



Discussion Document: Digitalization Processes in Agriculture and the Rural Environment¹

I. Introduction

The challenges faced by agriculture and the rural environment are many, and encompass multiple social, cultural, ecological, territorial, economic and technological aspects. Territories also play a key role in this process.

Globally, economic sectors in general and agriculture in particular are undergoing a process of digital transformation that will deeply change the way in which goods and services are produced, sold and consumed. However, in the case of agriculture and the rural environment, there is a significant delay in the adoption of digital technologies, which particularly affects small and medium sized enterprises.

Digitalization involves all stakeholders in the agrifood chain: input providers, farmers, food processors, software providers, logistics operators, distribution chains, retailers and consumers, public administrations, etc. The value added by new technologies is of particular importance to them, since it allows them to integrate and process data from different sources.

In addition to considering the stakeholders of agrifood chains individually, a comprehensive approach must be applied, by understanding the relationships and synergies between them. Transparency and partnerships aimed at improving traceability, food security, and the opportunity to generate projects focused on creating shared value are essential.

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It is equally important to acknowledge that the sector produces food for consumers who are increasingly concerned about different factors including their health, the environment and social responsibility. These consumers demand to have access to information on the foods they consume, which entails paying close attention to their experiences and incorporating them into decision-making processes. A faux-pas in any link of the agrifood chain may trigger a food-related crisis or bring about undesired consequences for consumers, farmers, agroindustries, public institutions and the agrifood chain as a whole.

II. Potential benefits of digitalization in the agrifood sector

Digitalization processes are thought to contribute to improving knowledge generation and use, developing more sustainable systems and ensuring that farmers and rural workers are better prepared to address the various economic, environmental and social challenges they will face. Moreover, these processes help mitigate the effects of traditional barriers such as the size of the business, the place of origin or access to markets, on account of a more connected society, both internally and externally.

Digitalization processes provide new opportunities for agriculture and the rural milieu, and create expectations for citizens, especially for youths, who find these processes very engaging and can therefore contribute to reversing the rural

depopulation trend and improving quality of life in the rural milieu.

Having said this, digitalization is necessary but not sufficient to change economic, ecological, cultural, social and territorial trends associated with agriculture and the rural world. Interventions based on global innovations must be implemented, considering their impact and repercussions throughout the rural value chain and in the different time frames. It will also be necessary to consider the vulnerability of stakeholders in the rural world, on account of their lack of training, information and knowledge of digitalization processes.

Collaboration between the information and communication technologies (ICT) sector and the agriculture and rural sector to foster digitalization processes may prove very beneficial for territories and citizens in general.

III. Digital agendas in Latin America and the European Union

In the case of Latin America and the Caribbean (LAC), as pointed out by García Zaballos and Iglesias (2017) in a study conducted for the Inter-American Development Bank (IADB), as digital technologies permeate all activities, their importance and impact on economic growth patterns grows, along with social inclusion and environmental sustainability.

Following a decade of policies aimed at promoting more access and use of these technologies, countries in LAC have

made significant progress, especially in regards to telecommunications and use of applications and social media, as well as in the implementation of policies and programs for education, health, e-government and approval of the corresponding regulatory frameworks. Nonetheless, countries are moving forward at different speeds and displaying large gaps within and between them, showing important delays vis-à-vis more developed economies.

Countries in the region must address the challenge of articulating and consolidating their digital economy, which calls for a better understanding of how to identify and leverage new opportunities arising within the context of technological convergence, in order to move towards economic development and equality.

Initially, it is necessary to update the strategies aimed at maximizing the impact of digital economies on growth, innovation, structural change and social inclusion. In this regard, the main challenges are: ensuring minimum conditions for ICT investments to have a positive impact on economic growth; promote and consolidate a broadband-based model of technological innovation and dissemination that is compatible with social inclusion goals; and foster changes in the productive structure, so that knowledge can be articulated with production to strengthen the digital sector based on the economic and institutional specificities of each country.

