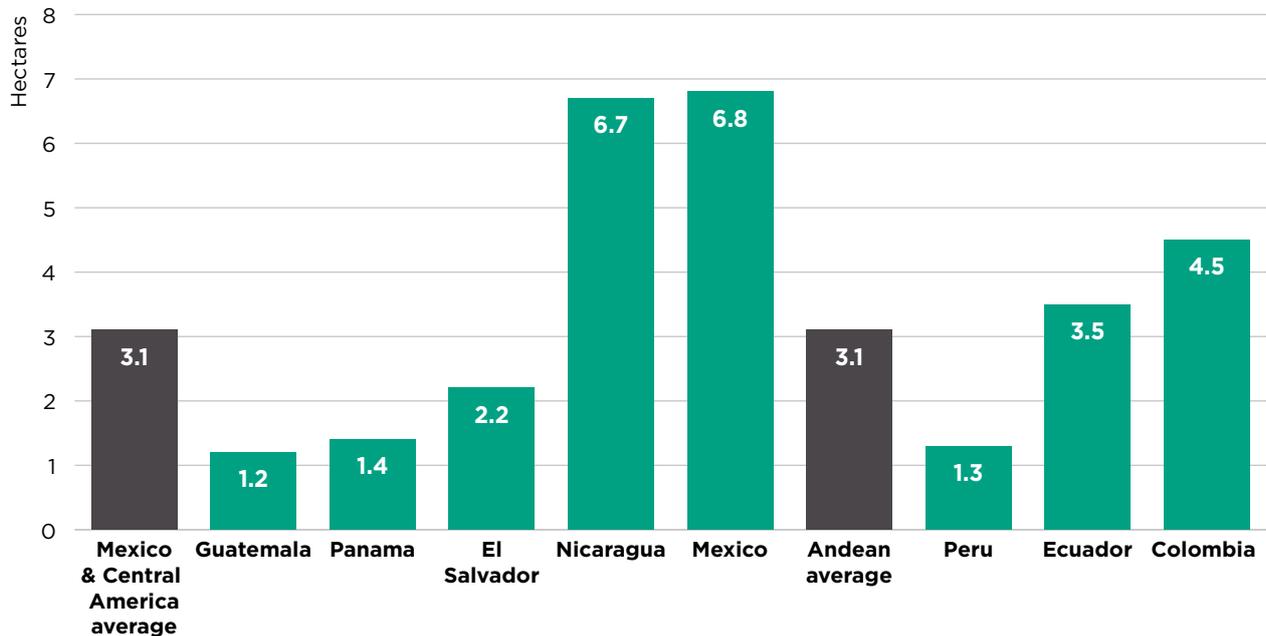
The Food and Agriculture Organization of the United Nations (FAO) estimates there are 16.6 million smallholder farms throughout Latin America where approximately 60 million people live and work.<sup>65</sup> These farms account for 81.3 per cent of all farms in the region and between 27 and 67 per cent of total crop production, depending on the country.<sup>66</sup> In Central America, smallholder farmers account for 50 per cent of total agricultural production and 70 per cent of all food consumed in the region.<sup>67</sup>

According to the FAO, the average size of a smallholder farm in Latin America (excluding the Southern Cone

where vast amounts of land are used for cattle rearing) is 2.5 hectares.<sup>68</sup> This is slightly higher than the average size of smallholder farms in Sub-Saharan Africa and Asia. In the Caribbean, smallholder farms average 1.3 hectares, whereas in the Andean and Central American regions, the average is 3.1 hectares. Interestingly, in Mexico and the Caribbean, there has been a fragmentation trend as farms are split from one generation to another, leading to an increase in the total number of discreet farms and a decline in average farm sizes. This trend stands in contrast to the consolidation trend taking place in Southern Cone countries like Argentina and Uruguay where average farm sizes are increasing.

Figure 14

**Average size of smallholder farms in selected Latin American countries (in hectares)**



Source: FAO

Roughly 60 per cent of all smallholder farmers in Latin America are classified as subsistence farmers. In countries like El Salvador, Nicaragua and Colombia, the share of smallholder farmers classified as subsistence

farmers exceeds 70 per cent.<sup>69</sup> Not coincidentally, countries with a higher incidence of subsistence farming also have higher rural poverty rates.

65 FAO (2014), *Agricultura Familiar en América Latina y el Caribe: Recomendaciones de Política*.  
 66 Ibid.  
 67 FAO (2014), *Agricultura Familiar en América Latina y el Caribe: Recomendaciones de Política*.  
 68 ECLAC, FAO and IICA (2019), *The Outlook for Agriculture and Rural Development in the Americas: 2019-2020*.  
 69 FAO (2014), *Agricultura Familiar en América Latina y el Caribe: Recomendaciones de Política*.

## 3.2 The role of women in agriculture

There are important differences in the participation of men and women in the agriculture sector in Latin America and the Caribbean. Whereas 62.1 per cent of the male rural labour force is employed in agriculture, 40.8 per cent of the female rural labour force is employed in agriculture.<sup>70</sup> Andean countries, such as Bolivia, Ecuador and Peru, report similar participation rates between men and women in the agricultural workforce. In Central America and the Dominican Republic by contrast, the ratio of women working in agriculture is one-third to one-fifth that of men.<sup>71</sup> This imbalance is in part related to higher rates of insecurity and violence in several Central American and Caribbean countries. It is also due to differences in the types of crops grown. Coffee, an important crop in much of Central America, the Caribbean and Colombia, for example, has historically been dominated by men, with limited female participation.

Accessing employment in the agriculture sector is not the only challenge rural women in Latin America face. Women also find it much more difficult than men to own land and gain access to other agricultural assets, such as irrigation systems, the result of cultural norms that have long favoured men when it comes to inheritance, marriage and land redistribution efforts by governments and indigenous communities. Women-owned farms are generally smaller, located in less desirable areas and have limited access to productivity-enhancing tools.<sup>72</sup> Women farmers also have less access to extension services and technical support. According to the FAO, while 22 per cent of male farmers have access to technical support in Peru, only 13 per cent of female farmers do.<sup>73</sup> The combined impact of all these factors make it difficult for women to access financial services like credit and insurance, perpetuating the cycle of female poverty in rural areas.



70 These figures capture official employment statistics only. They do not adequately measure the large number of rural women engaged in agricultural activities for subsistence or to support their male relatives. IICA (2018), [Atlas for Agriculture in the Americas](#).

71 IICA (2018), [Atlas for Agriculture in the Americas](#).

72 FAO (2014), [Agricultura Familiar en América Latina y el Caribe: Recomendaciones de Política](#).

73 Ibid.

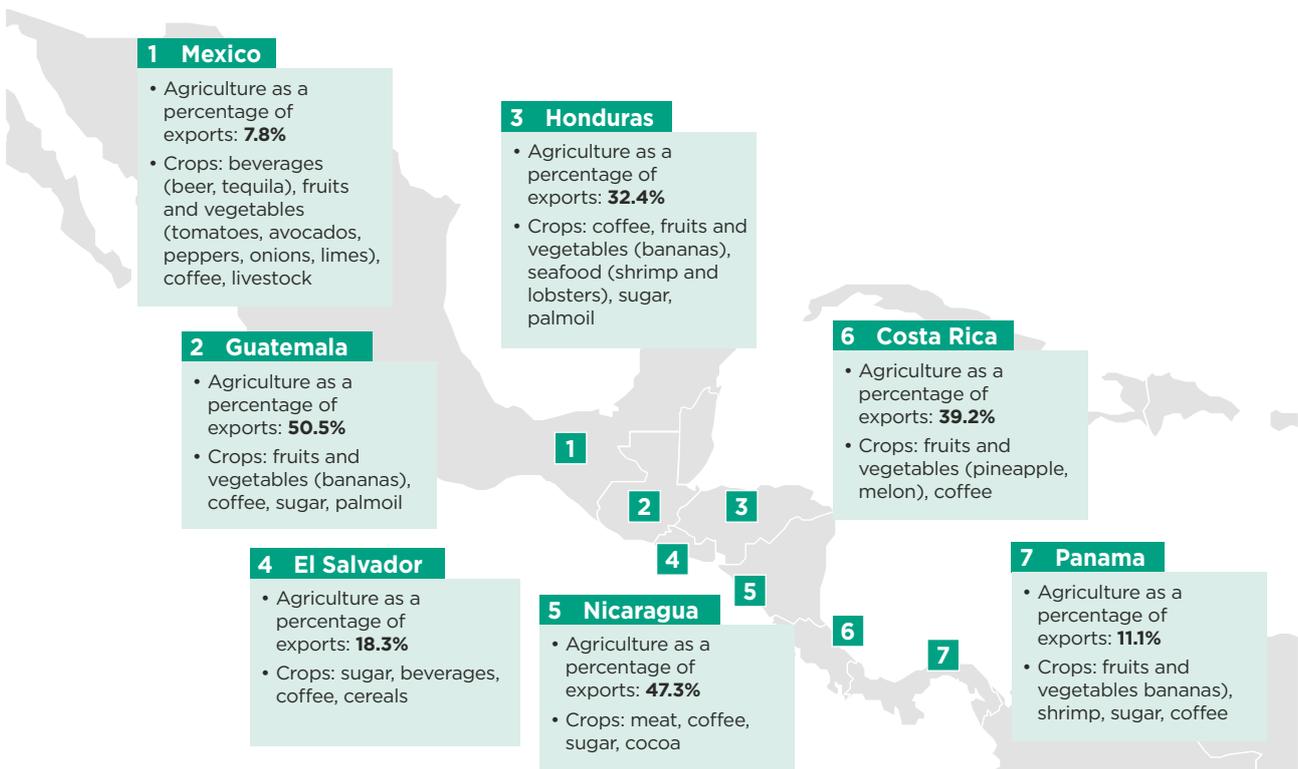
### 3.3 Leading crop production and exports

Latin America is a large and heterogeneous area with different topographies and climates suitable for a variety of different crops. Central America, for instance, is characterised by tropical forests, volcanic

ranges and fertile valleys, which are well suited to the production of export crops like coffee, fresh produce (particularly bananas, melon and pineapple), cocoa, sugar and palm oil.

Figure 15

#### Leading agricultural exports in Mexico and selected Central American countries



Source: IICA, Rabobank, Trading Economics

The Andean region has a varied topography of tropical areas, dry corridors and mountainous terrain. The sub-region's main export crops include coffee, cocoa, flowers, fruits and vegetables (mainly banana, avocado and grapes) and seafood. Colombia and Ecuador are the second and third largest exporters of fresh flowers globally, only behind the Netherlands. Ecuador is also the world's largest exporter of bananas, accounting for roughly 30 per cent of the world's banana supply.<sup>74</sup> Fruit exports have had particularly strong growth in recent years as Andean countries position themselves as the main suppliers to European and North American countries during the Northern Hemisphere's off-season.

The Southern Cone region is characterised by more temperate weather and vast plains that are suitable for livestock and large-scale farming. Soybeans and soybean products are the leading export crops in Argentina and Brazil.<sup>75</sup> Brazil is also the world's largest exporter of several key products, including sugar, coffee, orange juice (80 per cent of the world total) and poultry. It is also a key supplier of beef, corn, pork, milk and grains.<sup>76</sup> Argentina and Chile are the region's leading wine exporters and have seen a rise in the export of some fruits, including grapes, lemons, apples, pears and berries. Chile's long coastline along the Pacific also makes it an important exporter of seafood, specifically salmon and bass.

<sup>74</sup> Rabobank (2015), *Latin America: Agricultural Perspectives*.

<sup>75</sup> IICA (2018), *Atlas for Agriculture in the Americas*.

<sup>76</sup> Rabobank (2015), *Latin America: Agricultural Perspectives*.

Figure 16

## Leading agricultural exports in selected Andean and Southern Cone countries



Source: IICA, Rabobank, Trading Economics

The Latin American region exported roughly \$250 billion in agricultural products in 2017, accounting for a quarter of the region's total exports.<sup>77</sup> The region is an important source of food globally, generating 13.6 per cent of total agricultural exports.<sup>78</sup> Over the last five years, the significance of the United States as a destination market for Latin American agricultural exports has declined. Countries in the region are deepening ties with Asian countries in response to growing demand from several markets in the region, most notably China, and the increasingly protectionist policies of the United States. According to the IICA, Asia now receives just over a third of all Latin American agricultural exports, compared with a quarter of all exports received by North America.<sup>79</sup>

Although agricultural export markets in countries like Brazil and Mexico are large, the importance of agriculture to overall export value is not as significant as some smaller Latin American markets. In Ecuador and Guatemala, for instance, agriculture accounts for over half of all exports, and in Uruguay for over three quarters (see Figures 15 and 16).

Throughout the 1990s, two crops—coffee and sugar—dominated Latin America's export market, together accounting for roughly 40 per cent of the region's agricultural exports. The importance of these two crops has declined in recent years (to 10.8 per cent of the region's agricultural exports by 2019) as soybean production has increased. In terms of crop production, Latin America is much less diversified than other regions. The top 10 crops account for 56 per cent of the region's total agricultural exports, compared with an average of 29 per cent in the rest of the world. There have been significant efforts to diversify the export base in recent years, with some success. Chile, for instance, has emerged in recent years as the third largest exporter of cranberries in the world.<sup>80</sup>

The agriculture sector in Latin America holds great promise and has come to be regarded as the “next global breadbasket.”<sup>81</sup> To achieve this promise, however, significant gains in productivity will be needed, especially in smallholder farming. Digital agriculture interventions can play a key role in driving these gains.

77 World Trade Organisation (2017), <https://timeseries.wto.org/>

78 IICA (2018), *Atlas for Agriculture in the Americas*.

79 Ibid.

80 World Atlas (2018), “Where are Cranberries Grown?”

81 IDB (2014), *The Next Global Breadbasket: How Latin America Can Feed the World*.

# 4 Agritech landscape and trends in digital disruption in Latin America

Digital interventions can have a substantial impact on the health and incomes of smallholder farmers by closing knowledge gaps, improving access to finance, providing access to formal markets and opening access to assets that would otherwise be out of reach.

To better assess the opportunity for digital tools to support smallholder farmers in Latin America and the Caribbean, it is important to first map out the landscape of digital tools already available in the region to understand how these tools are funded and scaled, and to identify the leading trends underpinning these interventions.

In the first half of 2020, the GSMA AgriTech team conducted 40 interviews with regional stakeholders and identified roughly 131 digital tools currently in use or being deployed for the benefit of smallholder farmers in Latin America and the Caribbean.

This section begins by highlighting some of the high-level trends across a variety of use cases. We then look more closely at each of the five digital agriculture use cases identified by the GSMA AgriTech team. Each use case section presents a regional map of the agritech landscape, reviews different business models and identifies major trends. The section concludes by highlighting some of the main challenges agritech companies have faced when deploying digital agriculture solutions in the region.

## TREND #1

Latin America's digital agriculture tools have not reached the same scale as in Asia and Africa.

The AgriTech team identified very few digital agriculture tools with active user figures above 25,000.<sup>82</sup> Most of the tools profiled in this study have between 1,000 and 5,000 active users with only a few agritechs targeting smallholders, such as Colombia's Control Ganadero (77,000 farmers) Comproagro (26,000 farmers) and Mexico's Smattcom (25,000 farmers) breaking the 10,000 user mark. In Asia and Africa, by contrast, some

services have scaled into the millions of users, although it should be noted that these regions have addressable markets four to six times larger than the Latin American market. Most tools in Latin America continue to be managed by cooperatives or NGOs with limited user numbers, and there have been fewer impact investors helping to scale commercial digital agriculture solutions in Latin America than in Asia and Africa.

<sup>82</sup> This refers to active user figures in the target markets of Central America and the Andean region. Apps prevalent in Argentina and Brazil, such as Booster Agro, are nearing 100,000 active users. Some of the global solutions analysed in this study, such as Farmforce, ECOM's Integrity, Olam's OFIS, SourceTrace and Cropin, manage hundreds of thousands of users worldwide.

**TREND #2**

There is growing demand for more holistic agritech tools that address multiple pain points for smallholder farmers.

Agribusinesses, cooperatives and smallholder farmers are increasingly interested in holistic solutions that do not require downloading several different applications and tools. Decision agriculture company Arable, for example, makes its APIs available to third parties that want to integrate its IoT solution in their own smart advisory or digital procurement tools. Cropin also makes its APIs available so that data collected from third-party sensors can feed more easily into its farm management and traceability solutions.

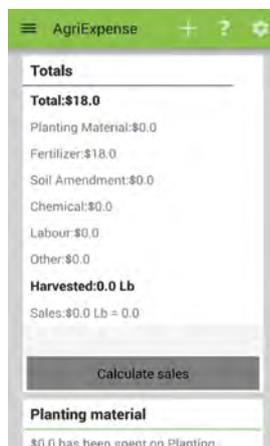
Savings and loans cooperative Abaco, which is working with aquaculture start-up Umitron to implement a smart farming solution on its subsidiary Piscifactoría de los Andes’ (Piscis) trout farm on Lake Titicaca, already has digital credit and loan tools and hopes to develop

a procurement app that will enable smallholders to digitise their supply contracts. FACES in Ecuador is pairing its green microlending product with agronomic advisory and links to potential buyers through a mobile app that it is making available to borrowers.

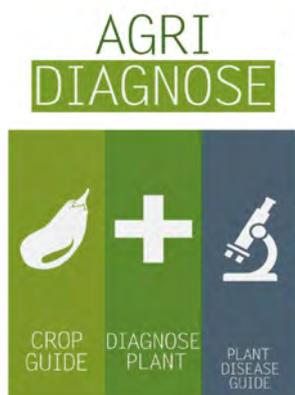
In 2016, Trinidad and Tobago’s government launched AgriNeTT, an e-government initiative that uses digital technologies to promote the growth of the agriculture sector. The government-funded initiative created two open data repositories that consolidate data from various sources and use that data to create a suite of applications that address different pain points for farmers. The initiative has received both international awards (from the ITU) and local awards (FRIDA) for agriculture sector innovation.<sup>83</sup>

Figure 17

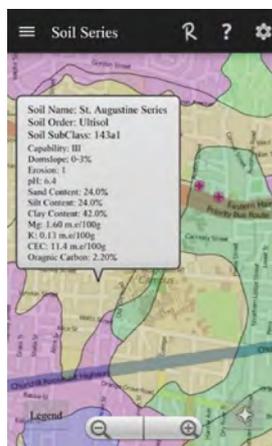
**AgriNeTT suite of products, Trinidad and Tobago**



**AgriExpense**  
Farm financial management tool



**AgriDiagnose**  
Crop pest and disease diagnostic tool



**AgriMaps**  
Site-specific land management tool



**AgriPrice**  
Updated market pricing for 53 commodities

Source: FAO, AgriNeTT

83 FAO (2016), *E-agriculture Solutions Forum 2016: AgriNeTT - Strengthening the Enabling Environment for Food Security in the Caribbean*.

Apptank SAS in Colombia has developed a suite of services under the Control Ganadero umbrella to meet different needs of livestock farmers, from keeping detailed records of cattle to monitoring weather events, linking livestock farmers to veterinarians, livestock buyers and sellers, and providing farmers

with insurance to transport livestock. Lutheran World Relief is evolving its Cacao Móvil app to include not only tutorials but also cost management tools, flavour maps, crop calendars and extension support under the new AG Móvil brand.

