THE OUTLOOK FOR AGRICULTURE AND RURAL DEVELOPMENT IN THE AMERICAS

A Perspective on Latin America and the Caribbean

2021-2022

UNITED NATIONS
ECLAC

Food and Agriculture Organization of the United Nations

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GENERAL INDEX

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ABBREVIATIONS AND ACRONYMS

ADR - Agencia de Desarrollo Rural. 70

AFSs - Agri-food systems. 14-17, 21, 26, 35, 40-46, 48, 51 - 58, 61, 64-69, 74, 75, 77, 81, 83-86, 93, 95, 98, 99

ALADI - Latin American Integration Association. 52

ARIPSIP - Regional Intersectoral Agenda on Social Protection and Productive Inclusion with Equity. 72

CAN - Andean Community of Nations. 52, 71

CELAC - Community of Latin American and Caribbean States. 71

CENPROMYPE - Regional Centre for the Promotion of Micro, Small and Medium Enterprises. 52

CFPI - Consumer food prices index. 25

CM12 - 12th Ministerial Conference of the World Trade Organization. 51

COVID-19 - Coronavirus disease 2019. 14-16, 22-33, 37, 38, 40, 42, 44-47, 50, 52, 54, 62, 64, 68, 71, 72-77, 81, 86, 89, 94, 92, 100

CPI - General consumer price index. 14, 25

CSR - Corporate social responsibility. 32, 69

CVP - Permanent Veterinary Committee of the Southern Cone. 64

DA - Digital Agriculture. 16, 55, 84

DALYs - Disability adjusted life years. 16, 62

ECLAC - Economic Commission for Latin America and the Caribbean. 14, 22-25, 27, 31, 33-35, 39, 41, 45, 48, 50, 51, 67-69, 71-73, 78, 79, 82, 92, 95, 99

FAO - Food and Agriculture Organization of the United Nations. 14, 24, 26-29, 35, 38-41, 45, 46, 50, 52, 56, 61, 62, 63, 68, 69, 71, 79, 92, 98

FF - Family farming. 42, 47, 49

FSS - Food Systems Summit. 42, 51, 54, 56

GDP - Gross domestic product. 14, 15, 22, 23, 27, 32, 34, 56, 58, 65, 68, 73, 99

GHG - Greenhouse gases. 15, 38, 43, 45, 47, 48, 52 - 54, 60, 61, 68

ICA - International Cooperative Alliance. 64, 65

ICT - Information and communication technology. 79, 92

IICA - Inter-American Institute for Cooperation on Agriculture. 32, 49, 50, 52, 55, 56, 59, 71, 77, 87, 88, 92, 94

ILO - International Labour Organization. 24, 65

IoT - Internet of Things. 84

LAC - Latin American and the Caribbean. 14-17, 22-27, 29-35, 38-41, 45, 46, 49, 60, 64, 65, 68, 69, 73, 74, 77, 87, 89 - 93, 94, 99

MAMCEPAZ - Mancomunidad de Municipios del Centro de la Paz. 82

MAPA - Ministry of Agriculture, Livestock and Food Supply. 96

MCTI - Ministry of Science, Technology and Innovation. 96

MFD - Mobilizing Finance for Development. 80

MGAP - Uruguay's Ministry of Livestock, Agriculture and Fisheries. 96

MGI - McKinsey Global Institute. 89

MSMEs - Micro, small and medium-sized enterprises. 79

NAMA - Nationally Appropriate Mitigation Actions. 54

NCDs - Non-communicable diseases. 42

NDCs - Nationally Determined Contributions. 52 - 54, 58

OECD - Organization for Economic Co-operation and Development. 16, 26, 27, 49, 81, 84, 85, 87, 98

OIE - World Organisation for Animal Health. 62, 63, 64

PDET - Development programs with a territorial approach. 70

PES - Payment for environmental services. 69

PRIEG - Regional Policy for Gender Equality and Equity. 72

PSIR - Regional Integral Social Policy. 71, 72

PTAs - Preferential trade agreements. 51

PxD - Precision Development. 88

R&D - Research and development. 57, 79

REDCA - Central American Trade Network. 52

RMCI - Rural Meaningful Connectivity Index.

SDGs - Sustainable Development Goals. 14, 15, 38, 40, 52, 54, 56, 64, 68, 69, 76, 81, 84, 99

SICA - Central American Integration System. 71, 72

SIECA - Central American Economic Integration Secretariat. 52

SMEs - Small and medium-sized enterprises. 42, 82, 96

UN - United Nations. 42, 45, 68, 69, 79

UNFCCC - United Nations Framework Convention on Climate Change. 52

WFP - World Food Programme. 29, 30

WHO - World Health Organization. 62, 63, 64

WTO - World Trade Organization. 51

RURAL AND AGRICULTURAL TRANSFORMATION ACTIONS IN LAC

IN THE POST-COVID-19 PANDEMIC RECOVERY PHASE

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The more than **7 %** contraction of the regional GDP in 2020 is the largest downturn in economic activity in LAC in 120 years (See Section 2.1).

LAC is the developing region that has been most impacted by the pandemic, accounting for only **8.4 %** of the world's population, but with **18.9 %** of the confirmed cases and **29 %** of the deaths from COVID-19 up to mid May 2021.

It is estimated that in 2020 the total number of poor people increased to **209** million, **78** million of whom were subject to extreme poverty.

In May 2021, the FAO food price index showed a **39.7 %** increase in comparison to the same period last year (see 2.1.4).

The health, economic and social crisis triggered by the COVID-19 pandemic also offers opportunities for rebuilding and transformation that will strengthen resilience and reduce or prevent future crises. The pandemic has demonstrated that the principle of "rebuilding better" should be the basis of efforts to emerge from the crisis, which will necessitate the transformation of the Latin American and the Caribbean (LAC) development model and the implementation of the necessary adjustments in its agri-food systems (AFSs) to build resilience to future risks.

Transformative actions will need to take into account the central role and importance of ensuring prosperous and inclusive AFSs and rural territories, given that they represent an important source of income, employment and food for the region and the world. LAC's rural territories produce food for more than 800 million people; cultivate 14 % of the world's crops; are home to a large part of the planet's biodiversity, freshwater and natural forests; produce half of the energy in the region and provide the ecosystem services on which cities depend. At the same time, it must be acknowledged that even before the onset of the pandemic, it had been said that AFSs were in need of transformation in line with the Sustainable Development Goals (SDGs). This was due to the fact that, prior to the pandemic, rural areas were already lagging considerably behind in terms of their development indicators, due to the interplay of multiple social, economic and territorial inequalities reproduced from one generation to the next (see Section 3.2).

However, before considering the actions that could possibly bring about this transformation, one must first measure the **economic and social impact of Covid-19**, which has been one of the greatest pandemics that humanity has experienced in modern times.

As far as the **macroeconomic impact** is concerned, internal control measures in response to the pandemic, as well as the secondary effects of a contracting global economy (-3.3 %), precipitated an approximately 7 % decline in LAC's GDP in 2020 (see Section 2.1). Therefore, reduced household incomes and increased food prices have eroded the gains made in reducing poverty, food insecurity and undernutrition in the world and in LAC (including other forms of malnutrition, such as overweight and obesity). It is also likely that income inequalities will increase significantly due to the pandemic.

Indeed, according to data from the Economic Commission for Latin America and the Caribbean (ECLAC), in 2020 poverty and extreme poverty rose to levels that had not been observed in the region for the last 12 and 20 years, respectively. In the same vein, despite the support policies implemented by the governments of the region, **the incidence of food insecurity**—whether moderate or severe—increased 6.5 percentage points relative to 2019, which is equivalent to an additional **44 million** people experiencing either moderate or severe food insecurity, 21 million of which were in the severe food insecurity category (see 2.1.2).

This increased food insecurity and decline in nutrition can be partly explained by increased **inflation**, particularly for food. The accumulated regional inflation over 12 months was 4 % in March 2021, which is 1 percentage point more than the increase in the general consumer price index (CPI) (although in some countries it more than doubled).

Domestic inflation was partially due to the significant increase in international prices for agricultural commodities, which reached their highest level since

2011, primarily because of the rebound in the demand following the relaxing of pandemic restrictions and increased imports from China, coupled with climate problems that have affected crops.

On a much more positive note, despite the effects of the pandemic crisis, the region is firmly on the path to becoming the major food producing region in the world, as the agri-food sector appears to be **more resilient than other economic sectors** that have been severely affected by the COVID-19 pandemic. Forecasts in the early months of the pandemic suggested that AFSs would collapse, but the sector has responded well to the health, logistical and financial challenges.

The greater resilience of the sector has been demonstrated by the fact that the value of regional production and trade has been trending upwards. In 2020, the decline in the GDP was lower in the agriculture sector than in the overall economy, and in many cases, production value actually increased (see 2.1.3).

Moreover, international trade in the agri-food sector appears to be on a better footing than overall trade in goods. However, some subsectors have been affected by greater logistical restrictions in international trade in the last year, for example, in the export of live animals and perishable foods, such as fruits, vegetables, fish and shellfish.

As mentioned before, the crisis and its repercussions offer opportunities and challenges that should be translated into **transformative actions**, prioritizing those issues that require the most urgent attention and recognizing that transformation is a long-term process that should begin in tandem with the immediate recovery process, while also tackling the health, economic and climate crisis. It is a well-known fact that current agricultural production processes are not sustainable; therefore, to build AFSs resilience, a more harmonious relationship must be established between human beings and nature (see 3.3.6); and the multiple social, economic and territorial inequalities in the rural environment must be corrected (see 3.2).

The transformation of AFSs requires innovative action in diverse spheres, in addition to new relationships, partnerships and collaborative work among actors from the public and private sectors, civil society, the scientific world, academia, and from international cooperation and financial agencies. These changes had already started to take place, driven primarily by three trends and major engines of change (technological change, climate change and dietary changes), which are transforming everything—relationships, production systems, the economy, society, culture, etc.— and may or may not already be a means of spurring rural transformation to facilitate the fulfillment of the SDGs and the creation of more resilient and sustainable AFSs.

Outlined below are actions that are discussed in this report and that could be considered as safe bets to transition out of the post-pandemic period and to strengthen the role of LAC in the creation of more prosperous, sustainable, resilient and inclusive AFSs:

1. Combine strategies to develop local AFSs (3.3.1) and to stimulate international trade to better balance the economic, social and environmental costs and benefits of each, while contributing to more diverse, affordable and abundant diets; more efficient use of resources; a better global carbon balance, and in turn, the creation of more resilient AFSs.

2. Strengthen multilateralism (3.3.2), make better use of opportunities afforded by trade agreements and regional integration processes,

A review of data from 17 LAC countries reveals that agri-food exports grew **2.7 %** in 2020 when compared to 2019, whereas total exports of goods fell **9.1 %** (see 3.3.2).

Agricultural production processes are responsible for **46 %** of greenhouse gas emissions (GHG) in the region and are key agents in biodiversity losses.

Whereas **71 %** of the urban population has access to significant connectivity services, in rural populations this percentage decreases to **36.8 %** (see Chapter 4).

Diet "is the most powerful springboard to optimize human health and the environmental sustainability of the planet" (see 3.1).

Emissions generated through energy use by AFSs—mainly carbon dioxide from fossil fuel use throughout the supply chain—rose to more than 4 billion tons in 2018, representing a **50 %** increase since 1990 (MacNamara 2021).

Ninety-five percent (**95 %**) of food and fibers come from the soil; **99 %** of freshwater passes through the soil and half of the water cycle takes places in the soil.

In reviewing **31** global food threats that cause **32** illnesses, there was an average of **600** million clinical cases of disease, **420,000** deaths in 2010 and **31** million disability adjusted life years (DALYs) (see 3.3.6).

In 2019, LAC had approximately 108,000 active registered cooperatives, of which nearly 29,000 were related to the agriculture sector (**26.6 %**). Agricultural or rural cooperatives include approximately 6.6 million members.

foster trade policy measures and strengthen trade promotion programs.

3. Promote greater inclusion of the agriculture sector in Nationally Determined Contributions (see 3.3.3), which will help to accelerate the changes needed to enable sustainable social, environmental and economic transformation; climate resilience and low emissions.

4. Invest in and promote best practices for the sustainable management, restoration and regeneration of soils (3.3.4) which, undoubtedly will yield positive returns for AFSs in the short-, medium- and long-term. This will require integrated solutions, based on updated information, research and investment, and the implementation of best practices (4i).

5. Capitalize on the numerous opportunities that the region has to utilize and add value through biological resources, in order to foster more profitable and competitive agricultural businesses and to promote new socioeconomic opportunities in rural territories, which will facilitate the achievement of environmental and nutritional objectives and the decarbonization of economies (see 3.3.5).

6. Foster a "One Health" approach to strengthen intersectoral work (public health–animal health/agriculture – the environment), which will help us to understand, address and deal with complex problems such as zoonosis, among others (see 3.3.6).

7. Promote cooperativism (see 3.3.7) as a key tool for inclusion and the regularization of family farming in production chains, as well as for the generation of public goods that contribute to territorial and sectoral development. Cooperatives, given their principles and attributes, have a tremendous opportunity to foster mutual assistance, solidarity and cooperation, as well as the development of solid AFSs with a notable market presence.

On the other hand, a special chapter of this report advocates for the acceleration of and support for agricultural digitalization (Chapter 4), as this can significantly contribute to the achievement of sustainable and inclusive AFSs, allowing the region to capitalize on and scale up the economic, environmental, social and governance benefits of agriculture.

Clearly, digital technologies can accelerate the transformation of AFSs, which would call for joint and planned action by public and private sector actors to enable the creation of agendas to guide and provide a framework for actions. There will be a need to drive integrated processes and to create the necessary conditions to reap the multiple benefits offered by the digitalization of agriculture (see 4.1.1). It is also essential to minimize the risks of the process creating inequality, exclusion and conflicts among actors or chains; or decreasing competitiveness and markets, among other factors.

In order for these actions to give rise to more productive, profitable, financially and environmentally resilient, and equitable AFSs and to foster more sustainable rural development, it is imperative that a renewed institutional structure and a new public policy agenda be created (see Section 3.4), aligned with the challenges and opportunities of the post-pandemic transition out of COVID-19 and countries' internal capacities to tackle these changes, while also establishing a new mode of governance that facilitates collaborative work among all actors and social sectors.

It will also require differentiated development strategies and public policies that take into account the heterogeneity of the rural world and agriculture, where territories that are lagging behind in multiple dimensions of development co-exist with other territories that are generating billions of dollars in food exports to countries across the world.

The complexity and multisectoral nature of the policies needed to achieve the multiple outcomes outlined above will mean that at least three conditions will have to be fulfilled. The first is the development of a long-term strategic vision, based on leadership, political commitment and policy integration. The second is the implementation of institutional mechanisms and efficient and inclusive governance to manage the interconnection among policies from all sectors and to align the actions of all levels of government. This will call for intersectoral and interinstitutional coordination and partnerships with civil society and private sector actors. The third condition is the need to establish a set of receptive and adaptable tools to anticipate, evaluate and manage the national, cross-border and long-term impacts of these policies.

On the other hand, there will be a need for institutional restructuring in diverse spheres and by diverse actors. **The States** (see 3.4.4) should commit to undertaking those actions that cannot be delegated, such as investing in systems for agricultural innovation, connectivity, biosecurity and infrastructure that have great potential to drive the sustainable growth of productivity and to improve resilience, which are key to guaranteeing food security, viable livelihoods and the sustainable use of resources.

This report also addresses the contributions and transformations that must occur at the **supranational level** (3.4.1), to spark a global conversation about the coherence of policies related to the agri-food sector, by **international cooperation and financial organizations** (3.4.2), which face the challenge of aligning agendas and policies with governments, the private sector and civil society, and with **academia and research systems** (3.4.3). This will be essential to the generation of knowledge, technological development and capacity-building among actors in rural areas.

Finally, the central question is how to finance development programs—including not only production investment, but also innovation, technical assistance and extension services—while also maintaining financial assistance to producers who are at risk of exclusion and food insecurity. This report proposes that, in order to avoid stagnation in a situation of scarce economic resources (see 2.4), such as what could occur in the coming years, efforts to foster agriculture- and food-related economic activities must ideally be based on concepts involving endogenous solutions, low-cost solutions or autonomy and use of one's own resources (see 3.4.5). The fragile fiscal situation calls for a new balance between the State, companies and civil society, which will lead to new relationships and types of public instruments and will attract private resources that will help to achieve development objectives, by optimizing the use of public resources.

The current crisis should be seen as an opportunity to rethink the financial agenda for the development of LAC, as well as an occasion to bring about widespread social and political consensus, aimed at implementing ambitious reforms to establish a process of sustainable and equitable rebuilding, both within and outside of AFSs.

The pandemic has increased the need to expand social protection in the rural environment, which will need to be linked to production inclusion policies and programs.

The region must begin to formulate evidence-based policies that serve to promote the most promising interventions and to support decision-making that maximizes results and minimizes implementation risks and costs.

In 54 countries that are being monitored by the OECD, only **17 %** of the public agricultural budget is being allocated to investment in agricultural innovation systems, biosecurity and infrastructure, despite the high economic and social return on investment (OECD 2021a).

Given that it is an essential sector, food production, along with health, should head the list of priorities for financing and investment during the recovery and transformation phases in the aftermath of the pandemic.

Infographic

#TRANSFORMINGAFSs

Opportunities to rebuild and transform agri-food systems (AFSs) to create resilience to future crises.

LAC HAS EXPERIENCED ONE OF ITS WORST CRISES IN MODERN TIMES

7% ↓ DECLINE IN GDP **vs.** **3.3%** ↓ DECLINE AT THE GLOBAL LEVEL

22 million more people suffering from **POVERTY** compared to 2019
(Total: 209 millones)

8 million more people experiencing **EXTREME POVERTY**
(Total: 79 millones)

44 million more people suffering from **MODERATE OR SEVERE FOOD INSECURITY**
(Total: 267 millones)

21 million more people suffering from **SEVERE FOOD INSECURITY**
(Total: 93 millones)

THE AFSs OF LAC HAVE PROVEN TO BE MORE RESILIENT THAN OTHER SECTORS

2.7% ↑ INCREASE IN AGRI-FOOD EXPORTS **vs.** **9%** ↓ DECREASE IN TOTAL EXPORTS OF GOODS

The decline in the agricultural GDP was less than the decline in the overall GDP and in some countries it actually increased.

Employment in agriculture was less affected than other sectors of the economy.

157% ↑ INCREASE IN E-COMMERCE IN THE REGION

AFSs, along with health, should head the list of priorities for financing and investment during the recovery and transformation phases in the aftermath of the pandemic.

STRATEGIES TO ENABLE MORE PROSPEROUS, SUSTAINABLE, RESILIENT AND INCLUSIVE AFSs

Transformation should address the health, economic and climate crises as a whole.

MAIN DRIVERS

- TECHNOLOGICAL CHANGE
- CLIMATE CHANGE
- DIETARY CHANGES

- Local consumption and international trade **(3.3.1)**.
- Multilateralism and trade integration **(3.3.2)**.
- The agriculture sector and climate change **(3.3.3)**.
- Soil restoration and regeneration **(3.3.4)**.
- Capitalizing on and adding value through biological resources **(3.3.5)**.
- The "One Health" approach **(3.3.6)**.
- Cooperativism **(3.3.7)**.
- Digitalization of agriculture **(Special chapter 4)**.

THE NEED FOR A NEW GENERATION OF POLICIES

- Strategic long-term vision
- Differentiated and coherent policies
- Policy integration
- Evidence-based policies
- The need to anticipate, evaluate and address the impact of policies
- Need for a new institutional structure
  - Supranational
  - Cooperation and international financing
  - State
  - Local governments

The fragile fiscal situation calls for a new balance between the State, companies and civil society. More private resources and the promotion of endogenous solutions will help to optimize the use of public resources and to achieve more results.

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GLOBAL AND REGIONAL CONTEXT

2

Priorities for agri-food systems (AFSs) in the coming years should include investing in green infrastructure to help mitigate climate change, promoting universal access to social security, introducing initiatives to boost productive capacity and to adapt to the digitalized economy, and solving the over-indebtedness of families and productive farms.

2.1
IMPACTS OF THE COVID-19 PANDEMIC

2.1.1 Impacts on the prospects for global and regional economic growth

The COVID-19 pandemic has affected LAC more than any other region in the world, in terms of both health and economic outcomes. The contraction of more than 7 % in the regional gross domestic product (GDP) in 2020 is the largest drop in economic activity in 120 years (ECLAC 2021a).

