Collective Action for Inclusive Digital Transformation of Agriculture in Latin America and the Caribbean

Current Scenario and Needs for the Development of an Inclusive Digital Agriculture Program for Latin America and the Caribbean

2022

Funded by the European Union

With participation from

Table of Contents

Contents

Presentation

This paper explores the possibilities for strengthening agriculture, in particular small agriculture, often represented by family farming, with the use of digital technologies. Within the framework of an initiative of the Global Forum on Agricultural Research and Innovation (GFAR), the Forum of the Americas for Agricultural Research and Technological Development (FORAGRO),with its secretariat at the Inter-American Institute for Cooperation on Agriculture (IICA), and the Confederation of Family Producer Organizations of the Expanded Mercosur (COPROFAM), in collaboration with international partners AgGateway and Global Open Data for Agriculture and Nutrition (GODAN), the approach of putting small-scale producers at the center of digital solution design has been adopted, called "inclusive digital agriculture" (IDA).

This document is divided into three sections. The first section explores the topic of Digital Agriculture, from secondary sources, with an emphasis on inclusion. The second is an analysis of a regional survey that was conducted within the framework of the project on the basic uses of digital technologies by small producers. In the last section, conclusions and recommendations are proposed in relation to the next phases of the project.

Fifty-four percent of the people living in rural areas of Latin America and the Caribbean (LAC) depend on agriculture. Despite its importance, this is a sector that faces low productivity, little access to opportunities and the constant need to adapt to rapid and substantive transformations, such as the impact of climate change. This sector has also been one of the most affected by the consequences of the pandemic (Salazar *et al.* 2020).

Smallholder agriculture, generally expressed as family farming, is fundamental for domestic consumption in the countries of the region, eradication of hunger, food security and environmental sustainability. Around 60 million people in Latin America are engaged in this economic activity, representing about 80% of agricultural units. 56% of these farms are located in South America, and 35% in Mexico and Central American countries (Sabourin *et al.* 2014:17, Salcedo and Guzmán 2014:36).

Generational change is one of the greatest difficulties facing smallholder agriculture; the age of the people responsible for the productive units are mostly close to 60 years. The processes of migration of rural youth to urban areas seeking greater opportunities affect the development of the sector.

Women own the smallest farms (less than one hectare). In recent years, agricultural production led by women has been increasing in LAC, representing 16% of agricultural producers in 2014 (Sabourin *et al.* 2014).

Table 1. Years of schooling in rural and urban populations in ten LAC countries.

	ARG	BOL	BRA	COL	COS	ECU	PAN	PAR	PER	URU
Urban	11.1	11	9.8	9.9	9.2	10.6	11.5	10.8	10.3	10.2
Rural	-	5.8	5.8	5.8	7.1	6.9	7.5	7.7	5.5	8.1

Source: SITEAL (IIEP-UNESCO) cited by Ziegler (2021:29).

The level of schooling is low among people linked to small agriculture with a level of illiteracy recorded in 2013 of more than 30% (Sabourin *et al.* 2014). As it is known, the urban-rural gap is multi-causal and is also expressed in the difference in the years of formal education completed according to the place where one lives.

Subsistence (for self-consumption) is the main destination for small agricultural production, representing in 2007 about 60% of the units; only 12% was considered as having land resources with greater potential, with access to markets, technology and capital, and with generation of surplus (Soto Barquero *et al.* 2007).

Unfortunately, the studies on family farming or small agriculture conducted in LAC were carried out more than 10 years ago. It is presumed that there have been important variations, and it is urgent to ascertain what they are in order to develop actions aimed at technological appropriation by the producing families.

For example, in a recent study on agriculture in general, the Economic Commission for Latin America and the Caribbean (ECLAC) (Namdar Irani et al. 2020:17) re-emphasizes the heterogeneity of the agricultural sector in terms of size of the productive units:

> Latin American agriculture is characterized by the coexistence of small family farms with medium and large farms, generating a very heterogeneous and unequal agrarian structure, which reproduces constantly over time... Oxfam estimates that 1% of the largest farms at the regional level account for 51% of the regional agricultural area (Oxfam 2016:23). In terms of trends, the behaviour of the agrarian structure is dynamic, observing contradictory phenomena between countries. In some cases, there is an increase in the number of farms, generally associated with a deepening of the process of fragmentation and subdivision of land into smaller plots. In others, it can be seen that the great sectoral dynamism, accompanied by the growth of the economy and liberalization of investments, generates processes of land concentration and vertical integration of value chains that finally imply a reduction in the number of farms, especially the smallest ones. Although one can have only a partial overview of the regional evolution of the agrarian structure, the available data show these differentiated behaviours. The group of countries made up of Paraguay, Argentina, Uruguay, Chile, Brazil and Venezuela shows a tendency to concentration, more or less marked according to the country. Thus, there is a reduction in the number of farms ranging from 2% in Brazil to 20% in Argentina, and an increase in their average sizes ranging from 6% (Venezuela) to 38% in Paraguay.
>
> A reverse process of fragmentation is unfolding in El Salvador, Nicaragua, Costa Rica, Mexico, Peru and, to some extent, Ecuador. There, the number of farms grows from 26% (Mexico) to 47% (Salvador). This translates into a reduction in the average area from 4% (Ecuador) to 35% (Salvador). In absolute numbers, the process of fragmentation is more intense than that of concentration." (translated from Namdar-Irani *et al.* 2020:19).

These results on the difference between concentration – increase in the size of the units, and de-concentration – reduction of the size of the plots, should be an orientation for the work of the project that is focused on small agriculture.

Chapter I. Inclusive Digital Agriculture: relevant advances based on previous studies

The importance of smallholder agriculture for the LAC region, as well as its particular characteristics, motivate interest in exploring the possible role for digital technologies to strengthen this productive sector, using the inclusive digital agriculture (IDA) approach.

This chapter reviews recent studies addressing digital technologies for agriculture, family farming and smallholder agriculture for LAC. It is important to mention that the challenge of finding references for the Caribbean region is always greater.

A. The rural digital divide

A large part of the small agricultural production units is located in the rural areas of the region where the digital divide continues to be an unresolved situation, both in access and in quality of connectivity.

IICA, the Inter-American Development Bank (IDB) and Microsoft conducted a study that focuses on understanding this situation (Ziegler *et al.* 2020). This study shows that the digital divide due to geographical condition continues to be a challenge for the region, despite the fact that it has been discussed since the beginning of connectivity projects in the region.

It is especially important to understand that the rural digital divide is expressed by such numbers as those presented in this analysis:

> A total of approximately 77 million rural inhabitants from 24 countries in Latin America and the Caribbean do not access connectivity with minimum quality standards .... 71% of the urban population has significant connectivity services while, in rural populations, the percentage drops to 36.8%, a gap of 34 percentage points. It should be noted that it is not only important to have connectivity, but that it has a sufficient quality to be able to provide education, medicine or any other public service. In short, the objective of coverage is as important as the objective of quality (Ziegler *et al.* 2020:12).

The difference in terms of access to connectivity resources (Figure 1), depending on where families live and its consequences on opportunities, the right to information and communication, the economic, educational and productive possibilities, and participation in political and citizen life, are determined by the urban and rural condition. This condition affects the possibility of using digital tools in agriculture.

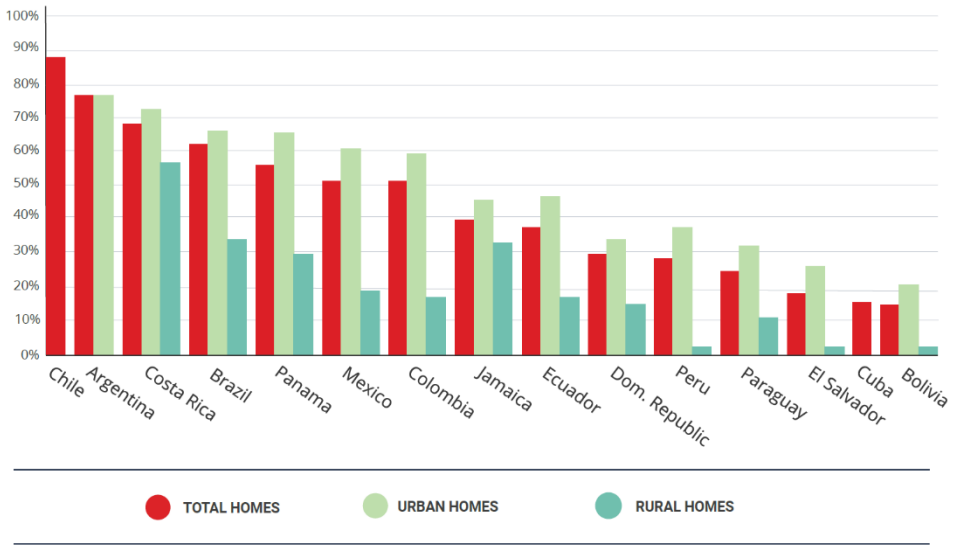

Figure 1. Connected households in urban and rural areas.

Source: Ziegler *et al.* 2020:35.

The cell phone is the device to which the majority of the population of LAC has access. However, according to the Global Association of Mobile Systems (GSMA), 24 million people in Latin America (that is, 4% of the population) do not have access to mobile telephony and are practically all inhabitants of rural areas (GSMA 2020). More than half of the region's population does not have a mobile Internet subscription, although there is coverage, and again the majority is concentrated in rural areas.

Gender also affects the rural digital divide. As indicated in the study on the digital gender divide in Latin America developed by IICA (Rotondi *et al.* 2020:7):

> Mobile phone ownership is not only, on average, lower in the case of women, but also varies according to the rural/urban distinction. There is evidence of higher ownership among men in urban areas, followed by that of women in these same areas, that of men in rural areas and that of women in the latter areas. In other words, gender and household location interact, producing multiple levels of disadvantage for rural women, who constitute the least 'connected' group.