Figure 18

### Cacao Móvil adds new capabilities and services to its mobile app

**Cacao Móvil**  
Repository of ten different guidebooks helping cocoa farmers at every stage of the cocoa producing/selling process



**Edgar**  
Cocoa planting and harvesting calendar and repository of tutorials

**Flavour maps**  
Tool that maps the flavour profile of all the cocoa farms identified in Central America



**AG Móvil**



**Cost analysis**  
Tool that helps cocoa farmers plan costs associated with their annual cocoa harvest



**Cocoa answers**  
Forum for cocoa farmers to ask questions

Source: Cacao Móvil, Lutheran World Relief

#### TREND #3

Colombia has emerged as a regional hub of digital agriculture innovation for smallholder farmers.

Colombia benefits from an enabling regulatory environment, numerous institutions of higher learning that have committed resources to agriculture sector research and development, rising incomes and urbanisation, a nascent agritech investment ecosystem and commitment from both private and public sector

entities to rural development. Across most use cases, particularly e-commerce and agri DFS, Colombia has launched more digital tools than any other country in the Central American and Andean regions. Of the 131 digital tools aimed at smallholders in Latin America identified in this research, roughly a third can be found in Colombia.

#### TREND #4

Most digital agriculture interventions aimed at smallholder farmers in the region have donor support, either a government agency, NGO or multilateral lending institution.

The IDB Lab, for example, has teamed with cooperatives (e.g. COOPSOL), agribusinesses (e.g. Ritter Sport and Chocolats Halba), fintechs (e.g. EthicHub) and microcredit agencies (e.g. Abaco, FACES, Sembrar Sartawi) to help fund and provide technical support

for the development of several new digital tools. Solidaridad, Rainforest Alliance, Lutheran World Relief and Heifer International have launched nearly two dozen tools between them. However, very few have scaled and become commercially viable on their own.

Figure 19

### Examples of start-up funders in Latin America

Funder	Definition	Examples
<b>Accelerator</b>	Accelerators support early-stage, growth-driven start-ups through education, mentorship and financing. Start-ups typically enter accelerators for a fixed period and as part of a cohort of companies.	NXTP Ventures, The Yield Lab, Innóvate Perú, Start-Up Chile, Apps.co, Glocal Managers, Pomona Impact, Hugo Ventures, Heifer International
<b>Angel investor</b>	Angel investors can either be an individual or group of individuals who use their personal money to finance companies. Angel investors can often be a founder's friends and family.	Leon Lowenstein and Flora L. Thornton Foundation
<b>Corporate investor</b>	Corporate investors invest strategically, such as buying a company to access its proprietary technology. They are similar to venture capital firms and are often referred to as corporate venture capital.	Telefónica's Wayra
<b>DFI</b>	Development finance institutions (DFIs) are specialised, government-owned organisations that invest in private sector projects in low- and middle-income countries to promote job creation and economic growth.	Taiwan ICDF, DID
<b>Donor</b>	A company, individual or government agency that provides capital to a start-up or company without typically taking an equity stake in the company.	USAID, USDA-FAS, GlobalGiving, Solidaridad, Fundación San Sebastián, Fundación Salva Terra, Mercy Corps, Feed the Future
<b>Impact investor</b>	Impact investors aim to generate specific beneficial environmental or social impacts in addition to financial gains.	Acumen, Grassroots Capital
<b>Incubator</b>	An incubator is a company that helps start-ups during the early stage to develop from ideation to product or service development. Incubators typically provide desk space, mentorship and other business advice.	Toyota Mobility Foundation, PQS
<b>Private equity</b>	Private equity firms source investment capital from high net-worth individuals and firms and typically invest in companies in later stages of growth to take control of them.	Draper Cygnus, Velum Ventures
<b>Venture capital</b>	Venture capital firms invest in companies, typically those with long-term potential, using funds raised from pension funds, endowments and wealthy individuals.	SP Ventures, Softbank

Source: Crunchbase, Investopedia and the GSMA AgriTech programme

**TREND #5**

The COVID-19 pandemic is accelerating the trend towards digitisation.

Smallholder farmers in Latin America, whose average age is over 50 years,<sup>84</sup> have been resistant to digital interventions, preferring face-to-face interactions over the use of digital tools.

However, when stay-at-home orders went into force in 2020, farmers were forced to rely more heavily on their devices to communicate, making them more open to adopting digital solutions. Shoppers are also increasingly relying on e-commerce platforms to buy their groceries. Jüsto, an online supermarket, saw demand increase by 500 per cent in the weeks

following the imposition of stay-at-home orders in Mexico.<sup>85</sup> A survey of 2,000 online shoppers in Latin America by AMR and EchoMR found that 20 per cent of the shoppers interviewed in Colombia and Mexico, a group they termed “newbies,” had made their first ever e-commerce transaction during the pandemic.<sup>86</sup>

The COVID-19 pandemic is also influencing buying preferences. More consumers are interested in understanding where their food is coming from because of the pandemic, and this will accelerate the push for tools that enable certification and traceability.



84 FAO (2014), *Agricultura Familiar en América Latina y el Caribe: Recomendaciones de Política*.

85 El Universal (2020), *Apps locales ganan terreno en compras*.

86 AMI (2020), *The New COVID Consumer in Latin America*.

## 4.1 Digital advisory



Mobile network coverage and connectivity are among the most important enablers for the successful deployment of digital advisory tools in any market. Although early iterations of agricultural value-added services (Agri VAS) services could be accessed using a feature phone, many newer tools require farmers to own a smart device and have at least periodic internet access. Other important enablers include the prevalence of specific value chains like fresh produce, livestock, coffee and cocoa, as well as regulation that favours open data access.

### 4.1.1 Mapping advisory initiatives in Latin America aimed at smallholder farmers

Over the last 10 years, dozens of advisory tools have been introduced throughout Latin America to help smallholder farmers overcome the knowledge gaps that limit productivity. The most common tools are Agri VAS that provide information on market prices, weather and agricultural best practices through voice, SMS, WhatsApp or an app interface. There has also been

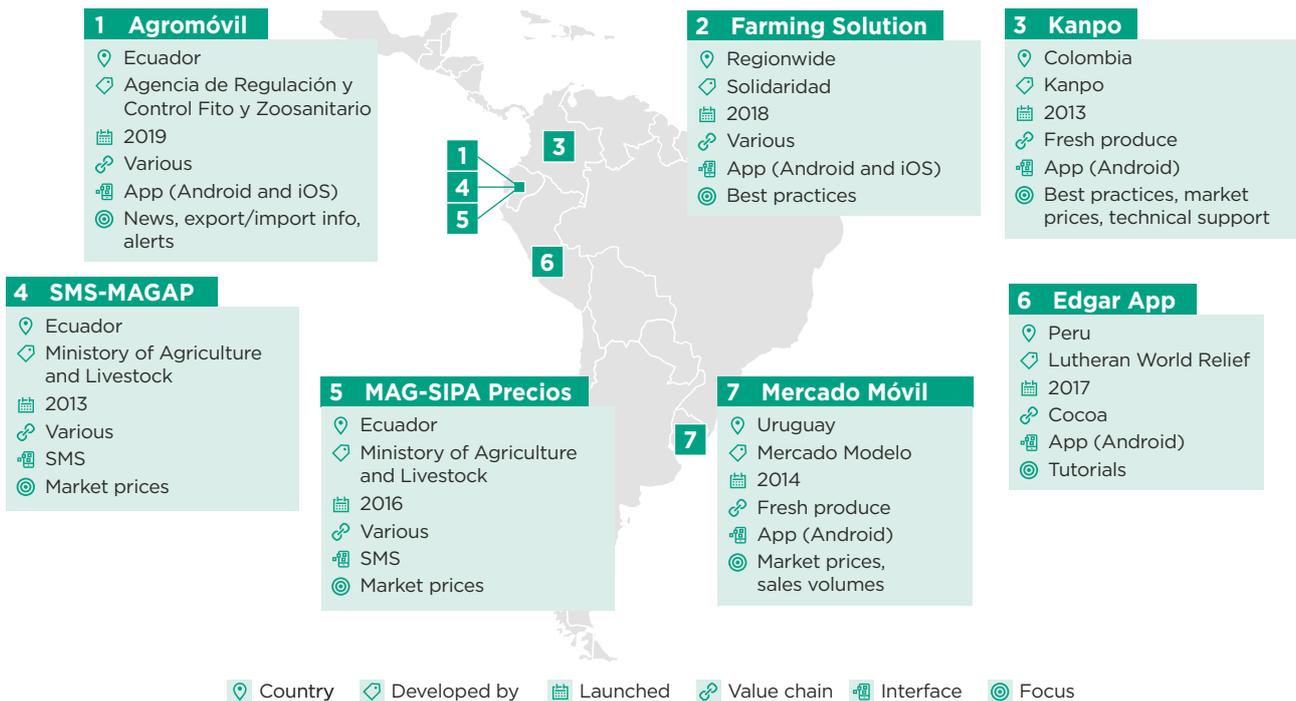
a rise in solutions that address specific pain points, such as pest and disease management or agro-met advisory.<sup>87</sup> With the advent of technologies like AI and big data analytics in the back-end, some new agritechs are focusing on record keeping and the provision of smarter, more individualised advisory (see Appendix).

Figure 20

#### Map of selected Agri VAS in Latin America



87 Agro meteorological (agro-met) advisory refers to weather information-based crop/livestock management strategies and operations dedicated to enhancing crop production by providing real-time crop and location-specific advisory services with outreach to rural communities.



Source: Companies, GSMA

Most digital agriculture tools developed to date have supported smallholder farmers with information specific to a particular country and value chain (e.g. coffee, cocoa or fresh produce). However, there are some examples of multi-country initiatives:

- The IICA worked closely with the Market Information Organization of the Americas (MIOA) and the USDA Foreign Service to launch some of the earliest Agri VAS services in the region, typically in partnership with local government agencies. They teamed with Costa Rica’s CNP, PIMA and ICE to launch Agromensajes, Ecuador’s Ministry of Agriculture, Livestock, Aquaculture and Fisheries to launch SMS-MAGAP, Trinidad and Tobago’s National Agricultural Marketing and Development Corporation to launch SMS-NAMDEVCO, and with Uruguay’s Mercado Modelo in Montevideo to launch Mercado Movil (see Figure 20).<sup>88</sup>
- Rainforest Alliance and Solidaridad, two NGOs with a global presence, have developed tools such as the Farmer Training App (Rainforest Alliance) and

Farming Solution (Solidaridad), which are available in multiple markets (see Figure 20).

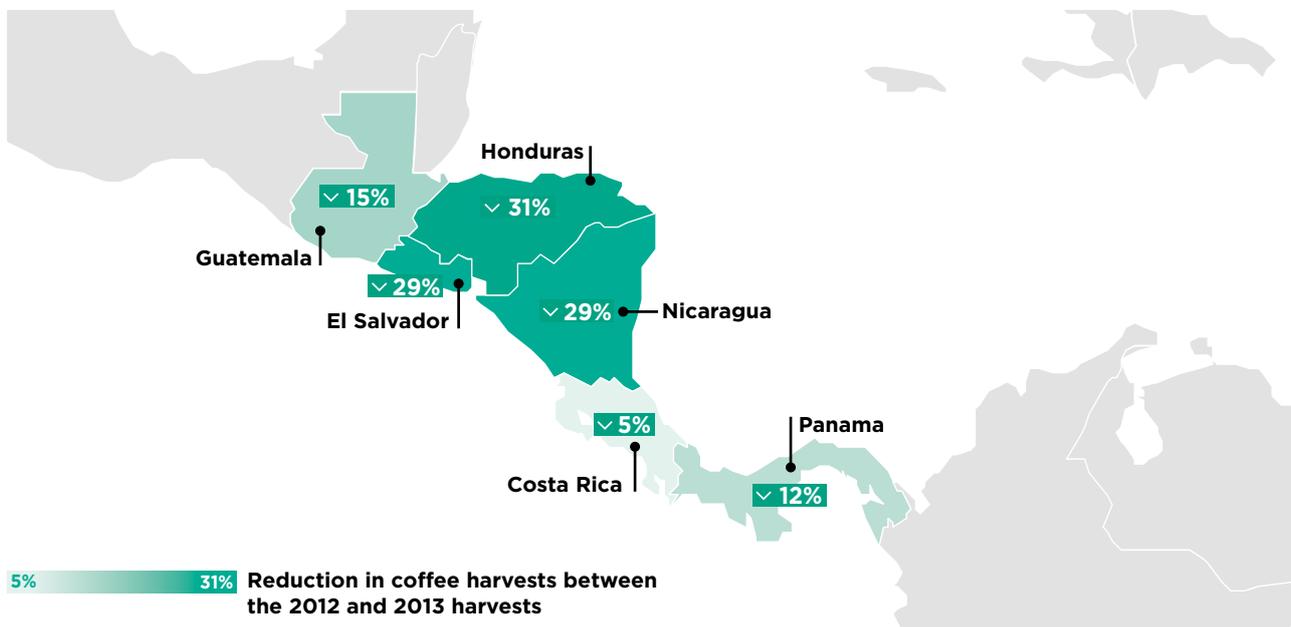
- Pure-play agritechs, such as Extensio and Booster Agro, have expanded beyond their original borders to achieve scale (see Figures 23 and 24). Extensio, for example, recently expanded from its base in Mexico to Ecuador and Colombia. Booster Agro is now present in several Latin American countries, including its home base of Argentina, Brazil, Paraguay, Bolivia, Uruguay and Mexico.

Pests and diseases have had a negative impact on the production of several of the region’s key crops, including banana, cocoa and coffee. This is particularly true in Central America, a region disproportionately affected by climate change. Between 2012 and 2013, for instance, coffee rust reduced Central America’s coffee harvest by 15 per cent, which in turn led to the loss of 265,000 jobs, according to the IICA.<sup>89</sup> It is in this context that several pest and disease management advisory tools, such as Coffee Cloud and Tumaini, have emerged (see Figure 22).

88 OIMA (2016), *Experiences in the use of text messaging services and mobile telecommunications in the agricultural markets of Costa Rica, Ecuador, Trinidad & Tobago and Uruguay*.  
 89 DAI (2019), *Coffee Cloud: precision ag at the touch of a button*.

Figure 21

### Impact of coffee rust on Central American coffee harvests between 2012 and 2013



Source: DAI

Figure 22

### Map of selected pest and disease management advisory tools in Latin America



Source: Companies, GSMA

Figure 23

### Map of selected weather advisory tools in Latin America



Source: Companies, GSMA

Figure 24

### Map of selected record keeping and smart advisory tools in Latin America



Source: Companies, GSMA

## 4.1.2 Business models

Most of the advisory tools available in Latin America are available at no cost to smallholders. A few exceptions include JetBov and Anacafé's Mejor Suelo, Mejor Café app, which charges farmers a small fee to test a soil sample they submit for analysis. Government and NGO-led tools have generally not been designed with revenue generation in mind. Rather, they are typically aimed at meeting social objectives (e.g. improving rural incomes) or providing services more cost effectively. According to Extensio, the cost of an extension or field officer can range from \$74 to \$329 per farmer per year,<sup>90</sup> compared with just a few dollars per farmer for a typical Agri VAS service.

Even agritechs whose main objective is monetisation have pursued business models in which a third party, not the smallholder, pays for the service. Most of the organisations interviewed for this study agreed that smallholder farmers in Latin America have a limited appetite to pay for agri advisory services. As a result, most of the models in the region to date are offered under a subsidy model, with some agritech companies pursuing a cooperative-pays model or a freemium model. In some cases, agritechs pursue a hybrid business model, adding the sale of insights or advertising as a complementary revenue stream.

Figure 25

### Digital advisory service business models

	<b>MODEL 1</b> Farmer pays	<b>MODEL 2</b> Cooperative pays	<b>MODEL 3</b> Freemium	<b>MODEL 4</b> Subsidy	<b>MODEL 5</b> Insights	<b>MODEL 6</b> Advertising
Service aimed at	 <b>Smallholder farmers</b>	 <b>Smallholder farmers</b>	 <b>Smallholder farmers, large farms</b>	 <b>Smallholder farmers</b>	 <b>Agribusinesses, NGOs, governments, research agencies</b>	 <b>Smallholder farmers</b>
Payment model	Farmer pays subscription or one-time fees directly to access the service.	Farmer pays subscription fees indirectly through annual cooperative dues to access the service.	Basic version of the service is free to smallholder farmers. Premium version typically carries a fee. Objective of agritech is to upsell farmers to premium version once stickiness is established.	Service is provided free of charge to farmers. A third party (research institute, NGO, agribusiness or government) pays a per-farmer fee for smallholders to access the service.	Organisation sells insights from the management of data used by or collected from farmers. Includes insights from short surveys carried out over the platform with farmers.	Organisation sells advertising on the platform to companies targeting smallholders like sellers of seeds, fertilisers and other inputs.

Source: GSMA

Kanpo, a Colombian-based agritech targeting smallholder farmers who receive government subsidies, has adopted a hybrid business model (see Figure 20). Its main clients are cooperatives that pay for members to receive Kanpo's service, an app that provides market prices, best practices and technical support. The cooperative funds the cost of the service from the annual dues received from members. Kanpo also monetises the insights gathered from the smallholder farmers themselves, as well as advertising sales to input vendors and other suppliers targeting smallholder farmers on the app.

Apptank SAS in Colombia employs the freemium model for its Control Ganadero service (see Figure 24). Farmers with 20 heads of cattle or less operating out of a single location can access a basic record-keeping solution for free. Farmers with more than 20 heads of cattle, multiple locations and/or with more sophisticated needs can pay an annual membership fee to access premium services, such as access to a veterinarian.<sup>91</sup> Booster Agro, which operates in several Latin American countries, experimented with the freemium model early on, adding a \$5 option for a package with premium weather features. However,

90 Extensio

91 Control Ganadero: [www.controlganadero.co](http://www.controlganadero.co)

unable to find enough farmers to pay for the premium service, it returned to a B2B2C model and identified agribusinesses, input suppliers and other agriculture ecosystem players to pay for smallholders or their own field officers to access the service.

Mexico's Extensio has opted for a subsidy model (see Figure 24). The agritech's clients include government and research agencies (Mexico's Secretariat of Agriculture and Rural Development, CIMMYT), agribusinesses (Grupo Modelo, Bavaria and Agrana

Fruit) and NGOs (Alternare). Extensio monetises its digital extension services by charging these clients an annual subscription fee ranging from \$7 to \$20 per farmer. Extensio's clients gain the ability to communicate with farmers in even the most remote locations and access data collected from the field. Farmers, meanwhile, receive satellite-powered smart advisory, including pest and disease management, best practices, weather insights and market opportunities for their specific crops.

### 4.1.3 Trends in the deployment of advisory tools in Latin America

#### TREND #1

Advisory services are getting smarter.

As in other parts of the world, advisory services in Latin America are becoming more sophisticated (see Section 2.1). Solidaridad, for instance, has an app that uses satellite imagery to help farmers in Honduras meet zero deforestation objectives. Booster Agro uses normalised difference vegetation index (NDVI) satellite imagery to assess crop performance (see Figure 23). Tumaini uses AI to automatically mine thousands of photos of diseased banana plants to more quickly identify the pest or disease in a photo uploaded by a farmer from their smartphone (see Figure 22). Tumaini already has accuracy rates of approximately 90 per cent, but is continuing to fine-tune the algorithm.<sup>92</sup>

Extensio is seeking to leverage AI to automate agronomic advisory inquiries from smallholder farmers it has historically handled on a case-by-case basis (see Figure 24). As the business scales, Extensio will build a database of responses to farmer inquiries that can then be mined to provide smallholder farmers with responses to their queries automatically. Improvements in network speed and device capabilities are also enabling the increased use of media-rich applications, such as video tutorials, chat boxes, among others. They are also facilitating the bundling of services.