In sum, these authors propose a digitalization process that responds to a tangible business model that is

adaptable to the actual characteristics of each country. They also suggest that public policies are paramount to ensure equal access and use of ICTs, which are of public interest on account of their ability to facilitate the provision of social services (public management, health and education) and public goods. Institutions must therefore ensure the implementation of a digital economy that integrates policy initiatives focused on broadband, ICT industries and digital inclusion.

These considerations are especially relevant in the case of the food chain, which accounts for 19% of employment in the region and 9% of its Gross Domestic Product (GDP). Among other things, these authors highlight the problem of limited access to relevant information on climatology, market prices, products, seeds, irrigation, machinery and other relevant aspects of the agricultural business; it is because of these observations that they suggest the need to develop policies to foster the adoption of technologies in the sector by means of training, financing and support for innovations such as the Internet of Things (IoT) and big data, with a focus on the agriculture sector.

During the Sixth Ministerial Conference on the Information Society in Latin America and the Caribbean, the countries agreed to implement the “eLAC 2020 Digital Agenda for Latin America and the Caribbean” (ECLAC and CAF 2018), which refers to the use of digital technologies as sustainable development instruments, with the mission of promoting the development of a digital ecosystem in LAC through

a process of regional integration and cooperation aimed at strengthening digital policies that foster knowledge, inclusion, equality, innovation and environmental sustainability. At this meeting, LAC countries committed to promoting the digital ecosystem, e-trade, access to public information and privacy protection.

The Preparatory Meeting of the Seventh Ministerial Conference on the Information Society in Latin America and the Caribbean (September 2019) is of particular interest, and aims to analyze the agreements established within the framework of the Digital Agenda for Latin America and the Caribbean, and revise the content to be discussed during the Seventh Ministerial Conference in Brazil in 2020.

The conference will address different issues, including: moving towards a secure, inclusive and sustainable digital future; connectivity and regional digital markets; digital economy; governance and cybersecurity; digital transformation in MSMEs of LAC; big data; challenges to measure digital economies; and the goals of the digital agenda.

In order to drive these digitalization processes, it is crucial to consider each situation individually, and to be aware of the fact that a significant part of their construction must involve “bottom-up” commitments and appropriations that respond to real needs. They must also be supported by an ongoing surveillance system that accompanies the process of learning, design and implementation of initiatives in the region.

The transparency, abundance and availability of information on digitalization strategies in the European Union (EU) significantly facilitates a detailed analysis, the interpretation of cause and effect, and helps draw conclusions that could be useful to devise digitalization initiatives in other parts of the world.

In 2016, the European Commission launched the digitalization strategy entitled “Digitising European Industry (DEI)”, as a complement to existing national initiatives, and with the purpose of ensuring that all companies within the EU, large or small, regardless of their sector or location, can fully benefit from digital innovation to update their products, improve their processes and adapt their business models to the digital era. This initiative is supported by a strategic planning effort of smart specialization (RIS3) developed by all the EU countries (European Commission 2014a).

Within this context, a wide range of initiatives have been developed. A noteworthy example is the creation of the Knowledge and Innovation Communities (KICs) of the European Innovation and Technology Institute (EIT), specifically EIT Food, which brings together all stakeholders in the food value chain who belong to universities, research centers, institutes and companies from 13 European countries.

The creation of the “Smart Specialization Platforms” has also proved useful, specifically the one dedicated to the agrifood sector, which is enabling collaborative actions between many EU regions (European Commission 2017).

This platform provides assistance to countries and regions of the EU for the design and implementation of the Smart Specialization Strategy (S3), providing guidelines and examples of good practices, sharing information on strategies and policymaking, facilitating peer review and mutual learning, supporting access to relevant data and training political authorities.