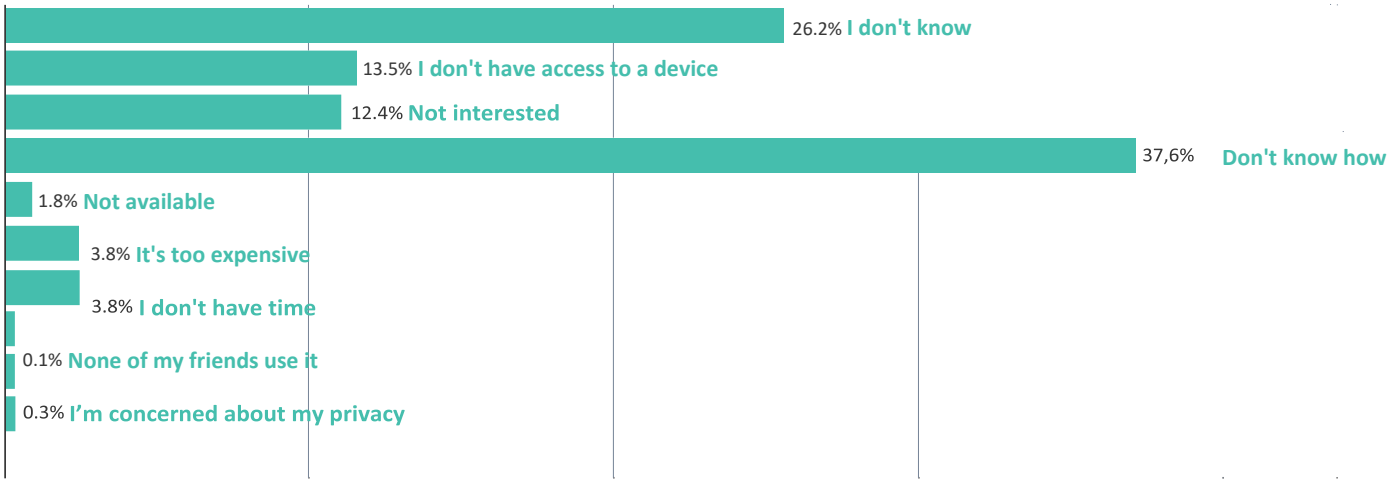

Figure 2. Main reasons for not using the Internet in rural areas (in percentage).

Source: Barrantes *et al.* (2020), based on After Access-LATAM, cited by Ziegler (2021:40).

The digital divide not only refers to connectivity and the quality of access, but also to the uses of digital technologies by the population. The IDB-IICA-Microsoft study (Ziegler 2021) delves into the topic of digital skills required in rural areas and highlights the main reasons why its inhabitants do not use the Internet, citing a study by Barrantes (2020). It is interesting to note that there is a combination of reasons, the most prominent of which are ignorance of what the Internet is, low availability of devices to access, lack of interest in connecting and little training to make use of this network.

It is impossible to separate the work on IDA from that of reducing the rural digital divide, based on elements highlighted in the work on this topic by IDB, IICA and Microsoft (Ziegler *et al.* 2020), which identify the following actions to address it:

a. **Produce data to analyse in depth the rural digital divide in LAC**: There is no regular comparative analysis of the situation of digital technologies in the region, so the availability of data and information is scarce. Public and open data, collected by national censuses, for example, do not incorporate this approach.

b. **Create common multi-stakeholder agendas:** There are several initiatives to reduce the digital divide, but many are isolated from each other, and the agendas and interests are diverse. It is essential to have a multi-stakeholder approach at the national level that is supported by public policies and by commitments from the parties, so that the rural digital divide does not continue to widen, as is currently happening.

c. **Understand and address the rural digital divide as a cause and consequence of other multiple gaps:** The lack of access to opportunities and the exclusion of rural populations are determinants for the widening of the rural digital divide. Two substantive factors are schooling and gender roles. If an intersectional analysis were to be done, it would reveal that black women, indigenous

women, women heads of families, and female fishers are the ones who have the greatest digital divide and are in rural areas.

B. Inclusive digital agriculture: a strategy for sociocultural, economic and political transformation of the territories where it is developed

The digital issue is not just a technological or infrastructural matter. Digital gaps persist due to the inequities that exist in the societies in which we live; not only do they constitute a new and powerful factor of inequality, but they can also enhance existing inequities.

In the case of digital agriculture, it is important to highlight the findings of Rijswijk *et al.* (2021), reinforced by ECLAC (Namdar-Irani *et al.* 2020), where they indicate that the digital transformation of agriculture and rural areas should not be driven by technology, but rather by the problems in these territories, and should be open to different transition pathways. Past experience of agricultural and rural modernisation has shown that "'technological momentum', without addressing the underlying socio-economic (and ecological) dimensions, risks generating unpleasant or unwanted outcomes... For this reason, **the issue of digital transformation cannot be just a matter of catching up with the digital divide; rather, the digital transformation of agriculture and rural areas must be linked to a broader transformation of socio-economic patterns of development and linked to coherent strategies**." (Rijswijk et al. 2021:86).

The integration of digital technologies into smallholder agriculture must be done with a holistic approach and must be adapted to each context, thus addressing the socio-cultural, economic, and political conditions of the groups with which we work. A narrow approach to technology risks widening existing gaps. For this, it is essential that any IDA project incorporate non-technological resources and actions (social, infrastructural, organizational, regulatory, new capacity building, among others) that will transform the living conditions of the territories where we work.

Rijswijk et al. (2021) insist that any integration of digital technologies into the smallholder agriculture sector, without a comprehensive approach, can have dire consequences and have very harmful, unwanted impacts that will only manifest themselves once implemented. Digital technologies can rather reinforce the economic, social and environmental gaps that favour existing power relations. If a wide-ranging approach is not considered, the incorporation of digital technologies in agriculture can widen inequalities and favour systemic conditions that weaken small agriculture and the populations that live on it.

It is essential to work in this context with an integral vision of IDA, so as not to cede the magical solutions of technology that are promoted from a vision of digital society founded on technological consumption. An IDA strategy must contribute to, and be supported by, a comprehensive transformation of the territory where it is developed.

C. Potential uses of digital technologies in agriculture

Without losing sight of the comprehensive approach on which a proposal for IDA is based, this section exemplifies, based on the consulted literature, uses of digital technologies in agriculture.

In the study carried out by FORAGRO, the people consulted highlighted that digital transformation in family farming can contribute to issues such as increasing the quality of its agricultural products, its productivity, its profitability and improving both the level of income of farmers and the salaries of agricultural workers. The importance of digital agriculture in helping to achieve food security in a changing climate, while offering co-benefits for environmental sustainability, nutrition and livelihoods, was also cited (FORAGRO 2019:4).

However, the World Bank and GSMA indicate that digital agriculture lags behind in Latin America compared to Africa and Asia (GSMA 2020, World Bank 2019).

The literature highlights the following uses of digital technologies in agriculture (FORAGRO 2019, Ziegler *et al.* 2020, Birner *et al.* 2021):

a. **IoT (Internet of Things),** drones, satellites, geographic information systems, artificial intelligence and *big data* to generate data that allows the development of precision agriculture with decision-making adjusted to the territories and in real time.
b. **Smart farm** that has enabled significant increases in productivity in pilot applications, but is not yet very widespread. The costs of permanent connectivity of the sensors, as well as the costs of implementation, have proven to be high.
c. **Blockchain** applications to generate financial opportunities, enable traceability and maintain cadastral records have also been relevant applications for agricultural processes (e.g., fair trade, community exchanges, among others).
d. **Robotization** of production processes that allow farmers to deal with the challenges of climate or terrain, as well as reduce the risks of accidents.
e. **Fintech**, for example, for the use of data to increase financial options, mainly due to the possibility of expanding support to producers, as well as better risk management.
f. **Digital technical assistance and advisory services** have been integrated through basic digital tools such as chats, web browsing and applications, but they have been fundamental in obtaining weather forecasts, market information, advice on pests and other diseases, among others. The transformation that technical assistance is undergoing with the use of digital tools to send up-to-date information and pest alerts, and with remote cultivation practices and real-time data collection, among others, is particularly important.
g. **E-commerce**, both to acquire inputs and to sell products, as well as to streamline the supply chain, including up-to-date market information and future projections.
h. **Traceability for monitoring of the production process** that facilitates the control of origin, quality, costs, losses, inventories, destinations, buyers. This ranges from the incorporation of chips in animals, to the collection of data at each step of the production process.
i. **Early warnings** for natural disaster prevention and risk reduction, as well as for mitigation of the consequences of climate change.
j. **Education and training** processes with the use of digital tools for small producers.
k. **Analysis of big data,** starting with the collection of data that facilitates the development of actions and strategies by productive sectors, by territories or markets.

Within the region, some experiences with the use of these digital technologies in agriculture can be identified, but the vast majority were conducted by large corporations and agricultural companies with high economic power.

As Ziegler indicates in the study by IDB, IICA and Microsoft (Ziegler *et al.* 2020:87), "the rural contexts in which technology has to be incorporated are frankly dissimilar and therefore there are multiple modalities of incorporation of these technologies and different benefits that are obtained from them." The digital technologies relevant to large agriculture are not the same as for family farming and small farming. For this reason, the development of a particular strategy for IDA is required.

D. The main challenges for the development of an IDA strategy

Gaps in connectivity, the need for appropriate digital developments for different types of producers in different regions, lack of clarity in the regulation of information privacy, and lack of capacities of producers, other actors in agricultural chains and agricultural support services to take advantage of options based on digital technologies were identified by FORAGRO (2019) as the most immediate challenges for the development of digital agriculture.

Some broader systemic factors that can help steer the approach towards a strategy for the development of IDA in the region are detailed below:

a. **Low priority of rural territories**: As previously mentioned, the rural digital divide is caused by other existing gaps and in turn exacerbates them. In many rural territories, not only is there no connectivity, but there is also no access to electricity, telephony, education, public services, etc. This is largely due to the absence of public policies that promote agricultural and rural development and help close cultural, educational, economic and social gaps. An IDA strategy should promote an inclusive vision of the rural environment.

b. **Little importance placed on a multi-knowledge approach**: The fact that there are few educational opportunities, not only in digital capacities but also in general, reduces the options of capacity development in agriculture. However, it is essential to understand that the knowledge of small farming families is based on daily experience. For this reason, a multi-knowledge approach is very necessary where technological knowledge is combined with knowledge about agriculture to find IDA solutions that are appropriate and valid for populations. As Ziegler (2021:13) indicates:

> We are not only facing a problem of technological access (which is indeed present), but it is also essential to meet the conditions and skills necessary for the use of these technologies. It should be noted that both obstacles also require different strategies and policies to address them, and that although they are associated, it is not necessary to undertake the resolution of one of the problems and then address the other, but it is necessary to face them simultaneously.

c. **Agriculture has lagged behind in digital matters**: As indicated in the study by FORAGRO (2019), agriculture has lagged far behind other sectors in the development and implementation of digital tools. Mention is made of the low schooling in computer science of those belonging to the agricultural sector, both in the case of medium and small producers, as well as in the technical field staff.