#### TREND #2

While governments, research institutes and NGOs were behind most of the first generation of digital advisory services, agritech companies are leading the latest generation of smart advisory services.

Smart advisory services tend to be more complex, relying on different technologies and bringing together dozens of public and private partners. Most smart advisory services identified in Latin America, including

Cultivando Futuro, Booster Agro, Control Ganadero, Extensio and Jetbov are run by local agritech companies (see Figure 24).

92 CIAT (2019), [Artificial intelligence helps banana growers protect the world's most favorite fruit](#).

**TREND #3**

Building sustainable solutions has proven a challenge.

Because many of the tools are funded by government agencies and NGOs, long-term sustainability depends on continued government or donor funding or the ability to transition the tool to beneficiary farmer groups or cooperatives. The Rainforest Alliance's Farmer Training App, which was piloted in Guatemala, cost an initial \$300,000 to set up and \$150,000 per

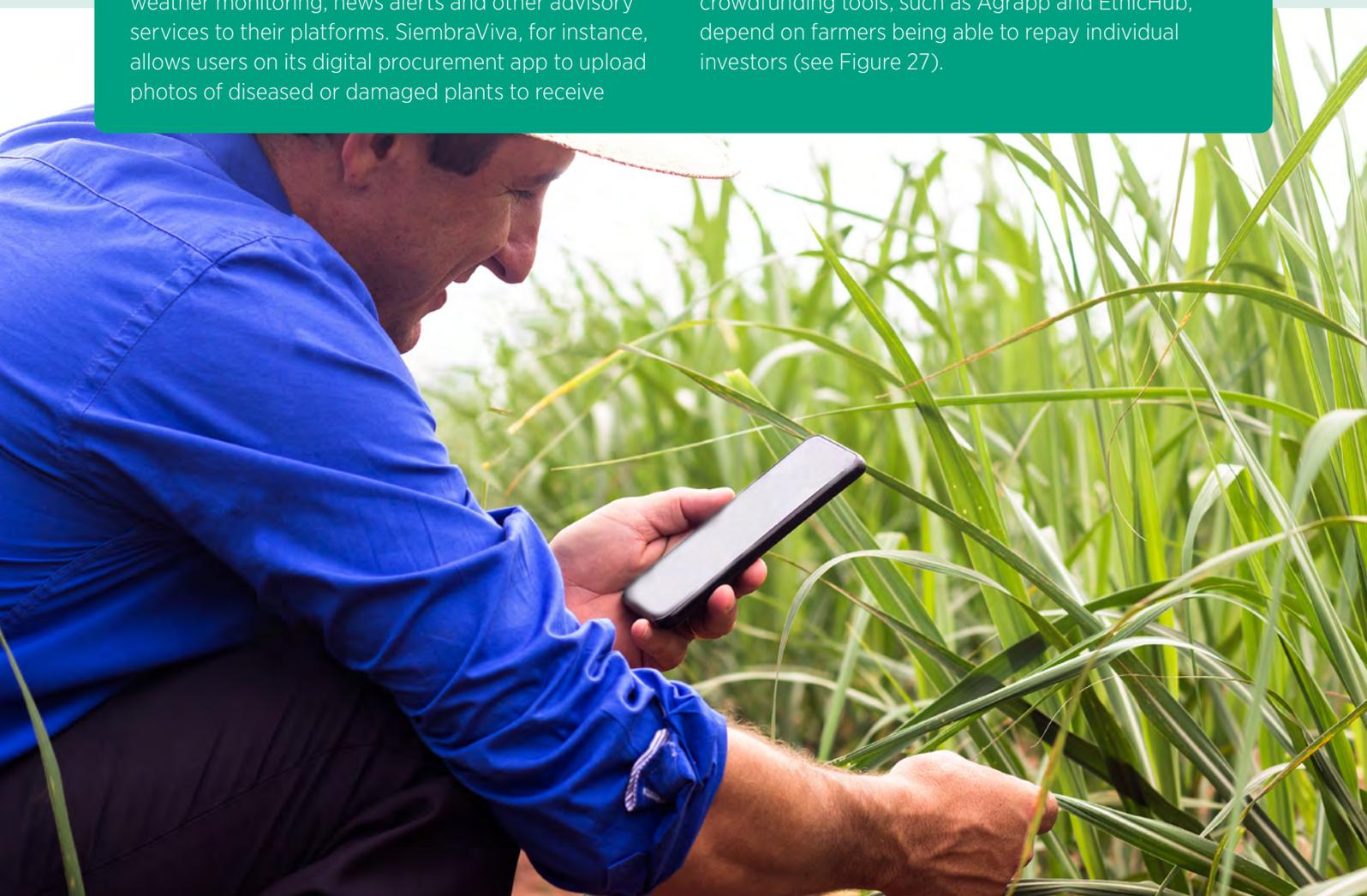
year to maintain.<sup>93</sup> Anacafé invested \$200,000 in the Guatemalan version of the CoffeeCloud pest and disease management app.<sup>94</sup> Governments often face budget constraints that limit their ability to maintain an app, while NGOs are often constrained by time with projects funded for only a certain period. This leads to high attrition rates for many advisory services.

**TREND #4**

Advisory services are increasingly being embedded in holistic tools

Demand for one-stop solutions that address various pain points along the value chain has led many agritechs to make advisory services part of their offering. Many of the digital procurement tools identified in Latin America have added, or are planning to add, best practice tutorials, market pricing insights, weather monitoring, news alerts and other advisory services to their platforms. SiembraViva, for instance, allows users on its digital procurement app to upload photos of diseased or damaged plants to receive

recommendations on mitigation. Bolsagro has added pricing data to its digital exchange, and Smattcom in Mexico has added a tutorial feature called Agromoooc.<sup>95</sup> Digital financial tools are also increasingly adding advisory services to make it easier for farmers to repay a loan. For example, the long-term viability of crowdfunding tools, such as Agrapp and EthicHub, depend on farmers being able to repay individual investors (see Figure 27).



93 UNESCO-Pearson (2018), *The Rainforest Alliance Farmer Training App*.

94 DAI (2019), *Coffee Cloud: precision ag at the touch of a button*.

95 Agromoooc: <https://edu.agromoooc.com/p/inicio>

## 4.2 Agri digital financial services (DFS)



High mobile internet penetration, an enabling regulatory environment, high rates of mobile money use and a robust fintech ecosystem are some of the most important enablers for the development of agri DFS tools in a market. Although slow to introduce favourable regulations for the entry of digital banks and MMPs, governments throughout Latin America have begun passing legislation to support the entry of these players. As a result, fintech transaction volumes in Latin America have increased from approximately \$50 million in 2013 according to CB Insights, to over \$2.1 billion in 2019.<sup>96</sup> Only a fraction of this investment, however, has been directed to fintech initiatives focused on agriculture.

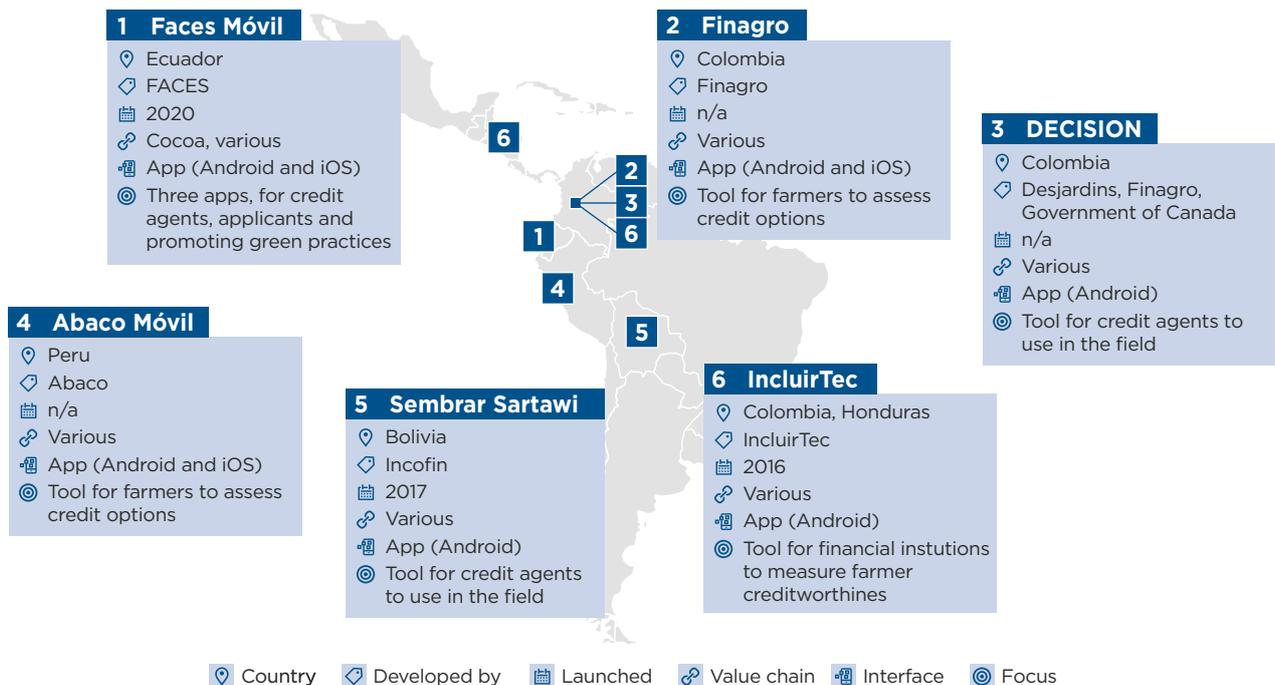
### 4.2.1 Mapping agri DFS in Latin America aimed at smallholder farmers

Unlike other parts of the world where MMPs have played an active role in the deployment of DFS aimed at smallholder farmers, in Latin America, most of the digital financial tools we identified have been led by banks or fintechs. Most of the tools in the region are credit and loan tools that either help credit officers determine the creditworthiness of an applicant, or that smallholders or small agri entrepreneurs can use to assess the type and size of the loan they could be eligible for (see Appendix).

Like other digital agriculture use cases highlighted in this report, Colombia is a leader in agri DFS innovation and home to just under half of the tools identified. This reflects a friendlier regulatory environment for digital banking in general, as well as a more robust ecosystem for fintech development.

Figure 26

### Selected credit and loans and credit scoring agri DFS aimed at smallholder farmers in Latin America

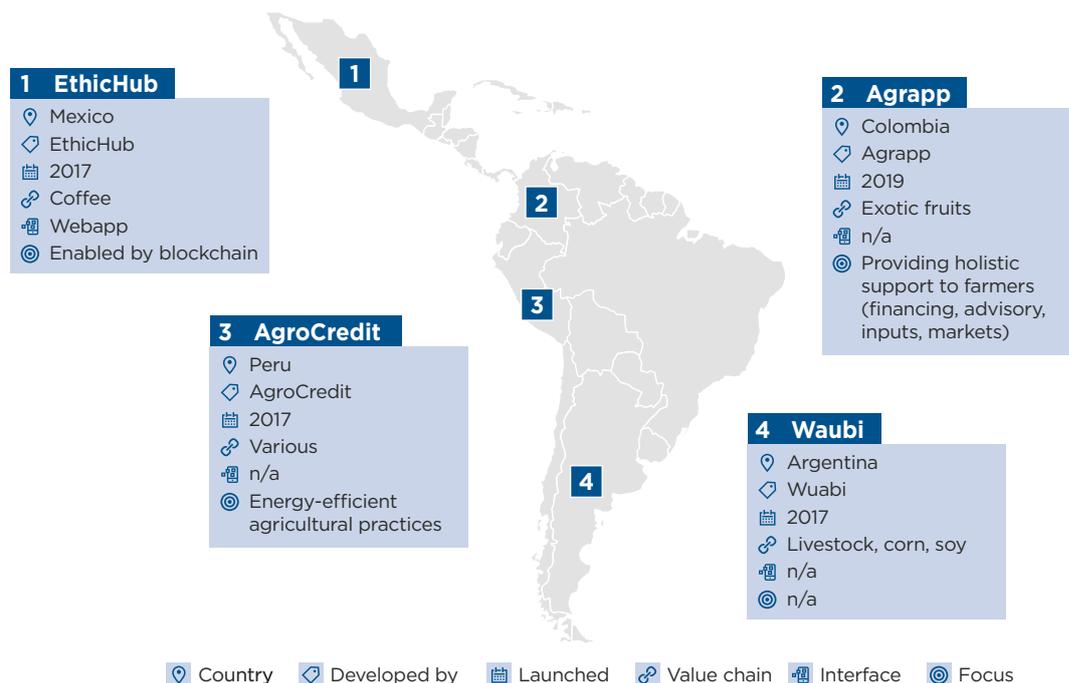


Source: Companies, GSMA

96 CBI (2020), [Latin America is Suddenly Fintech's Hottest Market. Here are the Three Reasons Why.](#)

Figure 27

## Selected crowdfunding agri DFS aimed at smallholder farmers in Latin America



Source: Companies, GSMA

### CASE STUDY

## PASAC – Proyecto de Apoyo al Sistema Financiero Agropecuario Colombiano (Project in Support of the Agricultural Financial System in Colombia)

 **Geography:** five departments across Colombia

 **Project financing:** \$14.6 m (CAD 19.6 million)

 **Goals:** Roughly half of Colombia’s farmers lack access to formal financing. The Government of Canada, in conjunction with the Fund for Financing the Agriculture Sector (FINAGRO), developed PASAC to: (1) promote financial inclusion for smallholder farmers, (2) reduce rural poverty, (3) generate sustainable rural development in post-conflict zones, (4) promote gender inclusion and (5) develop tutorials to promote financial literacy and best practices in the agriculture sector.

 **Timeline:** 2014–2019

 **Partnerships:** In 2014, FINAGRO signed an agreement with the Government of Canada, launching the PASAC project. Other partners involved in the project include Développement International Desjardins (DID), Financière Agricole du Québec – Développement International (FADQDI), Banco Agrario de Colombia as well as 40 financial institutions and 30 cooperatives.

Figure 28

## PASAC partnerships



The Government of Canada provided financing for the project that covered algorithm development, framework development and training.



DID and FADQDI provided on-the-ground project management and development of credit algorithms and reference frameworks.



FINAGRO acted as the Colombian lead on the project. FINAGRO funds are among those being accessed through the DID-designed credit algorithms.



Banco Agrario of Colombia has 784 branches throughout the country. All the branches have been trained on the PASAC credit algorithms and frameworks and credit officers have been trained in the use of the decision tool.



About 40 various financial institutions and about 30 cooperatives have been trained in the new algorithms to increase lending to agriculture sector workers.

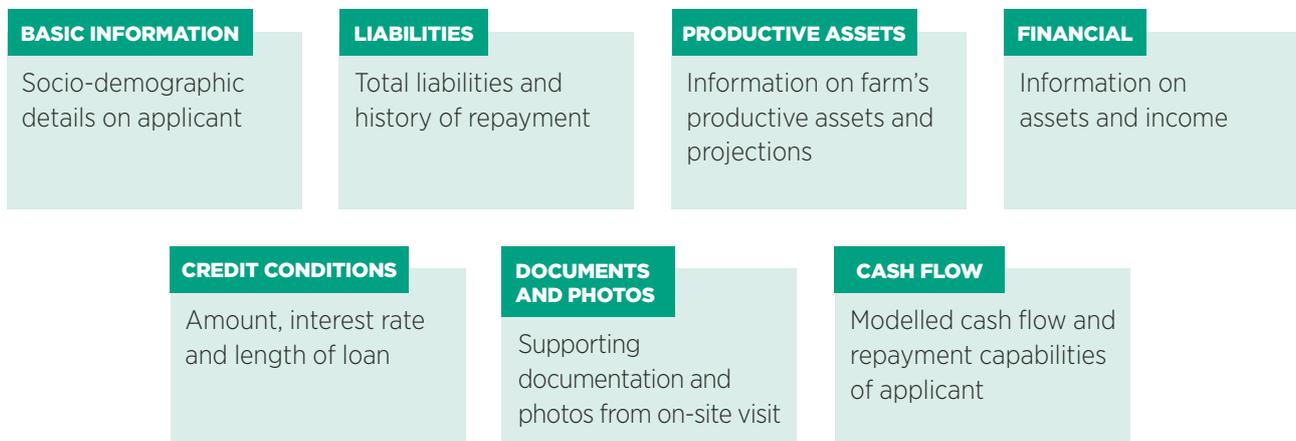
Source: PASAC

**Digital tool:** The project resulted in the creation of DECISION, an agri DFS tool that credit officers from different banks and cooperatives can access through a smartphone or tablet device while visiting an applicant. Data collected on site is then combined with previously collected data on the applicant as well as general

sector data (type of crop, price of crop, geographic location, etc.) and run through a series of algorithms developed by DID specifically for smallholders. The algorithms use data from seven different modules to calculate the creditworthiness of agriculture sector applicants.

Figure 29

## DECISION tool modules



Source: Desjardins

**Results:** During the five-year project, 136,000 credits were granted to 80,000 farmers, 3,500 credit officers (57 per cent women) received training on the new algorithm and DECISION tool and training was provided to 15,000 farmers.<sup>97</sup>

**A look ahead:** Although the project officially ended in early 2019, the algorithms developed by Desjardins to assess creditworthiness are still used by financial institutions, and FINAGRO continues to train new organisations on the use of the DECISION credit tool. A team from Peru's Formagro also conducted a site visit to assess the viability of implementing a similar programme in Peru.

### 4.2.2 Agri DFS business models

The business models employed depend on several factors, including the sub-use case being pursued, the target client for the solution (business or consumer) and whether the solution is bank- or fintech-led. For banks, the objective behind the launch of a digital tool is not always to generate additional revenue streams.

For fintech-led credit and loan solutions, the most common model includes a combination of fixed and variable fees. IncluirTec, for example, charges its clients (mainly banks and other financial institutions) a fixed monthly fee to subscribe to the service (see Figure 26). In addition, IncluirTec charges a fee for each credit report requested through the tool.

In the case of crowdfunding solutions, most of the companies providing this type of solution charge a commission. EthicHub makes a commission on the size of the loan (see Figure 27) and when its network of farmers in Mexico sells coffee to buyers in Europe and China. In the case of Agrapp, this commission fee is eight per cent of all transactions conducted with the tool (see Figure 30). Agrapp also generates revenue through the purchase of farm inputs and equipment (e.g. irrigation systems) in bulk, which it can then sell to smallholder farmers at a small mark-up. Finally, Agrapp can also secure a bonus from crop buyers if it can guarantee minimum volumes and if certain quality criteria are met.

Figure 30

#### Agrapp crowdfunding business model



Source: Agrapp

### 4.2.3 Trends in the deployment of agri DFS tools in Latin America

#### TREND #1

New technologies, such as AI, big data, satellites and drones, are increasingly underpinning agri digital financial tools.

The richer the data sets available to fintechs and financial institutions, the lower their risk when extending loans and other products to smallholder farmers. Agri DFS companies are increasingly cross-referencing data collected from farmers (such as farm location, farm size, estimated crop production, among others) against hundreds of technical resources and publicly available databases to assess the likelihood

of repayment. IncluirTec’s app, for example, raises red flags if a farmer decides to plant a crop that is not ideally suited for the elevation and location of the farm. Leveraging public and private sector data, Desjardins developed 75 different reference frameworks for its DECISION credit app, making the tool much more robust for assessing the creditworthiness of agriculture sector workers.

**TREND #2**

New credit and loan digital tools tie financing to sustainable practices.