Thanks to an unprecedented political response, the COVID-19 recession impact is likely to be less severe globally than the 2008 financial crisis. However, low-income countries and emerging economies will suffer more compared to advanced economies, which were more affected in the 2008 crisis (IMF 2021).

LAC is the developing region most impacted by the pandemic: Despite the fact that it only has **8.4 %** of the world's population, by mid-May 2021 the region had accounted for **18.9 %** of confirmed cases and **29 %** of deaths from COVID-19 (Johns Hopkins University 2021).

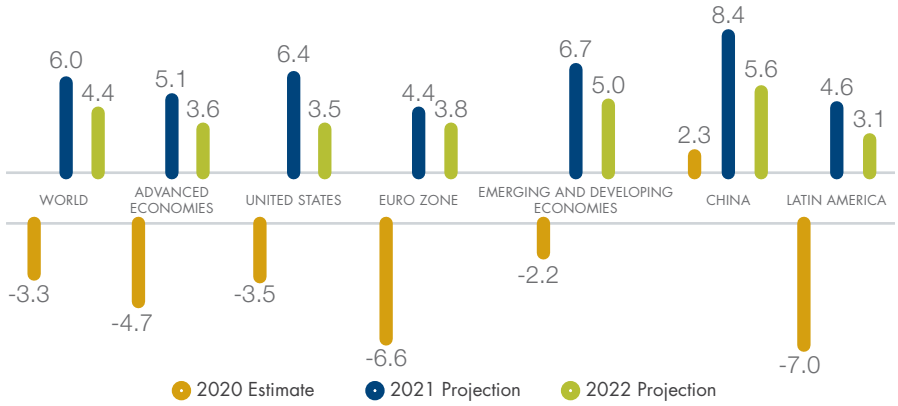
Following the 3.3 % drop in economic growth in 2020 due to the COVID-19 pandemic, global activity is forecast to expand 6 % in 2021 (IMF 2021). Although the recovery has been impacted in the short term by a rebound in COVID -19 cases, factors such as adaptation to pandemic restrictions, and the unprecedented fiscal policy response in several countries, have driven upward forecast revisions for 2021 in recent months (IMF 2021, UN-DESA 2021, World Bank 2021).

Towards 2022 the forecast includes growth moderation, reaching 4.4 % globally. The projections of international agencies are based on important assumptions, such as that vaccination against COVID -19 will accelerate during the second half of 2021 and that oil and metal prices will tend to increase. As a result of the uncertain evolution of the pandemic and its consequences, these assumptions are currently subject to a higher level of uncertainty than usual. Should even some of them not materialize, the recovery in the world economy could be even weaker.

The post-COVID-19 economic recovery is characterized by a difference in speeds, both between countries and within them. The fiscal margin and access to vaccines have conditioned the speed of recovery of the economies in recent months. Other variables that determine the differentiated impact of the pandemic are, on the one hand, the level of specialization in activities strongly affected by the crisis, such as tourism and exports of raw materials, and, on the other, the levels of pre-existing debt prior to the pandemic. Factors such as the proportion of "teleworkable" jobs, the size of the informal sector and access to digital infrastructure also influence both the depth of the recession and the speed of recovery (IMF 2021).

Internal control measures of the pandemic as well as the side effects of a global economy shrinking, gave as a result a drop in the Gross domestic product (GDP) of Latin America and the Caribbean (LAC) near 7 % in 2020 (ECLAC 2021a, IMF 2021). Compared to the depth of the recession in 2020, the expected rebound in the region in 2021 (4.6 %) and 2022 (3.1 %) - provided that expectations of acceleration of vaccination plans and relaxation of pandemic mitigation measures are met - will be moderate, about 1.5 percentage points below the global rate, after a decade of already slow growth.

Figure 2.1
GDP growth rates (%) by world regions, 2020/2022



Source: Prepared by the authors based on data from IMF (2021).

Emerging economies, with the notable exception of China, as well as low-income countries, have been most affected by the pandemic and are expected to have a slower recovery than advanced economies (Figure 2.1).

Despite entering the crisis with high levels of debt, many emerging economies, including several in LAC, have implemented unprecedented fiscal support measures in response to the COVID-19 pandemic. Although the resources allocated to fiscal support were much more limited compared to advanced economies, policy actions, including income transfers, contributed significantly to counteracting the economic and social crisis in several LAC countries. Key components of fiscal stimulus programs have included direct transfers to households, rebates and tax deferrals, commercial loans at preferential rates, subsidies for the maintenance of formal employment and additional health expenditures.

Globally, it is estimated that without these actions the contraction of world GDP in 2020 could have been three times worse (IMF 2021). However, even with this extensive support, the impact of the pandemic on unemployment and underemployment has been high in the world and in LAC, resulting in significant income losses for certain groups of workers - among which informal workers and workers with low qualifications, especially women, stand out - and a two-decades of backsliding in the incidence of extreme poverty to unprecedented levels.

Social transfers have covered a significant proportion of the population in Bolivia, Brazil, Chile, Colombia, Peru and the Dominican Republic (ECLAC 2021a).

2.1.2 Impacts on poverty and food security

The reduction in household income has reversed progress in reducing poverty and food insecurity in the world and in LAC. Income inequality is also likely to increase significantly due to the pandemic.

According to ECLAC (2021c), it is estimated that in 2020 the extreme poverty rate stood at 12.5 % and the poverty rate reached 33.7 % of the population. This means that the total number of poor people reached 209 million at the end of 2020; 22 million more people than the previous year. Of that total, 78 million people were in extreme poverty, 8 million more than in 2019.

If we apply to these numbers the percentage corresponding to people

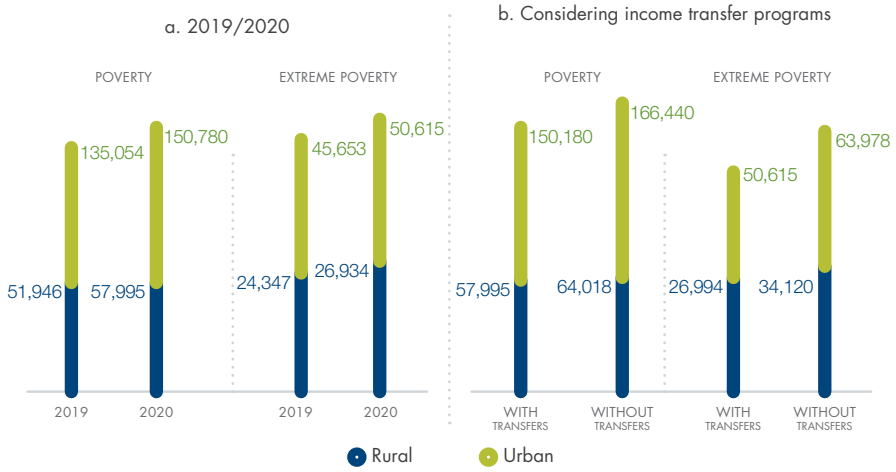
In LAC, poverty and extreme poverty reached levels in 2020 that had not been observed in the last 12 and 20 years, respectively.

There has been a strong impact of the crisis caused by the pandemic of COVID-19 on the labor market. The regional unemployment rate stood at **10.7 %** at the end of 2020, with an increase of **2.6** percentage points with respect to the value registered in 2019 (ECLAC 2020a).

living in poverty and extreme poverty in rural areas in 2019[1], we find that rural poverty increased by 6 million people, with almost half corresponding to people living in extreme poverty (figure 2.2). The levels of poverty and extreme poverty would have been even higher without the measures implemented by governments to transfer emergency income to households. Governments in the region implemented 263 social protection emergency measures in 2020. These amounted to 49.4 % of the population, i.e., about 326 million people, with an additional cost estimated at USD 86 billion (ECLAC 2021c). Without these measures, the incidence of extreme poverty would have reached 15.8 % and that of poverty, 37.2 %, equivalent to 98 million and 230 million people, respectively (figure 2.2).

An additional **44** million people are moderately or severely food insecure in the region, of which **21** million became severely food insecure.

Figure 2.2
Estimated number of people living in poverty and extreme poverty in Latin America, rural and urban areas



Source: Prepared by the authors based on ECLAC (2021a).

Employment has declined to a greater extent in sectors with a large proportion of young and/or less skilled workers and in activities most vulnerable to automation. The crisis has accelerated the transformative forces of digitalization and automation, making it unlikely for lost jobs to recover in the same proportion (IMF 2021).

The category most affected by the greater unemployment generated by quarantines and other measures to curb the pandemic has been informal employment - prevalent in the region and made up mainly of women, youth, indigenous people and migrants - as well as the jobs most vulnerable to automation, which are generally the lowest professionally trained workers.

The unfair social organization of care and lack of support during the pandemic has represented a decade-long setback in labor inclusion for women. Unlike other sectors, such as services and commerce, employment in the agricultural sector has been less affected by quarantines and other pandemic measures (**FAO-ECLAC 2020**), but it should be taken into account that the sector has a high level of informal work and migrant and seasonal employment, especially female, which has been greatly affected. According to **ILO** (2020), in 2019 86 % of workers in the agricultural sector were informal.

Income is the most important factor for food security in emerging and low-income

[1]It is important to highlight the limitations of this exercise: there are still no calculations of the variation of poverty rates in rural areas in 2020, so we have assumed that they have risen in the same proportion as the national averages (which are determined mainly by the dynamics of quarantines and employment in urban areas).

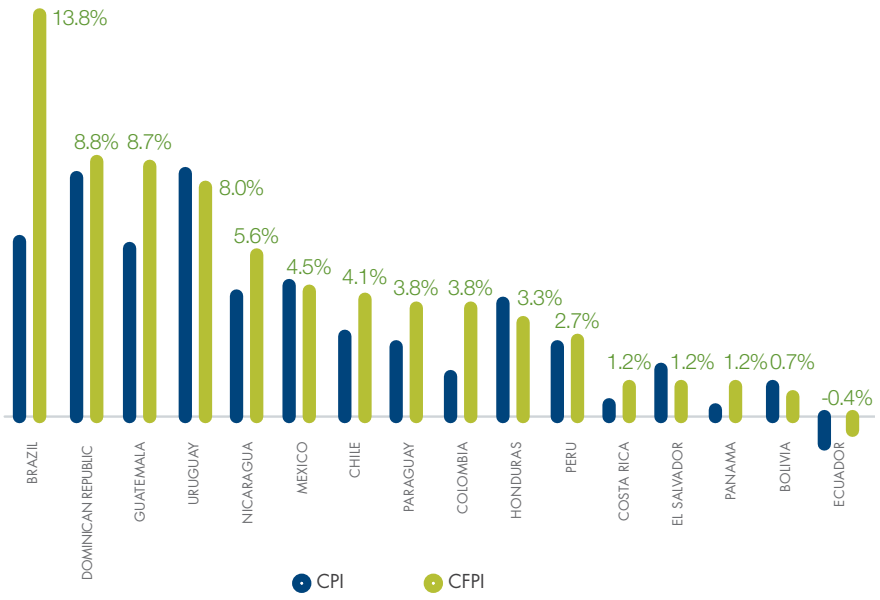
countries, especially in some population groups. The impact of the COVID-19 pandemic on employment has resulted in a reduction in household income. Throughout the crisis, households used up their savings, consumed working capital and/or assets, and went into debt, and thereby increased their vulnerability to new shocks. In the case of remittances, they have had a mixed performance. Between January and September of 2020, remittances to LAC countries grew an average of 5 % (ECLAC 2021a), a lower growth rate than in previous years, but still an evidence of some resilience. However, 2020 growth rate is highly influenced by the remittances expansion to Mexico, while in seven out of the thirteen countries in LAC for which information is available, remittances suffered a retraction.

At the consumption level, the reduction in income translates into changes in eating habits (for example, a reduction in the number of meals or calories and the purchase of foods of lower nutritional value). This has led to an increase in hunger and other forms of food insecurity and malnutrition (including overweight and obesity). Access to food, particularly those of better nutritional value, has also been affected in some countries of the region due to an increase in prices (figure 2.3).

More than 820 million people in the world were hungry or food insecure before the COVID-19 pandemic broke out. Without the policy interventions, it is estimated that declining incomes and rising food prices in 2020 (figure 2.3) would have raised the number of hungry people by 62 million and 4 million respectively in the world (IMF 2021). In LAC, despite policies supporting income and food, the incidence of the moderate or severe food insecurity increased 6.5 percentage points in relation to 2019 (figure 2.4). The food crisis has been particularly severe in some countries in the region: for example, in Guatemala, Honduras and several countries in the Caribbean the effects of the pandemic and have been aggravated by concurrent natural disasters.

These trends in food insecurity and malnutrition increase the risk of non-compliance with Sustainable Development Goal (SDG) 2, reducing the number of undernourished people to zero by 2030, especially in countries with weak social safety nets.

Figure 2.3
General inflation (CPI) and consumer food prices index (CFPI), 12-month variation in March 2021

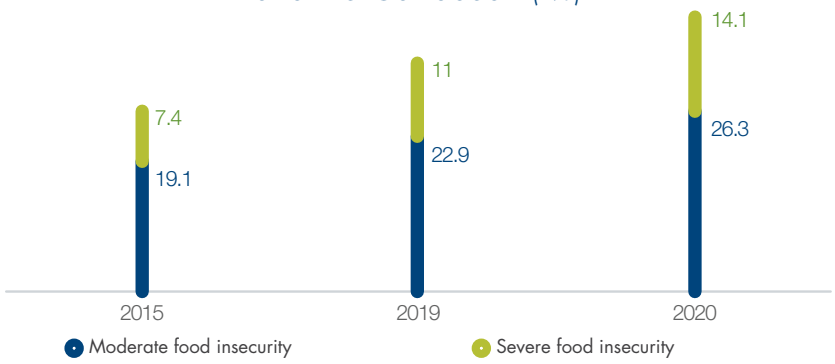


Source: Prepared by the authors and based on country official statistics.

In March 2021 the regional average of the consumer food price index (CFPI) reached **4 %** in the accumulated 12 months, which is **1** percentage point higher than the general consumer price index (CPI). In several countries (Panama, Costa Rica, Colombia and Brazil), the CFPI has been more than double the general CPI in the period (figure 2.3). The strong increase in food prices in Brazil, the highest in the region, seems to respond mainly to the exchange rate devaluation, of around **30 %** in 2020.

In LAC the incidence of the moderate or severe food insecurity reached **40.4 %** of the population in 2020, up **6.5** percentage points compared to 2019 (figure 2.4).

Figure 2.4
Incidence of food insecurity in Latin America and the Caribbean (%)



Source: Torero 2021.

2.1.3 Impact on the growth prospects of agricultural demand, production and trade

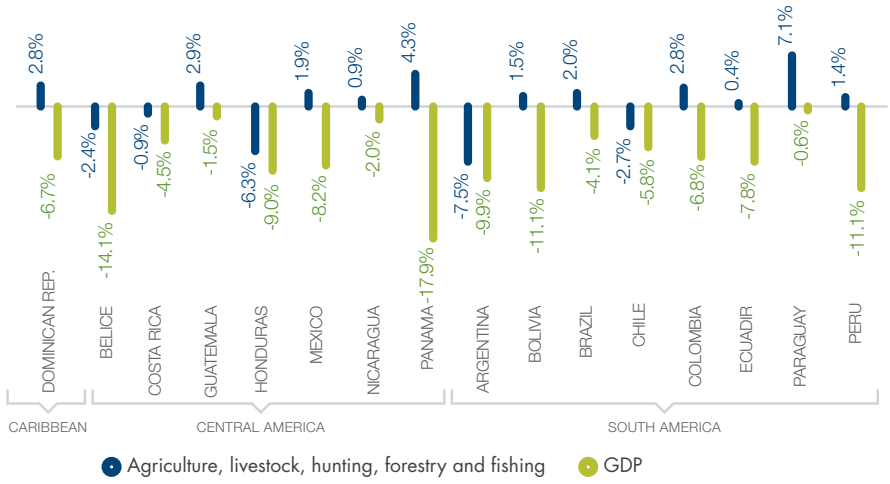
Despite the predictions of AFSs collapse in the first months of the COVID-19 pandemic, the sector has responded well to health, logistical and financial challenges, with nothing but occasional disruptions observed so far. In LAC, agri-food production and exports performed better than the average of economic sectors.

At the global level, after the collapse in growth during 2020, industrial production has already returned to pre-pandemic levels, but consumption of contact-intensive services has remained depressed. A similar pattern is observed in international trade: merchandise trade volumes have returned to pre-pandemic levels, but cross-border trade in services remains subdued. This highlights the differentiated effect of the pandemic between activities and economic sectors. While activities related to tourism and services in general remain depressed, the strong demand for products that support teleworking and online education, as well as the release of the repressed demand for consumer and durable goods, have been key factors in the global economic recovery (IMF 2021).

At the sectoral level, the shocks related to COVID-19 have highlighted AFSs vulnerabilities in many countries. In April 2020, an expert consensus on the impacts of the pandemic had predicted a contraction in both supply and demand for agricultural products, pointing to the effects of falling income on demand and prices, as well as possible trade and logistics disruptions (OECD and FAO 2020). However, despite some occasional disruptions in supply chains that were integrated into sectors heavily affected by the pandemic, such as hotels and restaurants, the AFSs have been able, so far, to respond well to health and logistical challenges. In the medium term, the impact of the pandemic on food consumption and production is not expected to be particularly strong, but the least developed countries appear to be most at risk and in any case the impact will be greater for the poorest segments of the population in each country (OECD and FAO 2020).

The agricultural sector has been more resilient than other sectors in terms of growth of production value (see figure 2.5) and regional trade. When analyzing the data on GDP, we can see that it has contracted in all the countries for which data are available; the agricultural sector, on the other hand, exhibited a more favorable behavior (see figure 2.5).

Figure 2.5
Annual variation in the GDP of the agricultural sector and total GDP, 2020 (%)



Source: Prepared by the authors based on official statistics..

Agricultural production in 2020 value showed a reduction lower than that of overall GDP, and in many cases it has even increased (figure 2.5).

Regarding international trade, the pandemic has had a negative impact on all the region's exports, but the food sector seems to be on a better footing. According to data reported by 17 countries in LAC, during the first year of the pandemic (accumulated from January to December of 2020), agri-food exports totaled USD 240 billion, an increase of 2.7 % with respect to 2019, while total merchandise exports registered a fall of 9.1 % (Salazar and Arias 2021). Beyond being an essential good, food has low elasticity, so demand in the main destinations - the United States, the European Union and China - has not changed significantly during the pandemic. However, some subsectors have been affected by the greater logistical restrictions of international trade in the last year, as is the case of exports of live animals and perishable products such as fruits, vegetables, fish and shellfish (FAO and ECLAC 2020).

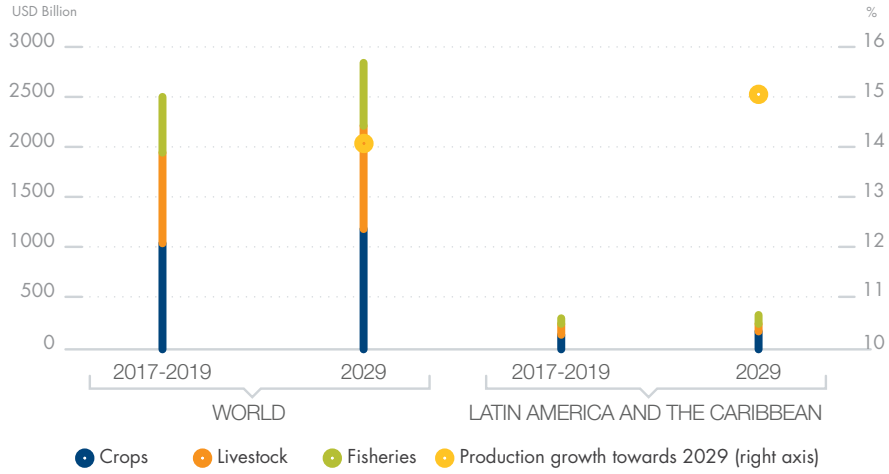
Agricultural production and trade are currently facing other uncertainties in addition to those generated by the COVID-19 pandemic. On the supply side, these include the spread of pests and diseases, such as African swine fever and locust invasions (and, of particular importance in LAC, the fusarium outbreak in bananas), increasing resistance to antimicrobial substances, regulatory trends in new plant breeding techniques and responses to extreme weather events (OECD and FAO 2020). On the demand side, the main unknowns refer to the evolution of income and diets, as well as concerns about the health and environmental sustainability of food production and the evolution of trade agreements. Structural factors are expected to have a greater impact on agricultural supply and demand in the coming years than the repercussions of the shocks caused by the COVID-19 pandemic.