An IDA strategy develops specific actions and strategies for inclusion as a fundamental axis.

d. **Financial exclusion of small agriculture**: Financial exclusion has been one aspect of the inequalities in which small agriculture has developed. It is desirable, as previously

mentioned, that the applications of digital technologies favour digital inclusion by generating more data that can function as support for access to financial opportunities. At the same time, without financial opportunities, it is extremely difficult to establish digital agriculture practices, since investments in digital tools are expensive.

e. **Smallholder agriculture is, in many cases, subsistence agriculture**: It is important to be aware of the percentage of small-scale agriculture that is mainly subsistence. The ECLAC study (Namdar-Irani *et al.* 2020) indicates that production units, when they continue to be family-operated, are divided into smaller and smaller portions. Therefore, although the productivity of the land is high, there are not many possibilities to connect with the markets, since they do not have surpluses. We have to ask ourselves what the role of digital tools should be in these contexts. The approaches to digital agriculture that have been prioritized thus far are geared towards improving marketing and commercialization, but they will not be able to have an impact on small subsistence farming if products are not available for sale. Likewise, the cost-benefit ratio for small production units must be assessed. Digital tools can contribute to increased productivity, but in the case of productive units that are for self-consumption, the role of digital technologies would take a back seat. The role of digital technologies should be oriented towards strengthening inclusiveness and integration of various aspects of modern life such as education, health, social advancement and citizen participation. Above all, digital technologies should direct organizational integrative solutions in these fields.

f. **Climate change hits small farming families**: "The climate and environmental crisis we face today affects all human activities, but especially fishing, as well as agricultural and livestock activities, which are very vulnerable to climate change" (ECLAC et al. 2021:45). The timing of sowing and harvesting, seeds, and production techniques must adjust to the changes brought about by this crisis to guarantee productivity. Digital technologies can play an important role in this, but investments are expensive and technical knowledge is required. For this reason, they must be collective solutions and must be supported by the technical entities interested in inclusion.

g. **The rural digital divide**: Although a section has been previously dedicated to this problem, it is still important to highlight it among the challenges. Access to connectivity and the Internet creates inequities and conditions of exclusion mainly in rural areas and among people with fewer opportunities. It is imperative that significant connectivity be taken into account in order to create an IDA solution (Ziegler *et al.* 2020).

h. **The exclusion of women and older people**: Gender and age are determining factors for the development of IDA, and any strategy must contemplate these two factors (Ziegler 2021). Women have less access to technological tools due to time and cost factors. On the other hand, young people can be the catalysts of the appropriation of digital technologies in rural families, if programs adjusted to their interests and needs are developed. This is explained by Ziegler for the study by IDB, IICA and Microsoft (Ziegler 2021:39), showing that:

> There is a difference in terms of age: the older a person is, the less likely they are to use the Internet due to lack of digital skills. So young people are more

committed to technology, while older adults are less likely and more resistant to its use.

Many of these challenges can be better addressed if the digital agriculture practices that are put into operation have a collective rather than an individual approach. In this sense, cooperatives and other forms of the social solidarity economy represent a very important alternative in the Latin American region to enable associated agricultural family units to acquire equipment, organize collectively, train different people and different areas, etc. Associative processes should accompany the development of IDA aimed at small producing families[1].

E. Enabling factors

There are enabling factors for the deployment of digital agriculture solutions by small producers. The study by FORAGRO (2019), based on a regional consultation, organizes them into seven main areas:

a. Quality connectivity coverage and access to digital technologies.
b. Implementation of public policies that promote and strengthen rural territories and digital agriculture.
c. Training programs for the proper use of digital technologies in agriculture.
d. The drive and incentives to develop specific applications and devices for digital family farming.
e. Agricultural extension that appropriates digital technologies and considers IDA.
f. Agricultural research that enables the appropriation of digital technologies for family production.
g. Incorporation of local organizations in the IDA solution.

In addition to these fundamental areas, the review of referents identifies other specific actions that provide guidance to a regional IDA strategy (FORAGRO 2019, ECLAC *et al.* 2021):

a. **Interested State**: A State that works on the digital development of rural areas with the aim of reducing the digital divide with significant connectivity, capacity building and the promotion of solutions adjusted to local contexts.

b. **Enabling regulatory** environment: Policies and regulatory environment conducive to digital agriculture, which create conditions and possibilities for the development of projects, together with small producers.

c. **Multi-stakeholder agreements**: Multi-stakeholder platforms to set common agendas with multiple actors with collective agreements that combine the interests of all parties. It is also essential to base the proposed actions on a deep understanding of the realities. The study on Outlook on Agriculture and Rural Development in the Americas 2021-2022, prepared by ECLAC *et al.* (2021), identifies actors and roles for joint proposals.

d. **Linking with local living forces**: Link digital tools for agriculture with local living forces, especially those that represent producer organizations. Develop digital technologies based on the interests, visions and proposals of local organizations.

[1] For an excellent example of inclusive and associative digital agriculture, see www.coopetarrazu.com

e. **Enabling a digital ecosystem**: A digital ecosystem interested in developing IDA and generating solutions that are implemented, remain and grow. For this, it is necessary to have better connection between supply and demand, one that favours the use of available technologies to solve specific problems, and where the technological processes developed are localized and oriented toward inclusion.

f. **Local connectivity projects:** Endogenous and autonomous connectivity options that are developed in local spaces such as community networks. For this, specific conditions must be created, such as support from digital solidarity funds and spectrum for local connectivity projects, among others. In this way, connectivity alternatives that do not depend exclusively on the telecommunications market are sought, since rural territories do not represent a commercial interest for large operators (for example www.rhizomatica.org in Oaxaca, Mexico).

g. **Connection with connectivity providers with rural commitment**: As it is widely known, large telecommunications companies prioritize the market for their connectivity offer, thus disregarding the territories where the population is scarce or dispersed. Universal Access Funds have failed to solve the digital divide, which was the objective for which they were created (Ziegler *et al.* 2020). As an alternative, local connectivity initiatives have emerged in rural territories, such as www.conelectricas.com in Costa Rica, as well as local connectivity and application development companies with a social commitment, such as https://facttic.org.ar/ in Argentina, with which it is important to develop alliances for IDA strategies.

h. **Tailor-made training**: Development of capacities and skills in IDA tailored to the needs of the populations that are dedicated to small agriculture, as well as professionals and technicians in the sector, such as the Agricultural Technical Institute of Buga, Colombia (https://ita.edu.co/).

i. **Incentive systems**: Incentives for innovation that promote digital technology initiatives adapted to the contexts, which involve financing programs for the development of IDA, with participation in the management of the resources of the producer families. An interesting example is shown in https://test-okamasuei.pantheonsite.io/, where the Sulá Batsú Cooperative works using this approach with the indigenous Cabecar women of Alto Pacuare, in Costa Rica.

j. **Development of collective models of digital technologies**: Promoting collective models for IDA can be approached in two ways. On the one hand, by strengthening existing associative initiatives such as cooperatives, producer associations and other expressions of social solidarity economy that provide more possibilities for collectively addressing digital projects. A good example is www.coopetarrazu.com in Costa Rica, which uses geographic information systems for the detailed monitoring of its 4000 small producer associates. On the other hand, by developing collective projects on digital technologies for agriculture such as data cooperatives, collective use of mobile phones, community training centres, among others, such as www.hispatec.com with the agri-food cooperatives of Spain.

F. Summary of Findings from Previous Studies

It is necessary to emphasize the need to differentiate between digital agriculture and inclusive digital agriculture. To make the distinction, one must ask where the focus of digital technologies is placed: whether in agriculture only, or in the inclusive dimension. In using a digital appropriation approach, it would be necessary to ask what inclusive agriculture means and how it is achieved, and then define what are the possible digital technology strategies.

Digital agriculture has developed mainly in the research, innovation and development (R+D+I) processes of large agricultural corporations – and sometimes from the State and the academic institutions that accompany them. IDA refers to other strategies for the appropriation of digital technologies that are aimed at strengthening the agricultural processes of the producer families, their organizations and private or associative enterprises. When digital tools are incorporated into these processes, it must be done from the standpoint of these social groups that are finally an important majority in LAC.

Within this framework and reflecting on the factors analysed, a scheme is presented that highlights the elements that have emerged to address an IDA project (Figure 3).

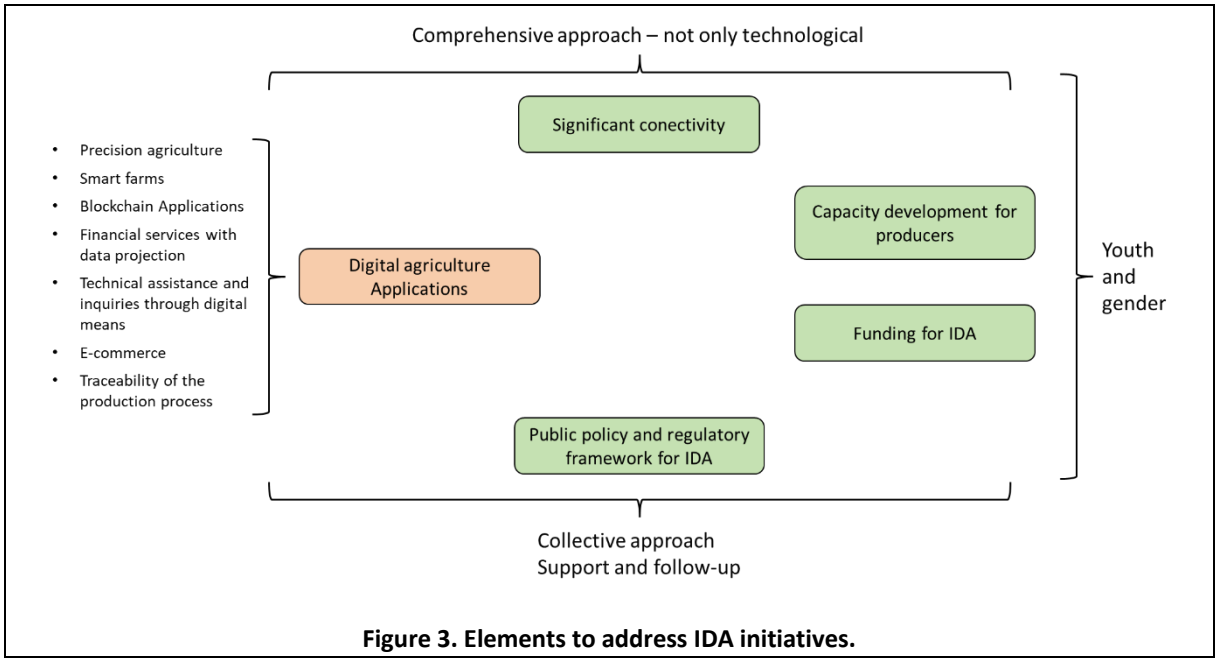

Figure 3. Elements to address IDA initiatives.