In an effort to move towards sustainable practices that can help support farmer incomes over the long term, several new tools are supporting the adoption of sustainable or green farming practices. FACES in Ecuador is working with IDB Lab to develop a credit product that rates a farmer on the sustainability of their farming practices (see Figure 26). If a smallholder

receives a high score, they are eligible for a loan at a reduced rate. If they receive a low score, they are given pointers on how to improve it through more sustainable agricultural techniques. Banco Agrario in Colombia has a Green Credit product that incentivises farmers to adopt climate change mitigation strategies.

**TREND #3**

Several agri DFS link individual investors in international markets to smallholder farmers in Latin America who need financing.

Over the last few years, some fintechs have identified an opportunity around individual investors, typically millennials, who want to either secure a higher return on their savings or use their savings for social impact. EthicHub, for example, identifies individual investors in Spain who contribute to projects on coffee farms in Mexico (see Figure 27). IBM and Farmer Connect launched a new app, also aimed at millennials, called Farmer Connect in early 2020. This app enables

a consumer purchasing coffee in Europe or North America to scan a QR code on the packaging and access information on the farmer who grew the beans. Through the app, the buyer can then send a tip to the farmer to supplement their income. Propina's Tip Your Farmer app works similarly, allowing coffee buyers in countries like Spain to buy tokens that are then applied towards the purchase of weather insurance and credit for farmers in Colombia.

**TREND #4**

Blockchain is facilitating many new agri DFS tools.

Blockchain is a distributed ledger technology that, according to the FAO, is a “decentralized system for recording transactions with mechanisms for processing, validating and authorizing transactions that are then recorded on an immutable ledger.”<sup>98</sup> Transactions are transparent to all parties, extremely

secure, fast and virtually free.<sup>99</sup> In Latin America, EthicHub, Farmer Connect and Tip Your Farmer all leverage blockchain to facilitate transactions between investors or “tippers” in developed markets and smallholder farmers in Latin America.

98 FAO (2019), *E-Agriculture in Action: Blockchain for Agriculture Opportunities and Challenges*.

99 Jori Armbruster as interviewed by Disrupter Daily (2019), *Blockchain in Agriculture Use Case #5: EthicHub*.

## 4.3 Digital procurement



Widespread connectivity, smart device ownership and the prevalence of export crops, such as coffee, cocoa and fresh produce, are key enablers for the development of digital procurement tools in Latin America. Digital procurement refers to the roll-out of digital technologies in the agricultural last mile<sup>100</sup> that enable a range of digital systems and processes to transition from paper to digital (see Appendix).

### 4.3.1 Mapping digital procurement initiatives in Latin America aimed at smallholder farmers

Digital procurement tools are widely adopted in Latin America both by large-scale global exporters, such as ECOM and Olam, as well as smaller cooperatives that manage as few as 250 members, such as Argentina's COOPSOL. The main drivers for adopting digital procurement tools are to improve on-farm practices through the digitisation of farmer records, and to manage certification and traceability requirements needed to export specific crops, such as cocoa, coffee, honey and fresh produce, to North American and European markets.

Some agribusinesses have opted to use digital procurement tools available from global software providers, such as SourceTrace, Agritask, Farmforce and Cropin, customising these solutions to local circumstances as appropriate. Some global players, like Olam, have opted to build their own tools internally and deploy them across their footprint as part of broader sustainability initiatives. Still others have hired local software developers to build simpler, less expensive tools suited to the specific needs of cooperative members in the last mile. ECOM, which

operates in several Latin American countries, has pursued a hybrid model in Colombia. It leverages ECOM's proprietary Integrity platform, which is deployed globally to digitise data collection from its more than 8,800 coffee farmers in the country. However, to collect the additional metrics required for certification by the Colombian government, such as number and frequency of on-farm audits, and number of farmers trained in the use of potable water, ECOM Colombia developed a tool locally that can integrate with the Integrity solution.

The bulk of digital procurement tools deployed in Latin America are either digital records tools or digital records with traceability (see Appendix). There are a few digital records with payment tools in the region, but these are largely concentrated in countries such as Colombia and Mexico. Although companies expressed a strong interest in digitising payments due to the added security and time savings they would offer, they noted that their smallholder farmer partners were not generally open to these efforts. This was particularly true in Central American countries.

100 In agricultural value chains, the "last mile" refers to the web of relationships and transactions between farmers, crop buyers and input suppliers. Such solutions create a digital record of the interactions between farmers and agribusinesses or cooperatives.

Figure 31

### Map of selected digital procurement tools in Latin America and the Caribbean



Source: Companies, GSMA

Although some of the digital tools identified address smallholder farmer needs in the honey, peanut, quinoa, chia and fresh produce markets, the vast majority of digital procurement tools support farmers operating in

the coffee and cocoa value chains because exporters must meet strict traceability and certification requirements to sell internationally.

### 4.3.2 Business models

Many of the digital procurement tools in the region are proprietary tools developed in-house with the assistance of a software developer providing technical expertise. For these companies, the tool is not meant to generate revenue; rather, it is regarded as a necessary operating cost for farmers to improve on-farm efficiencies or to meet traceability criteria required by their international buyers.

For agritechs seeking to monetise their solution, the most prevalent business model found in Latin America is the SaaS licensing model. The solution provider will typically charge an upfront set-up fee to customise its off-the-shelf solution to the client. This includes customising the language, incorporating

the appropriate value chains and adjusting metrics to ensure the specific needs of the client are being met. After set-up is complete, the agritech charges a monthly licensing fee with discounts provided based on the number of farms, number of hectares or number of individual users. The client in this model can be an agribusiness, a cooperative or an NGO. Farmforce, for example, collaborated with donors Mercy Corps, USAID and the Clinton Giustra Foundation (now Acceso), which funded various digital procurement initiatives supporting smallholder farmers in Central America and the Caribbean. Nuup, which is based in Mexico and registered as a non-profit, follows a similar model, teaming with large entities like Danone to offer digital procurement and advisory services to smallholders.

### 4.3.3 Trends in the deployment of digital procurement tools in Latin America

#### TREND #1

Digital procurement tools are increasingly using satellites and drones to improve data collection.

Sending field agents to hundreds, if not thousands, of smallholder farms in dispersed rural areas to collect and input data into a smartphone or a tablet can be extremely time consuming, prone to error and imprecise. The reliability of the data provided by the farmers can also be poor if farmers feel that providing accurate information may result in paying more tax or losing access to certain social programmes. Agribusinesses, traders and cooperatives running digital procurement tools are increasingly looking to satellites and drones to automate some data collection requirements while also improving the veracity of the data. Satellites and drones can confirm the size of an individual farm, provide an accurate crop count and detect the early signs of pests and diseases by

monitoring discoloration of the leaves, among other benefits.

CIMMYT and COLPOS are using satellite technology to help smallholder farmers in Mexico's sugar cane and wheat value chains improve on-farm management. By linking satellite images to 30 on-farm metrics, the tool can help farmers increase yields and boost income. The Latin American agritechs and cooperatives interviewed stated that technology solutions that rely on satellite can be expensive and are typically less effective for crops grown under heavy tree cover (like coffee and cocoa). For these value chains, drones may offer more useful readings.

**TREND #2**

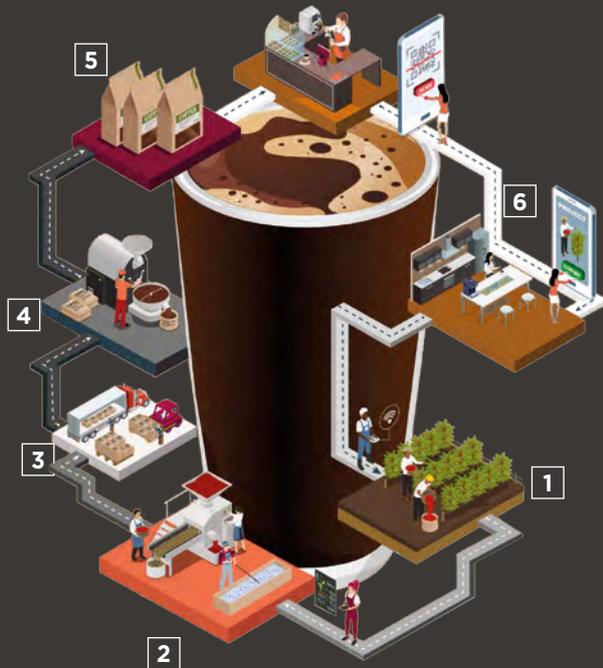
Agribusinesses, traders and cooperatives are increasingly using blockchain to manage their sustainability efforts.

Over the last couple of years, some of the world's largest companies have begun using blockchain to extend traceability all the way to the consumer. Large coffee companies, such as Nestlé and Starbucks, as well as retailers like Carrefour and Walmart, have been early adopters. Many of the cooperatives and agribusinesses interviewed in Latin America have stated their intention to move towards blockchain technology to meet demand

for greater traceability. COOPSOL in Argentina, for instance, is leveraging IBM's blockchain technology to enable consumers in Europe to scan a QR code found on the label to access information about the farmer who produced the honey. COOPSOL is one of the first cooperatives to implement blockchain for traceability in the region. Heifer International is also working to implement blockchain technology as part of its Chocolate-4-All initiative in Honduras and the Vetiver initiative in Haiti.

Figure 32

**Blockchain enhances traceability in the coffee sector**



Source: IBM Food Trust, Farmer Connect

**1 Farmer** – Coffee cherries are harvested and data, such as counterparty ID and bean variety, are uploaded to the blockchain.

**2 Processor** – Coffee cherries are then pulped, washed, sorted and their protective hulls are removed, leaving a raw green bean.

**3 Shipper** – The processed beans are loaded into shipping containers and sent across the ocean to various markets.

**4 Roaster** – Beans are roasted and different varieties and grades are sometimes blended to optimise flavour and cost.

**5 Consumer** – Each package is stamped with a QR code that consumers can scan to see their coffee's journey.

**6 Contributor** – Through a mobile app, consumers can feel closer to coffee farmers and their surrounding region.

**TREND #3**

There is a strong need to “Latin Americanise” digital procurement solutions.

Most of the agribusinesses, traders and cooperatives interviewed cited a strong preference for working with an established digital procurement tool rather than “reinventing the wheel” and building a new tool from scratch. Despite this preference, many agribusinesses have ended up hiring a local developer to build a proprietary digital procurement tool because the cost of off-the-shelf services is too high or do not meet the specific needs of its clients. SiembraViva, for example,

looked at several off-the-shelf solutions before deciding to build its own digital procurement tool to support its e-commerce efforts. It found there was not an off-the-shelf solution able to manage the large number of fresh produce varieties they needed to track. ECOM, which deployed its global Integrity tool in Colombia, had to build a complementary tool to capture some of the data that Colombian officials required, but that the Integrity tool was unable to capture.

## 4.4 Agri e-commerce



The size of the agri e-commerce opportunity in a given market depends on several enabling factors, including mobile network coverage, adoption of digital payments, solid logistics networks, familiarity with e-commerce platforms, rising incomes and urbanisation levels and an enabling regulatory environment.<sup>101</sup> A busier lifestyle in urban areas, as well as evolving food consumption and lifestyle preferences that come with rising incomes, help strengthen the business case for convenient, direct-to-consumer services that e-commerce platforms provide.

### 4.4.1 Mapping agri e-commerce services sourcing from smallholder farmers in Latin America

The GSMA AgriTech programme identified over two dozen agri e-commerce platforms in Latin America that source directly from smallholder farmers. Of these, over half are headquartered in Colombia, operating out of Bogotá, Medellín and Barranquilla. Compared with other countries in the region, especially in Central America, Colombian agri e-commerce businesses have benefited from a growing middle class, high levels of urbanisation

and the presence of multiple large cities, a favourable regulatory environment, a clear addressing system and a solid logistics network. Growing familiarity with e-commerce platforms, aided by the growth of Mercado Libre and Colombia's own Rappi,<sup>102</sup> is also enabling the growth of agri e-commerce in Colombia. Furthermore, Colombia is the only country in the region to have a government ministry dedicated entirely to e-commerce.

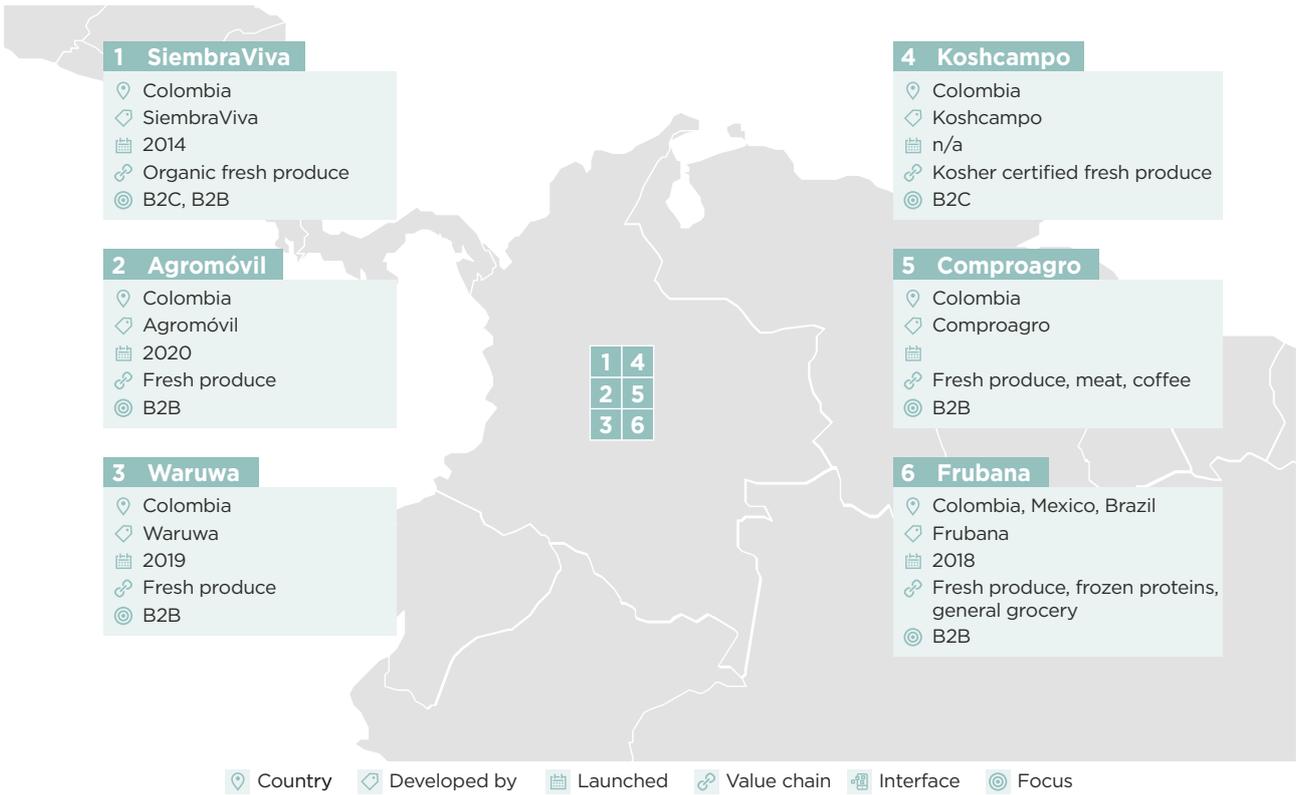
Figure 33

#### Map of selected agri e-commerce services in Latin America



101 GSMA (2019), *E-commerce in agriculture: new business models for smallholders' inclusion into the formal economy*.

102 Mercado Libre is Latin America's largest marketplace for e-commerce and online auctions. It is headquartered in Argentina and has subsidiaries in 18 countries, including Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Panama, Paraguay, Peru, Uruguay and Venezuela. See <https://www.mercadolibre.com>. Rappi is a Colombia-based e-commerce and delivery platform with a presence in several Latin American markets, including Argentina, Brazil, Chile, Colombia, Costa Rica, Ecuador, Mexico, Peru and Uruguay. See [www.rappi.com](http://www.rappi.com).



Source: Companies, GSMA

Although many of the agri e-commerce companies interviewed aspire to grow their businesses internationally by linking new urban metropolitan areas to rural smallholders in surrounding areas, most agri e-commerce companies in Latin America currently operate in a single city. Notable exceptions

include Frubana, which currently operates in four cities throughout the region (Barranquilla and Bogotá in Colombia, São Paulo in Brazil and D.F. in Mexico), and Smattcom, which links smallholders in Mexico and 22 other countries to buyers both domestically and abroad.



## 4.4.2 Business models

As is the case globally, most agri e-commerce platforms in Latin America have adopted a mark-up business model. Companies like Frubana, Waruwa and SiembraViva purchase produce directly from smallholder farmers and then sell it at a mark-up to business or residential consumers (see Figure 34). By eliminating intermediaries, these e-commerce

agritechs can both pay farmers a premium and reduce prices for customers, particularly businesses that purchase in bulk like restaurants and supermarkets. Frubana claims that restaurants pay up to 10 to 20 per cent less when purchasing through their platform than through more traditional, non-digital channels.<sup>103</sup>

Figure 34

### Business models for agri e-commerce companies in Latin America<sup>104</sup>

Model	Description	Examples
<b>Mark-up</b>	This is the most common revenue model for agri e-commerce businesses worldwide. Under this revenue model, the online platform can apply a margin to the price paid to farmer suppliers. By eliminating several intermediaries and making distribution more efficient, agri e-commerce businesses can offer farmers a higher price for their produce than traditional middlemen, while maintaining the flexibility to target different market segments with differentiated prices.	d'Market Movers, Frubana, Waruwa, Mercadito, SiembraViva, Koshcampo, Plaz, Jüsto
<b>Commission fees</b>	Agri e-commerce businesses can charge buyers and sellers a fee when they complete a transaction on the platform. As commission fees tend to represent a small percentage of the total order value, online platforms require a high volume of transactions to achieve meaningful revenue.	Agromóvil, Bolsagro Móvil
<b>Membership fees</b>	Agri e-commerce businesses can charge membership or subscription fees from buyers to receive periodic (e.g. weekly) deliveries of a pre-selected basket of goods. This model can also be appropriate for meal delivery services.	SiembraViva, Koshcampo, Smattcom
<b>Advertising</b>	Agri e-commerce businesses can sell product display advertisements on their platforms. This model generally requires the business to have a large number of users to attract advertisers, including sellers of inputs, farm equipment and other services targeting smallholder farmers.	Smattcom, Comproagro
<b>Insights monetisation</b>	Under this model, agri e-commerce businesses can sell insights from user data to third parties, including governments, NGOs, farmer groups, logistics companies, among others.	Being considered by some like Comproagro

Source: Companies, GSMA

103 Dinero (2018), *Frubana: la 'startup' de frutas y verduras que crece a toda velocidad*.

104 GSMA (2019), *E-commerce in agriculture: new business models for smallholders' inclusion into the formal economy*.

Agromóvil, which is still in the pilot phase and has yet to launch commercially, is pursuing a different business strategy. The company will earn a share of transactions conducted over the platform, including transactions between buyers and sellers, as well as between buyers/sellers and transportation companies. Over time, Agromóvil plans to monetise insights from the data they collect on transactions, particularly insights related to logistics.