According to OECD and FAO (2020), it is estimated that the expansion of the world population will continue to be the main factor conditioning agricultural growth, especially in the case of basic products that already have high levels of per capita consumption, such as cereals. In the case of vegetable oils, sugar, meat and dairy products, the impact of population dynamics is smaller as income and individual preferences play a more important role.

In response to population growth and other factors that increase demand, world agricultural production is expected to increase by about **14 %** over the next decade, similar to the increase in LAC production, estimated at **15 %** (figure 2.6).

Global agricultural production is projected to increase over the next decade (figure 2.6), with most of the increase resulting from productivity improvements, due to intensification and ongoing technological change, and given increasing constraints on the expansion of agricultural land in various regions.

Figure 2.6
Estimated evolution of world and regional agricultural production



Source: Prepared by the authors based on data from OECD and FAO (2020).

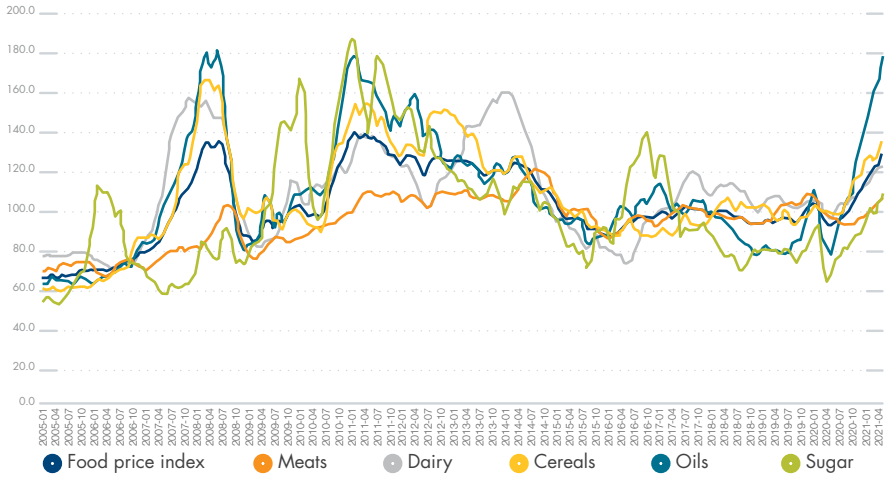
2.1.4 Impact on the prices of agricultural products

Food prices are expected to continue their upward trend this year as a result of the global economic recovery, although they are not expected to reach the levels of the price boom of ten years ago.

While agricultural prices tended to decline in the first months of the pandemic in response to the COVID-19- induced drop in disposable income, especially in low-income countries, prices began to rise in the second half of 2020 (IMF 2021). More recently, the recovery in demand after the easing of the pandemic restrictions and the increase in imports in China (especially corn and soybeans), added to weather problems that have affected the harvests of some grains, have pushed international food prices to levels not seen since September 2011.

In May 2021, the Food and Agriculture Organization of the United Nations (FAO) food price index reached its highest value since September 2011 (see 2.7), standing at just 7.6 % below the maximum value of 137.6 points registered in February 2011. Some food groups stand out for significant price increases, as was the case of vegetable oils and soy, whose prices increased by about 70 %, and cereals and meats, with increases of the order of 35 %. Soybean and corn prices rose due to reduced harvests in the United States and South America and strong demand from China.

Figure 2.7
Variation in the FAO food price index, January 2005 to May 2021, 2014-2016 = 100



Source: Prepared by the authors based on data from FAO (2021).

In May 2021 the FAO Food Price Index averaged 127.1 points; that is, 5.8 points (**4.8 %**) more than in April and 36.1 points (**39.7 %**) more than in the same period last year.

For other commodities (IMF 2021), oil prices are projected to grow 30 % in 2021 from their base value in 2020 and metal prices are expected to accelerate strongly, largely reflecting the rebound in demand in China.

2.2 HABITS DEVELOPED DURING THE PANDEMIC: THEIR PERSISTENCE AND POSSIBLE EFFECTS ON FOOD SYSTEMS

The pandemic and the resulting quarantines and lockdowns have generated important changes in consumer preferences and have worsened the conditions of food insecurity and undernourishment for a significant proportion of the population. In addition, they have increased the production and consumption of digital products and services.

2.2.1 Strategies for adapting food consumption

Measures to curb the spread of COVID-19 have had profound effects on food intake relative to what, where and how much to eat. The pandemic led to important changes in consumer preferences due to income effects (as seen previously, the falls in employment have been reflected in reductions in the wage bill), substitution effects (the relative prices of foods have changed to reflect logistical problems and changes in demand, with prices for a healthy diet rising more than those for an unhealthy diet) and changes in consumer preferences.

The food security monitoring system (WFP 2021), with information available for ten LAC countries, shows that at the end of December 2020, insufficient food consumption affected **16 %** of the population of those countries.

The food security monitoring system developed by WFP (WFP 2021), with information available for ten LAC countries[2] shows that in late December 2020 insufficient food intake affected 16 % of the population of these countries (see also Box 2.1). The main barrier to accessing food markets in these countries in the context of the pandemic has been lack of money, followed by travel restrictions and physical distance to the markets. In addition, in response to the restrictions of the pandemic, about 40 % of households have implemented crisis strategies in food consumption, such as changing the diet to less expensive foods, limiting portion size, reducing the number of meals, borrowing food or limiting adult food consumption in favor of minors.

Furthermore, many countries have for several years grappled with a double burden of undernourishment, in which undernutrition (e.g. emaciation, stunting, and micronutrient deficiencies) coexists with overweight, obesity and diet-related noncommunicable diseases. The sum of these structural factors - prevalent especially in some countries of the region highly dependent on food imports, as is the case of the Caribbean countries - and the worsening in the access to healthy food, be it due to food restrictions, reducing income or due to the interruption of supply chains and public programs (school food programs, for example), have an impact on regional diets and on the health of the population that goes beyond the short term.

Box 2.1:
Nutritional impact of the COVID-19 pandemic

Before the pandemic, around 60.5 million people in the region could not afford a nutrient-adequate diet (that is, a diet that provided adequate calories plus minimal levels of all essential nutrients). This number is estimated to have increased by 17 million in 2020, reaching more than 77 million. As the economy recovers, diets will improve, but in 2022 still between 800,000 to 2.8 million more people will not be able to afford an adequate diet compared to the situation before the pandemic.

Source: Simulations with the MIRAGRODEP model (IFPRI 2021).

The health problems derived from an insufficient diet in micronutrients, whose incidence is increasing as a result of the COVID-19 pandemic, exacerbates not only the vulnerability of people to the same pandemic, but also its medium- and long-term negative effects on households, communities and health systems.

Unhealthy diets, which are one of the main contributors to noncommunicable diseases that affect the well-being of millions of people in LAC, operate as a drain on resources in health systems.

The pandemic also appears to disproportionately affect people with pre-existing medical conditions, some of which have important links to diet and chronic food insecurity or malnutrition.

[2]Bolivia, Colombia, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Nicaragua, Peru and Dominican Republic.

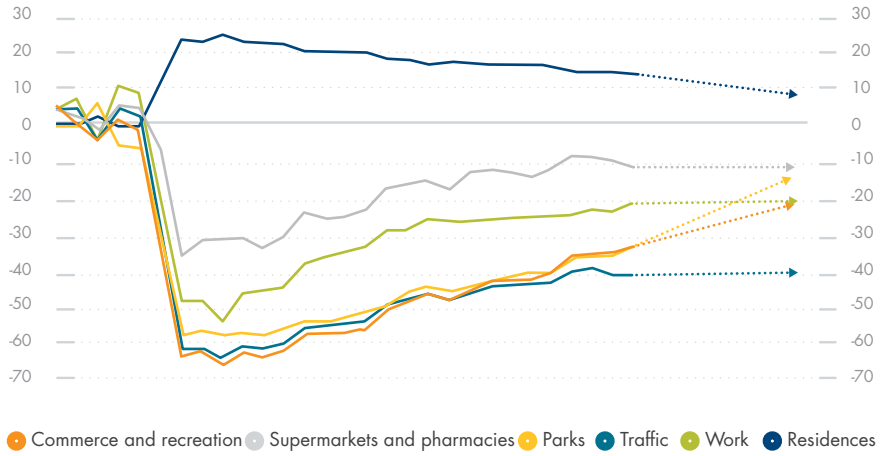
2.2.2 Digital consumption and production

Another trend that leapt forward during the pandemic and that will continue to have an impact in the future is digitalization. The mobility data show a world paralyzed *physically*, due to quarantines and lockdowns, but very active *virtually* (ECLAC 2020b). The pandemic has significantly increased the range of products available online. In July 2020, 55 % of the world supply of trade was available online (LaBerge *et al* 2020) versus 35 % that was available in December 2019. These changes will likely stick. According to McKinsey (LaBerge *et al* 2020), 53 % of companies surveyed believes that the increased demand for goods and services online will be permanent.

Food purchases were not immune to these trends. The reduction of movements due to the COVID-19 pandemic has been a challenge for food systems as both interaction with consumers and the final point of sale have changed. Three trends have dominated: 1) consumers spend less time on physical purchases; 2) some final outlets have closed (at least temporarily); and 3) the result has been an increase in online sales and home deliveries. However, food systems have been defined as "essential", so that the drop in time spent in supermarkets is lower than in other categories (Figure 2.8). At the same time, website traffic and the use of online shopping and delivery applications increased 157 % in the region in 2020 (ECLAC 2020b).

Globally, **58 %** of trade interactions were digital as of July 2020, while a few months earlier, in December 2019, the proportion was **36 %**.

Figure 2.8
Mobility in Latin America and the Caribbean: variation per week of 2020 versus the first 5 weeks of the year (weighted average)



Source: Prepared by the authors based on Google 2021.

Time spent in supermarkets and pharmacies dropped nearly **40 %** in LAC in the first weeks of the pandemic (Figure 2.8).

The digitalization processes in agri-food supply chains and in food consumption are not homogeneous, but rather replicate inequality in terms of income, educational level and access to digital infrastructure among the actors in the chain. Connectivity is a necessary, although not sufficient, condition to appropriate the value generated by digital technologies. According to ECLAC (2020b), 66.7 % of the inhabitants of the region had Internet access in 2019. In the remaining third, which does not have

The Rural Meaningful Connectivity Index (RMCI), developed by IICA-IDB-Microsoft (Ziegler *et al.* 2020), reveals that an alarming percentage (**63 %** and, if Brazil is excluded, **75 %**) of the inhabitants of rural areas in seven countries in the region (Bolivia, Brazil, Costa Rica, Ecuador, Honduras, Paraguay and Peru) do not have access to good quality connectivity.

Internet access, half of the households (around 23 million) are part of the two lowest quintiles of the income distribution (quintiles I and II).

As will be explored in greater detail in Chapter 4, one of the most relevant gaps in connectivity in LAC occurs between urban and rural areas. At regional level 67 % of urban households are connected to the Internet, while in rural areas connectivity drops to 23 %. In some countries, such as Bolivia, El Salvador, Paraguay and Peru, more than 90 % of rural households do not have Internet access (ECLAC 2020b).

In some cases, the trend towards more digital production and consumption facilitates the transition towards greater sustainability and awareness in agri-food systems and consumption habits. According to Westbrook and Angus (2021), consumers will demand that companies take more interest in protecting the health and interests of society, even above their profits. The pandemic and its possible zoonotic origin have led environmental threats to rank first among consumers' priorities, ahead of issues considered more important before the pandemic, such as the use of plastic or climate change. The survey conducted in the publication reveals that 69 % of professionals surveyed expected that consumers care more about sustainability than before the COVID-19 pandemic. Digitalization, through technologies such as traceability and blockchain, allows consumers to follow the practices of companies from their origin to the final product, which ultimately help them take a more informed purchase decision.

2.3 THE PANDEMIC AND THE INCREASE IN ENVIRONMENTAL VULNERABILITY

Addressing the loss of biodiversity and ecosystem protection, in conjunction with the agroecological transition, is an essential element of the holistic approach necessary to guide the transformation of food systems towards greater resilience.

Global greenhouse gas emissions were approximately **4 %** lower in 2020, in line with reductions in global production. The world economy must achieve similar annual declines over the next 30 years in order to reduce emissions by **80 %** by 2050 (IMF 2021).

The probable zoonotic origin of SARS-CoV-2, which causes COVID-19, is an example of how increased environmental vulnerability can amplify global systemic risks. The fall in world economic activity during 2020 and the associated increases in undernourishment, poverty and unemployment are only an approximation of the costs of the augmented environmental vulnerability. The COVID-19 pandemic also shows how environmental vulnerability can cause sudden discontinuities in the functioning of human societies by affecting individual habits, as well as economic and social life (Jahel *et al.* 2021).

Warnings that environmental vulnerability could lead to a pandemic (such as COVID-19) had existed since the middle of the previous decade in evaluations of the first SARS-CoV pandemic, in 2003 (Cheng *et al.* 2007). The link between factors related to the development of agriculture (such as the expansion of the agricultural frontier, deforestation, the globalization of food production chains and the trade in animals, among others), the increase in environmental vulnerability

and the risk of zoonotic diseases has increased the awareness of the need for transformation of food systems.

The above is relevant in the context of the call made in 2019 by the Secretary General of the United Nations, António Guterres, for a Summit on Food Systems, to be held in 2021. In particular, it highlights the relevance of two of the action paths that have been proposed for the identification of transformative solutions to move towards more sustainable and resilient food systems: a) promote production that is favorable to nature; and b) build resilience to vulnerabilities, shocks and stresses. The response to the pandemic must be aligned with the responses to other long-term problems, such as global change and climate change, with a systemic and inclusive perspective.

It is key to think of recovery as an opportunity to make changes, which in the case of the rural world entails implementing a transition towards a more sustainable and inclusive agriculture. Without immediate and coordinated global political action, global change and climate change will continue to impede economic growth and convergence; and the environmental vulnerability of the planet will continue to increase, as well as the risk of the occurrence of new pandemics with high economic and human costs, especially for lower-income countries (IMF 2021).

2.4
THE FINANCIAL SITUATION FOR INVESTMENT AND THE TRANSFORMATION OF LAC'S FOOD SYSTEMS

Given its essential nature, food production, along with safeguarding health, should be at the forefront of financing and investment priorities for the post-pandemic recovery and transformation phase.

In LAC, the COVID-19 pandemic broke into a complex economic, social and political scenario, after a decade of low growth that resulted in increased poverty and growing social and political tensions. The worsening of inequality indices in the region reveals that the economic crisis resulting from the pandemic has hit the most vulnerable population above all. To cope with the social and economic effects of the pandemic, the countries of the region adopted expansionary fiscal policies. Fiscal efforts announced in 2020 represented 4.6 % of GDP on average in LAC. Unprecedented rates of real growth in primary spending were recorded, so much so that total central government spending reached its highest level (24.7 % of GDP) since comprehensive fiscal data has been published, 1950 (ECLAC 2021b).

These efforts were aimed at strengthening public health systems, supporting families, and protecting the productive structure. The increase in current primary spending in LAC was determined mainly by the growth (of 2.5 percentage points of GDP or more) of cash transfers and subsidies in various countries: Argentina, Brazil, Chile, Colombia, El Salvador, Peru and the Dominican Republic (ECLAC 2021b). These resources were channeled

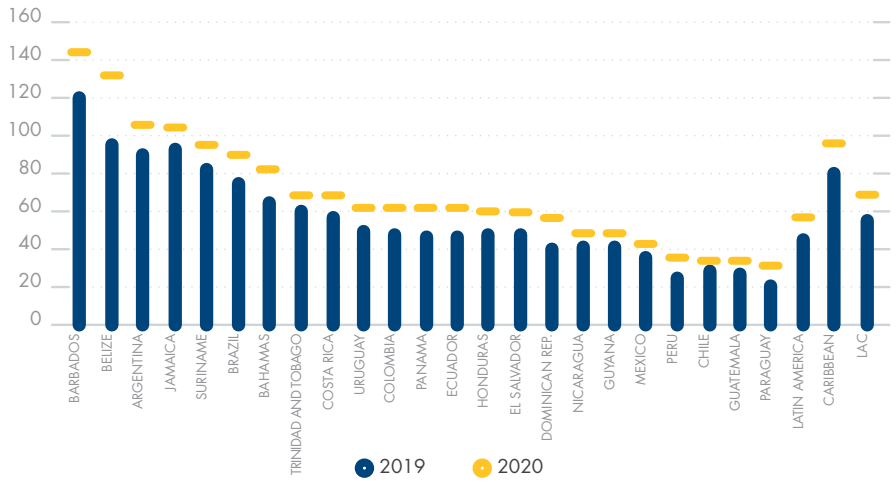
According to ECLAC (2021c), the increase in total income inequality per person increased in 2020, giving rise to a Gini index that is **2.9 %** higher than that registered in 2019 in LAC. Without the transfers made by governments to mitigate the loss of labor income, the expected increase in the average Gini index for the region would have been **5.6 %**.

directly to families, businesses, and local governments. Thanks to this set of measures, in 2020 some 20 million people have escaped falling below the poverty line in the region.

As economic activity declined, tax collection also fell sharply in some cases. Between March and May 2020, revenue from value added tax (VAT) fell by more than 40 % in real terms in some countries (ECLAC 2021b). However, after the shock of the initial months of the pandemic, major taxes recovered in the second half of the year. The trend of increase in the deficit was widespread in the region, but its impact is asymmetric among countries, generating additional fiscal strain on those economies that had pre-existing vulnerabilities (e.g. a high level of debt and limited access to international funding).

The expansion of public spending, together with the fall in tax collection, translated into significant increases in fiscal deficits and debt levels (figure 2.9).

Figure 2.9
Gross public debt of central governments and subregional averages (% of GDP)



Source: The authors based on ECLAC (2021c).

Throughout 2020, tax collection fell 0.5 percentage points of GDP in LAC, from **18.4 %** to **17.9 %**. Although a significant reduction in tax collection was recorded in most countries (with falls equivalent to 0.8 percentage points of GDP or more in seven countries), in others, the tax burden increased (ECLAC 2021b).

EIn 2021 it will be necessary to maintain and, in some cases, expand emergency cash transfers to meet basic needs - including strengthening social safety nets and health systems, mitigating the risk of food price surges, and ensuring the smooth running of supply chains - and to support recovery. LAC is one of the most indebted regions, with the highest external debt service in the world (59 % of the value of exports of goods and services), which complicates the task of maintaining the levels of transfers and subsidies that prevailed in the region in 2020.

The divergence between advanced and developing economies presents further complications in relation to the speed of the post-pandemic recovery, which influences the behavior of interest rates. According to the IMF (2021), lower interest rates in advanced economies at the beginning of the pandemic provided great relief to financial markets in emerging and low-income economies. But divergent economic recoveries could lead to interest rates in advanced economies starting to rise when conditions in other countries continue to justify a loose monetary policy stance.

The agricultural sector is not alien to the dynamics of monetary and fiscal policy. Although there are no figures on how

much of the additional expenditures of the central governments in the region went to rural families and businesses, there is evidence that monetary easing and some subsidies have benefited the agricultural sector. In 2020, the conditions for granting credit to agricultural producers in several countries have been relaxed, with a reduction in interest rates, granting guarantees and other financial reprogramming facilities (ECLAC and FAO 2020). There is also evidence that the budgets of various ministries of agriculture were expanded in response to the pandemic. However, in Mexico and Brazil, these budgets suffered significant cuts in 2020 compared to 2019 values, of 27 % and 21 %, respectively (see section on financing 2.4).

In a context of increasing financing needs, the market for so-called green, social and sustainable bonds (ECLAC 2021b) has gained relevance, which should be a more explored source of credit for the agricultural sector. These bonds are fixed income instruments associated with projects aligned with the objectives of the green transition or with inclusive social development objectives. Worldwide, there was a notable increase in the issuance of green bonds in 2020 compared to previous years, mainly due to the dynamism of social bonds, which reached a value of USD 145.6 billion, a figure eight times higher than in 2019 (ECLAC 2021b). The market for green, social and sustainable bonds in LAC, which represents only 2 % of global transactions, doubled in 2020.