Another aspect to consider in digitalization processes in rural areas is the Community Action on “Smart Villages” (European Commission 2014b), which promotes the development of smart villages by improving their networks and their traditional and new services by means of digital technologies, innovation and a better use of knowledge in favor of individuals and companies. A “smart village” is concerned about the literacy skills in digital technologies, health telematics and other basic services, innovative environmental solutions, recycling of agricultural waste, promotion of local products supported by technologies and implementing and capturing the benefits of smart specialization.

One of the pillars of the “Digitising European Industry” (DEI) initiative is the Pan-European network of Digital Innovation Hubs (DIH) (AIOTI 2019), designed as “one-stop-shops” that help companies become more competitive with regard to their business/production processes by using digital technologies.

These centers are based on technology infrastructure (Competence Centers - CC) and provide access to the latest

knowledge, expertise and technology to support their customers with piloting, testing and experimenting with digital innovations.

DIHs are designed as a support device for companies, especially SMEs and non-technological industries, to ensure their digital transformation. DIHs can also assist in the assessment of requirements to strengthen digital skills and provide access to them when necessary.

Within the DIH network, the needs of the different stakeholders in the agrifood value chain and the rural milieu are the main engine to establish priorities in regards to innovation by applying a bottom-up approach.

An Agricultural Digital Innovation Hub (ADIH) must provide a wide range of services to its members including: assistance in the creation of a global vision on the current status of the agrifood ecosystem and the rural world; understanding the problems faced by its members and available solutions; bringing together farmers, scientists, ICT companies and entrepreneurs; defining processes; ensuring cooperation and building trust among members; managing problems (for instance, intellectual property, data ownership, transparency and reliability of data exchange); providing the means for entrepreneurial incubation of innovative ideas; identifying and fine-tuning innovative ideas and facilitating the implementation of operative groups; supporting the creation of a friendly, modern regulatory framework; creating the conditions to show the benefits of new technologies

in real-life scenarios; and developing a catalogue of products adapted to real-life conditions.

ADIHs must be deeply rooted in territorial demarcations and strongly aligned with their needs and the regional/national context. Regional and national authorities must be actively involved in the configuration and definition of ADIH by working closely with the agrifood sector and all stakeholders of the rural world and the innovation ecosystem. This alignment with regional and national strategies will most likely require coordination between different government entities in charge of implementing public policies and support instruments. An ADIH must be an instrument to support the digitalization strategy of a region in coordination with other measures, rather than an end in itself.

a potentially significant role to play in digitalization processes of agriculture and the rural world.

With regard to available technologies that are especially useful for agriculture, Geographical Information Systems (GIS) are certainly worth mentioning, along with: satellite climate and Earth observation; smart technological surveillance systems; cognitive technologies; sensor networks; low-consumption, affordable sensors; open data; big data; cybersecurity; control panels; systems to support decision-making for farmers, technicians, companies and public administrations; virtual assistants; cloud computing; supercomputing; analytic and predictive models; and finally, the technology that will most likely have a high short-term impact on traceability and transactions: blockchain.

IV. Potential of digital technologies.

A wide range of technologies, tools and actions are now available to help foster digitalization, with enormous potential to foster innovation in agriculture and rural development, and also to fight against depopulation in these areas.

In a paper written for Gartner Inc., Panetta (2019) lists the most strategic technology trends for 2019: autonomous devices; augmented analytics; new developer strategies; digital twins; powered computing; immersive experiences; blockchain; smart spaces; privacy and ethics; and quantum computing. Many of them are already being used, with

Connectivity is highly relevant for the massive implementation of IoT and its associated services, applicable for agriculture, forestry and the agrifood industry. Those activities located in territories with coverage difficulties will need to implement connectivity technologies (Sigfox, LoRa, wifi, wimax, bluetooth, 4G, 4G+, 5G, etc.) with a differential coverage, capacities and costs, which must be adapted to the needs of each situation and seek to establish pluristratified networks as a system where standards and inter-operability are key. This means that the different locations within the territory will be connected as networks with different services, and that these networks will be connected to one another. Additionally, the process must consider digitalization strategies

that are less dependent on connectivity (applications that can operate without a connection and hybrid models) so that they can be used in any location.