Two of the agri e-commerce businesses identified, Mexico's Smattcom and Colombia's Comproagro, rely on advertising for at least part of their revenue. Smallholder farmers can set up a profile, upload photos of their produce to the platform and provide the attributes of the crops they are selling. Smattcom allows companies, primarily input and farm equipment companies targeting smallholders, to advertise on the site. Both Smattcom and Comproagro have been aggressively growing the number of smallholder farmers on their platform to increase the revenue they can generate from the sale of advertising. The number of registered farmers on Comproagro's platform has increased from 5,700 in 2017 to 12,000 in 2018 to over 26,000 in 2019.<sup>105</sup>

Some of the agri e-commerce companies are producers themselves and have leveraged their e-commerce platform to increase sales of their own produce. Comproagro was initially founded to increase the market for the founder's onion crop. Comproagro has since hired more than 30 women to harvest and process the onions from Comproagro's farm as well as the farms of 120 other local families. Comproagro now processes 10 tonnes of onions per week, compared to 10 tonnes of onions per year before it launched the platform.<sup>106</sup> D'Market Movers in Trinidad and Tobago expanded into papaya harvesting, which it promotes aggressively through the platform.

In some cases, monetisation is not the ultimate goal of an agri e-commerce platform. Government agencies have teamed with technical partners and multilateral agencies to launch e-commerce platforms to promote new laws or other government initiatives. In Guatemala, for example, the Ministry of Education is currently piloting DIGITAGRO, a platform that links schools seeking to purchase healthy foods for school meals with smallholder farmers. This initiative was launched in response to Guatemala's School Feeding Law, passed in 2017 to improve food security and nutrition for Guatemala's school children. In addition to mandating a significant increase in per-student spending (from \$0.14 (Q1.11) per day in 2017 to \$0.52 (Q4.00) in 2020) and a shift towards more nutritious food, the law mandates that at least 50 per cent of all food purchased by schools be purchased from smallholder farmers. The project provides additional training for women smallholder farmers to support their inclusion in the DIGITAGRO platform. As a result of the new law and DIGITAGRO platform, the FAO estimates that smallholders can generate \$87.75 million (Q675 million) in sales each year by selling to schools.<sup>107</sup>

Other government-sponsored agri e-commerce platforms include Chile's CampoClick and Costa Rica's Cr Orgánico. Chile's CampoClick was launched by the country's Ministry of Agriculture in 2016 to give smallholder farmers access to new markets. Smallholder farmers with less than 12 hectares of land can register on the platform and access buyers from all over the country (mainly retailers, restaurants and hotels). Costa Rica's CR Orgánico platform was developed by mobile operator ICE for the Ministry of Agriculture as part of its efforts to promote organic practices among smallholder farmers. The app creates linkages between consumers looking to buy organic produce and smallholder farmers that have adopted organic practices.

<sup>105</sup> Comproagro.

<sup>106</sup> Diario las Americas (2017), [Campesinos colombianos crean una aplicación al estilo eBay para superar la pobreza](#).

<sup>107</sup> de Ferrari Piazza, C., Perego, V. and Kennedy Freeman, K. (28 January 2020), "[Promoting food security and empowering women farmers in Guatemala, one school day at a time](#)," World Bank Blogs.

## CASE STUDY

Colombia's government launches El Campo a un Clic (The Countryside at a Click) to help farmers reach new buyers during the COVID-19 pandemic

 **Geography:** Colombia

 **Project financing:** N.A.

 **Timeline:** 2020–

 **Goals:** The Government of Colombia, through the Ministry of Agriculture and Rural Development, seeks to minimise the impact of COVID-19 on the country's food supply chain. Through the Campo a un Clic platform, the government aims to help preserve the income stream for Colombia's smallholder farmers while also ensuring that food continues flowing to Colombian homes despite stay-at-home orders.

 **Partnerships:** The Ministry of Agriculture and Rural Development teamed up with 15 Colombian agritechs, primarily e-commerce platforms that purchase directly from smallholder farmers. SENA is helping with advisory and training support, while the National Association of Colombian Entrepreneurs (ANDI) is helping to create linkages with retailers, restaurants, hotels and other potential consumers.

Figure 35

### Campo a un Clic partners



Source: Ministry of Agriculture and Rural Development Colombia

 **Digital tool:** Smallholder farmers can complete an online form that forwards information on the available crop for sale to selected e-commerce agritechs. The transaction is completed off the platform, although farmers are asked to submit a copy of the invoice to the Ministry of Agriculture after the sale is completed.

 **Results:** As of early May 2020, over 50,000 farmers had registered on the platform to sell their crops. The goal is to have over 130,000 farmers registered by the end of 2020 and 300,000 registered farmers by the end of 2022.<sup>108</sup>

### 4.4.3 Trends in the deployment of agri e-commerce platforms in Latin America

#### TREND #1

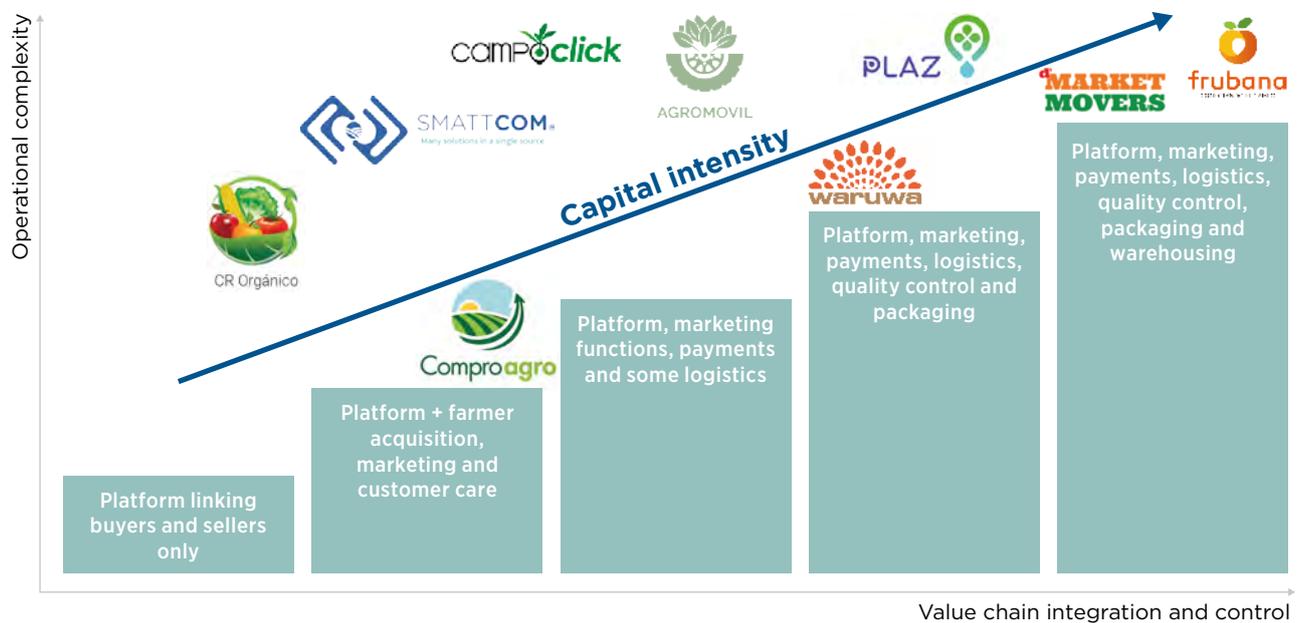
As is the case globally, agri e-commerce companies in Latin America are doing more than just connecting buyers and sellers.

Many have collection and/or processing facilities that receive, process and package crops from smallholder farmers. Some, like Agromóvil and Waruwa, handle logistics while others, like Colombia's SiembraViva,

assist with certification. SiembraViva is also piloting a digital procurement tool to help its farmers achieve and maintain certification standards.

Figure 36

#### The evolution of the agri e-commerce business model in Latin America



Source: Companies, GSMA

#### TREND #2

The COVID-19 pandemic has forced many business-to-business (B2B) agri e-commerce platforms to move more quickly into business-to-consumer (B2C) sales.

The priority of most agri e-commerce agritechs to date has been linking smallholders to businesses, including restaurants (Frubana, Plaz), small family-run stores (Agruppa), hotels, supermarkets or a combination of all four (Agromóvil, Waruwa). The COVID-19 pandemic has put pressure on agri e-commerce companies focused exclusively on B2B markets. With demand from restaurants and hotels collapsing amid state-

mandated stay-at-home orders, companies like Frubana and Waruwa have been forced to accelerate their plans to set up a B2C channel. After seeing demand from its B2B channel fall 95 per cent<sup>109</sup> in the early days of the pandemic, Plaz shifted to making its B2C platform easier to use for first-time shoppers. Frubana, for example, launched Tucan, a brand focused exclusively on B2C agri e-commerce sales.<sup>110</sup>

109 Forbes (2020), [Incrementa apogeo de frutas y verduras a domicilio desde plazas de mercado.](#)

110 La República (2020), [Frubana lanza Fresco, startup para garantizar en los barrios abastecimiento de alimentos.](#)

**TREND #3**

B2C agri e-commerce players are expanding their offerings to include products beyond fresh produce.

SiembraViva, an agri e-commerce company that initially focused on the sale of fresh produce in Barranquilla, Colombia, found it difficult to scale its business by selling fresh produce exclusively. Recognising that certain segment of households prefer to visit a single e-commerce site to buy fresh produce, meat, dairy and other groceries, the company ceased selling fresh produce through the SiembraViva site in May 2020, instead becoming the exclusive supplier of fresh produce for a new e-commerce platform,

Mercaviva. Mercaviva is part of Mystic Foods, a holding company with a stake in five different restaurants in Medellín. The new Mercaviva platform brings together 12 different suppliers of high-quality organic goods to provide consumers with a one-stop online grocery shopping solution. Trinidad and Tobago’s d’Market Movers and Frubana have also found it easier to scale their businesses by offering customers a full suite of grocery staples in addition to locally sourced produce, meats, seafood and specialty items.

**TREND #4**

Most of the agri e-commerce businesses identified can be classified as pure-play agri e-commerce players,

although an important minority (around 15 per cent) are either spearheaded by, or operated on behalf of, a government ministry to support a social programme. These include Guatemala’s DIGITAGRO, Chile’s

CampoClick and Costa Rica’s CR Orgánico. A new initiative in Colombia, Campo a un Clic, brings together 15 different agritechs on a single platform to make it easier for smallholders to reach new buyers for their crops.

**DEEP DIVE**

Agri e-commerce platforms in the region are supporting gender inclusion

Platform	How the platform promotes women’s participation in the agriculture sector
<b>DIGITAGRO</b>	The FAO is running a series of training seminars aimed at women farmers to promote their inclusion in the School Feeding Law through the DIGITAGRO platform.
<b>Comproagro</b>	Comproagro mainly hired women to work in its collection facility processing onions for sale through the platform. Comproagro offers women flexible hours that allow them to build their schedules around parenting and other responsibilities in the home.
<b>SiembraViva</b>	SiembraViva has worked towards and largely achieved, a 50:50 distribution of its registered farmers between men and women.

## 4.5 Smart farming



Smart farming refers to the use of sensors, drones, satellites and other farm assets to generate and transmit data about a specific crop, animal or practice to support agricultural activities. Smart farming solutions rely on connectivity between IoT-enabled devices to optimise production processes and growth conditions while minimising costs and saving resources (see Appendix). The scaling of smart farming applications in rural areas relies on the availability of low-power wide-area (LPWA) networks. LPWA networks will support devices requiring low power

consumption, long range and low cost, all of which are critical for success in the agriculture vertical. To date, most LPWA Internet of Things (IoT) networks have been deployed using unlicensed spectrum, relying on technologies such as LoRa and Sigfox. Despite challenges around revenue growth, most MNOs are starting to invest in building licensed IoT networks, including LTE-M and NB-IoT. Telefónica is deploying both NB-IoT and LTE-M networks in Argentina, Brazil and Colombia. América Móvil is rolling out an LTE-M network in Mexico.

Figure 37

### NB-IoT and LTE-M IoT network deployments in Latin America, 2020



Source: GSMA, Telefónica

NB-IoT and LTE-M offer several key advantages, including substantial improvements in transmission ranges suitable for wide area deployments, better in-building penetration, reduced power consumption (enabling 10-year battery life for connected devices) and rapid deployment given the ability to leverage existing mobile network assets.<sup>111</sup>

In Central America and Andean markets, such as Bolivia, Ecuador and Peru, smart farming innovations will likely continue to rely on unlicensed spectrum solutions as well as cellular M2M until licensed

networks are up and running. The availability of networks is tied to the availability of low-cost sensors. While IoT is widely used in large-scale, intensive farming, the cost of implementation has put IoT solutions largely out of reach of most smallholder farmers in the region.

Other important factors driving smart farming adoption include an enabling regulatory environment and the prevalence of value chains (e.g. livestock, fish, fresh produce, cocoa and coffee) that can benefit from smart farming interventions.

#### 4.5.1 Mapping smart farming initiatives aimed at smallholder farmers in Latin America

While smart farming solutions have long been widely deployed in Southern Cone markets where large-scale farming is common, solutions that use IoT sensors and IoT-enabled devices like drones and satellites to generate and transmit data about a specific crop, animal or practice have been more limited in Andean and Central American regions. This is a reflection of the greater influence of smallholder farmers in Andean and Central American agricultural markets and their difficulty in accessing smart farming solutions.

Many global providers of smart farming solutions, like Logicalis, Libelium and Arable, have focused most of their efforts on large farms due to the higher use of IoT and drone readiness. This is also the case for locally based smart farming agritechs like Colombia's Farmapp, which targets flower exporters in Colombia and Ecuador, Peru's Alium which works with Peru's largest poultry farmers, and Peru's SpaceAg which works with the largest exporters in Peru. While

Farmapp and Alium can deploy their tools on smaller scale farms, the bulk of sales to date (about 90 per cent) have come from larger players.

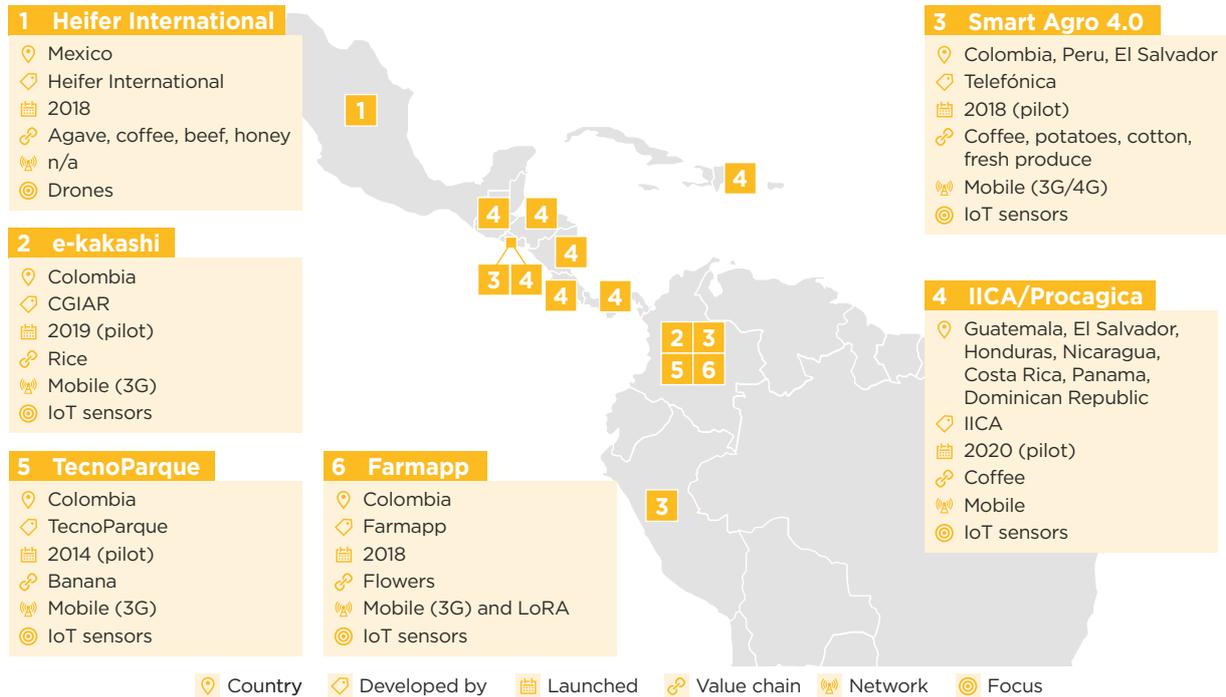
As a result, most of the smart farming deployments benefiting smallholder farmers to date have been projects led or sponsored by tech companies (Telefónica and Microsoft), research groups (SENA, IICA, CGIAR, CATIE), NGOs (Solidaridad) or multilateral organisations (FAO, IDB Lab) testing the viability of smart farming solutions in the context of smallholder farming.

The most prominent smart farming solution aimed at smallholder farmers identified in Latin America is remote equipment monitoring, specifically solutions that use data gathered from sensors to provide recommendations on irrigation and pesticide use (see Appendix). The AgriTech team identified a handful of smart farming projects focused on irrigation and pesticide use in Colombia, Peru and Central America.

111 GSMA (2020), "Mobile IoT".

Figure 38

### Selected remote equipment monitoring smart farming solutions in Latin America



Source: Companies, GSMA

A handful of deployments identified focused on the livestock and aquaculture management use case, including Alium, Abaco (Piscis) and Celotor.

Figure 39

### Selected livestock and aquaculture management smart farming solutions in Latin America



Source: Companies, GSMA

The AgriTech team did not identify any shared asset IoT solutions in the region even though this is the leading smart farming use case deployed in the rest of the world.<sup>112</sup> Smart shared asset solutions enable farmers to access agricultural equipment, such as

tractors, drones and other farm equipment, via digital booking systems. The equipment is usually fitted with IoT-enabled tracking devices to allow remote monitoring. Services are primarily provided via mobile money for PAYG billing.

### 4.5.2 How smart farming interventions are addressing farmer pain points

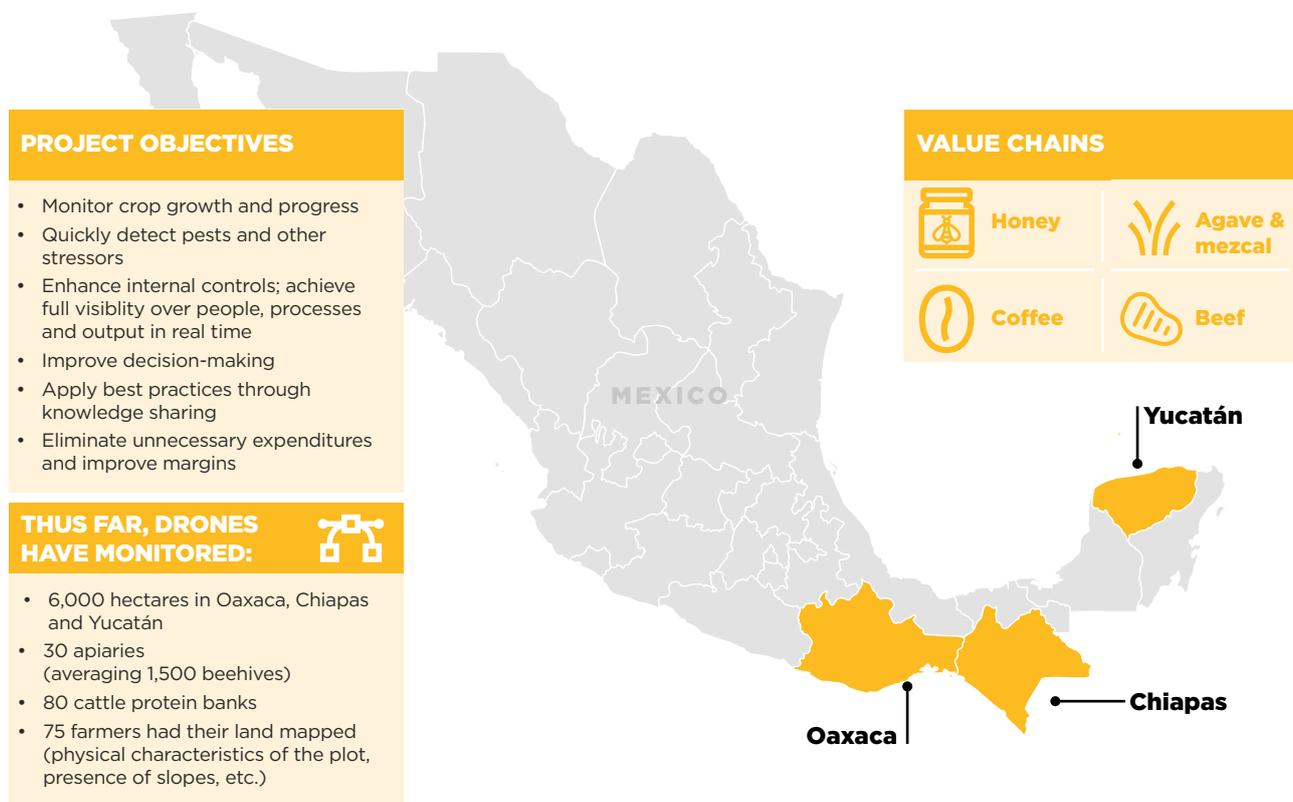
In interviews, most of the businesses currently deploying or assessing the future deployment of smart farming solutions indicated that the main impetus for implementing smart farming technology is to dramatically improve on-farm productivity and performance, thereby increasing income potential. Lower costs through more efficient use of resources are also driving the deployment of smart farming solutions.