In the agricultural sector, the central question in 2021 is how to finance development programs - including not only productive investments, but also innovation, technical assistance and extension - while maintaining social transfers to producers at risk of exclusion and food insecurity. According to an IDB study (Salazar *et al*. 2021), in which a survey was carried out among family farmers in five LAC countries, almost a year after the start of the pandemic a significant percentage of producers have perceived a decrease in their income (84 %); experienced liquidity problems, having to resort to savings and loans to tackle the crisis (82 %), or are in a situation of food insecurity (12 % in severe insecurity, 12 % in moderate insecurity and 42 % in mild insecurity). In addition, more than 70 % of farmers surveyed had not received any help from the government. The latter, given the high rates of extreme poverty and food insecurity among family farmers, raises questions about the ability of income transfer policies and subsidies to cover the neediest population groups.

In order to avoid the immobility of a situation of scarcity of fiscal resources such as the one that could take place in the coming years, the promotion of economic activities related to agriculture and food should preferably be based on the concepts of endogenous solutions, low cost or autonomy solutions and own resources (Sotomayor 2021).

In operational terms, this implies making sure to design public policies and programs that take advantage of local leaderships and all the resources of the communities and territories that can serve to reduce the cost and increase the quality and impact of interventions. The current crisis should be seized as an opportunity to rethink the financing for development agenda in LAC (ECLAC 2021d), as well as an occasion to reach a broad social and political consensus aimed at implementing ambitious reforms that allow a process of sustainable and egalitarian reconstruction to be undertaken, inside and outside AFSs.

Increases in long-term interest rates have already been observed in the first months of 2021, reflecting expectations that the United States Federal Reserve will normalize monetary policy as the growth prospects for the economy improve. Depending on the pace of these increases, there could be adverse spillover effects in emerging economies, particularly those with high debt and high financing needs.

Chile is the country of LAC that most has used green, social and sustainable bonds as a financing source, having placed nearly USD **14.4** billion in these instruments between June 2019 and March 2021, equivalent to **15.5 %** of the stock of central government debt (ECLAC 2021b).

RURAL AND AGRICULTURAL TRANSFORMATION

IN THE FACE OF THE CHALLENGES AND OPPORTUNITIES OF THE POST-COVID-19] PANDEMIC TRANSITION

3.1

The post-COVID-19 pandemic transition is an opportunity to promote a more sustainable, inclusive and resilient rural and agricultural transformation. This requires innovative actions in various fields and new relationships between public, private and civil society actors.

3.1
TRENDS AND DISRUPTIVE FACTORS SHAPING THE TRAJECTORY OF AGRICULTURE AND FOOD SYSTEMS PRIOR TO THE PANDEMIC

The region of LAC has been facing significant changes since before the pandemic. Several trends, acting simultaneously, have been promoting transformations in the social, economic and environmental structures of the region with important impacts in rural areas.

The challenge is to ensure that the **three drivers of change** (technological change, climate change and changes in food and diets), which are currently active in the region, become a transformative force towards agriculture and food systems that are more prosperous, inclusive and sustainable.

At the current rate of production of greenhouse gas (GHG) emissions, **40 %** of the LAC area will have reached or exceeded the +2 °C threshold in the next 10 years (Jarvis *et al.* 2019).

Rural areas, agriculture and the food systems of Latin America and the Caribbean (LAC) had been facing changes before the pandemic of the coronavirus disease (COVID-19) due to the convergence of several trends, among which are three key drivers of change that affect the planet and livelihoods: technological change, climate change and new trends that affect food and diets (Trivelli and Berdegué, 2019). These drivers are transforming everything (relationships, productive systems, economy, society, culture, etc.) and may – or may not – be being taken advantage of to generate rural transformation processes that lead us towards achieving the Sustainable Development Goals (SDGs) and more prosperous, inclusive and sustainable agriculture and food systems.

Technological change: This document discusses how to take advantage of advances in digitalization (see Chapter 4) for a more productive, sustainable and inclusive agriculture, but the technological change underway, which includes digitalization, is broader in scope. The use of artificial intelligence and *big data*, and advances in the Internet of things, complement the digital innovation facilitated by the expansion of new digital and information and communication technologies (Echeverría, 2021; FAO, 2018; Ziegler *et al.* 2020). Technological developments create new opportunities for increasing production, improving marketing channels, reducing costs and providing more and better information and services, but at the same time they face the risk of being available only to those in a better relative position to use them (Trigo and Elverdin, 2019).

Climate change: The increase in the temperature of the planet and its consequences, such as changes in productive conditions, the accessibility and quality of resources (water, land) and the greater frequency and severity of natural disasters, among others, have direct effects on agricultural production, which, particularly in our region, contributes significantly to climate change (see 3.3.3).

Changes in diet: The growing increase in food demand due to population growth and the reduction of global poverty requires food systems that produce not only more food in aggregate, but also incremental production of some high-demand foods derived from changes in the overall diet (oils, dairy, fruits, vegetables, etc.). LAC can benefit from these changes because of its ability to respond to these demands. However, along with increased demand, food systems are increasingly related to health, which generates new trends,

consumption habits and changes in formal and informal social norms (Intini *et al*. 2019; Rapallo and Rivera, 2019; Popkin, 2020). These changes involve actors other than producers and consumers (supermarket chains, logistics chains, restaurant networks, etc.), on which they also depend.

In addition to these global drivers of change, three trends with important impacts in the region should be mentioned (see also Box 3.1 for drivers that can affect agriculture and food systems in LAC):

1. **The aging of the population.** We are reaching the end of the Latin American demographic dividend. In particular, in rural areas of LAC, the lower population of young people is aggravated by migration to the cities or to other countries.

2. **The stagnation in the reduction of rural poverty** in the region. Since 2014, the rate of reduction in rural poverty has slowed significantly after more than a decade of marked decline. In 2016, several countries already registered increases in the monetary poverty rate (FAO 2018). Even before the pandemic, the improvement of this social indicator had stopped, and today it clearly shows a significant deterioration (ECLAC *et al*. 2019).

3. **Changes in the international context,** geopolitics and international tensions regarding trade and large technology producers affect various markets with important consequences (Willett *et al*. 2019, Piñeiro and Elverdin 2019, Morris *et al*. 2020).

It is estimated that by 2050 **50 %** more food will be required compared to 2013 (FAO, 2017).

The EAT Lancet Commission noted in 2019 that food "is the most powerful lever for optimizing human health and environmental sustainability on Earth" (Willett *et al*. 2019).

The rural poverty rate is more than double the urban poverty rate in LAC, and the rural extreme poverty rate is more than triple the urban extreme poverty rate (ECLAC *et al*. 2019).

Box 3.1:
Drivers of change: Trends and disruptive factors that can affect agriculture and food systems in LAC

Agriculture and food systems in LAC will be influenced by many forces acting in many different ways and at multiple scales over various time horizons.

In the World Bank publication (Morris *et al*. 2020), nine drivers are identified and described that are particularly relevant to agriculture and food systems in LAC: (1) population growth, (2) urbanization, (3) migration, (4) increase in income, (5) changes in preferences and tastes in diets, (6) increase in productivity, (7) emerging technologies, (8) climate change, and (9) policies. It is suggested that addressing these drivers can help to ensure the existence of adequate food for all without destroying the planet.

The main drivers include trends and disruptors. Trends are gradual forces acting over the long-term, with high inertia and a low probability of changing rapidly, so their impact on agricultural and food systems is relatively safe and predictable. Disruptors are disturbances that can appear suddenly, without warning, and which have an impact on agricultural and food systems that is difficult to predict. Some drivers do not clearly fit into one of the two categories, but rather share characteristics of both.

Source: Morris *et al*. 2020.

3.2
STRUCTURAL GAPS AND THE CHALLENGE OF TRANSFORMING AGRICULTURE AND FOOD SYSTEMS AMID THE POST-PANDEMIC RECOVERY

Poverty and inequality are endemic in the region's AFSs and the pandemic has exacerbated this situation. It is urgent to transform AFSs in order to make them more inclusive, resilient and sustainable.

The COVID-19 pandemic will undoubtedly increase existing structural gaps.

It is estimated that in 2020 the number of people living in poverty increased by **22 million,** compared to 2019 (see section 2.1.2).

Agriculture and agri-food systems (AFSs) play a key role in LAC economies, as they represent an important source of income, jobs, and food for the region and the world. However, since before the pandemic, it is widely accepted that the AFSs require a transformation that should be aligned with the SDGs (Trivelli and Berdegué, 2019). The reason is that, even prior to the pandemic, the rural population faced significant lags and gaps in their development indicators, due to the interaction of multiple social, economic and territorial inequalities that are reproduced from generation to generation.

Economic conditions, structural imbalances (income, assets and resources) and the lack of social protection policies are the main causes of hunger and malnutrition in the region, which also interact with disasters and crises that make it more difficult to escape from this vicious circle (FAO *et al.* 2020).

Some of the existing gaps in key areas of development are:

1. **Poverty:** In LAC, as discussed in Chapter 2, poverty in urban areas reaches 26.9 percent of the population, compared to 45.7 percent of the population in rural areas. Different estimates indicate that the number of people living in poverty has increased after the pandemic. However, poverty in rural areas is not due only to lower levels of economic growth,

but also to the prevalence of high levels of multidimensional inequality. In other words, poverty must be analysed alongside other dimensions, such as nutrition. In this regard, the evidence shows that it is extremely urgent to prevent the health crisis from turning into a food crisis.

2. **Health:** Differences in access to health or sanitation services negatively impact people's capacities to contribute to production processes. In rural areas there is a greater probability that their inhabitants have health problems associated with malnutrition, overweight, obesity and risk of mortality (Gaudin and Pareyón Noguez 2020).

   Additionally, improving access to healthy food remains a pending challenge in the region. Healthy eating is 270 percent more expensive than a diet that provides the minimum calories (FAO *et al.* 2020). As a result, 60 percent of adults and 30 percent of children and adolescents are overweight, which affects more than 120 million people in LAC.

3. **Educatión:** In urban areas, the population of working age (15 years or older) has an average of 10.5 years of education, while in rural areas the average is only 6.9 years, which limits the possibilities of rural inhabitants to access higher-paying jobs (ECLAC, 2021b). The educational gap is not only limited to educational coverage, but also to differences in the quality of education provided (ECLAC *et al.* 2019). The first year of the pandemic has been a blow to the education sector in LAC, where schools have remained closed for longer periods than in any other region in the world (Banco Mundial, 2021).

3. **Information and communication technologies:** The pandemic has shown the need for populations to have access to quality Internet connectivity infrastructure, in order to access educational, commercial and financial services, among others. In LAC, more than 77 million rural inhabitants do not have Internet connectivity with the minimum quality standards necessary (Ziegler *et al.* 2020). This aspect is addressed in depth in Chapter 4.

4. **Gender:** In rural areas, women have access to fewer services and productive assets relative to men. In addition, they receive lower wages and work more unpaid hours. Therefore, women are more affected by poverty than men, increasing their risk of food insecurity. In 2019, food insecurity already affected 20 million more women than men (FAO *et al.* 2020). As previously mentioned, projections establish that poverty, extreme poverty, unemployment and hunger will be higher in LAC after the pandemic (ECLAC, 2020c, FAO *et al.* 2020), which will widen the gaps between rural and urban areas. This is why countries have focused their immediate recovery measures on protecting existing jobs, creating new jobs, and strengthening the social protection network. However, if the competition, equity and sustainability of AFSs, are to be increased, the recovery should incorporate more transformational aspects.

   Transformation is a long-term process, which must begin alongside the immediate recovery process, focusing on economic, social and environmental gaps such as those mentioned above. In this regard, the need to respond quickly to avoid an economic,

The number of hungry people in the region could increase by almost **20 millon**, from **47.7 million** in 2019 to **67 million** in 2030 (FAO *et al.* 2020).

While **71 %** of the urban population has access to meaningful connectivity services, in rural populations this percentage drops to **36.8 %** (Ziegler *et al.* 2020).

With the current and anticipated effects of climate change – droughts, floods, hurricanes, losses in agricultural production, energy losses and exposure to an increase in pandemics, among others – the ability of most countries to respond to climate crises will be severely diminished.

Countries should design economic stimulus packages to accelerate systemic change towards a sustainable economy (United Nations, 2020a).

In order reduce hunger, the access to and use of technologies must be democratized so they are a factor of inclusion and not exclusion.

To make food safer, good practices should be promoted in the AFSs, in order to ensure the quality and safety of food, as well as to reduce waste.

The effort to increase inclusion should be focused on artisanal fishing and family farming (FF), which represent **80 %** of the productive units of rural areas.

social and food crisis can be a strong argument for ignoring climate considerations. However, if these are not integrated, the recovery will push the region down a path with even more dramatic effects than those of the COVID-19 pandemic (United Nations 2020a).

In this context, it has never been more important to make COVID-19 response strategies different from the economic recovery plans seen so far. In addition, the incorporation of sustainable and "climate proof" solutions is essential to improve the resilience of societies, as well as to ensure the best preparation possible for the future. Recovery from the COVID-19 pandemic must simultaneously address health, economic and climate crises, while reducing inequalities.

One of the first challenges faced by AFSs is ending hunger and all forms of malnutrition, as well as reducing the incidence of food-related non-communicable diseases (NCDs). This requires increasing the availability and accessibility of safe and nutritious food. In this context, in the framework of the Food Systems Summit (FSS), some solutions are being discussed to guarantee access to healthy and nutritious food for all:

1. **Possible solutions to reduce hunger:**
   - Establish a zero hunger fund.
   - Expand the infrastructure and technology of the sustainable cold chain.
   - Encourage agri-food innovation in order to reduce food losses and waste.
   - Multisectoral collaboration with public-private partnerships.

2. **Possible solutions to increase access to nutritious food:**
   - "One Health" approach (see subsection 3.3.6).
   - Make social protection programmes more nutrition-sensitive.
   - Expand biofortified crops.
   - Improve governance for public procurement of nutritious food.
   - Integrate market information that facilitates commerce (see subsection 3.3.2).
   - Multisectoral collaboration with public-private partnerships.
   - Launch a Workforce Nutrition Alliance to reach workers in the food system.
   - Promote cooperativism and associativism (see subsection 3.3.7), as well as encouraging the participation of women in food systems.
   - Create a virtual global hub of innovation in nutritious food for small and medium-sized enterprises (SMEs).
   - Foster a global conversation about the coherence of food policies to improve the diets of children (including comprehensive school feeding programmes).

3. **Possible solutions to make food safer:**
   - Science-based food safety for all (which does not differentiate whether the food is for local or foreign consumption).

- Develop a new world food security index.
- Develop a global alliance on safe food for all.
- Create and launch a food security toolkit.

In rural areas, inequalities are not only reflected in malnutrition, but also in other dimensions, such as access to connectivity, accessibility and basic services (Saravia-Matus and Aguirre Hörmann 2019). Failure to ensure a minimum supply of these requirements will limit the social and economic development of rural areas.

Therefore, another challenge is to increase inclusion in AFSs with public policies tailored to the countries and territories that provide integrated solutions for rural areas.

The work is divided into five main areas:

1. **Support increased investment in public and private goods.:**
   - Extend the coverage and quality of rural services and infrastructure.
   - Provide better information to the agricultural sector.
   - Improve access to the Internet, information and telecommunications.
2. **Expand social protection in rural areas.**
   - Link productive policies with inclusion programmes.
3. **Promote rural non-agricultural employment.**
   - Improve links between urban and rural centres.
   - Improve the connection between the agricultural sector and markets for goods and services.
4. **Financing for recovery.**
   - For consumers: A subsidy to fight hunger.
   - Small agricultural and fishing units: Increase in soft loans, as well as the one-time provision of non-reimbursable funds for a basic kit (fertilizers, seeds and others).
   - Special financing for infrastructure related to climate change.

To increase investment in public and private goods, public, private and academic work must be reorganized with the support of the digital and technological revolution (see special chapter 4)

Finally, it is necessary to consider the vulnerability of agriculture and fisheries to disasters associated with climate change (see the subsection on climate resilience in 3.3.3), especially small productive units of fishermen and farmers (IPCC 2014), as well as the serious loss of biodiversity due to agriculture and associated with land use change (UNEP and WCMC 2016; see the soil subsection in 3.3.4).

It is important that the focus on food security and inclusion does not leave out the environmental component.

Therefore, it is proposed that agriculture should move towards a resilient and sustainable development model that not only exploits natural resources, but also enhances and values them:

1. **Produce in a more sustainable way, under the "One Health" approach (see subsection 3.3.6), reducing the environmental footprint and integrating ecosystems and biodiversity.**
   - Reduce the environmental footprint, improving soil health and moving towards efficient water use (see 3.3.4).

Sustainable production implies reducing GHG emissions by preventing deforestation, promoting low-emission livestock farming, re-carbonizing soils and reducing food losses and waste.

- Integrate biodiversity conservation into production policies, which will protect the basis of agriculture and regional food security.
- Sustainably manage forests, fisheries and aquaculture, thus ensuring the sustainable growth of the sector.
- Launch clean energy information and coordination platforms.

2. **Support farmers, rural communities and ecosystems to make them more resilient to climate change (3.3.3)**
   - Invest in disaster risk reduction: improve risk-related information systems.
   - Recognize ecosystem services and incorporate technologies related to nature-based solutions to increase resilience to climate change (see 3.3.5).

3.3 OPPORTUNITIES FOR A MORE RESILIENT, EQUITABLE, SAFE AND ENVIRONMENTALLY FRIENDLY AGRI-FOOD FUTURE

Crises are great opportunities for change, even if they do not always appear to be so. In the history of humanity, it can be seen that both concepts generally go hand in hand – where there is a problem, there is an opportunity for improvement, and where there is an opportunity for improvement, there is room for transformation.

The solutions identified must be compatible with the capacities, context and the priorities of each country. The result should be a country that is different from what it was prior to the pandemic, because it has been able to change or eliminate those elements that prevented it from overcoming the situation it was in (Diamond 2019).

The COVID-19 pandemic has been, without a doubt, one of the greatest crises that humanity has experienced in modern times and, as in all crises, we will recover from it. However, history tells us that not all countries will be equally successful in finding solutions to this situation. Probably, those that manage to recover first will be those that: i) recognize they are in a crisis and then, through a critical review, have the courage to identify what they need to change to recover from this crisis; ii) have the human and financial resources necessary to respond effectively; and iii) achieve rapid progress in vaccination processes that allow greater security and open economies.

Reconstruction or recovery has often been conceptualized and designed so that a country is able to return to the same conditions of development it experienced before the disaster or crisis. This, however, is what has led countries to repeat pre-existing conditions and, therefore, to risk falling back into the same emergencies or crises of the past (UNDP, 2012). However, this way of analysing risks has evolved over time. Thus, a few years ago it was established that the **reconstruction phase** should be the

opportunity to rebuild by creating resilience to reduce or avoid future crises, that is, to **build back better** (United Nations 2015).

There are more and more voices pointing out that the health, economic and social crisis caused by the **pandemic** is an **opportunity** to reflect on what kind of responses are required to recover from a crisis of this magnitude. The transformation of the agri-food system requires a rigorous analysis of the external factors (opportunities and threats) that could affect the achievement of the transformation objectives, as well as the internal capacities (strengths and weaknesses) of the countries to face these changes. In this way, the external elements associated with the pandemic are an opportunity to advance towards the achievement of the transformation objectives.

In this regard, **society's greater awareness about the importance of a healthy environment to sustain social well-being and economic development** is identified as an opportunity. The pandemic has made many decision makers rethink whether the growth model focused exclusively on economic variables has been enough to increase and maintain the well-being of citizens. The answer seems to be no, since growth based on economic objectives, and not on the internalization of negative social and environmental externalities, has brought us to the point where we are today.

For this reason, the recovery process after the COVID-19 pandemic is presented as an opportunity to make AFSs more resilient to the risks associated with climate change and to promote environmental, social and economic sustainability.

With regard to resilience, considerable progress has been made in the development and implementation of early warning systems for climatic hazards and in the development of technologies that value ecosystem services, such as nature-based solutions. However, it is important not to ignore mitigation measures that reduce GHG emissions, which are the main cause of the greater frequency and intensity of disasters.

In terms of sustainability, digitalization has played an important role in the development of technologies related to waste management and the circular economy, among others, even though the incorporation of digitalization remains a challenge facing AFSs in the region.

Therefore, the COVID-19 crisis is considered **an opportunity to accelerate** digitalization processes. New technologies can be an important engine for rural transformation, creating new opportunities for farmers (FAO and ECLAC 2020b). Digitalization reduces costs and increases the efficiency of AFSs at any link in the value chain. Within the AFSs, the actors that have benefitted the most from the acceleration of digitalization are producers and intermediaries who market their products through *e-commerce* platforms. However, it is necessary to improve connectivity, literacy and infrastructure in rural areas, with the aim of making digitalization a driver of greater inclusion, which will help to reduce gaps between rural and urban sectors. This issue will be discussed in depth in special chapter 4.