In green, the enabling factors of an IDA project that were highlighted in the review, in which four factors have been prioritized:

a. Significant connectivity, which means connection all the time and everywhere, with a device that is always available and a browsing speed that allows for upload and download of all the files.
b. The initiative has integrated the development of capacities in digital technologies adjusted to each context of producers.

c. There is a way to finance IDA projects, through a solidarity approach.
d. There is public policy and a regulatory framework to generate the conditions and the necessary support to promote IDA.

IDA projects should have a collective, and not an individual approach. Technological development should be locally adapted based on each context. Although there is a great diversity of digital technologies, the development that takes place must suit the reality of each territory and the specific situation of local actors, which should be well understood and reflected upon with them. In addition, it is necessary to support these developments in multi-stakeholder agreements that are concretized in common agendas where producers and their organizations have a decisive participation in decision-making.

It is also recommended that the gender and youth approach be always taken into account to ensure the inclusive aspect of IDA. On the one hand, this is due to the fact that the issues relating to gender impact the processes of appropriation of digital technologies, since women have fewer resources and less time for such processes, and on the other hand, because rural youth can make an important contribution to the processes of technological appropriation in family and collective agriculture.

All of this underscores the very important fact that IDA initiatives should always be based on a comprehensive approach, which contemplates social, economic, cultural, and power relations, among others. It is not a purely technological but rather an integral approach for which it is important to remember that:

- Digital agriculture is not the same as inclusive digital agriculture: The strategies, methodologies, approaches to developing IDA projects must be differentiated from those carried out for other actors and territories that are not in situations of exclusion and vulnerability.
- The importance of a technological appropriation approach: Work from an approach that is not techno-centric, nor based on the excessive consumption of technology, but rather, is based on the condition, potentialities and identified needs of family farmers. To strengthen this approach, it is urgent to have more studies on the situation of family farming and small agriculture in LAC, as well as their non-digital needs (it was not possible to locate recent works on this subject).
- IDA's approach must be localized and adjusted to each specific context. Priority must be given to actions that create capacities for connectivity and to the use and appropriation of digital technologies. Critical analyses of technology that support the development of criteria determining the choice of one technology over another fall in the prioritization matrix, as well as the collective alternatives of technological solutions for agriculture. Developing projects that foster active participation by producers is also high on the agenda of priorities.

Chapter II. Analysis of the survey

A regional survey was undertaken to gather input from the production units, i.e., the family farming producers in LAC, for the identification of current uses, needs and expectations in terms of digital solutions. It was conducted within the framework of the collective action on inclusive digital transformation of agriculture facilitated by GFAR and implemented in LAC by FORAGRO, in conjunction with IICA and COPROFAM, with international partners AgGateway and GODAN.

The instrument for collecting this input was an online survey distributed by various digital media, through email, social platforms, and chat tools. Although this medium had the limitation of requiring connectivity, the invitation was channelled through COPROFAM and other farmer organizations to ensure that family farmers were reached. In addition, the invitation was disseminated through the regional platforms of FORAGRO and AgGateway Latin America, as well as the global GFAR channels.

A. General characteristics

With respect to the survey, 365 responses were obtained, of which 167 were from women and 198 from men. They are distributed by regions as follows: 5 from the Caribbean, 22 from Central America and Mexico, 285 from the Southern Cone and 53 from the Andean Region.

Sixty-two percent of respondents identify themselves as family farmers and 28% as members of a family farming unit (Figure 4). This means that 90% of the people surveyed are engaged in family farming. 50% of the people who responded are leaders or representatives of family farming organizations, irrespective of the fact that they can also be producers, since this question was multiple choice. The remaining 10% are self-qualified as leaders or representatives, only.

Most of the answers were obtained from people with some affiliation to COPROFAM (312 of 365 responses), who managed to distribute the questionnaire among their associated population. For this reason, the majority of responses are from people in the Southern Cone.

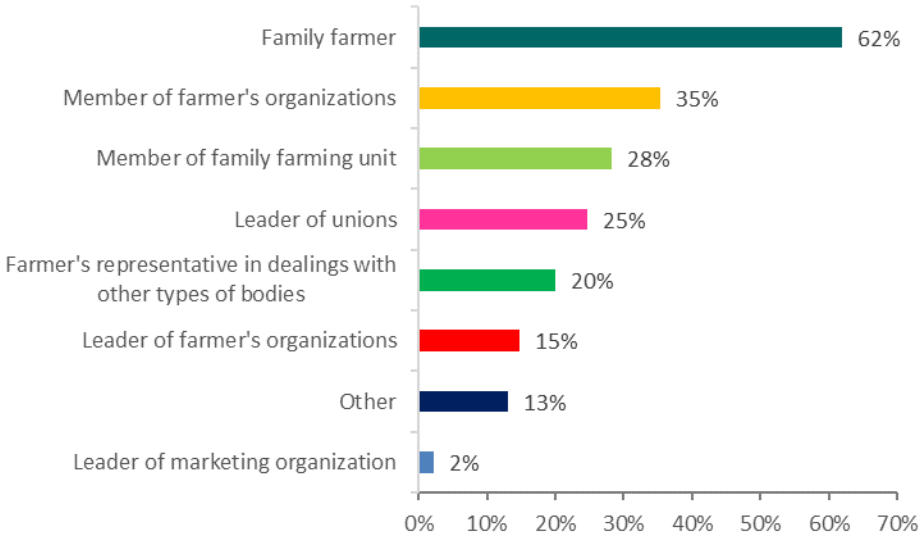

Figure 4. Role of the person responding to the survey.

Only 33% of the answers correspond to people under 40 years of age, with the predominant range being those aged 40 to 60 years, and there were 18% of people over 60 years of age (Figure 5). Age is very relevant for digital strategies, due to the age gap in the management of these tools.

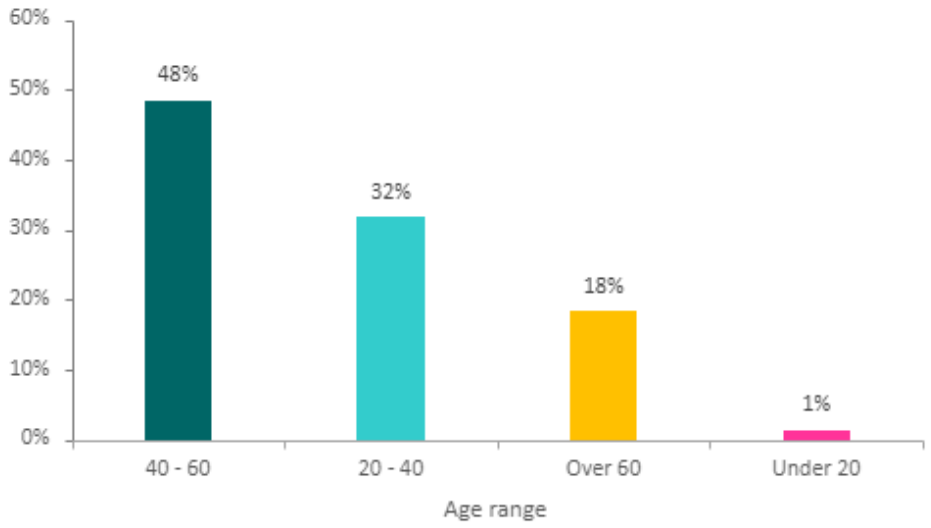

Figure 5. Age of the person responding to the survey.

B. Use of digital tools for agriculture

The population surveyed primarily has access to electronic devices. Almost 80% have a computer and 75% have smartphones (Figure 6). The rest have access to basic cell phones (about 25%). There is also an indication that 15% use other devices including geo-locators and tablets; drones are sometimes mentioned.

The fact that the population surveyed has access to high-end devices is also a logical consequence of the medium used for the survey, but this statement cannot be generalized to family farming producers in the region.

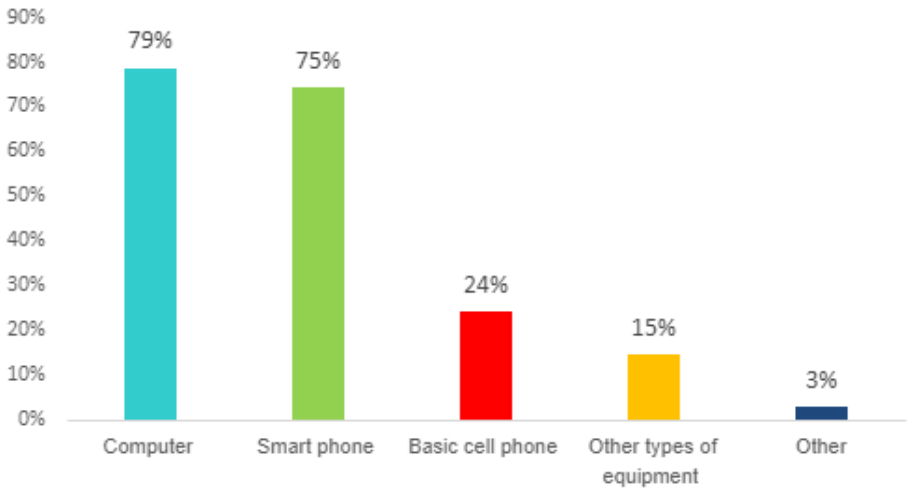

Figure 6. Devices used by the respondent.

Regarding the availability of devices, generalizations cannot be made, since within survey data there is an important variation between men and women according to the regions from which answers arose (Figure 7).