The productivity improvements derived from the use of smart farming technology can be significant. For example, farmers can focus on higher-value activities when they rely on satellite or drone imagery to alert

them to potential problems with pests and diseases. Heifer International in Mexico has acquired drones to monitor 6,000 hectares in the states of Chiapas, Oaxaca and Yucatán. Farmers use the drones to identify the best locations to grow coffee, honey and agave, and to monitor beehives and high protein forage crops for cattle.<sup>113</sup> Heifer International splits the cost of operating the drones across three of its projects in Mexico, including Replicating Opportunities, Honey Promise and Coffee Matters.<sup>114</sup> One of the early benefits of drone use has been a significant reduction in the impact of pest and diseases as the drones allow for early detection.

Figure 40

## Heifer International's drone programme for smallholder farmers in Mexico



Source: Heifer International

112 GSMA (2020), *Digital Agriculture Maps: 2020 State of the Sector in Low and Middle-Income Countries*.

113 Heifer International (2020), "Technology and Innovation."

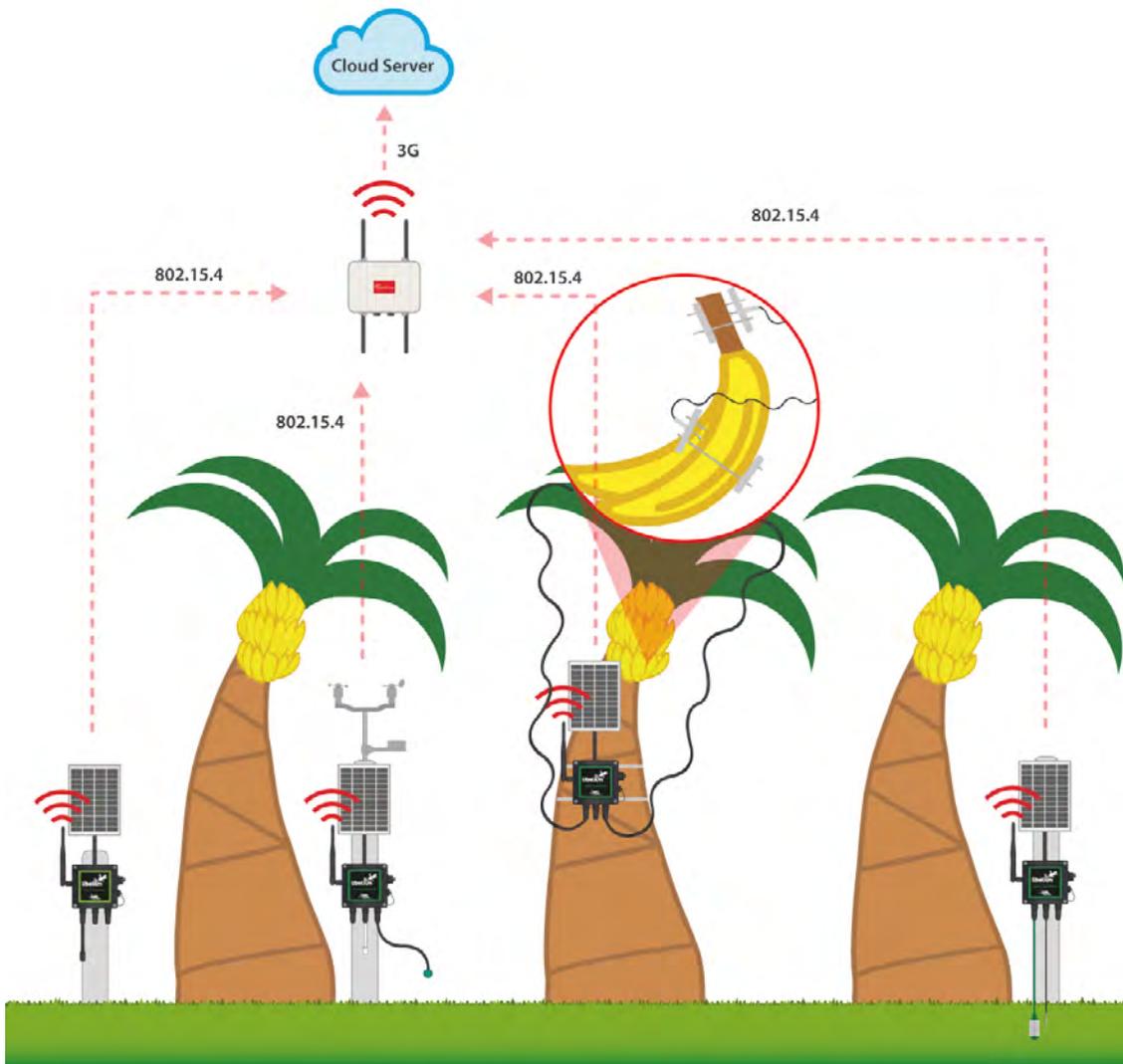
114 Ibid.

In Colombia, the country's national learning service, SENA, worked with Libelium under the auspices of the Tecnoparque technological innovation initiative to install various types of sensors on a banana plantation. The sensors measure indicators such as solar radiation, soil moisture, soil temperature, trunk diameter, fruit diameter, precipitation and ammonia levels. By tracking various indicators, farmers can better monitor the health of the crops and fend off pests and

diseases. Tracking these indicators also contributes to traceability efforts, which are important for exporting production. Colombia produces over three million tonnes of banana each year and is one of the biggest banana exporters after Ecuador and Guatemala.<sup>115</sup> The biggest risk to banana crops include pests and diseases, flooding, low oxygen levels in the soil and high humidity levels.

Figure 41

### Libelium's IoT solution for Tecnoparque Colombia



Source: Libelium

Although relatively small in scale, the FAO-Telefónica Smart Agro 4.0 pilots have shown some encouraging results with smallholder farmers, including a positive impact on productivity and the quality of the crop, both of which contribute to higher sales. The tools have also reduced irrigation and input costs (up to 22 per

cent in the case of the potato trial in Ventaquemada, Colombia) which, when combined with higher sales, have had a marked impact on smallholder farmer profits. These positive results have translated into greater engagement from smallholder farmers who have also become more receptive to new technologies.

115 Libelium (2016), "Improving banana crops production and agricultural sustainability in Colombia using sensor networks."

Figure 42

## Preliminary results of FAO/Telefónica Smart Agro 4.0 projects

Location	Value chain	Local partners	Families	Results
<b>Ventaquemada (Colombia)</b>	Potatoes	<ul style="list-style-type: none"> <li>Asociación de Productores Agropecuarios de San José del Gacal</li> <li>Agencia de Desarrollo Rural (ADR)</li> </ul>	38	<ul style="list-style-type: none"> <li>Production up 50%</li> <li>Costs per batch down 22%</li> <li>Quality and consistency of crops increased, enabling farmers to receive more for their harvests</li> </ul>
<b>Nariño (Colombia)</b>	Coffee	<ul style="list-style-type: none"> <li>ASOPROCAFE</li> </ul>	72	<ul style="list-style-type: none"> <li>Quality of coffee harvest improved</li> <li>Improved water efficiency through improved irrigation management</li> </ul>
<b>Ica, Lambayeque (Peru)</b>	Cotton	<ul style="list-style-type: none"> <li>Peru's Ministry of Agriculture and Irrigation (MINAGRI)</li> <li>Brazilian mission</li> </ul>	3	<ul style="list-style-type: none"> <li>Production up 77%</li> </ul>
<b>Morazán (El Salvador)</b>	Fresh product (papaya, cucumbers, peppers, tomatoes, paprika)	<ul style="list-style-type: none"> <li>Cooperativa del Cantón San Bartolo de Guatajiagua</li> <li>SIGEL</li> </ul>	12	<ul style="list-style-type: none"> <li>Improved water efficiency</li> <li>Production about 80% higher than neighbouring farms due to irrigation recommendations</li> </ul>

Source: Telefónica and FAO

In livestock and aquaculture markets, IoT solutions can help increase productivity by alerting farmers when cows are in oestrus, which increases birth rates by improving the overall health and size of the animals, and by reducing fish deaths on aquaculture farms.

- Celotor, for example, is an IoT solution that alerts farmers when cows are going into oestrus so they do not miss the window for insemination. Headquartered in Colombia, the agritech also operates in Bolivia and Costa Rica. According to Celotor, roughly 66 per cent of cows go into oestrus at night when they are not being visually monitored. This means that a cow's reproductive window may not be detected in time, at a potential loss of hundreds or thousands of dollars to a typical dairy farmer. When the cow is going into oestrus, behavioural changes captured by IoT sensors are analysed by an algorithm. The farmer then receives a text message alert or tweet identifying the cow, enabling the farmer to organise artificial insemination of the cow during the optimal window. Farmer resources can be redeployed away from monitoring cows into other, more productive activities.
- Umigarden, an IoT solution developed by Umitron<sup>116</sup> being implemented in Lake Titicaca by Abaco subsidiary Piscis, has had very positive results in other countries where it has been deployed. In one instance, fish deaths declined from 47 to 23 per cent as a result of increased monitoring of conditions, such as temperature, pH and algae levels, among others. Libelium had a similar experience in Iran where the implementation of its Waspote Plug & Sense! Smart Water solution resulted in a 30 to 40 per cent decline in fish deaths due to less pollution in the water.<sup>117</sup> Piscis hopes that Umitron's solution will reduce the cost of fish feed by 20 to 30 per cent, which is significant since feed can account for up to 70 per cent of the cost of running a trout farm.<sup>118</sup>

116 Umitron is a Singapore and Tokyo-based technology company that develops solutions for sustainable aquaculture that use satellite, IoT and machine learning. Available at: <https://umitron.com/>

117 Libelium (2018), [Controlling fish farms water quality with smart sensors in Iran](#).

118 Abaco (2020).

### 4.5.3 Business models

The AgriTech team has identified two main business models employed by smart farming agritechs in the region.

- **Direct asset transfer:** In this model, a customer pays a high(er) upfront fee to cover the cost of assets (sensors or drones, gateways), installation and set-up, software design and implementation. The customer then pays a relatively low monthly fee to cover cloud fees for data management and connectivity. Connectivity payments can be made directly to the connectivity provider or they can be part of a monthly package charged by the agritech or systems integrator.
- **IoT-as-a-service:** In this model, a customer pays no, or a limited, upfront fee to cover installation and set-up. The customer then pays a monthly fee that

covers the cost of using the sensors and gateways, software design, implementation, cloud fees for data management and connectivity. Assets may or may not become property of the customer after a certain amount of time. Often an agritech, MNO or distributor commercialising the IoT solution will team up with a bank to offer financing to further lower the barrier to entry.

Libelium, which works in Latin America through a network of distributors in various countries, offers both models to its customers. However, it noted that cooperatives and smallholder farmers tend to prefer the IoT-as-a-service model. Abaco's Piscis, which expects to launch its trout monitoring IoT solution in 2021, is leaning towards an IoT-as-a-service model to make the solution more accessible to trout farmers in the Lake Titicaca region of Peru.

### 4.5.4 Trends in the deployment of smart farming tools in Latin America

#### TREND #1

Many of the smart farming tools in Latin America have focused on irrigation and pest control.

According to the International Water Management Institute (IWMI), 87 per cent of farmed land in Latin America depends on rainfed sources, compared with 65 per cent in East Asia and 58 per cent in South Asia.<sup>119</sup> The region is particularly susceptible to climate events like El Niño and La Niña, as well as extreme weather conditions, such as drought and flooding. This is particularly true in the region's poorer countries. According to the World Food Programme (WFP), in 2019 Central America faced the "worst dry crop season in 35 years."<sup>120</sup> The FAO estimates that severe climate cost the Latin America and Caribbean agriculture sector over \$13 billion in crop and livestock losses between 2005 and 2015.<sup>121</sup> This has resulted in increased demand for smart irrigation technologies to help farmers make more efficient use of scarce resources and to help mitigate the effects of climate

change. Donors and other NGOs have been particularly active in funding these initiatives given the impact they might have not only on productivity, but also on food security and large-scale migration. Telefónica has been particularly interested in the smart irrigation use case, prompting involvement in the Smart Agro 4.0 pilot with the FAO.

Pests and diseases are another leading cause of crop loss. The impact of pests and diseases can be mitigated through more effective irrigation using sensors, or through solutions that monitor crop canopies from above (using satellites and drones) for early pest detection. Tecnoparque's banana pilot in Colombia is one example of a smart farming solution aimed at pest and disease mitigation.

119 IWMI (2020), [Rainfed Agriculture: Key Facts](#).

120 WFP (2019), [Dry Corridor Crisis](#).

121 FAO (2018), [Disasters causing billions in agricultural losses with drought leading the way](#).

**TREND #2**

Most smart farming initiatives benefiting smallholders in the region have yet to move from pilot stage to commercial deployment.

Research institutes like CGIAR, IICA and SENA are behind many of the smart farming pilots deployed in the region, in coordination with technical partners like Microsoft, Telefónica, Libelium and others. Despite positive results from these pilots, scaling and commercialising remote monitoring solutions have

proven elusive, largely because the cost of assets required to run these solutions (sensors, gateways, drones, etc.) are too high for smallholder farmers to absorb, as are the costs of ongoing maintenance and connectivity.

**TREND #3**

In the absence of wide-scale LTE-M and NB-IoT deployments, smart farming solution providers have had to rely on a combination of traditional 2G/3G/4G cellular and unlicensed LPWA solutions like Sigfox and LoRa to provide services.

Traditional mobile networks, which were not designed with IoT deployments in mind, can prove expensive for the deployment of smart farming solutions for smallholder farmers. Sometimes a gateway must be installed where the solution is being deployed, and the associated data subscriptions can be as much as

\$10 per month per sensor. Many of the smart farming solutions providers interviewed for this study rely on a hybrid strategy, leveraging mobile technologies where there is coverage, and LPWA solutions like Sigfox or LoRa to fill coverage gaps or lower operational costs.

**TREND #4**

Smart farming solution providers in Latin America have been slow to automate.

Although many of the smart farming solutions being tested and deployed in the region are capable of some level of automation (e.g. automatically dispensing food to fish, adjusting the temperature in a poultry barn or turning irrigation systems on/off), many of the companies interviewed did not feel that smallholder farmers were ready to automate. As a result, recommendations are sent to smallholders through the

tool interface, and it is up to the farmer to act on those recommendations. Telefónica, for example, stated that it can offer automated solutions to farmers in Spain where insurance products can mitigate the impact of an unforeseen event. Lower adoption of insurance products in Latin America means that automation may take longer to adopt since the risk is borne entirely by the smallholder farmer.

**TREND #5**

Many smart farming solutions require an agronomist to read the data provided by sensors and to translate that data into specific recommendations.

This adds to the cost of the deployment since the recommendations are not automatically generated through AI or big data. Piscis' smart farming trout solution, for example, requires a multidisciplinary staff in Singapore, Japan and Peru to interpret the data

collected from the cages in Lake Titicaca and provide feeding recommendations to farmers. Telefónica's Smart Agro 4.0 solution relies on an agronomist based in Chile for its recommendations.

**TREND #6**

The shared asset sub-use case has seen less traction in Latin America than in Africa and Asia.

The limited availability of mobile money solutions in the region, as well as the absence of the PAYG model, explains the lack of shared assets solutions.

Regulatory restrictions on the use of drones and other technologies that might be applicable to the shared asset use case are also a barrier.

## 4.6 Challenges encountered by agritechs launching digital tools in Latin America

Agritechs deploying digital agriculture tools in Latin America have faced a variety of challenges that they are seeking to overcome. Some of these challenges are outlined here.

### CHALLENGE #1

Lack of digital literacy and technical competency among smallholder farmers.



A lack of general technical competency means that organisations must spend a lot of time and capital on training smallholder farmers on everything from appropriate farming techniques to the proper use of new equipment to digital and financial literacy. Agri e-commerce player SiembraViva noted that after many months of capacity building, its smallholder farmer partners still struggled to meet established standards of quality and reliability. FAO and Telefónica noted that it took 12 to 24 months for the smallholders participating in the Smart Agro 4.0 pilots to fully adopt the recommendations they were providing.

Companies offering DFS for the rural sector recognised this challenge early on and began offering their smallholder partners digital agri advisory along with financial services. EthicHub, for example, has worked with smallholder coffee farmers in Mexico to reduce intermediation and open export opportunities (primarily to Europe) for its smallholder farmer partners. It now considers itself an agritech as much as a fintech company. Agrapp in Colombia has an in-house agronomist specialising in exotic fruits that provides recommendations on everything from inputs and irrigation to harvesting techniques. It also identifies buyers for farmers' produce on the tool. The PASAC initiative in Colombia includes a module that provides training on agricultural best practices.

Agruppa, an agri e-commerce platform that closed down in January 2018, stated that a key reason it was unable to turn a profit and scale was its decision to focus attention and efforts on the buyers (small family-run shops in Colombia) instead of the producers. In retrospect, Agruppa's management believes that the company would have achieved a better outcome had it focused more on meeting the needs of smallholder farmers.

Use of sensor technology also requires technical training and know-how. Sensors installed on smallholder farms can be easily damaged or moved, limiting their efficacy. Telefónica and FAO found that smallholder farmers would often damage the sensors when carrying out other on-farm activities. Farmers might also decide to rotate the crop being grown in the location of the sensor or move the sensor to the location of a different crop, making the recommendations on irrigation or pesticide use less relevant and potentially damaging to the new crop. Some of the companies interviewed also noted that recommendations were often shared across a community to save money. Because the recommendations are tailored to the specific conditions (temperature, soil moisture, pH levels, altitude) of a farm in a specific location, applying the same recommendations to a different farm in a different location might prove detrimental to the other farm's crops.

**CHALLENGE #2**

## Reliance on cash and personal relationships.



Smallholder farmers throughout the region have been reluctant to use digital tools for their financial needs, preferring to deal in cash for transactions and relying on the strength of personal relationships for credit and loans. Outside of Colombia, very few digital procurement tools have incorporated payments given the reluctance of farmers to be paid digitally. Grameen Foundation teamed with Cooperativa de

los Andes to develop an algorithm-based tool that the coffee cooperative in Colombia could use to assess the creditworthiness of its members. The pilot was eventually abandoned when the cooperative determined that shifting to an algorithm-based system would create too much tension between the cooperative and its members if a loan was denied.