Generalized production and the use of open data will probably constitute one of the most significant contributions of digitalization processes. International initiatives such as GODAN (Global Open Data for Agriculture and Nutrition <https://www.godan.info>) or OD4D (Open Data for Development. <https://www.od4d.net>) consider these data ecosystems as a major opportunity for agriculture and rural development, as they can be used by all stakeholders, creating shared value.

Satellites are a relevant source of open data for the planet, especially the “Sentinel” constellation of the European Space Agency (ESA), which is significantly helping develop new approaches to agriculture and the rural milieu. For instance, the opportunity to monitor territories and crops more than once a week with high spatial resolutions facilitates early alerts, harvest predictions, better use of diversity, etc.

The vast amount of information and the need to manage it adequately are advancing the development of information and data integration platforms to manage this information smartly. Although the future still holds many challenges, there are already significant examples such as the DIAS (Data and Information Access System) associated with the Copernicus program in the EU. The advances combined with the availability of high-performing computing services platforms, universal access and ongoing updates are

particularly noteworthy. Some examples include Amazon, Google Drive, Azure and IBM Cloud.

Cognitive techniques are crucial for the present and future of the agrifood chain and the rural world, and are therefore worth mentioning. Advances in Artificial Intelligence (AI) are the result of a higher processing capacity, improved strategies, algorithms, exponential growth in the volume, variety and availability of data associated with IoT development, and continuous improvements in connectivity that call for new strategies for its treatment and use.

All countries have started developing specific strategies to promote the use of AI. In the case of Latin America, Mexico was a pioneer, with the creation of the Artificial Intelligence Research Center in 2004, and by publishing in 2018 the white paper entitled “Towards a national artificial intelligence strategy in Mexico” (Mantilla, 2018). Argentina, on the other hand, has defined priorities to develop AI, which include talent, education, data, research and development (R&D), supercomputer infrastructure, actions to facilitate professional transition and facilities for public-private collaborations in data use. Finally, Brazil has created the Advanced Artificial Intelligence Institute, which focuses on fields such as agriculture, smart cities, digital governance, the environment, natural resources, security and defense.

AI systems are still far from possessing human cognitive abilities, and still lack transparency, reliability, security and an ethical and legal framework; however, there are many AI applications and

possible uses that could prove especially useful for the agrifood chain and the rural world, such as voice and image recognition, virtual assistants, robotics, driverless vehicles, machine learning, non-trivial pattern identification, etc.

An important aspect for AI development and its potential use is the need to promote local ecosystems of computing, data and skills, by actively involving the communities to help them respond to the real needs of societies and territories.

It is certainly urgent to dedicate efforts to disseminate ICT/RURAL and train stakeholders so they can leverage all the possibilities offered to them; hence the importance of developing digital education and training programs aimed at meeting real needs, and are more integrated and coordinated with advisory services. Equally important is the need to continue exploring and utilizing new pathways such as gamification, virtual reality and complementarity with virtual assistants, among others.

Further consideration must be given to the numerous existing initiatives, such as the international FAB LAB network (<https://www.fabfoundation.org/>) and especially those integrative solutions for agriculture currently being developed by different private companies: Climate Corp-Monsanto, MyJohnDeere, MyYara, Farm365, AgriRouter, FarmBeats, etc.

V. In conclusion

It is reasonable to predict that in the future, digitalization processes will provide a large

number of services such as teaching, leisure, trade, health, civil services, etc., and will also offer the opportunity to optimize existing services.

Digitalization processes offer new opportunities for the agrifood value chain and the rural world, as well as for new value chains, including bioenergies, bioeconomy, circular economy, diversification and rural development in general. These may prove particularly appealing for the rural population, especially for the youth, and may help reverse the depopulation trend and improve quality of life in the rural milieu.