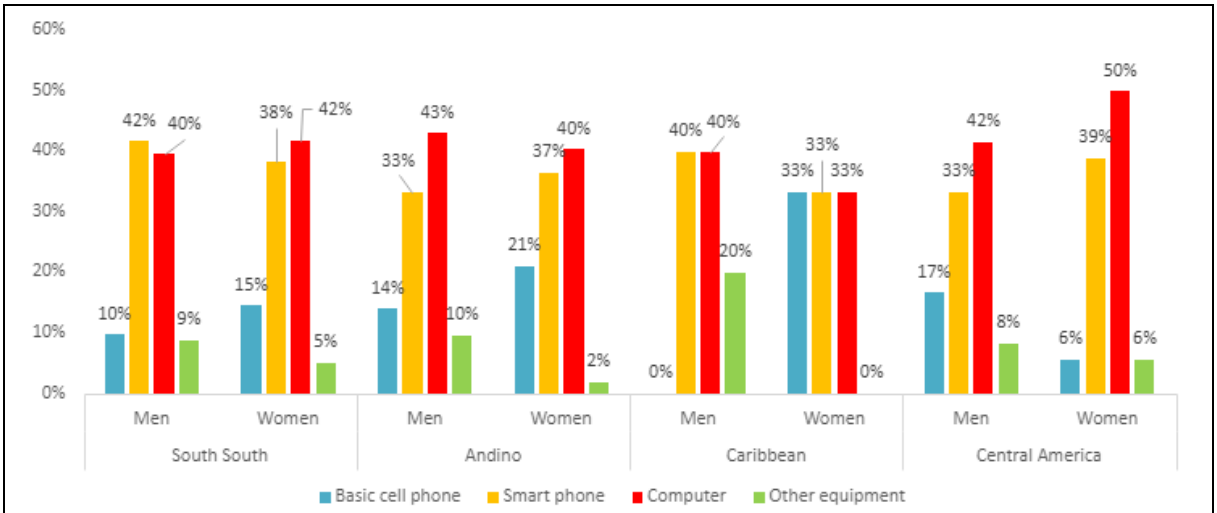

Figure 7. Device availability by gender and region.

Moreover, it is clear that the people who answered the survey have access to the Internet. The quality of connectivity stands out as one of the main problems for people in the agriculture sector, especially for those who live in rural territories. When asked about the main obstacles to accessing quality connectivity, those related to signal quality and high costs are mentioned first (Figure 8). Additionally, they point out those related to the skills and knowledge needed for taking better advantage of digital technologies.

Significant connectivity (access to the Internet with appropriate devices, quality and permanent signal as well as accessing any information from a variety of places) continues to be a central problem in rural territories.

Work in IDA must take into account this condition and consider innovative solutions for Latin American rural areas that are not dependent on traditional telecommunications companies, such as their own community networks, public-private partnerships, and access to the resources of solidarity funds, among others.

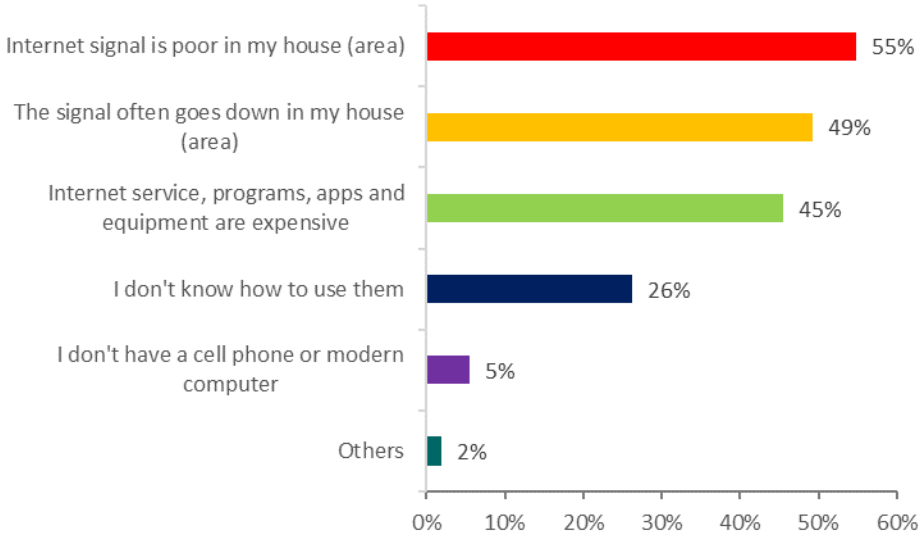

Figure 8. Difficulties in accessing the Internet.

It is important to note that 56% of connectivity is provided by international telecommunications companies, while the remaining 44% is served through local companies (Figure 9). This provides room for negotiation to develop digital agriculture projects together with these companies, and to influence connectivity expansions to reduce the digital divide. This is particularly true in the case of small local cooperative companies, community networks and others (14%) which, based on prior experience, are willing to create connectivity projects aimed at achieving social, economic and environmental impacts in the territories where they operate. This route could be explored in the process of building any inclusive project.

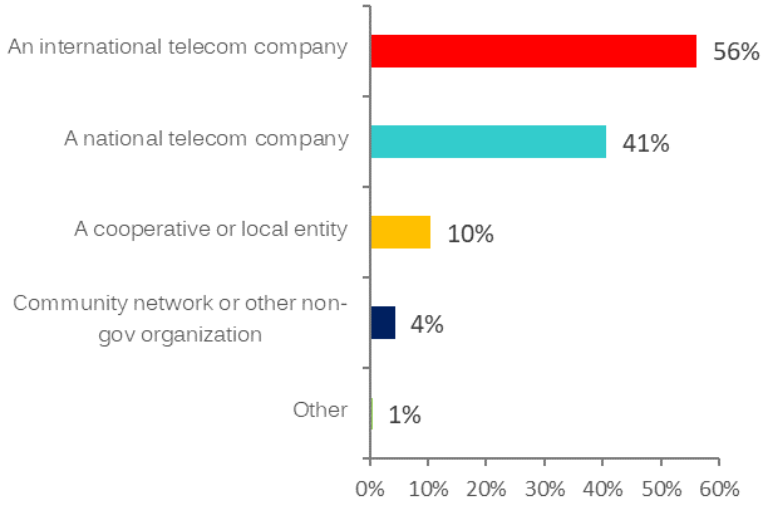

Figure 9. Company that offers the telecommunications service.

There are tools such as Whatsapp and email (Figure 10) that are used by almost all the people surveyed, followed by platforms for meetings, social media, and browsers. In the analysis by gender, it can be noted that women use these tools up to 10 percentage points less, which is understandable since they have less access to smart devices.

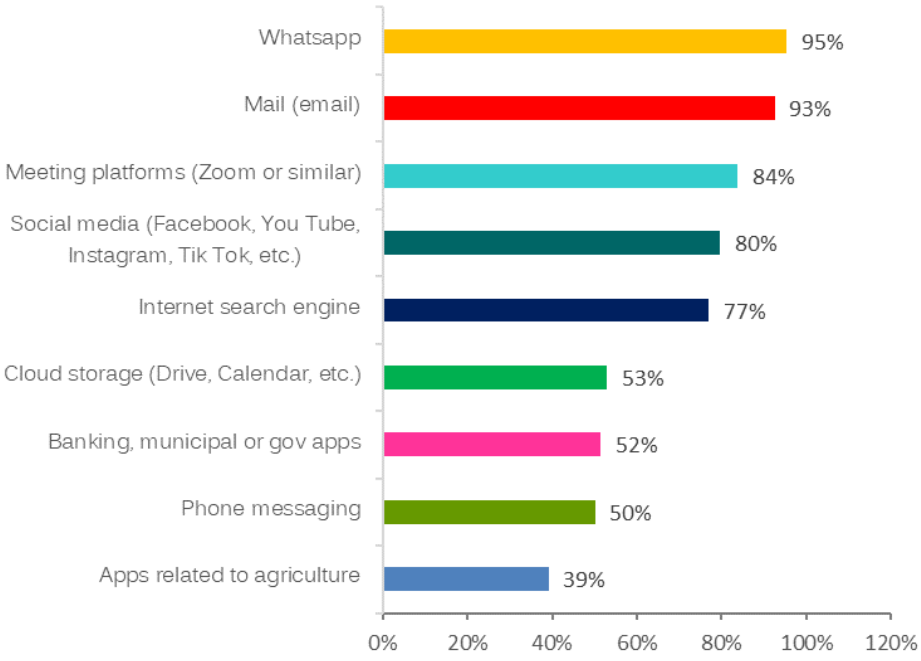

Figure 10. Digital tools used by the persons surveyed.

One notable aspect of the answers to this question is that only 39% of the people surveyed make use of applications related to agriculture, and that this option is the least selected, despite the fact that a large majority of people identify themselves as producers. To delve deeper into the uses of digital technologies, the survey asked about the purposes for which these digital tools are used (Figure 11).

In the first instance, digital technologies are used to obtain general information, followed by use for family communication. Digital technologies are also used for online meetings and trainings. Marketing ranks last: only 32% of the people surveyed use digital tools for promotion and sale of their products.

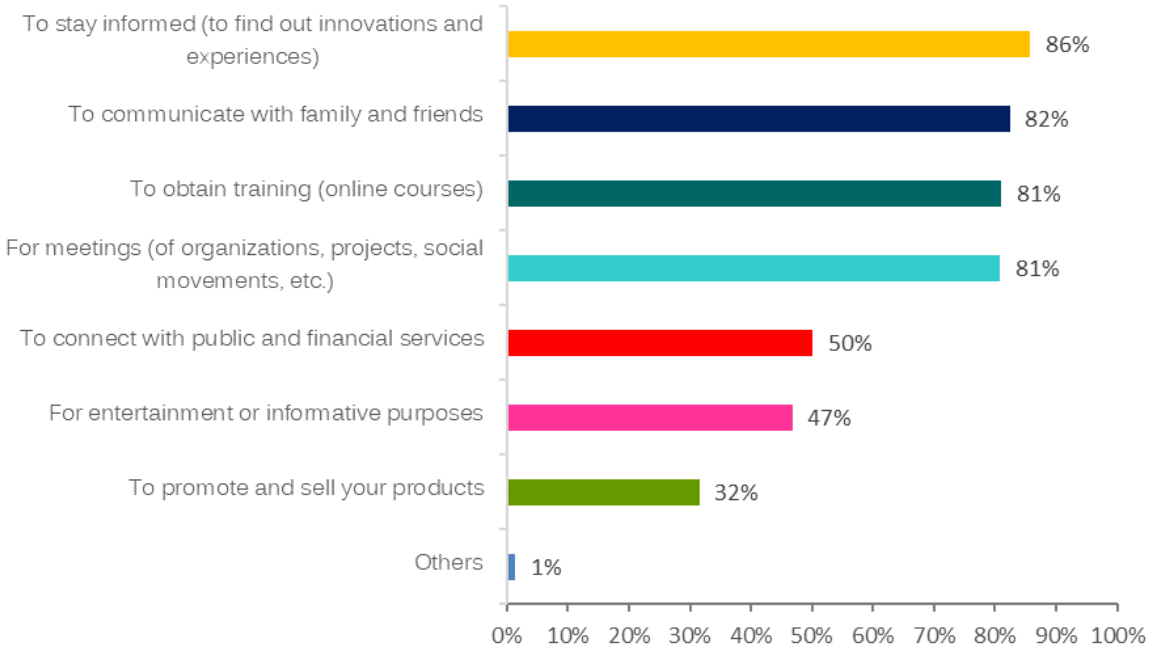

Figure 11. General uses of digital technologies.