**CHALLENGE #3**

## Limited connectivity in some rural areas.



Although mobile network coverage in Latin America is much stronger than in Africa and many parts of Asia, remaining coverage gaps are generally in rural areas where agriculture is the main source of income. For this reason, many of the advisory, digital procurement and agri DFS implemented in the region must have an offline mode that allows use when not connected to a mobile network. This is the case for advisory tools like Cacao Móvil, which allows tutorials to be downloaded and used offline, as well as agri DFS like DECISION, which allows a credit officer to input data and take photos while offline visiting a loan applicant.

In rare cases, agritechs that have built digital tools have had to invest in radio base stations or gateways to extend the reach of mobile networks to farmers.

This is the case of COOPSOL in Argentina, which received financing from IDB Lab to install two radio base stations near the location of its bee farmers to allow the implementation of its blockchain-enabled digital procurement tool.

Connectivity gaps can prevent a tool from achieving its full potential. In the case of the Smart Agro 4.0 trial in Colombia, for example, FAO officers sometimes had to deliver their irrigation recommendations in person because farmers were unable to receive them on their phone. Coverage gaps were felt even more acutely by providers of smart farming solutions given the more limited coverage of IoT networks in the region, particularly lower-cost NB-IoT and LTE-M networks, which are better suited for tools aimed at smallholders.

**CHALLENGE #4**

## High cost of data services.



One of the biggest complaints donors and agritechs receive from farmers is the cost of downloading and using the mobile data apps that many digital tools require. Although most app-based solutions are free to

download, the farmer still incurs the cost of the data to download and run the app. Farmers often wait until they are within reach of a WiFi network to download and use digital agriculture tools, which limits their efficacy.

**CHALLENGE #5**

High cost of equipment, particularly sensors and drones.



The cost of deploying sensors or drones remains out of reach for most smallholder farmers. Even if a farmer can acquire an IoT sensor from an NGO or cooperative at no cost, the price of the connection, particularly if it is a 2G/3G/4G connection, can be too high for a smallholder farmer to bear over the long term. The weather and humidity stations installed in Colombia for Telefónica's Smart Agro 4.0 pilot, for

example, each required a 10MB data subscription to operate. Telefónica estimates that the cost of a sensor must drop to \$50–\$100 before it can be more widely adopted by smallholder farmers. Similarly, NB-IoT and LTE-M networks must be more widely deployed for the price of the connectivity and the power requirements of the sensors to drop to acceptable levels for smallholder farmers.

**CHALLENGE #6**

Regulatory restrictions on the use of some equipment, particularly drones.



Although there is significant interest in the capabilities of drones to monitor and guide on-farm activities, agribusinesses and cooperatives have been restricted from using them in some markets because of regulatory restrictions. Ritter Sport in Nicaragua, for example, is interested in deploying drones in

support of the advisory, traceability, certification and productivity services it extends to its cocoa cooperative partners, but Nicaragua's restrictions on drone use have prevented it. Ritter Sport applied for a special permit to use a small number of drones, but had yet to receive any approvals as of August 2020.

**CHALLENGE #7**

Many tools fail to make it past the testing phase or are quickly phased out once NGO or government funding runs out.



Some of the organisations interviewed spoke of "farmer fatigue" with the development of new digital tools. Farmers in some markets have been approached multiple times by different organisations seeking information on their farms for the deployment of digital procurement tools. When the tool fails to materialise or is phased out, farmers feel their time and

effort have been wasted. In some cases, in exchange for access to advisory tools, farmers are asked to fill out weekly or monthly surveys. This can also create farmer fatigue. Too many negative experiences can diminish trust and deter a farmer from becoming involved in similar initiatives.



# 5 Opportunities and recommendations

## 5.1 Opportunities

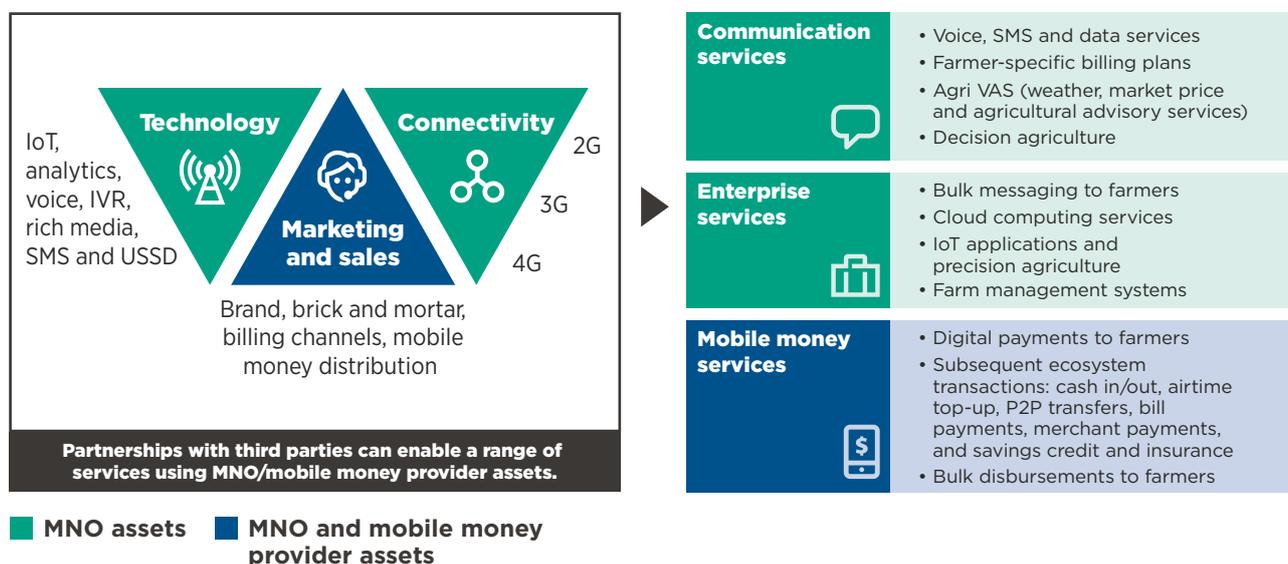
The productivity gaps and financial exclusion faced by smallholder farmers in Latin America are an opportunity for digital interventions to have a positive impact on rural economies and farmer incomes. This is particularly true in Central America where the challenges faced by smallholders are more acute, but the digital solutions available to address them are more limited.

To date, the role of MNOs and MMPs in digital agriculture innovation has been limited to a few initiatives, such as ICE's Agri VAS solution (Agromensajes), Telefónica's smart irrigation IoT pilot

project (Smart Agro 4.0) and a few payment initiatives in support of digital procurement tools, particularly in Colombia. There is an opportunity, however, for MNOs and MMPs to leverage their technology, marketing and sales and connectivity assets to play a bigger role in the development of digital agriculture solutions, particularly those that leverage digital payments like digital procurement, e-commerce and smart farming. To capitalise on this opportunity, governments throughout the region, particularly in Central America, will need to take steps to create a more enabling environment for digital interventions.

Figure 43

### MNO and MMP assets<sup>122</sup>



Source: GSMA AgriTech

122 GSMA (2020), [GSMA AgriTech Toolkit for the Digitisation of Agriculture Value Chains](#).

Benefits for MNOs and MMPs can be both direct and indirect. Examples of direct benefits include revenues from transaction fees levied for mobile money payments; the addition of new mobile money customers in rural areas and new mobile network service users; and greater loyalty or stickiness of existing users. Examples of indirect benefits include increased network use (SMS, calls, data); increased

mobile money use among existing subscribers; and increased agent activity that can support the development of the mobile money ecosystem and uptake of adjacent products like loans and insurance.<sup>123</sup> The GSMA estimates that the direct revenue opportunity from digitising agricultural B2P payments in Latin America will reach \$382 million by 2025.<sup>124</sup>

Figure 44

### MNO benefits from last mile digitisation

 CONSUMER BUSINESS	 ENTERPRISE BUSINESS	 MINISTRIES AND GOVERNMENT
<ul style="list-style-type: none"> <li>• Additional direct revenue will come from farmers who perform subsequent ecosystem transactions (airtime top-up, bill payment, merchant payment, etc.)</li> <li>• Indirect revenue from new mobile network users, and increased and more consistent use of the full range of mobile services available (voice, messaging, VAS).</li> <li>• Services could increase customer loyalty in rural areas and reduce customer churn.</li> </ul>	<ul style="list-style-type: none"> <li>• Fees from enterprises for licensing technology platforms involving supply chain management systems, such as track and trace and farm management.</li> <li>• Fees from enterprises for executing bulk SMS requests.</li> <li>• Fees from enterprises for executing bulk payment requests.</li> </ul>	<ul style="list-style-type: none"> <li>• Fees for government-to-person (G2P) disbursement of agriculture subsidies to farmers.</li> <li>• Fees from licensing last mile digital tools to ministries of agriculture and regional governments that enable data collection and profile management of subsidy beneficiaries.</li> </ul>

Source: GSMA AgriTech

Partnerships with ecosystem players familiar with the agriculture sector and smallholder farmers will be vital for MNOs and MMPs seeking to monetise the digital agriculture opportunity. Telefónica has teamed with FAO to launch its Smart Agro 4.0 initiative in El Salvador, Colombia and Peru. While Telefónica brought the devices, technology, connectivity and data analytics to the project, it would not have achieved the same results without the FAO’s understanding of agricultural value chains, relationships with cooperatives and farmers, extension officers and

farmer training capabilities. Agritech companies and other digital agriculture ecosystem actors interviewed for this study expressed strong interest in working more closely with MNOs to bring their solutions to market or to scale existing solutions.

A review of 131 digital agriculture services revealed two opportunities that could address low productivity and lack of access to financial services most effectively: smart farming tools and digital procurement data.

### Smart farming tools can improve productivity

Few digital tools have generated the productivity benefits that smart farming solutions have demonstrated over the last two years. Farmers participating in Telefónica’s Smart Agro 4.0 project, for example, saw production increases of 50 to 77 per cent and cost reductions of 20 to 22 per cent from lower water use and pesticides. Flower farmers in Bucamaranga were able to reduce their water use by 45 per cent after implementing Farmapp’s IoT sensors. Piscifactoría de los Andes is expecting cost reductions

of up to 20 per cent through the use of Umitron IoT sensors, in line with what Umitron has delivered with its aquaculture IoT solution elsewhere.

Despite these benefits, few smart farming solutions for smallholders have moved beyond the pilot phase to commercial viability. The main barrier is the cost of implementation, including both the cost of the sensors and on-going connectivity, particularly for IoT solutions that rely on traditional 2G/3G/4G cellular networks.

123 GSMA (2020), *GSMA AgriTech Toolkit for the Digitisation of Agriculture Value Chains*.  
124 Ibid.

Investors and donors have an important role to play in promoting the adoption of smart farming tools. For example:

- Subsidising the acquisition of sensors needed for early testing and deployment.
- Identifying smart farming initiatives that support more efficient use of natural resources like water, as well as pesticides, both of which have a proven track record in the region.
- Identifying opportunities in aquaculture given the expected growth in fish exports from Latin America over the next five to 10 years.
- Identifying existing digital tools that could be better utilised with the application of smart farming technologies. Guatemala’s Anacafé, for instance, launched Mejor Suelo, Mejor Café (Better Soil,

Better Coffee) in 2019, a digital tool that allows coffee farmers to access the results of soil tests using an app on their smartphones. After sending a sample of their soil to Anacafé’s Analab for testing and analysis, and paying a small fee, the farmer receives a report with a QR code to access a report on the condition of their soil, as well as recommendations for more efficient use of fertiliser and irrigation to improve yields and reduce costs. The use of sensors on site would reduce, if not eliminate, the need to send soil samples for analysis.

- Promoting initiatives that support the use of PAYG or IoT-as-a-Service business models to address smallholder farmers’ inability and unwillingness to make large upfront payments for sensors and network equipment. PAYG services can be built on airtime use and do not necessarily require a robust mobile money ecosystem to function effectively.

## Digital footprints offer a pathway to financial inclusion for farmers

Smallholder farmers in Latin America face significant gaps in short- and long-term financing, both for agricultural and non-agricultural financial needs. MasterCard Foundation estimates that the financial needs of smallholders in the region is approximately \$18 billion.<sup>125</sup> Farmers struggle to access financial services because they lack important data, in digital or paper form, to prove their creditworthiness to FSPs.

Mobile-based digital agriculture tools that generate digital footprints for farms and farmers offer huge potential to bridge the data gap in smallholder financing. Digital tools that enable farmers to access markets, such as digital procurement solutions and e-commerce services, are especially useful in generating rich data sets like transactional data from the sale of crops. For commercial farmers, these tools support the creation of economic identities and can open a pathway to financial inclusion. To unlock this opportunity, effective data-sharing partnerships must be created between those who collect it: agribusinesses, agritech companies and MNOs. These actors also have a shared interest in enabling financial services for farmers.

Donors and investors have important roles to play in the development of digital agriculture tools, including:

- **Funding the development of algorithms or frameworks that will help financial institutions assess the creditworthiness of applicants** – In the case of PASAC, the Government of Canada funded the original design of 75 frameworks that could be applied to smallholder farmers across various geographies and value chains. Once the algorithm was designed, it could be integrated in a mobile tool and scaled to all financial institutions disbursing both FINAGRO funds and their own funds designated for rural agriculture projects. Oikocredit has also played a role in developing methodologies applicable to smallholder farmers.
- **Providing financing to microfinance institutions (MFIs) and other financial institutions to support additional loans to smallholders** – Oikocredit has teamed up with many MFIs in the region to support credit and loan tools in Latin America.
- **Underwriting loans to smallholder farmers while financial institutions fine-tune their algorithms for reaching smallholders** – IDB Lab is adopting this strategy as it supports FACES in the launch of its new green credit products for smallholders.

125 MasterCard Foundation (2018), [Inflection Point: Unlocking growth in the era of farmer finance](#).

## 5.2 Recommendations

The GSMA AgriTech team has developed a set of 11 recommendations to support funding, product development and marketing for several key

stakeholders in the digital agriculture ecosystem, including agritech companies, donors and investors.

### RECOMMENDATION #1

Support viable, private sector-led digital advisory services.

Of the more than 40 digital advisory services reviewed by the AgriTech team, those that have achieved the highest user numbers and lasted the longest are private sector-led initiatives, not government- or NGO-led initiatives. Unlike governments and NGOs, agritech companies must develop commercially-viable business models, which allows them to be more innovative and agile in responding to changing farmer

needs. Private sector-led initiatives are also quicker to incorporate new, smarter technologies like satellite, sensors, drones, AI or data analytics. These offer farmers a richer, more personalised experience that, in turn, helps drive customer loyalty. Investors and donors should focus their efforts on backing agritech companies that are developing digital advisory and have potential to scale.

### RECOMMENDATION #2

Ensure that users are at the centre of service design.

Human Centred Design (HCD), or user-centred design, involves designing products and services around user needs and preferences, identifying the most suitable technology with which to deliver them and implementing a viable marketing and pricing strategy to target different users.<sup>126</sup> HCD ensures that users are engaged at every step of product development, from early stages of identifying opportunities and generating concepts, to advanced stages of product realisation, execution and scaling.<sup>127</sup>

The challenges that some agritech companies in Latin America have faced can relate to a failure to put users or farmers at the centre of service design. SiembraViva, for example, assumed that Colombia's

vast network of intermediaries was one of the main barriers to higher farmer incomes and originally built its business model on disintermediation. It later discovered that lack of training and appropriate farming techniques was an even bigger challenge, and had to adapt its strategy. Agruppa built an entire tool around what it perceived to be a major pain point for family-run shops—time spent travelling to and from the market to buy produce to supply their stores. It learned too late that these customers did not actually perceive this as a pain point, which limited the uptake of the tool. By involving smallholders directly in the product development phase, agritech companies, investors and donors can avoid such pitfalls.

126 GSMA (2020), *Digital Agriculture Maps: 2020 State of the Sector in Low and Middle-Income Countries*.

127 Ibid.

**RECOMMENDATION #3**

Focus on developing a strong value proposition that offers an end-to-end solution and a clear revenue model.

While many agritech companies have developed innovative digital agriculture solutions, some of these services struggle to attract investment because they are not deemed “fit for market” or are not “sticky” enough for farmers to use repeatedly. To attract investment, digital agriculture solutions should solve a range of pain points in agricultural value chains rather than one specific problem. For instance, improving farmers’ access to inputs and finance is not enough on its own. Farmers are more likely to make the best use of seeds and credit if inputs are supplemented with regular agricultural advisory and access to markets, both of which digital solutions can provide.

Mexico’s Smattcom, for instance, is adding advisory and tutorials to its platform connecting buyers and sellers. Colombia’s Control Ganadero has added

insurance to its digital advisory. Cacao Móvil continues to add new capabilities to its app to enhance its value for users. Such end-to-end digital solutions, which can demonstrate improved farming practices, higher yields, lower costs and better access to market, are more likely to attract the attention of investors, including major agricultural processors and even international buyers.

Agritech companies should also have a realistic approach to revenue generation. For instance, digital agriculture solutions that require farmers to pay user fees from the onset are less likely to scale rapidly, limiting their investment potential. Investors are more likely to work with agritech companies with a clear revenue model and a value proposition that addresses multiple pain points along a value chain.

**RECOMMENDATION #4**

Build reliable partnerships.

The provision of most digital agriculture tools involves a range of activities, from farmer acquisition and training to content acquisition, data analysis, financing and service delivery. It would be costly, and risky, for agritech companies to take on all these functions

internally. Partnerships are therefore key to rolling out many digital agriculture tools. MNOs can use their customer relationships, retail channels, agents, billing capabilities and networks to help agritech companies expand and reach scale.

**RECOMMENDATION #5**

Carefully assess smart farming opportunities before launch.

To date, most of the IoT-based smart farming solutions implemented in the region have failed to move beyond the pilot stage despite reporting significant productivity improvements. This is because the cost of implementation – from the cost of sensors to the data connectivity most solutions require (NB-IoT and LTE-M are not currently available in most of the region) – is

too high for smallholders. As the price of sensors comes down and NB-IoT and LTE-M networks become more pervasive, IoT-based smart farming solutions for smallholders will become more viable. Agritech companies offering smart farming solutions should consider IoT-as-a-Service or PAYG models when approaching smallholders or cooperatives.

**RECOMMENDATION #6**

Do not approach the region with a one-size-fits all approach.

Despite sharing the same language and cultural heritage, Latin America is a vast and diverse region where a one-size-fits-all approach will not work. Solutions that work well in Southern Cone markets where intensive large-scale farming dominates may not be transferable to countries in Central America or the Andean region where smallholder farmers play a bigger role. Agritech companies, investors and donors need to understand the key features of each market and how this influences their choice of business model.

Digital procurement tools, for example, must account for differences in certification and traceability standards from one country to another. Smart irrigation solutions that have been successfully

implemented in one market may not work in another where NB-IoT network coverage is more limited or data pricing is too high. Digital procurement solutions that incorporate payments work well in Colombia where there is enabling regulation supporting mobile money and digital payments, but may face an uphill battle in Central America where there is less enabling regulation and smallholder farmers are less open to digital transactions. Apptank SAS for example, recently introduced a transportation insurance module to its Control Ganadero digital advisory tool. Although Control Ganadero has a presence throughout much of Latin America, the insurance module (SEDUGAN) is only available in Colombia because there are too many regulatory hurdles in other countries.