It has been pointed out that in order to build back better, it is necessary to transform the LAC development model (ECLAC, 2020; United Nations, 2020a) into a more sustainable, inclusive and resilient system.

The climate and environmental crisis that we are facing today affects all human activities, but especially fishing, agricultural and livestock activities, which are highly vulnerable to climate change (Morris *et al.* 2020; UNEP, 2020b).

A study carried out in Brazil (Embrapa, 2020) showed an increase in the purchases of fruits and vegetables directly from producers during the pandemic, through the delivery of products via delivery, drive-thru or take-away. This has promoted the development of shorter supply chains for the marketing of healthy food products.

3.3.1 The future of agri-food trade: A review of food supply strategies

A combination of strategies that promote local AFSs and international trade can better balance the costs and benefits (economic, social and environmental) of both, thereby contributing to a diversified, balanced and affordable diet; more efficient use of resources; and the improvement of the global carbon balance and, therefore, to the generation of more resilient food systems.

Less than **1/3** of the world's population could currently meet its demand for locally produced food (within a radius of 100 km) (Kinnunen *et al.* 2020).

It is estimated that, in 2018, **35 %** of the global supply of food products for local industry was imported (calculation based on FAO, 2021a).

Of the total domestic supply of **cereals** in the Americas (623 million metric tons in 2018), **14 %** was imported. By comparison, in terms of **fruit**, an average **25 %** of the domestic supply in the Americas (128 million t) was imported (own calculations based on FAO, 2021a).

As a result of the COVID-19 pandemic, we could witness the evolution towards a new globalization characterized by a different type of governance, more inclined towards the diversification of strategies and forms of production (González 2020), consumption and distribution of food, as well as increased regionalization and greater emphasis on inclusion, resilience and environmental sustainability.

In the process of configuring this new approach to globalization, paradigms of free trade, sovereignty, self-sufficiency and food autonomy will coexist and sometimes conflict with the promotion of the consumption of locally produced products, initiatives for the regionalization of trade and the promotion of shorter value chains closer to the consumer.

Regarding the consumption of locally produced products (see Box 3.2), the **first question** to ask is whether it is feasible to source food products locally from the point of view of local productive capacity. In general, most countries cannot and could not supply themselves with locally produced food to achieve balanced and healthy diets throughout the year. A study published by Nature Food (Kinnunen *et al.* 2020) concludes that sourcing food locally, especially in developing countries, is not feasible for most. The authors estimated that less than a third of the world's population could currently meet its demand for locally produced food. Only 27 percent of the world's population can obtain temperate cereal crops, such as wheat, barley and rye, within a radius of less than 100 km, and only 28 percent can do so for rice. These percentages decrease even more for cereals, roots, beans and maize of tropical origin, which are important foods in the diet of people in LAC countries.

There are no comparable data on local food supply for countries in the Americas, but it is possible to identify important differences between product groups at least at the country level, and especially between net food exporters and importers.

For example (own calculations based on FAO, 2021a), in 21 out of 35 countries in the Americas, imports represented more than 50 percent of the domestic supply of cereals (from 53 percent in Guatemala to close to 100 percent in most Caribbean countries: Trinidad and Tobago, Jamaica, Barbados, Grenada, Antigua and Barbuda and Saint Vincent and the Grenadines); in the remaining 14 countries, imports represented less than 50 percent of the domestic supply, and in four of them, close to 10 percent or less of the domestic supply of cereals is imported (Argentina, Paraguay, the United States and Brazil). When it comes to fruit, in five out of 35 countries in the Americas, fruit imports represented more than 50 percent of the domestic supply (Saint Kitts and Nevis, El Salvador, the United States, Canada and Barbados), while in 22 countries it was less than 10 percent.

Box 3.2: The concept of "local"

The term local actually refers to two different things: the physically local and the culturally local (Parker 2020). If it is used to refer to food that was grown nearby, how close should it be? Somewhere within the country, state, province, or district? Although distances or areas differ, in general terms a food or local product can be defined as one that is grown, produced and/or processed in the locality or region where the final product is sold (Waltz, 2011).

In addition, many consumers link cultural and social values to the concept of the local, which makes it more complex to define (Andrée *et al*. 2014). In this regard, the demand for locally produced food has positive connotations with respect to product quality, support for local farmers and the local economy, and a preference for certain agricultural production and distribution practices. Furthermore, local foods are increasingly being incorporated into programmes designed to reduce food insecurity, support small farmers and rural economies, encourage healthier eating habits, and promote closer connections between farmers and consumers (Waltz, 2011; McIntyre *et al*. 2009].

Overall, empirical evidence has found that expanding local food systems in a community can increase employment and income in that community, but is insufficient to determine whether local availability of food improves diet quality or food safety, or if the location can reduce energy use or GHG emissions (Waltz, 2011; Mundler and Laughrea, 2016).

Throughout the Americas, farmers markets proved to be key to the supply of food during the COVID-19 pandemic, and in many countries they were declared essential services to ensure their continued operation.

In several countries there are regulatory frameworks that facilitate the participation of FF in public food procurement and local foods are prioritized in the improvement of diets (FAO 2019a, Cruz-Rubio 2020).

The second question is whether the consumption of locally produced food is environmentally sustainable. The evidence indicates that local does not necessarily equate to sustainability, once the multiple factors that must be considered in the analysis are taken into account.

One factor to consider is how the food is transported: by plane, boat or truck? It is estimated that a British consumer who travels 10km to buy a kilogram of fresh produce will generate proportionally more GHG than air transport of the same kilogram produced in Kenya (**Bellmann 2020**)[3]. The other key factor to consider is the GHG emissions from production or farming practices, which according to the available evidence is much more important than the footprint generated

Maritime transport generates **25** to **250** times less emissions than trucks, and air transport generates emissions on average five times greater than land transport (Bellmann, 2020; Sims *et al*. 2014).

[3] GHG emissions by mode of transport depend on many factors, such as vehicle technology, type of fuel used, infrastructure, and stowage volume or factor. See estimates of carbon equivalent emissions per tonne-kilometer in Sims *et al*. (2014).

Argentine biofuel generates **26** grams of carbon dioxide per megajoule (gCO_2/MJ), well below the European standard of **83.3** gCO_2/MJ (Hilbert *et al.* 2018).

It is estimated that the global net effect of a **1 %** increase in the intensity of trade openness reduces the extraction or consumption of water by between **1** and **1,5 %** (Kagohashi *et al.* 2015).

In communities better integrated to surrounding markets, local variation is less important for price determination, because food can be brought in from or shipped to other areas.

by the transport of food (Bellmann, 2020). A study shows that, for English people, eating meat produced on pastures in New Zealand is "greener" than consuming locally produced meat, where the animals' diets are based on feed or supplements. Another study (Broocks *et al.* 2017) compares production systems globally and concludes that beef produced in the United States tends to have an intensity or footprint between 5kg and 25kg of carbon dioxide equivalent (CO_2e) per kilogram of protein, compared to a footprint of more than 1,000kg of CO_2e per kilogram of protein from meat produced in much of Sub-Saharan Africa. The differences between countries and production systems are mainly explained by the use of higher quality (more digestible) feed, lower impacts of climatic stress (heat) on animals, improvements in animal genetics, advances in reproductive performance and reduction of the time required for an animal to reach its slaughter weight (Broocks *et al.* 2017, Desjardins *et al.* 2012).

Also, seasonality influences decisions related to production, marketing and storage. British apples that are stored for ten months carry emissions twice as high as apples that are transported by ship from South America (Blanke and Burdick 2005).

Third, in addition to GHG emissions, there are additional components of the environmental footprint to consider, such as water, soil and biodiversity. Sometimes what is good from a GHG point of view is worse from a biodiversity perspective; therefore, it is important to take the local context into account when measuring sustainability. For example, buying locally produced soybeans or asparagus – crops that tend to have a very high water footprint – is not more sustainable if these products are grown in water-scarce areas. In fact, a study (Kagohashi *et al.* 2015) found that greater trade openness reduces the extraction or consumption of water, which suggests that international trade can promote the efficient use of this resource through the diffusion of water-saving technologies and the effect of the comparative advantages of producing and marketing products in localities with a relative abundance of this natural resource.

Fourth, smaller-scale local food systems are more vulnerable to local events of droughts, floods or storms (Holmes, 2021); furthermore, they experience high transaction costs, seasonal high and low prices, and saturated markets, while consumers often lack quality food and options or encounter contaminated or unsafe products (McIntyre *et al.* 2009; Pinstrup-Andersen and Watson II, 2011). However, it is necessary to highlight that these vulnerabilities are also the result of market failures associated with various problems of access to information, productive assets and services, connection of family producers with different markets, physical infrastructure, communications and dependency intermediaries (ECLAC *et al.* 2013). In any case, when communities are better integrated into surrounding markets, local variation is less important for price determination, because food can be brought in from or shipped to other areas.

However, as observed in the food price crises, by integrating to new markets these local markets are also exposed to unwanted shocks from distant areas (Pinstrup-Andersen y Watson II 2011).

In conclusion, a combination of strategies to promote local AFSs (see Box 3.2) and to promote international trade can better balance the costs and benefits (economic, social and environmental) of each, recognizing that the consumption of products generated locally is not viable for most products, nor is it risk-free or

necessarily sustainable. Policy-makers should therefore focus on building food systems that provide healthy diets in an efficient, sustainable and resilient way, and to this end it is best to diversify risks by combining sourcing strategies from local or shorter supply chains with strategies for their integration with regional or international food markets.

Any effort to make food systems more resilient must address the enormous role of international trade in food products (see 3.3.2). American consumers eat Peruvian asparagus and Australian lamb, while Chinese eat American pork and Brazilian soybeans, on a global food trade carousel worth billions of dollars a year. Basically, many countries are outsourcing the production of their food to more suitable places to grow it and at a lower cost (Holmes, 2021). This not only contributes to the health, nutrition and well-being of consumers, but also the producers of avocado in Mexico, banana in Ecuador, pineapple or coffee in Costa Rica, citrus in Brazil and grapes and blueberries in Chile, to which are added the positive effects on the communities and supply chains that depend on these products.

Simultaneously, in line with the proposed diversification of strategies, it is necessary to promote marketing schemes that facilitate linkages between agricultural producers and local and international markets (Rodríguez-Sáenz and Riveros-Serrato 2016), as well as specific actions for the inclusion of FF and rural populations, which are the most affected by market failures that prevent them from selling products locally, as well as potentially gaining access to regional and international markets.

Finally, it is key to generate the necessary data to establish a clear understanding and measurement of the real cost of food from the economic, social and environmental perspectives, including all market failures (local, national or international). As a result, consumers will be in a better condition to make more sustainable consumption decisions, and countries will be better positioned to design and adapt their current agricultural policies to achieve the triple benefit of higher productivity/efficiency, resilience and environmental stability (Laborde *et al.* 2021).

It is best to diversify risks by combining sourcing strategies from local or shorter supply chains and strategies for their integration with regional or international food markets.

International trade can contribute to improving the global carbon balance (Piñeiro *et al.* 2018).

It is important to develop indicators of the intensity of resource use and of the environmental footprint of both locally produced and imported products.

3.3.2 Trade as an opportunity for the development of food systems and the promotion of regional and global supply chains

Strengthening multilateralism, taking better advantage of the opportunities of trade agreements and regional integration processes, promoting trade policy measures and strengthening trade promotion programmes are proposed as measures to enhance LAC's role in the transformation towards sustainable and resilient food systems[4].

The world food system has been able to increase production to feed a rapidly growing world population; since 1960, the population has more than doubled, while food production has tripled (OECD 2021a). Although this has been the product of a considerable increase in productivity, international trade has played an important role in the access and availability of food. Based on data from 2018, and using the new food balance calculation methodology, 35 percent of food consumption worldwide is imported, according to IICA (CAESPA)

[4]Prepared based on IICA, 2021b.

Over the past 40 years, the proportion of food, as measured in calories, that crosses an international border has increased from **12 %** to more than **19 %** (Martin and Laborde, 2018).

There are many net exporters in the region that are considered "pantries" for the world, including Argentina, Brazil, Chile, Costa Rica, Ecuador, Paraguay and Uruguay. The region also has countries that are net importers, including Belize, the Dominican Republic, Haiti, Venezuela, El Salvador, Suriname, Jamaica, Trinidad and Tobago, Barbados, and the Bahamas (Arias *et al.* 2020).

During the pandemic, the region has presented a positive performance in agri-food trade with respect to total merchandise. According to data for an aggregate of 17 countries in the region, during 2020 agri-food exports registered an increase of **2.7 %,** while total merchandise exports showed a fall of **9.1 %** (Salazar and Arias, 2021).

calculations based on FAO (2021a). Today, we face the challenge of achieving not only greater access to and availability of food, but also that these are accompanied by consumption patterns more compatible with human health and environmental sustainability.

Over the last 20 years, the region's agri-food trade surplus has grown steadily, from USD 35 billion in 2000 to almost USD 138 billion in 2019. Total agri-food exports increased from USD 45 billion to USD 193 billion in the same period, while imports grew from USD 20 billion to USD 55 billion (FAO 2020b). In this context, *LAC agri-food sector exports represent about 14 percent [IICA (CAESPA) with data from the United Nations, 2021] of world agri-food product exports* and a quarter of the region's total exports. The increase in production and exports in recent years made the region the world's largest net food exporter.

Despite its importance and the role it plays, the region's agri-food trade is not without its challenges. It is important to highlight that 86 percent of LAC agri-food exports are focused on third markets [IICA (CAESPA) with data from the United Nations 2021]. The United States represents 23 percent, followed by East Asia with 19 percent, the European Union with 18 percent and China with 13 percent. In addition, *the region's exports of agri-food products are concentrated in a limited number of products; 51 percent of the value of these exports is concentrated in 10 products, while at the global level 10 products account for 29 percent of exports* (ECLAC *et al.* 2019). This situation is even more exacerbated in some countries, which makes them vulnerable to international market conditions.

Trade within the sub-regions. In 2019, the sub-region that sent the least agri-food exports to other countries within the same sub-region was Mercosur with 6.2 percent, followed by the Andean sub-region with 8 percent, the Caribbean with 20.5 percent and Central America with 21.4 percent. By comparison, the North sub-region allocates 46.32 percent of its exports to the internal region. In the case of agri-food imports, in the Caribbean sub-region these represented 9.8 percent of the total imported, in the Andean sub-region 17 percent, in Central America 29 percent and in Mercosur approximately 50 percent [IICA (CAESPA), with data from TDM, 2021).

This situation raises the need for the region to diversify production patterns, including agribusiness and trade destinations, but it also presents the opportunity to increase its presence in international and regional markets, as well as to contribute to the supply of healthy, nutritious and safe foods produced under adequate environmental management, in a context of post-pandemic recovery from COVID-19 and in the face of an increase in global demand for agri-food products by 2050, as a consequence of population growth, increased urbanization, increased requirements for health, food safety and quality, growth of the middle classes and diversification of diets, among others.

By helping balance food deficits and surpluses between countries, international trade fulfils at least six key roles and functions: 1) it is crucial to tackling hunger and malnutrition; 2) it redistributes food production, increasing quantity and quality in all regions and thus strengthening food security on a global scale; 3) it improves economic access to food for the most vulnerable populations by acting as a price stabilizer; 4) it increases the variety of foods available, expanding the consumer choice frontier and helping to diversify diets; 5) it promotes safe food through the use of sanitary standards in internal production and distribution

systems; and 6) it creates opportunities to improve agricultural productivity and increase farmers' incomes, becoming a powerful mechanism for the dissemination of technologies and best practices.

To enhance the strategic role of agricultural trade in LAC in the development of sustainable AFSs and the promotion of regional and global supply chains, LAC countries should consider four key measures:

First, actively participate in the 12th Ministerial Conference (CM12) of the World Trade Organization (WTO). The search for a renewed global trading system is essential for the region to unleash its productive and commercial potential. Despite its global importance, the WTO is under significant pressure and faced with an uncertain and volatile business environment. Unless WTO members take decisive steps to reform the organization, its critical role in international trade will be reduced precisely at a time when the recovery of the global economy requires more, not less, policy cooperation (González, 2020). In the agricultural field, the strengthening of global governance is particularly critical to combat tariff increases, potential non-tariff barriers derived from the introduction of more restrictive sanitary requirements, and the significant increase in production and export distortions. CM12 provides an opportunity to reactivate multilateral negotiations to achieve new and significant results, especially in agriculture. In this area, LAC countries can proactively participate in the debates that are generated about the reform of the multilateral trade system, since it is the only space where basic issues for the future of trade in the region can be resolved.

Second, make efforts to take advantage of the more than 140 preferential trade agreements (PTAs) signed during the last two decades, in addition to continuing with regional trade integration processes. In this regard, complementary agendas should be implemented to overcome challenges such as the exclusion of products from tariff preferences, the lack of information and knowledge of the benefits offered by these agreements, the lack of effective exporter support programs, the weaknesses associated with the volume or the quality of the exportable supply and the problems of infrastructure, transport, logistics and customs procedures, among others (ECLAC *et al.* 2019). It is also necessary to advance in the matter of regulatory convergence, not only in the tariff area, but also in matters related to technical, sanitary and phytosanitary standards (ECLAC, 2021f). Similarly, efforts should be made to streamline customs clearance, automation and digitization of processes, among other issues. Finally, it is recommended to strengthen the existing regional negotiation spaces, to accelerate the integration processes and promote their better use.

Third, promote trade policy measures that enhance the contribution of international agri-food trade to the transformation of food systems and contribute to the fulfilment of the action tracks of the FSS. These include: 1) measures that promote trade liberalization that help facilitate supply and increase the availability and diversity of food and diets, stabilize quantities and prices in the domestic market, and generate business and employment options; 2) measures aimed at facilitating trade, helping to improve logistics times, food distribution and transparency; 3) scientifically supported and internationally harmonized sanitary, phytosanitary and quality measures, which promote a greater availability of safe products and improve animal and plant health; and 4) trade policies in line with environmental objectives, rules, laws and agreements, which can promote sustainable practices, boost access to clean technologies and green

International trade plays a very important role in transforming national food systems, connecting them and helping to shape a more sustainable global food system.

LAC countries should proactively participate in the debates on the proposed reform in the multilateral trading system, in order to generate a negotiating text proposal for this meeting based on the seven priority negotiation topics for agriculture: domestic support, market access, export competition, export restrictions, cotton, public stockholding for food security purposes, and the proposed special safeguard mechanism.

In the last two decades, more than **140** PTAs have been signed (ECLAC *et al.* 2019).

goods, and facilitate the exploitation of niche markets for sustainable products.

Finally, strengthen national trade promotion programmes. It must be recognized that measures such as those discussed above are often not sufficient to facilitate the seizing of business opportunities, especially by small and medium-scale producers' organizations. Beyond the competitiveness and productivity conditions that affect positioning in international markets, it is recommended to pay special attention to strengthening trade promotion programmes with a view to improving the diversification of markets and products (IICA 2020). To this end, actions related to the identification of trade opportunities and the strengthening of export capacities must be promoted, in addition to making efforts to link supply and demand, including new technologies and electronic means, such as business intelligence platforms, virtual businesses, virtual *marketplaces* and *blockchain* technologies. Finally, efforts must be integrated with sub-regional bodies that promote trade promotion actions, such as the Regional Centre for the Promotion of Micro, Small and Medium Enterprises (CENPROMYPE), the Central American Trade Network (REDCA) of the Central American Economic Integration Secretariat (SIECA), the Caribbean Export Development Agency, the Andean Business Meeting initiative of the General Secretariat of the Andean Community of Nations (CAN), and the virtual business roundtables promoted by the Pacific Alliance and the Latin American Integration Association (ALADI), among others.

To take advantage of trade opportunities and strengthen export capacities, business plans must be prepared and implemented, promote compliance with sanitary and phytosanitary regulations and requirements, and advance on issues such as transportation, logistics, and customs procedures.

To take advantage of trade opportunities and strengthen export capacities, business plans must be prepared and implemented, promote compliance with sanitary and phytosanitary regulations and requirements, and advance on issues such as transportation, logistics, and customs procedures.

3.3.3 Building resilience to climate change: Agriculture in Nationally Determined Contributions

In addition to emitting significant amounts of GHG, AFSs are among the most vulnerable to the impacts of climate change, especially in tropical and subtropical regions. This is reflected in reductions in production and productivity and in increased post-harvest losses, putting food and nutrition security and livelihoods at risk. Greater inclusion of the sector in Nationally Determined Contributions (NDCs) will help accelerate the necessary changes towards a socially, environmentally and economically sustainable, climate-resilient and low-emission transformation.