As can be seen in Figure 12, men have more diverse uses of digital technologies than women. Women only surpass men in the use of digital technologies for the sale of products.

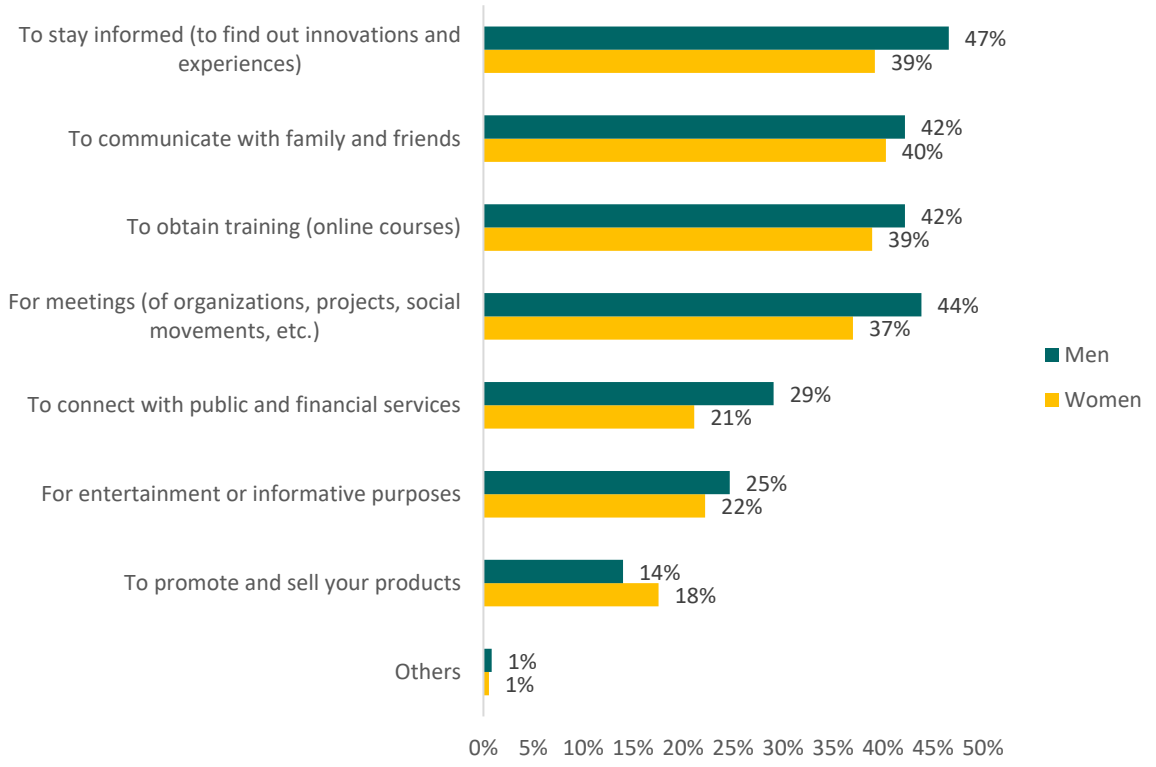

Figure 12. General uses of digital technologies by gender.

When asked specifically about the uses of digital technologies in agriculture, a little more than 50% of the people surveyed use digital tools for agricultural extension or advisory services (Figure 13), from public institutions in the first instance, followed by those from the private sector (Figure 14). Some support is also received by digital means from social organizations, but to a lesser extent.

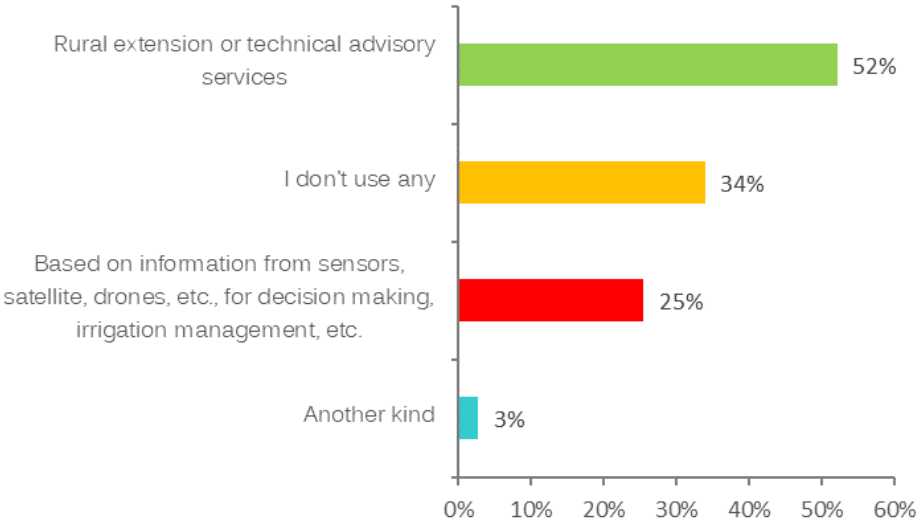

Figure 13. Uses of digital technologies in agriculture.

For the purposes of this project, it is noteworthy that a quarter of the population that uses data generated by digital devices such as sensors, drones and geo-locators in their decision making.

In both of these questions, it is important to note that 30% of the people surveyed do not use digital tools for agricultural advice.

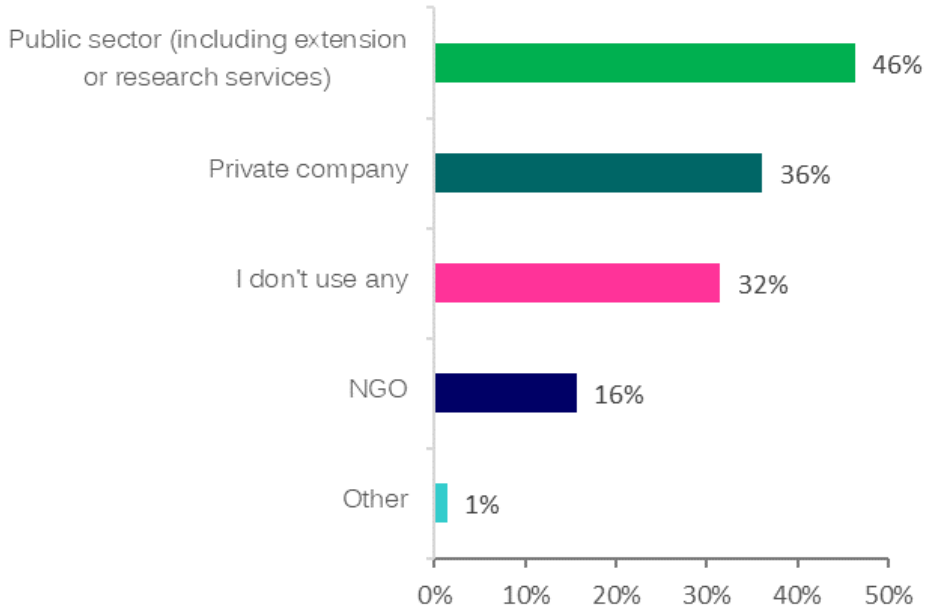

Figure 14. Providers of agricultural advisory services with digital technologies.

The following questions explore, in greater detail, the usefulness of information consulted via digital media. Twenty-eight percent (28%) of the people responding to the survey have no difficulty with the information they manage to access (Figure 15).

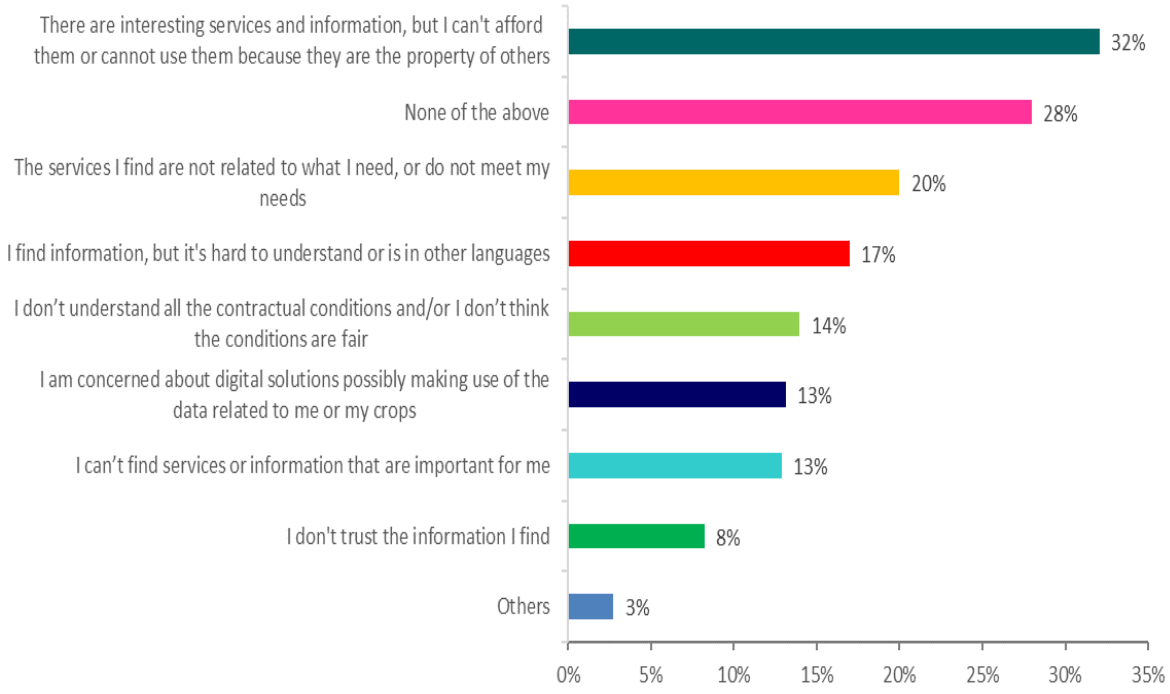

Figure 15. Usefulness of information on the Internet for family farming.