**RECOMMENDATION #7**

Focus on value chains where digital interventions can have the greatest impact.

Some value chains are better suited to digital interventions than others. Coffee, for instance, is an interesting value chain given its relative importance to the region’s exports, the highly structured nature of the industry, the technical savvy and readiness of many leading coffee cooperatives and the rising demand for traceability and certification from the world’s largest buyers. Cocoa, which is far less important to the region’s agricultural sector, is compelling for different reasons. Initiatives like Cacao for Peace and MOCCA are directing tens of millions of dollars to the development of the cocoa sector to help displaced rural populations in Colombia and Central America. Latin America is the leading exporter of premium fine cocoa and is well positioned to steal

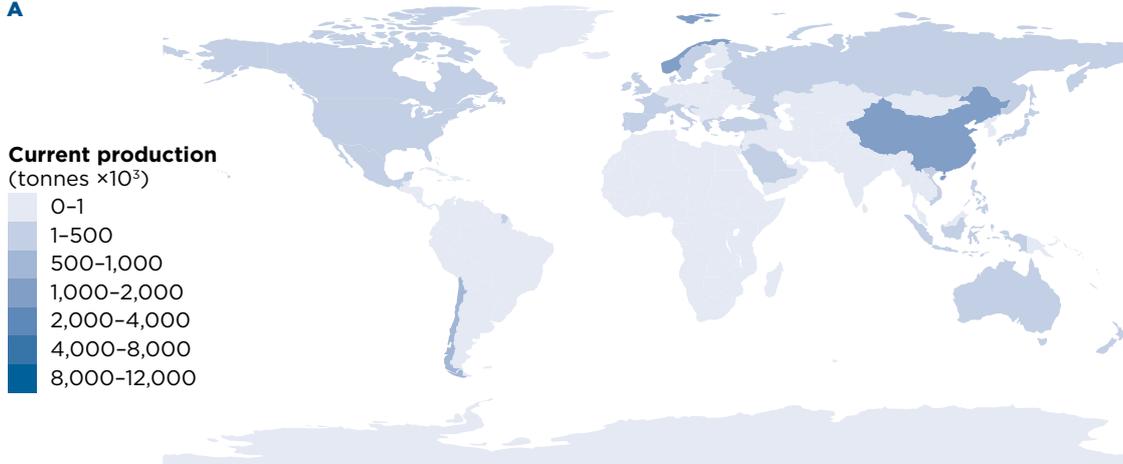
market share from countries in Africa and Asia as the global market for cocoa continues to grow.

Fresh produce is one of the fastest growing export categories given that Latin America is becoming a leading source of fresh produce not only for North America, but increasingly for Asia. Central American countries are also positioning themselves as alternative providers of palm oil while South American countries like Peru are seeking to take advantage of an expected increase in demand for fish (see Figure 45). As smallholder farmers in Latin America compete against smallholders in Asia and Africa to sell crops to developed markets, the need to meet increasingly strict traceability and certification criteria with digital tools will become even more critical.

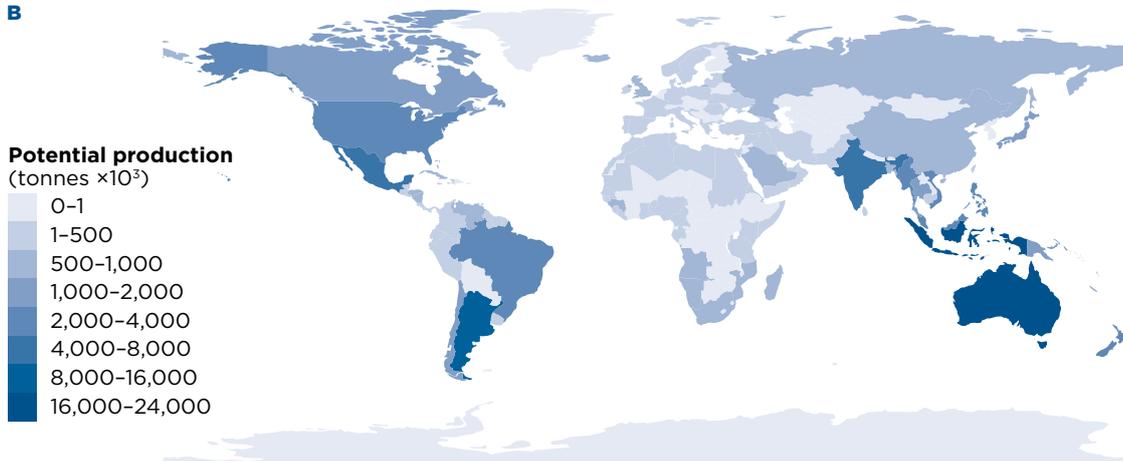
Figure 45

**Future potential of aquaculture markets globally<sup>128</sup>**

**A**



**B**



Source: Nature Ecology & Evolution

128 Nature Ecology & Evolution (2017), [Mapping the global potential for marine aquaculture](#).

**RECOMMENDATION #8**

Create an enabling regulatory environment, focusing on markets with the greatest need.

Governments can play an important role in promoting digital innovation in agriculture. Regulations that make it easier for companies to provide digital banking, mobile money services and e-commerce are particularly important to the development of a vibrant agritech ecosystem. For the roll-out of smart farming services in particular, it is important that regulators adopt policies that make it easier for MNOs to roll out IoT networks while also allowing for the use of drones and sensors in agriculture.

Governments also have a strong role to play in improving the digital literacy of smallholders. By adopting e-government strategies that digitise farmer subsidies, school fees and other government-to-person (G2P) or person-to-government (P2G) transactions could go a long way towards helping smallholders in the region feel more comfortable using digital payments and solutions. Governments can also help create linkages between buyers and sellers, either through initiatives like DIGITAGRO that require schools

to purchase produce from smallholders, or through initiatives like El Campo a un Clic that link smallholders to agri e-commerce players to limit interruptions in the food supply chain.

Countries where digital innovations could help bridge productivity and financial inclusion gaps most are also the riskiest for agritechs and traditional investors given less favourable economic and regulatory conditions. Central American countries in particular experience the combined impact of low productivity, low financial inclusion and exposure to extreme climate events. Donors can play an important role in promoting regulations that enable digital innovation. Government-backed incubators have helped promote digital innovation in countries such as Chile, Colombia and Peru. Chile's Start-Up Chile, Colombia's Apps.co and Peru's Innóvate and StartUp Peru are behind several of the agritech and fintech companies profiled in this study. Central American countries would greatly benefit from similar initiatives.

**RECOMMENDATION #9**

Help address the financing gap.

Increasing access to financing for smallholder farmers is a key obstacle that will need to be overcome for the region to reach its full productive potential. The region's traditional financial institutions have historically regarded smallholder farmers as too risky, and financial mechanisms designed to address the

rural agricultural segment, like Colombia's FINAGRO, are unable to meet market demand. Donors can help by either supporting agritechs and fintechs that are developing tools to address these segments, or by underwriting loans to smallholder farmers while the tools are being fine-tuned.

**RECOMMENDATION #10**

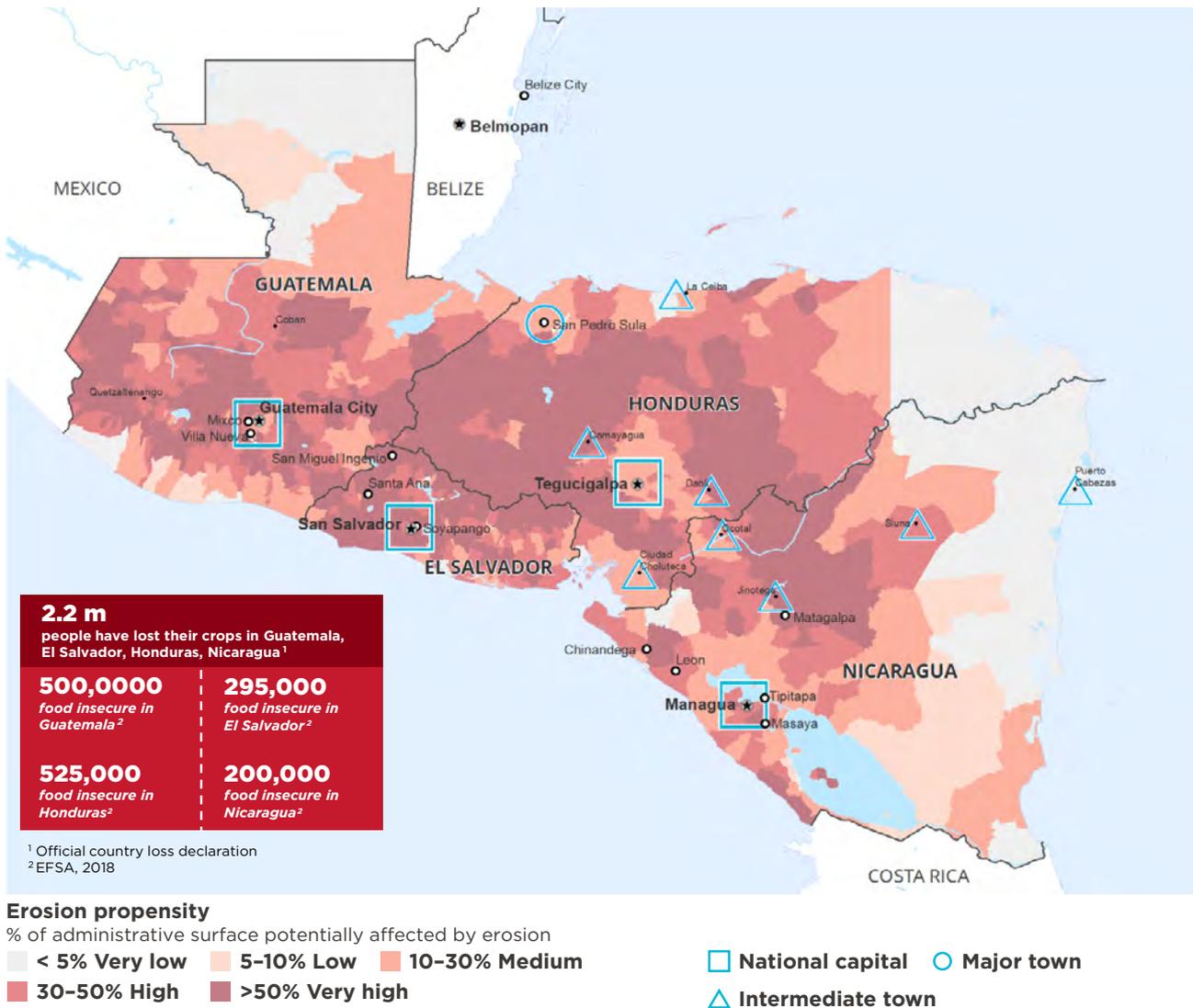
Support smallholder farmers to mitigate the impact of climate change.

The effects of climate change along the dry corridor, and weather events such as El Niño and La Niña, have a disproportionate impact on smallholders in Central American and Andean markets, leading to forced migration, food insecurity and lost income. Farmers in these regions require granular and highly localised, data-driven decision-making tools to help them anticipate extreme weather events and adapt

to changes in climate. Digital tools can also facilitate access to much-needed financing that enable smallholders to access mechanised tools, such as irrigation systems, drones or tractors. Together, these tools can strengthen climate resilience in the region, and open access to insurance to protect farmers from losing everything in an adverse weather event or pest and disease outbreak.

Figure 46

**The humanitarian impact of Central America’s dry corridor**



Source: World Food Programme<sup>129</sup>

129 World Food Programme (September 2019), *Dry Corridor Crisis*.

**RECOMMENDATION #11**

Leverage existing mobile assets and explore partnerships to develop digital solutions for smallholders.

MNOs can play a critical role in the development of digital solutions for agriculture. From strengthening rural connectivity to expanding 3G, LTE, NB-IoT or LTE-M networks, building mobile money networks or having agriculture portfolios aimed at smallholder farmers, MNOs can be catalysts for innovation in digital agriculture.

In Sub-Saharan Africa, South Asia and Southeast Asia, MNOs such as Telenor Pakistan, Grameenphone, MTN, Safaricom and Econet have introduced a large portfolio of advisory services that reach millions of farmers. MNOs in these regions have also been instrumental in advancing the adoption of mobile money services, which are critical for the development of key digital agriculture use cases, including digital procurement and e-commerce.

Latin America's leading MNOs have played a far less active role in promoting digital value-added services in agriculture and financial inclusion. MNOs can leverage key assets, such as a large and established customer base and distribution network, extensive near-nationwide coverage, technical know-how and partnerships, a reputable brand, local market knowledge, existing relationships with local banks and governments and customer and transaction data to help build digital identities. By teaming with organisations or agritechs that have a more intimate understanding of agriculture sector value chains and the pain points of smallholder farmers, MNOs can minimise the risks associated with serving lower income rural market segments.



# Appendix

Characteristics	Sub-category	Characteristics
<b>1 Digital advisory</b>		
Information-based services providing smallholder farmers with agronomic and livestock advice and best practices, information on market prices, weather and climate information as well as financial and digital literacy training.	<b>1. Agricultural value-added services (Agri VAS)</b>	One-to-many advisories covering agricultural and livestock information, weather and climate information and information on market prices. Agri VAS are delivered via voice channels (IVR, helplines), text channels (SMS and USSD) and via apps.
	<b>2. Smart advisory</b>	Data-driven advisory based on tailored, farm-level agro-climatic and crop-specific information to support decision making, maximise productivity and reduce costs. Technologies such as sensors, satellites and drones, as well as big data analytics and AI, underpin many of these services.
	<b>3. Weather information</b>	Specialist services that provide regional and localised weather forecasts. This sub-category may include weather-adaptive and climate-smart advice.
	<b>4. Pest and disease management</b>	Digital tools that help farmers diagnose plant disease and develop strategies to treat diseased plants as well as mitigate future outbreaks. Most of the services are accessible via mobile applications and require a farmer to upload a picture of the infected plant for diagnosis. Some services are also accessible via USSD. Also includes national and regional-level pest and disease early warning systems.
	<b>5. Product verification</b>	Digital tools designed to enable farmers to validate the authenticity of agriculture inputs such as seeds, fertilisers, agro chemicals and other agro inputs and prevent the proliferation of counterfeit products. Most services require farmers to send a scratch-off code from the product to a specified number via SMS.
	<b>6. Record keeping</b>	Digital tools that enable farmers to keep detailed records of livestock, including health and feeding data, to help mitigate diseases and avoid missed conceptions. Record keeping tools are also used to keep details of input use, procurement, cost and revenue and sales records.
<b>2 Agri digital financial services</b>		
Digitally-enabled financial services for smallholders to facilitate their inclusion in the formal financial economy and allow investment in farming activities. These services are customised to meet farmers' needs and tailored to suit their cropping cycles. This category also includes financial products that enable financial service providers to lower the risk of lending to smallholders.	<b>7. Credit and loans</b>	Lending products that target smallholders and address specific agricultural needs. Most of these products enable the provision of short-term financing for agricultural inputs.
	<b>8. Credit scoring</b>	Digital solutions that assess the creditworthiness of smallholder farmers using aggregated data from multiple sources, including bio data, procurement records and mobile money transactions. These tools enable financial service providers to serve smallholder farmers and lower their risks.
	<b>9. Crowdfunding</b>	Online platforms that enable investment in smallholders by sourcing funds from individuals (investors or sponsors). Most platforms also allow investors to "follow" the farmers they have invested in by providing updates via text, pictures and videos from their dashboard through a website or an app.

	<b>10. Input financing</b>	Digital tools that enable financing for the purchase of inputs like seeds, fertiliser, pesticides/herbicides from various sources, including governments, through subsidies.
	<b>11. Savings</b>	Targeted digital savings products for farmers designed to match their spending and savings habits, enabling them to put money aside for agricultural activities.
	<b>12. Digital agri wallets</b>	Digital wallets enable farmers to transact with various actors within the agriculture ecosystem, for instance, making and receiving payments, including electronic vouchers with which to redeem agricultural inputs. Digital wallets also allow farmers to save money and develop a transactional history, which can be used alongside other types of data to access additional financial services.
	<b>13. Insurance</b>	Digitally-enabled agricultural insurance services that help smallholder farmers mitigate the risks associated with external shocks, such as weather events and pest and disease outbreaks. Agricultural insurance includes weather index, area yield index, multi-peril, livestock and livestock index insurance products.
	<b>14. Accountability tool</b>	Digital tools designed to help farmers view farming as a business by allowing them to track farming expenses and revenues and prove their creditworthiness.
<b>3 Digital procurement</b>		
<p>Digital solutions in the agricultural last mile that enable a range of digital systems and processes to transition from paper to digital. These solutions help agribusinesses increase transparency in their transactions with smallholders and improve efficiency and operational profitability. At the same time, farmers benefit from more transparent transactions, improved market access and from establishing a digital footprint, which can be used to access financial services.</p>	<b>15. Digital records</b>	Digital solutions that replace paper-based systems and digitise transactions between farmers and agribusinesses.
	<b>16. Digital records with payments</b>	Digital solutions that replace paper-based systems, digitise transactions between farmers and agribusinesses and enable the integration of digital payments for the procurement of crops.
	<b>17. Digital records with traceability</b>	Digital solutions that replace paper-based systems, digitise transactions between farmers and agribusinesses and support the traceability of produce from "farm to fork".
	<b>18. Digital records with payments and traceability</b>	Digital solutions that replace paper-based systems, digitise transactions between farmers and agribusinesses, enable the integration of digital payments for the procurement of crops and support the traceability of produce from "farm to fork".
<b>4 Agri e-commerce</b>		
<p>Digital platforms that enable the buying and selling of agricultural produce and inputs online. Although most agri e-commerce businesses sell domestically to urban consumers, agri e-commerce also enables farmers to reach international buyers.</p>	<b>19. Inputs</b>	Agri input platforms enable the sale of inputs, such as seeds, fertilisers, pesticides/herbicides, from input suppliers to farmers. Such platforms may also enable groups of farmers to aggregate demand and place bulk orders.
	<b>20. Outputs</b>	Platforms that enable farmers to sell to consumers (B2C model) and to enterprise customers (B2B model), such as companies in the catering industry (e.g. hotels, restaurants) and market retailers, or a hybrid of the two.
	<b>21. Inputs and outputs</b>	Platforms that enable the sale of agricultural inputs to farmers from input suppliers, as well as the sale of agricultural produce from farmers to consumers and businesses.
<b>5 Smart farming</b>		
<p>Smart farming refers to the use of sensors, drones, satellites and other farm assets to generate and transmit data about a specific crop, animal or practice to support agricultural activities. Smart farming solutions rely on connectivity between IoT-enabled devices to optimise production processes and growth conditions while minimising costs and saving resources.</p>	<b>22. Equipment monitoring</b>	The smart monitoring of equipment, such as irrigation systems that enable farmers to remotely control, track and look after their equipment and farming operations, leading to a reduction in water consumption and waste.
	<b>23. Livestock and aquaculture management</b>	Digital tools that allow farmers to monitor herds remotely to determine their exact location at any time and track the health and habits of livestock, including when they are in oestrus or about to calve. Similarly, aquaculture management systems enable farmers to monitor feeding patterns of fish and other aquaculture, detect diseases in advance, control water quality and, in some cases, automate feeding completely.
	<b>24. Smart shared assets</b>	Digital tools that enable the sharing economy for assets, such as tractors, drones and other mechanised farming equipment. They provide smallholder farmers an opportunity to mechanise processes, such as crop spraying, crop monitoring and land preparation.







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