The agricultural sector in LAC is one of the most impacted by climate change, and although the impacts are differentiated between regions and crops, in general they are negative with respect to yield and production (FAO *et al*. 2018a; Prager *et al*. 2020; López-Feldman *et al*. 2018). The region will face more water risks, both from droughts and floods (Magrin *et al*. 2014). Prices are anticipated to rise and the Caribbean, the Andean sub-region, Mexico, and Central America will face major challenges in terms of food supply and demand (Prager *et al*. 2020).

As the most vulnerable and poorest people in the region depend on agriculture, fisheries, aquaculture and forests, and as the growing and increasingly urban population needs more food, increasing the resilience to climate change of AFSs in the region is essential to comply with the 2030 Agenda and its 17 SDGs (especially SDGs 1, 2, 12, 13, 14 and 15), and also with the Paris Agreement, since limiting GHG emissions is key to reducing the scale of the impacts and, therefore, the adaptation needs.

It is estimated that **21 %** of the soils in the region will become more arid (FAO *et al*. 2018a).

By mid-century, corn production in LAC will suffer a **10 %** reduction in its performance (Rodríguez De Luque *et al*. 2016).

The 2015 Paris Agreement was a decisive milestone in the fight against climate change, as all Parties to the United Nations Framework Convention on Climate Change (UNFCCC) agreed to contribute to GHG reduction, with common but differentiated responsibilities to keep the global temperature increase this century below 2 °C, and preferably 1.5 °C, compared to pre-industrial limits (UNFCCC, 2015). The NDCs are the basic component for the implementation of the Paris Agreement, since they specify the contribution that each country will make to the mitigation of climate change, as well as its priorities for adaptation and support needs.

There are key contributions the sector can make to reduce emissions. The unconditional commitments of the first NDCs would lead to an increase in global temperature of more than 3 °C, that is, they would not allow meeting the goal of the Paris Agreement (UNEP, 2019). Greater ambition is required in the NDCs of all countries and sectors. About 25 percent of global GHG emissions come from agriculture, land use change, and deforestation (Smith *et al.* 2014; Crippa *et al.* 2021), and 27 percent of them arise in the Americas (Crippa *et al.* 2021). It is estimated that the emissions of AFSs represent 34 percent of global emissions (Crippa *et al.* 2021); the majority come from production and approximately 30 percent from other links in the value chain, such as transport, sale, packaging, consumption, etc. (Crippa *et al.* 2021). To limit global warming to 2 °C, Campbell *et al.* (2016) estimated a preliminary emission reduction goal for the sector of 1 GtCO2e yr1 by 2030. This will require that all countries have to mitigate *business-as-usual* emissions from the sector by 2030 by a median of 10 percent, a target that most NDCs have not yet committed to for the sector (Richards *et al.* 2018).

The inclusion of the sector in the NDC has been important to indicate to the international community what investment in the sector is required to facilitate its adaptation to climate change. Most include it in a general way, without much detail, with a focus on sector adaptation or an emphasis on food security, and several have included adaptation actions that have mitigation co-benefits (Witkowski and Medina, 2016). Regarding the explicit mitigation goals for the sector, the most notable case in the first round was Uruguay, which committed to specific goals to reduce the intensity of emissions from beef production, maintain forest cover and avoid soil organic carbon emissions (Oriental Republic of Uruguay, 2017). Although there are several options to reduce sectoral emissions, both on the supply and demand sides, the first round of LAC NDCs only included actions to reduce production (supply) emissions (Day *et al.* 2017; Ross *et al.* 2019).

The NDCs are a cyclical process and the instrument should be updated every five years to include more ambitious goals. This second round provides ample opportunity for the sector to increase its advocacy and ambition. Countries were supposed to provide an update in 2020 on their progress towards the 2030 goals, but due to the disruption of the COVID-19 pandemic, only 48 countries were able to do this covering a third of global emissions (UNFCCC, 2021), including the European Union and 14 countries from LAC, although several other countries have committed to updating their NDCs in 2021. Even though several countries have set a carbon neutrality target for 2050, the projected emission levels for 2030 are only 0.5 percent lower than 2010 levels, instead of the required reduction of 45 percent (UNFCCC, 2021).

However, in this second round of NDCs, those of the LAC countries show

To facilitate the transformation of the sector in the face of climate change, it is necessary to increase the access of the agricultural sector to climate and environmental financing and, therefore, it is key that it be one of the national priorities stipulated in the NDCs.

GHG emissions from the agricultural sector in Latin America represent **45 %** of total emissions (Crumpler *et al.* 2020a), while in the Caribbean they represent **17 %**.

190 countries submitted first versions of their NDCs and **90 %** of them included agriculture (Richards *et al.* 2015); this pattern also occurred with LAC countries, as almost all included the agricultural sector as a priority in their NDCs (Witkowski *et al.* 2016; Crumpler *et al.* 2020b; Crumpler *et al.* 2020a; Witkowski and Medina, 2016).

To limit the increase in global temperature to 1.5 °C, science indicates that it is necessary to reduce emissions levels by **45 %** from 2010 to 2030, equivalent to an annual reduction of **7.6 %** for the next decade (UNEP, 2019), a difficult task, as emissions have been increasing **1.5 %** per year for the last 10 years (UNFCCC, 2021).

Multiple countries, including Colombia, Panama, Ecuador, Paraguay, Mexico, El Salvador and Costa Rica, among others, are promoting Nationally Appropriate Mitigation Actions (NAMA) in the sector in various areas.

It has been estimated that a low-carbon recovery could reduce projected emissions by 2030 by **25 %** (UNEP, 2020a), a significant contribution to the mitigation that science indicates is required.

Global agricultural productivity is **21 %** lower than it could have been without climate change. This is equivalent to losing about seven years of annual agricultural productivity increases since the 1960s (Ortiz-Bobea *et al*. 2021).

The FSS, which meets in September 2021, will raise global awareness about food systems and the need to transform the way we think about food production and consumption in order to achieve the 17 SDGs, including the goal focused on responding to climate change.

significant progress. Several countries stipulated that they will develop adaptation plans to guide the sector or that they will integrate climate change into existing planning instruments. At the same time, there has been an increase in the quantitative goals for the sector, both GHG and non-GHG. For example, Mexico has the goal of reducing emissions from the sector by 8 percent by 2030 (Government of Mexico, 2020), and one of the five adaptation axes is aimed at generating resilient production systems and food security. The circular economy and nature-based solutions were also included in several of the updated versions, and there are several countries that included goals in the chain beyond production. These advances are encouraging for the sector; however, there are still significant challenges and barriers that prevent climate action in the sector at the necessary pace and scale.

To take advantage of the opportunity that NDCs present to guide and advance towards more sustainable, resilient and low-carbon AFSs in LAC, the following measures are proposed:

Fostering a green recovery aligned with the NDCs: The COVID-19 pandemic has shown the world the importance of having resilient and sustainable AFSs. Every year that passes without adequate action increases the level of climatic risks for the sector, so it is urgent to invest in a green recovery to reach both economic and environmental goals. This is the only way to ensure that AFSs become more productive and profitable, economically and environmentally resilient, inclusive and equitable.

Increase the targets of the agricultural sector in the NDCs: Sending a clear signal to the international community can help channel more technical and financial resources to the sector. There are several ways to do this, including broadening the scope or changing the conditionality of goals, adding specific policies and actions, increasing transparency, moving further with implementation, increasing the participation of actors in the sector, and strengthening monitoring, reporting and verification of emission reductions (Day *et al*. 2017; Ross *et al*. 2019). To achieve this, the first step is to ensure that national institutions have greater awareness and knowledge about the importance of the sector to achieve climate change goals, as well as about the possible synergies and trade-offs between different mitigation measures and food security.

Promote potential synergies between adaptation and mitigation actions in the sector: There are many ways to increase the resilience of the sector and, simultaneously, reduce emissions (Harvey *et al*. 2014), improving soil management (see 3.3.4) and soil fertility, increasing energy efficiency in the sector, reducing deforestation, restoring land, and reducing food losses and waste, among others (Ross *et al*. 2019). In many of the region's small island developing states, where increased climate resilience, especially in the face of hydro-meteorological disaster risks, tends to take priority, the identification of these synergies can help to ensure that the adaptive measures taken in the sector also contribute to reducing emissions.

Adopt an AFSs approach: Many of the climate response actions in the sector are focused on primary agricultural production (Day, *et al*. 2017; Witkowski and Medina, 2016). However, it is necessary to think more about the entire value chain to ensure food security under a changing climate, and for the system to reduce the intensity of its emissions (Wollenberg *et al*. 2016; Loboguerrero *et al*. 2020). That should include efforts to reduce food waste and loss, which globally is close to 30 percent of food produced.

Promote capacity development and greater agricultural innovation to face the changing climate: Given the great socioeconomic and environmental heterogeneity of LAC agroecosystems, contextualized approaches are required to be able to respond effectively to the various climate risks. Investment in innovation and capacity building at the local, national and regional levels, together with greater horizontal cooperation between countries, will help achieve the necessary transformation, which implies constant evolution.

Reduce the economic and financial barriers that hold back the implementation of climate action in the region, given that all countries in LAC, and most in the Caribbean, cite these as a major impediment (Crumpler *et al.* 2020b; Crumpler *et al.* 2020a). This is required to facilitate the scaling up of climate action in the region, since the greater involvement of the private sector is essential to move forward.

Invest in digitalization for better access and to increase the data available for making better-informed decisions: The lack of data and information limits the planning, implementation and monitoring of climate action in the sector (Day *et al.* 2017). In addition, digital tools are key to collecting data in the field that allow planning, monitoring and evaluation of progress in mitigation and adaptation, as well as the fulfilment of sector commitments in the NDCs [see the special chapter on Digital Agriculture (DA)].

Greater investment in digital agriculture is key to facilitating extension services that help promote best practices adapted to the climate that contribute to minimizing emissions (see special chapter 4).

3.3.4 Healthy soils are the basis for the sustainable transformation of agri-food systems

Investment and good practices of sustainable management, restoration and regeneration of soils generate positive returns for AFSs in the short, medium and long-term, which requires integrated solutions based on updated information, research, investment and implementation of good practices (4i).

Soil is essential for life on earth, as it is intrinsically related to the dynamics of natural ecosystems and human activities. Soil functions contribute to the supply of the products obtained from ecosystems and to the regulation of their processes; in addition, they provide intangible or cultural benefits and are the basis of nutrient and raw material cycles (Alcamo *et al.* 2003). Soil is the natural environment that allows plants to grow and is composed of solid materials (minerals and organic matter), liquids and gases (USDA-NRCS, 2014). Healthy soil has the ability to act as a living entity and promote the productivity and health of plants and animals, support humans, and maintain water and air quality (Doran and Zeiss, 2000; USDA-NRCS, 2021). It has biological, chemical and physical characteristics that allow the storage of micro and macronutrients, facilitate carbon sequestration, recycle materials, filter water and contribute to climate regulation, among other benefits. In essence, soil provides a wealth of ecosystem services and lays the foundation for sustainable production and transformation of AFSs.

Soil is both a source of emissions (mainly due to land use change) and a carbon sink (IPCC 2019). Soil carbon sequestration potential increases as organic matter content increases, which largely depends on factors associated with land management (IICA and OSU 2021). Soil organic matter is the set of heterogeneous carbon-based compounds, formed by the

"Essentially, all life depends on the soil... there can be no life without soil or soil without life; they have evolved together." Charles E. Kellogg, USDA Yearbook of Agriculture, 1938 (Cox, 2016).

The ecosystem services provided by soils contribute particularly to the fulfilment of SDGs 2, 3, 6, 7, 12, 13, 14 and 15, as well as to the transformation towards sustainable AFSs according to action track 1, 3 and 5 of the FSS organized by the United Nations.

Soil organic matter has the potential to store **1.5 billion** tonnes of carbon globally, **three times** more than all terrestrial biomass. After the oceans, the soil is the **second** largest carbon sink in existence and "stores more carbon than all the world's forests combined" (Heinrich Böll Foundation and IASS, 2015).

"The basic principle for the sustainability of the soil is to return the organic carbon and the nutrients that are extracted from it during productive activities" Pedro Sánchez (Sánchez, 2016).

95 % of food and fibres come from the soil, **99.9 %** of fresh water passes through the soil (Channarayappa and Biradar, 2018), and half of the water cycle occurs in the soil.

Healthy soils promote agricultural productivity and, in turn, AFSs that operate under principles of sustainability contribute to maintaining the health of the soils, generating positive present and future agricultural yields. However, AFSs that operate intensively while neglecting the resource end up degrading future productive capacity.

accumulation of materials of animal and plant origin in a continuous state of decomposition (Gardi, *et al*. 2014), which is what turns the soil into a living entity (IICA and CATIE, 2016).

Soil is also a very fragile and finite resource that can be affected by climate variability and human activity. Its functions are affected depending on the handling and the quantity and quality of the inputs it absorbs (organic, inorganic and other inputs). The rate of loss is higher than the rate of soil formation, since it takes 2,000 years to form 10 centimetres of topsoil (Heinrich Böll Foundation and IASS, 2015; Villatoro 2021) and 75 billion tonnes of soil are lost each year worldwide due to anthropic action (Koo *et al*. 2016). Degradation reduces the capacities of the soil to provide ecosystem services of vital importance for agriculture, such as the regulation of the hydrological cycle and climate and nutrient cycles (Zhang *et al*. 2007).

Globally, annual losses due to land degradation[5] and deforestation reached between 1.5 trillion and 3.4 trillion euros in 2008; that is, from 3.3 to 7.5 percent of world GDP (ELD 2015). The annual costs of land degradation due to changes in land use and coverage were USD 231 billion in 2017 or 0.41 percent of global GDP (Nkonya *et al*. 2016). In LAC, more than half of the 576 million hectares of arable land show different levels of degradation (UNEP, 2016; UNCCD, 2014): about 48 percent of the soils in the Caribbean, 50 percent in Mesoamerica and 18 percent in South America are found in areas with high or very high severity of soil degradation. In addition, it is estimated that about 50 percent of agricultural lands in LAC "will face desertification and salinization in some areas by 2050" (IPCC, 2007).

Despite soil degradation, LAC is a privileged region with respect to the natural wealth it possesses. It is estimated to have 23 percent of the world's potentially arable land, 12 percent of the currently cultivated land, and 31 percent of the world's freshwater reserves. However, the agricultural conversion of natural ecosystems reaches 30 percent; that is, more than 600 million ha of agroecosystems (FAO and GTIS, 2015).

As previously mentioned, soils play a key role in moving towards more sustainable, healthy, resilient and equitable AFSs. Transformation requires the application of comprehensive approaches and multi-sector, interdisciplinary, multi-stakeholder and multi-level efforts in which the role of farmers is key to the transformation.

There are multiple opportunities for scaling up strategies and initiatives for sustainable management and restoration of soils, with high economic, environmental and social returns (see Box 3.3). It has been determined that the benefits and investment returns from restoring degraded forests, savannas, and agricultural landscapes in LAC would generate a net present value of USD 23 billion over 50 years, which is equivalent to a net benefit of USD 1,140 / ha (Vergara *et al*. 2016). On the other hand, the implementation of technologies for sustainable land management increases yields and reduces the costs of agricultural production, which could result in profits by 2030 of USD 274 billion for the private sector in LAC (World Bank, 2012) .

The priority actions focused on six themes are presented below:

1. **Land tenure:** Design and strengthening of public policies to address the irregularity of land tenure in rural areas, and thus generate greater incentives for

[5]According to the IPCC (2019), "land degradation refers to the long-term reduction or loss of biological productivity, ecological integrity or human value, due to direct or indirect human-induced processes. Soil degradation refers to a subset of land degradation processes that directly affect the soil"..

investment in healthy soils that provide long-term benefits.

2. **Regulations:** Updating of the laws and regulations on soils, since many of the region's policies have legal loopholes on the subject of soils; therefore, updating national public policies according to the current reality, and based on recent scientific evidence, provides better frameworks for action by researchers, technicians and landowners.

3. **Public-private partnerships** that allow increasing financing and investment for sustainable soil management. Investment in land and business developments can lead to economic and non-economic returns in the short, medium and long-term. Good agricultural practices to promote healthy soils provide returns that are reflected in increases in yield or income, in reduced costs in agricultural inputs such as nutrients and pesticides, and in lower machinery costs.

4. **Digitalization:** Promotion of the use of digital and satellite information for decision-making. Georeferenced satellite information and digital tools facilitate access to data in real time for decision-making. Soil organic carbon maps and digital soil maps make it possible to understand the state of the soil, monitor its conditions and the evolution of degraded or desertified areas. This information allows orienting decision makers who, by crossing these data with climatic and socioeconomic information, can define priority areas or "hot spots" for soil restoration according to their type of degradation, as well as the preparation of comprehensive plans for agriculture regeneration and the promotion of the sequestration of organic carbon from the soil.

5. **R&D**: Collaborative development in research, technology and innovation under *top-down and bottom-up* approaches that facilitate multi-stakeholder participation, focused on farmers, to overcome socio-cultural barriers and implement practices that increase soil quality based on its biological, physical and chemical properties.

6. **Coordination:** Connection between local, national and international levels to maintain healthy soils or promote their restoration for multiple purposes. Not only must the connection between science, politics and development be strengthened, but this connection must also occur in a coordinated manner between global, regional, national and community efforts and initiatives (see Box 3.3).

Current trends predict an increase in soil for agriculture of **400 million** ha globally (by 2050, base year 2000), representing an area twice the size of Mexico. However, the amount of forested and natural land area is expected to decrease by the same amount (Campari, 2021)

Box 3.3:
Initiatives that contribute to sustainable soil management and transformation of AFSs

- **The Living Soils in the Americas (LiSAm)** initiative seeks to adapt and apply methodologies and technologies to sequester soil organic carbon in a diversity of agricultural systems, in accordance with the "One Health" approach, and to provide policy makers and farmers with the tools to achieve the NDC goals in the countries.

- **The 20x20 Initiative** promotes the process of restoring 20 million hectares of degraded lands in LAC countries, through the recovery of the functionality of the land, natural and assisted reforestation, forest conservation, and carbon storage recovery, soil quality, vegetation cover and biodiversity, and the promotion of agroforestry and forestry.

- **The Recarbonization of the World's Soils Programme** (RecSoil) aims to promote collaborative efforts to prevent losses of organic carbon from soils, increase soil productivity, help improve food security and nutrition, and mitigate climate change. through the NDCs of the countries.

- **The 4p1000 Initiative** seeks to improve organic matter content and promote carbon sequestration in soils, through the implementation of agricultural practices adapted to local and environmental, social and economic conditions, through agroecology, agroforestry, conservation agriculture and management of landscapes that are compatible with land tenure rights and responsible investments in AFSs.

- **The Guatemalan Alliance for Soil Management** is a multi-stakeholder platform promoted by 14 institutions that seeks to create synergies for the preservation, good management, conservation and restoration of soils.

Sources: Sánchez (2016), IICA and OSU (2020), FAO (2019b), AGN and Contreras (2020).

3.3.5 Promotion of new forms of sustainable use and industrialization of biomass (bioenergies and biomaterials)

LAC, in addition to being the region with the highest biomass production, has the greatest biological wealth in the world, with the largest number of known terrestrial (24 percent) and marine (18 percent) ecoregions (UN News 2021). As a result, the region has numerous opportunities to take advantage of and add value to its biodiversity in order to promote more profitable and competitive agricultural businesses, create new socioeconomic opportunities in rural territories and support countries in achieving their environmental and nutritional objectives, as well as the decarbonization of the economy.

Depending on the country, the primary agricultural sector contributes between **2 %** and **15 %** of the national GDP and an average of 14 % of the jobs in the region (Morris *et al.* 2020).

Historically, agriculture in LAC has been the engine of internal development and today plays an important role in international markets (see 3.3.2). However, despite its multiple contributions and importance in national economies, agriculture in the region faces great challenges

in terms of increasing efficiency and sustainability, as well as in the integral use of biomass and adding value to products. For example, two key challenges facing the sector are as follows.

Firstly, there is a large amount of residual biomass generated by agriculture in the region, which in most cases is not only unused, but also causes environmental and pollution problems.

Secondly, there is a high level of "primarization" of the productive-commercial structure of agriculture in the region.