The rest of the answers in Figure 15 can provide useful guidance for aspects that should be considered in any IDA action. For example, useful information can be found but cannot be accessed because it is closed or under copyright, and often has access costs. Answers also mention information that has not been adjusted to the needs or to the language of the people surveyed, thus making it difficult for it to be used in agricultural practice.

It is also important to pay attention to aspects such as trust in information and data, conditions for use that are either incomprehensible, or not read, and concern for the handling of personal and production data generated from the use of applications, devices and information.

Comparison of the current uses of digital technologies (Figure 16) with the desired uses for agriculture (Figure 17) can also offer clues about any aspects that can be strengthened.

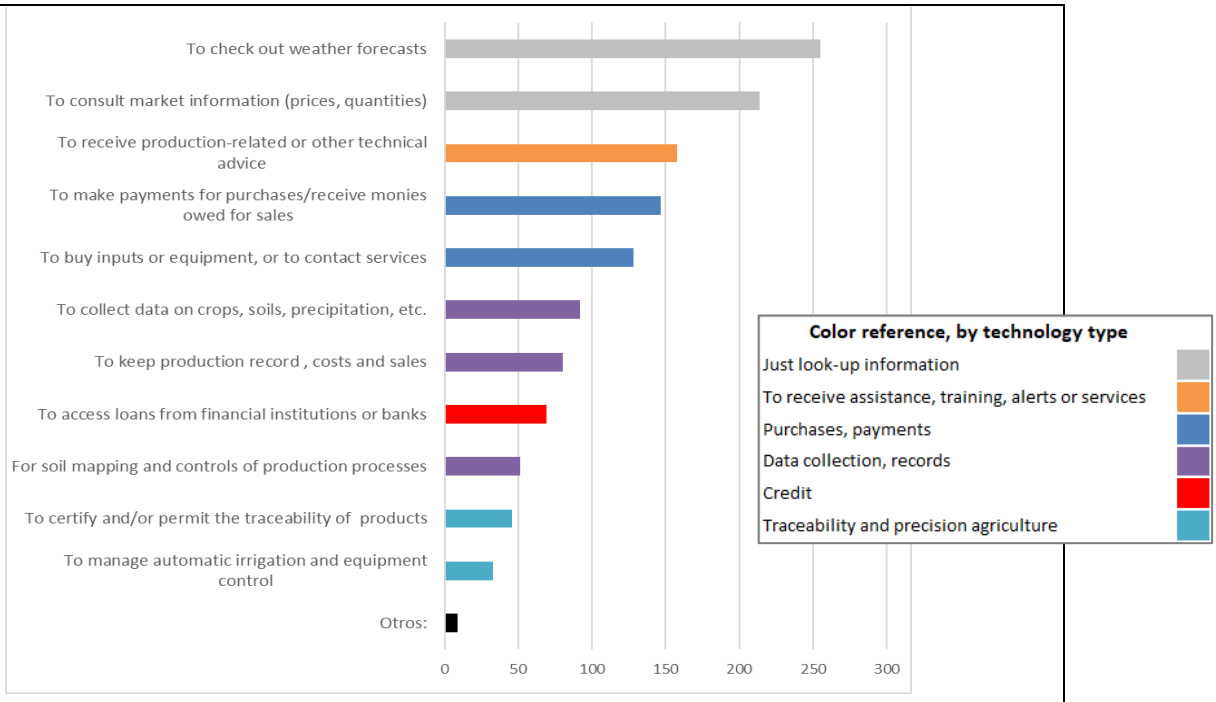

Figure 16. Current uses of digital technologies.
(number of positive responses in the sample of 365)

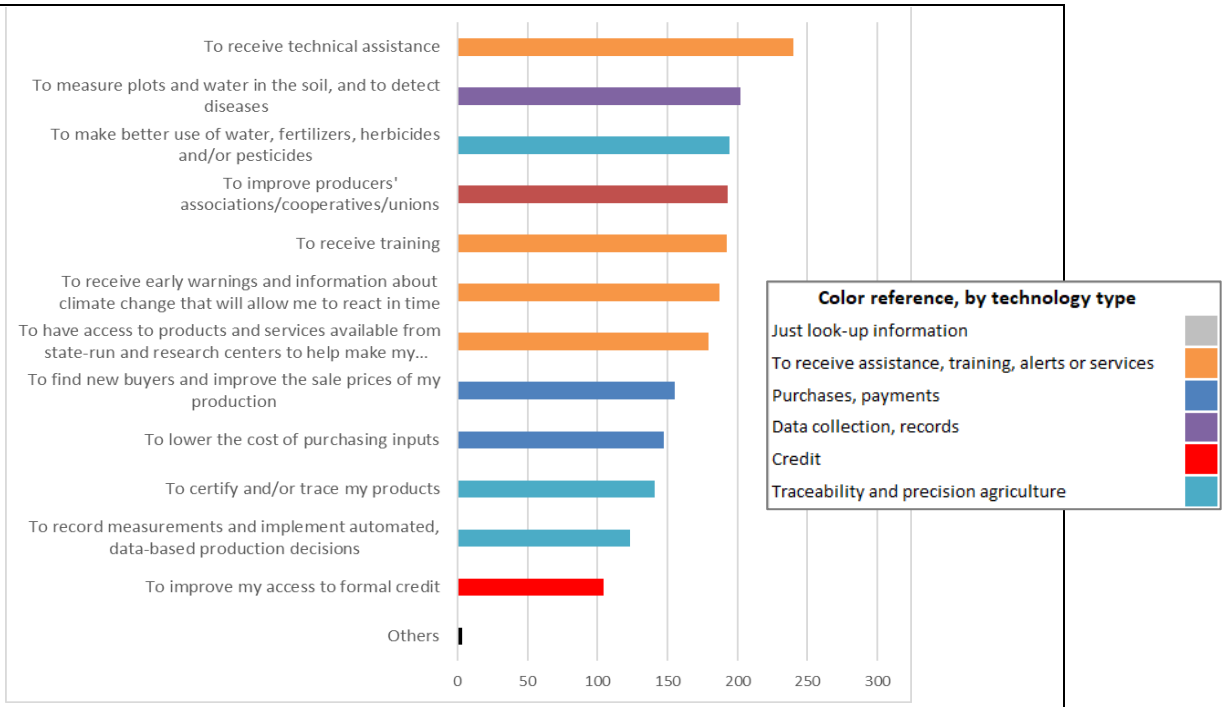

Figure 17. Expected uses of digital technologies.
(number of positive responses in the sample of 365)

Current uses of digital technologies are mainly concentrated in the more traditional support for agriculture:

a. Consult weather forecasts and market information.
b. Technical assistance.
c. Online payments and collections as well as access to public services.

Expected uses are more focused on other opportunities presented by digital agriculture:

a. For receiving training and technical advice.
b. Climate-smart agriculture based on measurements of water, soils, climate, agricultural practices and their adaptation to climate variability.
c. For risk management based on early warnings.
d. To reduce input costs and have greater production efficiency.
e. To expand and make marketing more efficient.

Again, it is important to note that women make less use of digital tools for agriculture than men (Figure 18). The gender approach should be a key element in any IDA project that is developed.

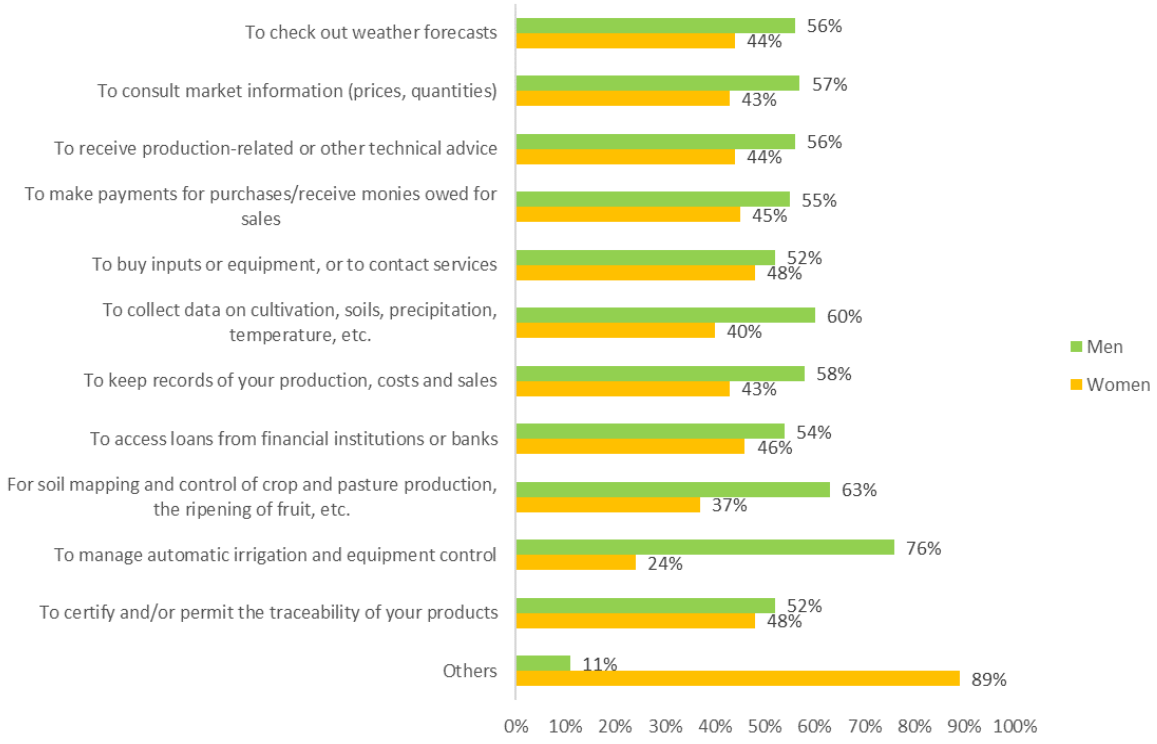

Figure 18. Differences in current use of digital technologies by gender.