Many stakeholders in the rural world are already benefitting from digitalization, but it is clear that many opportunities are lost for not using digitalization processes due to a lack of knowledge, poor connectivity or other factors, including low availability of trustworthy data, the financial efforts they involve, the absence of robust solutions, limited returns and adequate business models, among others.

A decisive factor to ensure viable, generalized and sustainable digitalization processes is cultural change. To achieve this however, it is necessary to dedicate efforts to shared value projects and public-private partnerships that enable their adoption in territories and communities of users, and which yield returns and tangible impacts in the short, medium and long terms, by generating ongoing learning for companies, individuals, the organized civil society and public administrations. Most importantly, stakeholders must understand that digitalization is necessary but not sufficient to change economic and social

trends that contribute to maintaining a dynamic, entrepreneurial rural world.

Digitalization processes have enormous potential to simplify and improve relationships between different public administrations, and between these administrations and the recipients of said administration; the value of data must be recognized to improve services and create business opportunities. It is necessary to develop joint roadmaps and align and coordinate agendas, strategies and programs to ensure a tangible impact on digitalization processes.

Improved communications in the rural milieu must consider the territory and not just the population. There are now initiatives in place, supported by satellite technology and the development of local connectivity networks, which facilitate their implementation in most rural centers. Nonetheless, a territory-oriented improvement also involves guaranteeing the provision of communication networks in the agriculture sector that allow for the digitalization and leveraging of new technologies in the entire territory, including agricultural and forestry exports.

Furthermore, actions must be aligned with the available technology, and must not wait for the optimal scenario. It is urgent to engage in actions and advance the digital culture, to improve technological receptiveness and response capacities, always ensuring that the technology to be implemented is strong and verified.

The innovation and digitalization process must be executed immediately, and this involves a generalized application

of proximity and remote sensors, advancement of IoT, cloud computing, food industry 4.0, precision agriculture, open data generalization, big data and AI. These technologies must be supported by multi-level decision-making and tied to the development of an ecosystem that supports innovation and digitalization.

Given the complexity of digitalization processes and the cultural changes they entail, it is advisable to consider the suggestion made by the London Town Hall Digital Transformation Office manager, who at the #TWBconf 2017 recommended to “start small, respond to real needs, do things well and share this information everywhere”.

In addition to public support offered through standards and resources, business models associated with digitalization processes in the rural world must be designed based on concepts such as economic sustainability and shared value, thoroughly quantifying and communicating returns on investment.

There is currently sufficient technology available to undertake valuable projects; the challenge is to disseminate these advances, showing their usefulness and implementing them in a cross-cutting and generalized manner. For this reason, it is necessary to promote actions in line with available, verified technologies, especially with regard to existing connectivity and technical support.

It is also necessary to place emphasis on the opportunity to create international public goods, implement, improve and escalate them, focusing on triggers and

on establishing partnerships for their implementation.

Within this context, the Medium-term Plan 2018-2022 devised by IICA (2018) recognizes digitalization as one of the most relevant trends in the Americas, and describes it as an irreversible process with major impacts on agricultural production and sustainability, agricultural structure, employment and rural well-being in general. The Plan further identifies the need to have public goods and build capacities that enable access to new technologies by rural workers. The plan establishes that “the member countries of IICA must create a new

paradigm for the role played by the rural areas. The current perception that these areas simply generate poverty and expel human resources must be replaced by a new approach that values rural areas as hubs for progress, by fostering their use of new technologies as well as by increasing their connectivity.” (IICA 2018:7).

Thus, in keeping with the digital agenda of Latin America, IICA can contribute to expanding and strengthening digitalization on the continent and play a key role within a shared value ecosystem, by offering support for digitalization processes within the agrifood value chain and in rural territories.

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