The new frontier of science, technology and knowledge allows producers not only to increase the efficiency and sustainability of biomass production (crops, livestock, fisheries and forests), but also to reduce losses and add value through sustainable industrialization (Lokko *et al.* 2018, IACGB 2020). In fact, these technologies and innovations of the bioeconomy make it possible to use residual agricultural biomass, which is abundant in the region, in the generation of products with high added value such as biofertilizers, biomaterials and substances for the chemical industry (Hassan *et al.* 2018).

These new sustainable uses and innovations have led to a process called "biomass cracking", through which it is possible to use primary and residual biomass to produce various co-products that can be used in animal and human nutrition (for example, protein meals, expeller cakes, bagasse, dry/wet distillery grains with soluble substances) or those with the highest added value in the pharmaceutical, alcohol and oleochemical industries, among others. This circular system gives rise to the concept of biorefinery and to an industry classified as "multiproduct" (Baumol *et al.* 1988), in which primary products and co-products make it possible to increase, diversify and complement agricultural business models. The positive impact of biomass cracking on factor productivity and associated costs throughout the chain has been analysed in detail for the cases of sugar and bioethanol in Brazil (Martinelli, 2011) and Argentina (Lachman *et al.* 2020).

In addition to increasing the efficiency of processes, biomass cracking allows for cascading added value, targeting national and international markets with high growth and profitability.

Also, the sustainable use and industrialization of primary and residual biomass would increase economic opportunities for both the agricultural and non-agricultural sectors of the region (which generate 58 percent of the income in rural territories), thereby contributing to the transformation of rural territories (ILO, 2020). Given that it is not economical to transport biomass long distances before processing, the biorefineries – integrated biomass processing facilities – are decentralized and located in places close to raw material producing areas.

LAC has made significant progress in this regard, especially in terms of biofuels, which involves the processing of biomass from cereals, sugars and oilseeds in a sustainable way (called flex crops, as they can be used as animal and human food and to produce bioenergy). Currently, LAC concentrates about 50 percent of the jobs generated worldwide by the liquid biofuels sector, with Brazil leading the way, where this sector employs more than 832,000 people (Torroba, 2020). In addition, thanks to the stability of the demand for raw materials in this industry (especially in multi-year crops), LAC crop producers have increased and could further increase their sales channels, thus expanding the supply of

Residual biomass represents between **70 %** and **80 %** of coffee beans, **66 %** of sugar cane, **50 %** of citrus fruit, **40 %** of pineapple and **20 %** of rice (IICA ,2019).

In LAC, more than **127** million tonnes of food waste are generated annually, which it is estimated could feed 300 million people (Macías *et al.* 2020).

45 % of LAC agri-food exports in 2019 were classified as agricultural primary products and **21 %** as livestock primary products, while only **34 %** of agri-food exports had some level of added value (ITC, 2021).

The global waste potential from forestry, agriculture and organic waste is estimated to be **40** to **170 EJ/year**, with an average estimate of about **100** EJ/year by 2050 (IPCC, 2012).

While exports of basic agricultural products from LAC, such as vegetable oil, sugar and cereals, grew at annual rates below **4.45 %** in the last decade, the bio-based sectors with the highest added value, such as biofuels, bioplastics and biofertilizers, grew **25 %**, **20 %** and **14 %** annually, respectively, in the last five years (Betancur *et al.* 2018).

raw materials involved in the process. When agricultural flex *commodity* prices are unattractive, redirecting crop-derived feedstock to the biofuel industry can be especially beneficial to farmers as it generates more stable demand for feedstock. This demand, and its possible positive impact on prices, can promote improvements in the living conditions of family farmers in the region, of which 60 million depend directly on the sector.

Another contribution of the sustainable transformation of biomass to rural and agricultural development is the supply of affordable and stable electricity through bioenergies (Mungodla *et al.* 2019), which could significantly reduce the cost by decentralizing expensive energy networks and improve environmental performance through a more integral use of residual biomass (Tamburini *et al.* 2020). They are also an alternative to advance the implementation of SDG 7 (affordable and clean energy), helping to increase access to affordable, reliable and modern energy services, especially in rural areas, as well as to increase the proportion of renewable energy in all energy sources.

In terms of the environment, there are two main benefits of the integral valorisation and sustainable industrialization of biomass:

1. The environmental gains associated with the production and consumption of bio-based products that replace fossil-based products, especially bioenergies (and particularly biofuels). Although it depends on the life cycle of the product, in general bio-based products (energy and non-energy) release less GHG emissions compared to fossil fuels (Antar *et al.* 2021).

2. The lower GHG emissions resulting from the reduction in the use of fossil fuels and the use of what was previously considered as waste, which, within the framework of new sciences and technologies, serve as raw materials for the production of bioenergy products and other high value added industries.

In summary, new sciences and technologies (and especially technological convergence) have facilitated the increased use of biomass (both primary and residual), while promoting new forms of industrialization. This not only makes it possible to foster more profitable and competitive agricultural businesses, but also to promote new socioeconomic opportunities in rural territories and support countries in achieving their environmental objectives and the decarbonization of the economy.

To take advantage of these opportunities, and promote new forms of industrialization of primary and residual biomass, it is necessary to advance in at least five areas of action:

1. Promote alliances between international cooperation organizations, the public and private sectors, academia and civil society to **generate evidence and raise awareness about the potential of the bioeconomy** (and particularly the sustainable integral industrialization of biomass) as a model for increasing competitiveness, sustainability and inclusion of agriculture and rural territories.

2. **Strengthen the financial and technical capacities** of public-private institutions for the generation and transfer of knowledge, technologies and innovations, in order to ensure the transition to new forms of production, use and sustainable industrialization of biomass.

3. Promote the **formulation of public policies and market instruments** that encourage the production and consumption of products and services of the bioeconomy, and that also ensure compliance with the best environmental practices in terms of GHG emissions, changes in land use and preservation of biodiversity.

4. Generate the conditions required in rural territories, especially infrastructure, **human capital and technology**, in order to facilitate the investments necessary for the sustainable integral industrialization of biomass, and promote and establish partnerships between the public sector, the private sector and academia that drive the new chains of the bioeconomy.

5. Promote the production processes of bioproducts (especially biofuels) as a strategy to not only promote the use of clean energies and diversify the energy matrix, but also so that their food by-products complement and optimize national AFSs.

3.3.6 "One Health" as an approach to promote intersectoral cooperation

"One Health", as an approach that promotes intersectoral cooperation (public health – animal/environmental health), needs to be strengthened in order to comprehend, intervene and solve complex problems, such as zoonoses and pests that affect food production.

The emergence and re-emergence of diseases in humans, and especially zoonoses (diseases shared between humans and animals), are of great concern (FAO and USAID 2019; Gibbs, 2005; Mcdermott and Grace, 2012; Gebreyes *et al*. 2014). According to Gebreyes *et al*. (2014), in the last 15 years, the planet has faced more than 15 fatal zoonotic or vector-borne diseases with the potential to generate global epidemics, including viral diseases such as Hanta, Ebola, HPAI (highly pathogenic avian influenza) [H5N1 and recently H7N9], *West Nile*, *Rift Valley fever*, norovirus, Severe Acute Respiratory Syndrome [SARS], Marburg, influenza A [H1N1]) and bacteria such as Escherichia coli O157: H7, *Yersinia pestis*, and *Bacillus anthracis*, which cause Hemolytic uremic syndrome, vplague and anthrax, respectively.

The "One Health" approach has existed since Aristotle's time and has been widely recognized for about 100 years. Thus, in response to the concern caused by these diseases, since the end of the 20th century different international conferences and publications have highlighted the need to take an interdisciplinary approach to protect life on the planet.

In 2004, the One World-One Health™ concept was introduced, followed by seminars, joint actions, and statements promoting the approach at the global level (Box 3.4) (Gibbs, 2014).

Zoonoses account for **61 %** of infectious agents in humans and **75 %** of emerging diseases (Gibbs, 2005; Mcdermott and Grace, 2012; Gebreyes *et al*. 2014).

There is an emphasis on the need for coordinated action between human and animal health, and the population-based public health approach proposed by physician Rudolf Virchow (1821-1902) and veterinarian Calvin W. Schwabe (1927-2006) (Lerner, 2013), while incorporating the importance of ecosystem management and protection from an integrated inter-institutional perspective (Rüegg *et al.* 2018).

Box 3.4:
First 10 years of "One Health"

- Pilanesberg resolution (2001).
- 12 Manhattan Principles proposes the One World-One Health™ approach that is established under the leadership of the Wildlife Conservation Society (2004).
- The One Health Initiative Task Force – including the American Veterinary Medical Association and the American Medical Association, among others – launches the One Health Initiative (2006).
- FAO-OIE-WHO, in collaboration with UNICEF-UNSIC and the World Bank, establish the Joint Strategic Framework to respond to emerging and re-emerging diseases (2008).
- The Hanoi Declaration and Concept Note of the FAO-OIE-WHO Tripartite Alliance, with the support and participation of the United Nations, the World Bank and the European Union (2010).
- First "One Health" World Congress (2011) held in Australia.
- Followed by multiple global and regional meetings and declarations (2011-2014)

Source: Own elaboration based on Gibbs (2014).

The World Health Organization (WHO) estimates losses of **USD 8.6 billion** annually due to rabies and indicates that **99 %** of cases are transmitted by canine bites and that 95 % of the cases are concentrated in Asia and Africa (WHO, 2021b).

The "One Health" approach has highlighted the interaction between human health and that of animals (domestic and wild) (Zinsstag *et al.* 2011), and the need for an inclusive human health – animal health and environmental approach at three different levels: individuals, populations and ecosystem (Lerner and Berg, 2015).

In line with this approach, there is evidence of the positive result of coordinated intersectoral work in public health, which began with the strengthening of inter-institutional coordination at the international level to promote and articulate the concepts and approach (see Box 3.4), and which continues to generate outputs such as the Tripartite Alliance for Zoonoses Management strategy (see Box 3.5) (FAO *et al.* 2019) and the memorandum of understanding for the tripartite management of antimicrobial resistance (FAO *et al.* 2018b).

Although there are multiple developments that show the validity and relevance of the approach, as an illustration some selected cases are presented below that show its application in different geographical and technical areas. First, there are a striking number of initiatives related to zoonotic influenza viruses that have promoted coordinated international actions aimed at the development of guidelines, preparedness and response tools, surveillance systems and networks supported by laboratory networks (Offlu), as well as capturing financial resources with the participation of organizations such as the World Bank, and facilitating knowledge and work management in the countries, with the current aim of supporting the containment of the COVID-19 pandemic (WHO, 2021a).

Box 3.5:
"One Health" in the Tripartite Alliance

WORLD ORGANISATION FOR ANIMAL HEALTH

OIE: "Human health and animal health are interdependent and bound to the health of the ecosystems in which they exist.

World Health Organization

WHO: "An approach to designing and implementing programmes, policies, legislation and research in which multiple sectors communicate and work together to achieve better public health outcomes.

Food and Agriculture Organization of the United Nations

FAO: "An integrated approach that recognizes this fundamental relationship and ensures that specialists in multiple sectors work together to tackle health threats to animals, humans, plants and the environment."

Source: FAO *et al.* 2019.

A second case is rabies, which has perhaps been the zoonosis par excellence, perhaps due to its dramatic mortality effect in humans and especially in children. In the Americas, from hundreds of cases annually in the 1980s and 1990s, the situation has improved significantly and there is a goal of zero deaths by 2030. This has been due to the successful coordinated actions of the ministries of health through the implementation of activities such as surveillance, case response, and human immunization through public health systems, as well as animal health interventions based on canine vaccination and community education (Vigilato *et al.* 2013, PAHO 2021).

Another case is foodborne diseases, which also require inter-agency interventions and must be addressed throughout the value chain. A specific example is *Taenia solium*, which is transmitted by pigs. After decades of research, the Cysticercosis Working Group of Peru announced the first proof of concept of a strategy to interrupt the transmission of the disease in 107 villages in the north of the country, where there are more than 80 people who own over 50,000 pigs, which are mostly raised on open fields (Garcia *et al.* 2016). The strategy has good prospects for the elimination of the disease in various parts of the planet. Research, development and scaling-up required coordinated actions between animal health and public health, and carrying out these actions in the future will also require institutional strengthening, the inclusion of the environmental variable, and further developments.

Finally, **the capacity-building action in "One Health" with resources from the European Union** which, based on three consecutive projects, consolidated a network of universities from 11 Latin American countries and five European countries, as well as 12 collaborating institutions, and which in the third project focused on educational

Considering **31** global food hazards (11 agents that cause diarrhea, 7 agents of invasive infection, 10 helminths and 3 chemicals), an average of 600 million clinical cases of disease were calculated, **420,000** deaths in 2010, and **31 million** disability-adjusted life years (DALYs) (WHO, 2015).

The disease *Taenia solium* (transmitted by pigs) caused **28,000** deaths and **2.8 million** DALYs (WHO, 2015).

materials related to "One Health" in the context of the SDGs (De Meneghi *et al.* 2011).

The main focus of the "One Health" approach has been in zoonotic diseases, which are closely related with poverty and inequality and, therefore, with developing countries (WHO, 2006). The scope of the concept has allowed it to spread from zoonoses to other topics, such as general food safety, food security, antimicrobial resistance, and other global health topics (Gibbs, 2014; Sinclair, 2019).

Although in some cases the contribution of the "One Health" approach is evident, it is necessary to strengthen research and the implementation of solutions based on this concept to move from conceptualization and statements to implementation (Lerner and Berg, 2015).

The COVID-19 pandemic has highlighted the disastrous effect on the health of the planet and the economies of emerging and re-emerging diseases with pandemic potential. In this regard, the "One Health" approach has been redesigned and reassessed. This includes possible adjustments in the OIE Codes, the results and conclusions of the OIE Regional Meeting of the Americas (OIE, 2020), its explicit inclusion in the Strategic Plan 2021-2025 of the Permanent Veterinary Committee of the Southern Cone (CVP, 2020) and the prioritization of the issue in the agricultural health area of the General Secretariat of the Andean Community and its explicit role as a way to prevent future pandemics (UNEP and ILRI, 2020).

On the one hand, the implementation of the "One Health" approach has had a direct effect in reducing the occurrence of diseases in animals and humans, but especially in reducing the negative effects that those have on the supply and quality of food, livelihoods and the well-being of rural and urban communities. However, the omission of the use of this approach implies the inefficient use of public resources and negative effects on global health, including environmental sustainability. In this regard, the discussion of "One Health" within the framework of the Millennium Development Goals (Villamil, 2010) and the SDGs represents an opportunity to achieve these goals in an integrated manner, while ensuring a positive impact on livelihoods and global food production systems (Sinclair, 2019) in the Americas (PAHO and WHO, 2016).

3.3.7 Cooperativism as an instrument to facilitate economic and social recovery in LAC

Cooperativism has proven to be a key tool for the inclusion and formalization of family farming in production chains, as well as for the generation of public goods that contribute to territorial and sectoral development. Based on their main principles and attributes – mutual support, solidarity and cooperation – cooperatives have an opportunity to contribute to the development of solid AFSs through their important presence in local markets.

Cooperativism is an associative and organizational modality that emerged at the end of the 19th century in Europe in order to increase the capacity of members for negotiation and scaling-up through cooperation.

SAccording to the International Cooperative Alliance (ICA), a cooperative is defined as "an autonomous association of people who have voluntarily come together to address their common economic, social and cultural needs and aspirations through a democratically controlled and jointly owned company" (ICA, 1995). These cooperatives currently have a presence in a wide range of activities such as production, marketing, financing, transportation, supplies, services, consumption, housing, tourism, work, etc., which have strengthened the inclusion of the inhabitants in economic

activity while promoting sustainability in local, regional and national economies.

The cooperative model is more widespread in agriculture and livestock than in other sectors. It is estimated that agricultural cooperatives have a total 32 % of the market share of this sector (ILO and ICA, 2015).

In 2019, some 108,000 active cooperatives were registered in LAC. Argentina, Brazil and Uruguay stand out among the countries with the highest number of cooperatives (9,782, 6,828 and 3,653, respectively). Of this total, almost 29,000 are in the agricultural sector (26.6 percent) with the relative weight of the cooperative movement in each country ranging between 6 and 27 percent (24 percent in Brazil with 1,613 cooperatives, 6.7 percent in Argentina with 654, 16 percent in in Ecuador with 521 and 27 percent in Peru with 395). Agricultural or rural cooperatives have some 6.6 million members, equivalent to about 11 percent of the members of cooperatives in general. It should be noted that about 73 percent of members are male and only 27 percent are female (Ramírez 2019).

In the Americas, agricultural cooperatives have facilitated the integration of the population into associative processes, promoting their participation in activities that generate income and contribute to the food security of small-scale farmers, fishermen, ranchers, foresters and other producers. In addition, cooperativism helps to improve the skills or qualifications of its members and their living conditions, which in turn promotes the development of communities.

The recent performance of agrarian cooperatives is a reflection of their leadership and impact on the design of public policies, which have contributed to creating a favourable economic and social environment for their operation. These aspects have helped to insert them in value chains and improve their competitive capacity by taking advantage of the benefits offered by cooperatives as collective ventures, such as the ease of access to inputs and services, the promotion of innovation and added value, the generation of economies of scale, the greater capacity of negotiation, the reduction of transaction costs and market risks, and the improvement of transparency.

Globalization, strong competition in markets, the integration of production chains, innovation and technological change have motivated cooperatives to increase their efforts to support the competitiveness of their members. In this context, agricultural cooperatives have overcome challenges through their management capacity, as well as the implementation in many LAC countries of various support initiatives, especially for small and medium-sized producers, which include the transfer of resources, economic assets and incentives to support the execution of business plans. In this way, cooperatives have provided technical assistance, training, access to inputs, services and information, and organizational and financial support, among others, to increase the productive efficiency of members and their insertion in chains and markets.

The cooperatives in the region represent a unique and complex AFSs that has managed to harmoniously and simultaneously combine a series of economic, commercial, social and environmental functions, which are key to respond to the current demands of consumers for food products with attributes of affordability, sustainability, efficiency, health, safety and nutrition (Piñeiro, 2020). The economic and social nature of cooperatives makes them an ideal instrument to help strengthen AFSs, as detailed below:

- On the one hand, cooperativism is the **most widespread associative scheme** in the entire continent, including public policies

In 2014, there were **2.6 million** cooperatives worldwide, with more than **1 billion** members and generating **12 million** jobs (Dave Grace and Associates, 2014).

In Uruguay, agricultural cooperatives produce **90 %** of milk, **34 %** of honey, and 30 % of wheat, with **60 %** of their total production exported to **40 countries** (COOP, 2015).

In Costa Rica, cooperatives employ **20 %** of the economically active population, generate **10 %** of agricultural GDP, and contribute **36 %** of coffee production and **16 %** of sugar cane (INFOCOOP, 2019).

In Ecuador there are more than **5,400** agricultural cooperatives, which produce **60 %** of the country's basic foods (Ramírez, 2014).

High capacity for dialogue and influence in the elaboration of public policies and development strategies related to AFSs.

They facilitate the design of public policies that reach all actors of the AFSs.

Inter-cooperative cooperation is undoubtedly one of the attributes with the greatest potential that cooperatives offer to AFSs in the hemisphere.

Cooperativism is a strategic partner of private companies through coordination in the organization and development of local, national and global value chains.

Internationalization, managed under collaborative relationships, also presents the potential for strengthening AFSs, since it promotes exchange between cooperatives, the development of regional services and the dissemination of technologies and good practices.

with regulation and stimulus mechanisms, as well as a strong institutional framework in all our countries, making it an interlocutor recognized by both the public and private sectors.

- In addition, cooperatives are **present in the various aspects of** AFSs, from the provision of inputs to production, transformation, supply, consumption and waste management, and they also include heterogeneous productive actors at various scales: small, medium and large, which strengthens their capacity for the development of integrated strategies, collective action and advocacy for beneficiaries.

- In the same way, they also operate as **promoters of efficiency in** AFSs, since they facilitate coordination between actors of the productive systems, including farmers, consumers and suppliers of inputs and services. This coordination potential can be expanded through inter-cooperative cooperation, linking and taking advantage of the experiences and capacities of the thousands of existing cooperatives in the hemisphere.

- Another way to support the AFSs is to take advantage of their potential to contribute to the development of rural territories, where in recent years they have **acted as a counterweight** to some dynamics that affect them, such as concentration and management of resources, migration and loss of biodiversity, among others. Cooperatives, as **agents of the social economy**, have the capacity to promote collective enterprises that distribute their benefits equitably and thus contribute to the generation of income, non-migration in rural areas, the sustainability of their resources and the strengthening of the AFSs.