An important element of this analysis relates to young people who become key persons in assisting their elders with consultation on digital tools (Figure 19). A digital agriculture program must take

into account this specificity and take advantage of the interest in digital tools to strengthen the generational change in agriculture in the region.

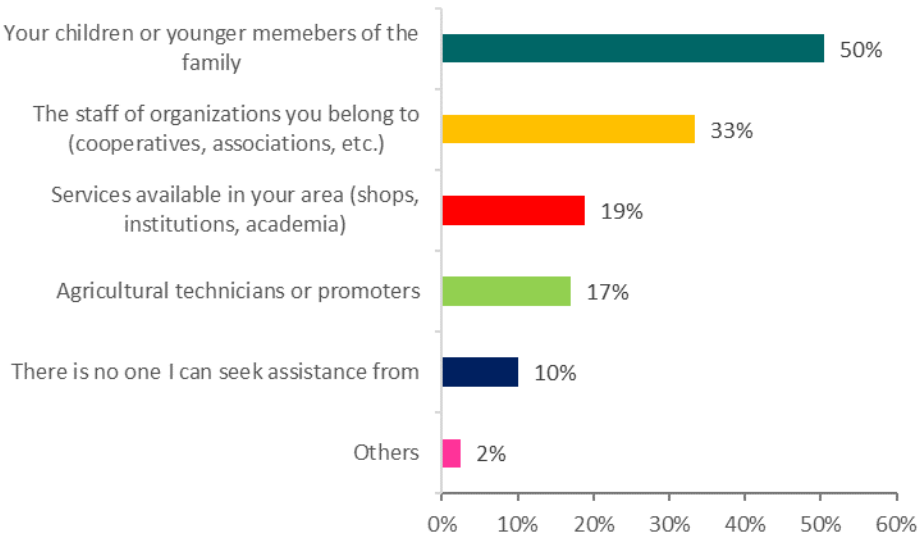

Figure 19. To whom you turn in case of doubt.

As can be seen in Figure 19, local organizations are also key actors as resources for consultation and strengthening of knowledge about digital technologies for farmers.

From the results of this survey, some key elements can be extracted for IDA actions in LAC. In order to use these results correctly, it is necessary to indicate that the framework of the exercise is as follows:

a. It is a survey that was answered by 365 people.
b. A significant majority of responses are from South America and especially from the Southern Cone. This limits diversity for broader analysis.
c. A large majority of the answers come from people associated with COPROFAM, which was the institution that was successful in generating interest in the survey.
d. The survey was answered by people who have access to digital technologies, given that it was sent out in digital format.

Chapter III. Key elements for the development of an inclusive digital agriculture agenda

With the inputs of the previous chapters, some lines of action can be identified to guide the work of designing an IDA agenda and future training programs in digital agriculture for LAC. This can be based on the following aspects:

a. New uses of digital tools for family farming. The current uses of technologies are focused on more traditional rather than innovative processes. However, the fact that roughly 25% of the people surveyed are using drones, sensors and other devices for decision-making in production processes, and can become reference cases, should not be underestimated.

b. Significant connectivity in the rural territories of the region cannot be ignored. In this case, these are producers with access to the Internet but who, despite this, are experiencing problems in terms of signal and costs. Additionally, there are farming families that do not have connectivity. It is well known that within the region, rural, indigenous, coastal and border territories have difficulty with Internet access and the quality of service, when it does exist.

c. Training, support and advice on digital agriculture is developed for producers. The main technological means should preferably be mobile phones and messaging tools, since they are the most widely used and are the most accessible to families.

d. Gender focus in the process of training, support, or advice on inclusive digital agriculture. Again, there are differences in opportunities and material conditions due to gender, with women at a disadvantage.

e. Inclusive digital agriculture project with an important component that is focused on young rural people and those from farming families. This not only facilitates any digital agriculture project, but also contributes to the attraction of young people to rural territories, thus preventing migration to cities.

f. Paying attention to the content, the media, and the languages of any material that is developed for a future digital agriculture project, as it becomes clear in the survey that the resources available are often not accessible to farmers.

g. Alliances with local organizations for advice, support and even the development of own connectivity projects seem to be a good route to develop an IDA program.

As a suggestion for further steps in this collective action to expand on the findings illustrated in this document, the following recommendations are made:

a. Take these findings as a basis for generating conversations primarily with diverse family farming and small-scale farming groups, but also other stakeholders whose behavior has an impact on the extent to which digital solutions can be inclusive. Among these, it will be interesting to address:

    - Women producers
    - Rural youth

- Cooperatives and associative organizations
- Environmental and environmental movements working in agriculture
- Technology developers for rural areas and agriculture, including promoters of community networks and other local connectivity alternatives
- Decision-makers of institutions and public policies

b. Reach out once again to other producer organizations from other regions. (They were contacted for the survey, but their response was inadequate).

c. Identify focus groups that represent a diversity of regions, genders, producer families, products, for more in-depth input.

d. Involve small-scale farmers in co-design and co-learning activities, not on technological aspects but on essential aspects that relate to access and benefits. This can be done through consultations among representatives of small-scale farmers and other relevant stakeholders on farmer-fair business models and good practices.

In addition to the recommendations above, the team in charge of the implementation of the collective action in LAC has discussed and defined the following topics as priorities for the compilation of good practices or business models for inclusive digital agriculture:

a. Management of Internet networks by local organizations (community networks).

b. Provision of technical assistance services using digital alternatives, with a focus on the use of the cell phone as a tool.

c. Use of applications to improve the management of soil, water, herbicides, pesticides, etc.

d. Use of apps to connect family farmers with buyers or markets, and thus improve sales revenues.

e. Use of applications to pay, collect and access credit through public and/or private financial institutions with an interest in serving the rural sector.

References

Birner, R; Daum, T; Pray, C. 2021. Who drives the digital revolution in agriculture? A review of supply-side trends, players and challenges. Applied Economic Perspectives and Policy 43(4):1260-1285. DOI: https://doi.org/10.1002/aepp.13145.

ECLAC (Economic Comission for Latin America and the Caribbean), IICA (Inter-American Institute forCooperation on Agriculture), and FAO (United Nations Food and Agriculture Organization). 2021. Perspectivas de la agricultura y del desarrollo rural en las Américas: una mirada hacia América Latina y el Caribe 2021-2022 (online). San Jose, Costa Rica, IICA. Available at http://repositorio.iica.int/handle/11324/18609.

FORAGRO (Forum of the Americas for Agricultural Research and Technology Development). 2019. Summary of the virtual consultation: Digital Agriculture and Inclusion – Priorities for the agricultural research, development and innovation agenda in Latin America and the Caribbean (online). n. p. Available at https://www.foragro.org/en/documentos/summary-virtual-consultation-digital-agriculture-and-inclusion-priorities-agricultural.

GSMA. 2020. Digital Agriculture Maps: 2020 State of the Sector in Low and Middle-Income Countries (online). London, United Kingdom. Available at https://www.gsma.com/r/wp-content/uploads/2020/09/GSMA-Agritech-Digital-Agriculture-Maps.pdf.

Namdar-Irani, M; Sotomayor, O; Rodrigues, M; Rodríguez, A; Wander P. 2020. Tendencias estructurales en la agricultura de América Latina: desafíos para las políticas públicas (online) Santiago, Chile, United Nations. Available at https://repositorio.cepal.org/bitstream/handle/11362/46519/1/S2000807_es.pdf.

Oxfam. 2016. Desterrados: tierra, poder y desigualdad en América Latina (en línea). Oxford, United Kingdom, Oxfam International. Available at https://www.oxfam.org/sites/www.oxfam.org/files/file_attachments/desterrados-full-es-29nov-web_0.pdf.

Rijswijk, K; Klerkx, L; Bacco, M; Bartolini, F; Bulten, E; Debruyne, L; Dessein, J; Scotti, I; Brunori, G. 2021. Digital transformation of agriculture and rural areas: A socio-cyber-physical system framework to support responsibilisation (online). Journal of Rural Studies 85:79-90. DOI: https://doi.org/10.1016/j.jrurstud.2021.05.003.

Rotondi, V; Kashyap, R; Pesando, LM; Billari, F. 2020. Desigualdad digital de género en América Latina y el Caribe (online). San Jose, Costa Rica, IICA, University of Oxford, IDB, IFAD. Available at https://repositorio.iica.int/handle/11324/12489.

Sabourin, E; Samper, M; Sotomayor, O (coord.). 2014. Políticas públicas y agriculturas familiares en América Latina y el Caribe: balance, desafíos y perspectivas (online). Santiago, Chile, United Nations ECLAC. Available at https://www.cepal.org/es/publicaciones/37193-politicas-publicas-agriculturas-familiares-america-latina-caribe-balance.

Salazar, L; Schling, M; Palacios, AC; Pazos, N. 2020. Retos para la agricultura familiar en el contexto del COVID-19: Seguimiento tras 6 meses de crisis (online). Washington, D. C., United States of America, IDB. Available at

https://publications.iadb.org/publications/spanish/document/Retos-para-la-agricultura-familiar-en-el-contexto-del-COVID-19-Seguimiento-tras-6-meses-de-crisis.pdf.

Salcedo, S; Guzmán, L (eds.). 2014. Agricultura familiar en América Latina y el Caribe. Recomendaciones de política (online). Santiago, Chile, FAO. 486 p. Available at www.fao.org/publications.

Soto Baquero, F; Rodríguez Fazzone, M; Falconi, C. 2007. Políticas para la agricultura familiar (online). Santiago, Chile, FAO. 145 p. Available at https://www.fao.org/3/a1248s/a1248s.pdf.

World Bank. 2019. Individuals using the Internet (% of Population) | Data (online). Washington, D. C., United States of America. Available at https://data.worldbank.org/indicator/IT.NET.USER.ZS.

Ziegler, S. 2021. Habilidades digitales en la ruralidad: un imperativo para reducir brechas en América Latina y el Caribe (online). San Jose, Costa Rica, IICA, IDB, Microsoft Corporation. Available at http://repositorio.iica.int/handle/11324/14462.

Ziegler, S; Camacho, K; Bosio, M; Arias Segura, J. 2020. Conectividad rural en América Latina y el Caribe. Un puente al desarrollo sostenible en tiempos de pandemia (online). San Jose, Costa Rica, IICA, IDB, Microsoft Corporation. 80 p. Available at https://repositorio.iica.int/handle/11324/12896.