- It is important to highlight the **relationship of cooperatives with the public and private sectors**. Cooperativism has been, and must continue to be, a strategic partner for these sectors in the supply of food and the sustainable transformation of AFSs, since it complements the role of the State by offering public and semi-public goods such as water, energy and education, among others, that benefit producers, consumers and rural inhabitants in general, while also promoting the sustainable development of the territories and local communities.

- Finally, an aspect that has increased in recent years is the internationalization of cooperatives, that is cooperatives that expand the scope of their operations beyond their borders.

Cooperatives have an important potential to contribute to the inclusion of agricultural producers in value chains and the strengthening of AFSs. However, this potential will only be realized to the degree that public policies and strategies are promoted that contribute to improving the competitive capacity of cooperatives in a sustainable way, which requires coordinated actions at different levels.

At the first level, cooperatives must continue to facilitate the availability of productive resources for their different business units, such as land, inputs, investment capital, sustainable technologies and technical assistance. They must also continue to implement marketing strategies and sustainable market linkages. Their members, for their part, must improve the efficiency of their managerial and productive processes, which means they must remain open to innovation and the adoption of new technologies.

At a second level, related to the linkage of cooperatives with rural territories, it is necessary to promote a closer relationship

with other private or public, cooperative and non-cooperative enterprises in their territories in order, on the one hand, to strengthen their economies of scale and strengthen productive associations with a territorial base that add value to the production of the territory. In addition, these relationships should reinforce their capacity to influence value chains, integrating efforts to manage the provision of public goods that facilitate agricultural production and marketing, connectivity of the territory and the infrastructure necessary to improve the efficiency of production and commercial processes.

A third level is related to the linking of cooperatives with those who formulate public policies that stimulate or limit their performance, which requires establishing alliances that allow them to strengthen their capacities for dialogue and political advocacy.

Similarly, improving the competitiveness and environmental sustainability of cooperatives requires social inclusion policies, which together ensure equitable and sustainable AFSs, which should be the foundation for creating opportunities, revaluing cooperativism, promoting territorial roots and promoting the inclusion of young people and women in rural areas.

Finally, although an emphasis has been placed on cooperatives, given that this is the associative sector with the greatest capacities in the continent, the importance of other organizational forms of the social economy must also be recognized, as well as the need to coordinate efforts to channel their potential towards the insertion of producers in the productive chains and the strengthening of the AFSs.

Cooperativism can make territorial identity a differentiating element in markets.

It is necessary to address challenges related to the transformation processes of the cooperatives' social base, such as the decrease in the number of producers and the problems of generational change they face.

3.4 INSTITUTIONALITY AND A NEW POLICY AGENDA FOR THE RECOVERY OF REGIONAL AGRICULTURE IN THE POST-PANDEMIC PERIOD

It is imperative to advance in the renewal of the institutional framework and its instruments, as well as in the development of a new mode of governance that facilitates coordination between all actors and social sectors to strengthen the AFSs by making them more productive and profitable, economically and environmentally resilient and equitable, while moving towards sustainable rural development.

As previously mentioned, since before the pandemic the rural population has faced significant lags and gaps in their development indicators. In 2017, 1 in 2 rural inhabitants in the region faced a situation of monetary poverty and 1 in 5 of extreme poverty (ECLAC *et al.* 2019). These rates double and triple, respectively, the same indicators in urban areas. These social differences are not static, but tend to reproduce and be transmitted from one generation to another, as a result of the interaction of the multiple social, economic and territorial inequalities present in rural areas. This is the manifestation of the territorial traps of poverty, inequality and low social mobility (Bebbington *et al.* 2016).

Ending poverty is not on the horizon for a large part of the rural population (Trivelli and Berdegué, 2019) and achieving it by 2030 will be difficult for most countries in the region.

In 2019, malnutrition levels reached **6.7 %** in Latin America and **16.6 %** in the Caribbean, while the world average was **8.9 %.**

Poverty in rural areas is not only the result of lower levels of economic growth, but also of the prevalence of high levels of multidimensional inequality. In other words, poverty must be analysed alongside other dimensions, such as nutrition. The prevalence of undernutrition has increased in the region in the last five years, probably due to stagnant economic growth.

In addition, it should not be forgotten that poor diet is associated with obesity and overweight, diseases that affect almost half of the regional population (FAO *et al.* 2020). Economic conditions, structural imbalances (income, assets and resources) and the lack of social protection policies are the main causes of hunger and malnutrition in the region, which also interact with disasters and crises that make it more difficult to get out of this vicious circle (FAO *et al.* 2020). This situation can be illustrated in the clear territorial inequality in LAC. While the rate of child overweight in highly lagging territories is 13.1 percent, in non-lagging territories it is half, or 6.6 percent (FAO *et al.* 2020).

The COVID-19 pandemic confirms the need for the recovery from the crisis to be based on the principle of "building back better".

AFSs are very important for some LAC economies, both in terms of GDP and employment. Many of the jobs generated are from the work of small-scale producers, since more than half of the region's food production comes from small farms. Agriculture is very diverse in the countries, as there is enormous heterogeneity in terms of scale, sophistication and contribution to the national economy (Trivelli and Berdegué, 2019). Therefore, given the heterogeneity of rural areas and agriculture, where territories lag behind in multiple dimensions of development are found alongside other territories that generate billions of dollars in food exports that reach the entire planet, differentiated development strategies and public policies are needed that consider this wide range of characteristics in rural areas and the agricultural sector.

As proposed before the pandemic, AFSs require a transformation aligned with the SDGs (Trivelli and Berdegué, 2019).

Prior to the health crisis, the AFSs were already facing an accelerated transformation. The drivers of food transformation prior to the COVID-19 pandemic (climate change and technological changes, as well as growing food demand and changing diets) remain important (see section 3.1). However, the pandemic has forced countries to consider strengthening resilience and social inclusion. COVID-19 has made it clear that stronger states and public agri-food and rural institutions with greater and better capacities are required. A change of course is needed because the strategic, political and institutional structure designed in the 1980s is out-dated and leaving it unchanged is to address the next crises with the same vulnerabilities (ECLAC, 2021e; ECLAC and FAO, 2020). This crisis has revealed many weaknesses in our countries, from the economic and fiscal aspects to the dependence on natural resources, and the need to improve capacities and resilience. That is why it has been pointed out that, in order to build back better, it is necessary to transform the LAC development model (UNEP, 2020b; ECLAC, 2020b). Transformation refers to the adjustments that are needed in AFSs to strengthen resilience to future risks (Torero, 2020).

Despite the effects of the pandemic, LAC is on the way to becoming the largest food-producing region in the world, which is why the agri-food sector appears to be more resilient than the rest of the economic sectors (see section 2.1), which have been strongly affected by the pandemic. However, current agricultural production processes are not sustainable: they are responsible for 46 percent of GHG in the region and are critical agents in the loss of biodiversity (FAO and ECLAC, 2020c). To improve the resilience of AFSs, it is necessary to correct the multiple social, economic and territorial inequalities present in rural areas (see structural gaps in section 3.2), and establish a more sustainable relationship between human beings and nature (see

"One Health" in 3.3.6) (United Nations, 2020a; ECLAC, 2020b; FAO, 2020). The care and conservation of LAC's natural resources will guarantee future production and thus meet the challenge of feeding more and more people.

The climate and environmental crisis affects all human activities, but especially fishing and agriculture, which are highly vulnerable to climate change (see section 3.3.3, Morris *et al.* 2020 and UNEP, 2020b). For this reason, it has been affirmed that it is necessary to generate strategies that allow achieving the objective of moving towards more resilient, sustainable and inclusive AFSs.

The development of LAC requires prosperous and inclusive rural territories. The region plays a key role since it produces food for more than 800 million people, and 14 percent of the world's crops are grown there. In addition, it is home to a large part of the global biodiversity, fresh water and natural forests of the planet. Half of the region's energy comes from rural territories, which also provide ecosystem services that cities depend on.

Today, there are very dynamic rural areas in the region, which generate quality jobs and participate in versatile markets, but there are also others where poverty, hunger and exclusion predominate, with severe deficits in infrastructure and services, low coverage of social protection programmes and situations of insecurity, violence and illegal economic activities.

The transformation of AFSs, in order to provide healthy diets for all and meet the dietary needs of a growing population with new consumption habits, while ensuring the health of people and the planet, represents an opportunity for agriculture, fishing and forestry to move towards new forms of sustainable production. This requires incorporating and using the benefits of technological innovation and digitalization (see special chapter 4) to develop sustainable agriculture, while also promoting processes of intersectoral and inter-institutional coordination, both in terms of public policies and programmes aimed at agricultural and rural development at the vertical and horizontal levels, as well as the generation of alliances with civil society and private actors.

Increasing and improving coordination is a challenge that is consistent with the proposals in the 2030 Agenda and its SDGs. The interrelationships of AFSs with health, social inclusion and sustainability pose institutional challenges and demand a new generation of multisectoral policies.

To develop the full potential of agriculture in the post-pandemic recovery of AFSs (more productive and profitable, economically and environmentally resilient and equitable) and of sustainable rural development, a renewed institutional framework and a new policy agenda will be necessary to meet these challenges.

At the same time, it is necessary to strengthen alliances and collaborative work with the private sector, civil society, and the scientific and academic sectors (ECLAC and FAO, 2020) and develop new sources of financing, such as: parafiscal taxes, payment for environmental services (PES), tax discounts or a new corporate social responsibility (CSR) with collective strategies (among other essential aspects in the development of new financing strategies, as outlined in section 2.4) to finance the necessary actions in the post-pandemic period (FAO and ECLAC, 2020c).

This renewed institutional framework, with instruments that promote a new mode of governance, requires re-evaluating institutional arrangements to allow a more orderly and environmentally friendly use of agricultural land (see 3.3.4). In this regard, land use planning is essential to develop an institutional framework that facilitates the harmonious coexistence of agriculture and environmental sustainability. This

Food demand is expected to grow **22.5 %** by 2050 (Morris *et al.* 2020).

More than **20 %** of LAC's exports and **20 %** of total employment is generated in rural areas.

The pandemic has highlighted the need to expand social protection in rural areas, linking it with policies and programmes for productive inclusion.

A renewed institutional framework will be necessary to achieve a truly innovative rural sector, with state-of-the-art science and digital technology, connected to urban centres and prepared to face the challenges of the 21st century.

While facing the challenge of achieving a rapid recovery may perpetuate unsustainable practices, it is important to understand this process as an opportunity to change direction and ensure that recovery leads to better resilience and stability.

highlights the importance of promoting the renewal of the institutional framework for agricultural and rural development through an integrated perspective in order to understand and promote rural development. This is a pre-pandemic challenge that is still pending. A good example of progress in this direction is the institutional transformation promoted by Colombia (see Box 3.6).

Box 3.6:
Main characteristics of the Colombian agricultural and rural development institutionality

The current map of Colombian institutionality is an attempt to move forward on the implementation of territorial development and a comprehensive rural development.

The Ministry of Agriculture and Rural Development (MinAgricultura) relies on a secondary structure for the operationalization of policies, for which it has created three large agencies:

- **Agencia de Desarrollo Rural (ADR)**, is the entity in charge of managing, promoting and financing agricultural and rural development for the transformation of the countryside and moving forward with programs with regional impact. The ADR offers the services that the agricultural community needs to make the land productive and improve the living conditions of rural people.
- **Agencia Nacional de Tierras**, will guarantee the access to land for farmers who do not have it or have very little and which is insufficient for their livelihood. For those who do own land but it is not legalized, the Agency will help them formalize their property. And for those who own land legally, the Agency will ensure that it is used appropriately in terms of fulfilling the social function of the land and following an environmentally responsible exploitation.
- **Agencia de Renovación del Territorio**, is a temporary institution, since it has a 20–year life span, that seeks to generate territorial development in 170 Colombian municipalities prioritized as those most affected by the conflict, and in which the compliance with the peace agreements will be materialized. It is an agency in charge of articulating cross-sectional and intra-sectoral processes that guarantee comprehensive interventions that contribute to closing rural-urban gaps and transforming prioritized territories, through the structuring and execution of projects, the implementation of development alternatives and the strengthening of institutional and community capacities in a sustainable way within the framework of the implementation of development programs with a territorial approach (PDET) and the voluntary replacement of illicit crops.

Source: Own elaboration

In the process of redesigning, the MinAgricultura of Colombia cedes its operational capability and keeps a guiding role regarding policies and priorities.

In the following sections, the challenge of institutional renewal is analysed from the perspectives of various sectors and actors involved.

3.4.1 Institutional framework and supranational policies

It is necessary to strengthen the institutional framework and supranational policies to promote collective and coordinated strategies in order to face the multidimensional challenges of the pandemic, as well as to strengthen trade integration in the region and globally.

Inequalities between countries and between social groups that increased the fragility of the world system need to be addressed. In this regard, the only sustainable solution to the socioeconomic problems generated by the COVID-19 pandemic will be the coordinated containment of the virus. The scale, speed and scope of its spread requires greater coordination of multilateral policies. At the sub-regional level, the different groups of countries have responded immediately to food transport problems, and have committed to monitoring the evolution of food security (FAO and ECLAC, 2020d). These actions are important from a regional perspective, since they show the understanding of the need for collective and coordinated responses.

There are several supranational bodies that have recently strengthened their efforts in this regard and have made significant progress. One of these entities is the CAN, which, supported by FAO and IICA, has developed a regional policy that addresses issues such as tax, health and cross-border shortages.

In addition, the Community of Latin American and Caribbean States (CELAC) developed its FNS CELAC Plan in 2013-2014. More recently, it has made progress in using this supranational space to present the region's proposals to powers such as China. In this regard, Mexico, under his Pro-Tempore presidency, has played a central role by establishing the CELAC-CHINA forum of agriculture ministers.

Another of the regional supranational institutions is the Central American Integration System (SICA), which has advanced in the post-pandemic recovery plans of the agricultural sector and in promoting agreements for contingency management, which were developed in response to the health crisis, unlike the Regional Integral Social Policy (PSIR), which is a longer-term mechanism (see Box 3.7).

The COVID-19 pandemic has the potential to reshape the geopolitics of globalization; it is also an opportunity to highlight the benefits of multilateral measures and initiate actions necessary to achieve a sustainable and inclusive development model (ECLAC, 2020a).

Box 3.7: SICA's integral regional social policy, 2020-2040

The approval of the PSIR by the Council for Social Integration is a historic milestone for the region of the Central American Integration System (SICA). First, because it is the result of a broad and participatory process that involved hundreds of social, state and private actors to identify regional priorities on social policy issues. Second, it was approved in a context marked by the impacts of the COVID-19 pandemic and the trail of destruction left by hurricanes Eta and Iota in Central America.

The PSIR represents an opportunity to highlight the importance of social protection and socio-productive inclusion mechanisms based on innovative

practices, which facilitate action and reach more people, with a more efficient use of resources. It is key to focus efforts on the most vulnerable areas, promoting participatory management and planning mechanisms that optimize the design and implementation of intersectoral public policies, while in turn highlighting the importance of regional integration spaces to strengthen horizontal cooperation efforts between countries.

In the first phases of its implementation, it will serve the population most affected by the COVID-19 pandemic, including those that suffer from food insecurity and hunger and those that are in a situation of multidimensional poverty and in a state of high social, economic and environmental vulnerability. The PSIR-SICA 2020-2040 will pay particular attention to children, adolescents, women, people with disabilities, the elderly, migrants, indigenous peoples and Afro-descendants, refugees, persons deprived of their liberty and their families.

From the point of view of the institutional framework of SICA, the PSIR-SICA 2020-2040 complements and strengthens the actions, programmes and regional social projects currently underway, but without losing sight of its medium and long-term strategic vision or integrated approach.

Source: Own elaboration

The PSIR-SICA 2020-2040 strengthens the 2030 Agenda, which is at serious risk of failing to meet its goals due to the negative effects of the COVID-19 pandemic, and seeks to contribute to the effective implementation of the Regional Intersectoral Agenda on Social Protection and Productive Inclusion with Equity (ARIPSIP) 2018-2030, the Regional Policy for Gender Equality and Equity (PRIEG) and other regional initiatives, especially those directly and indirectly linked to the strategic areas of the PSIR.

3.4.2 International cooperation and financing organizations

International cooperation and financing organizations face the challenge of coordinating agendas and policies with governments, the private sector and civil society at the international and territorial level, in order to facilitate their implementation and effectiveness, especially in the context of tighter fiscal conditions.

The challenges imposed by the new context require a serious commitment from the international community to work together, since resources are limited and coordination between all the actors is required.

Both international cooperation and multilateral organizations should design new technical and financial instruments to support countries facing fiscal pressure and constraints, as discussed in section 2.4. In this regard, the role of international cooperation to stabilize national systems is key, either by managing resources, generating processes that allow stability in political cycles, facilitating medium and long-term programmes, as well as promoting synergies between various actors. In addition, organizations should consider providing low-interest loans and offering debt relief and deferrals to increase fiscal space. Developed and developing countries have different means of dealing with this unprecedented crisis, which could increase international inequalities (ECLAC, 2020a).

International cooperation plays a central role at different levels of action (see Box 3.8). It contributes to the development of national and international political agendas to advance in sustainable agricultural and rural development. In addition, it requires connecting with a diversity of actors in specific territories that provide advice based on their experience in the implementation of their development strategies, programmes or projects. These strategies require joining forces with governments and academia, civil society and the private sector, as well as a constant search for innovation and scientific excellence.

In this scenario, it is important to provide a more multisectoral perspective and attribute a relevant role to multilateral organizations in the monitoring of agricultural policies around the world. In this regard, it is essential to take into account the experiences of each country or territory in relation to the experiences of other countries. That is, cooperation agencies can play a role as facilitators of solutions that can be implemented in different contexts, while also promoting encounters between people, actors, South-South cooperation entities and communities of practice, as well as serving as a laboratory for policy formulation.

Today, international cooperation is taking place in a new context with more capacities based in the territories, where there are more options for establishing research centres and think tanks, among others. However, the context of fiscal constraint requires higher levels of creativity and innovation not only in how to face productive, technological, social and environmental challenges, but also in how to mobilize financial and non-financial resources.

The need to respond quickly to the crisis caused by the COVID-19 pandemic has created strong fiscal pressure in countries of the region (see section 2.4). Expenditures have risen while tax revenues have fallen. By the middle of 2020, governments had already announced fiscal efforts equal to 4.1 percent of GDP in 16 LAC countries (see 2.1) and by the end of the year, the fiscal gap had only increased. Multilateral financing is an important source of resources for the most vulnerable countries in the region. In El Salvador and Honduras, multilateral financing amounted to 3.7 percent of GDP as of May 20, 2020 (ECLAC, 2020d).

The role that multilateral entities can play is very important, since, together with multilateral banks, support agencies and programmes, they act as regional benchmarks. This pandemic has also put global value chains into question, meaning that multilateral organizations should be vigilant to seize and address opportunities for their development at the regional and sub-regional levels.

During the pandemic, the rural sector of LAC has responded to the challenge of sustaining food production to meet demand (see section 2.1). This effort has been based on the capacity of rural producers to adapt to the new market conditions imposed by the different health authorities in the countries of the region. However, different structural conditions are needed for producers to maintain their capacity and flexibility to adapt to new conditions in the long-term. The pandemic has generated very strong changes in the awareness of consumers (see section 2.2) regarding the health and safety of food, which means that markets will become increasingly demanding on these issues. Therefore, food producers and the rural sector in general will need more access to quality infrastructure and sanitary conditions that meet the highest safety and quality standards at all times.

In the post-pandemic context, countries have been left with very

It is estimated that, by the end of 2020, the region will have the largest fiscal deficit in the last 70 years (see chapter 2, context).

So far in 2020, 25 countries in the region have accessed emergency funds from international financial institutions, reaching a total USD **22.59 billion** (ECLAC, 2020b).

Financial institutions are required to identify and finance investments in LAC countries in institutions and physical infrastructure aimed at generating public goods aligned with the new challenges and with a transformation-based recovery aimed at strengthening markets (see 3.3.2).

The function of guiding, helping to identify and making visible the needs and opportunities of agriculture and the rural sector for the development of LAC countries appears to be an opportunity and a challenge for development banks.

weak finances (see section 2.1 and World Bank, 2021a). Additionally, the pandemic has greatly diminished the sanitary conditions of countries and generated a very evident delay in the educational system. Therefore, the demands of countries for development assistance from financial institutions will be very much aimed at recovering their health systems and strengthening educational systems. Investment in productive infrastructure geared towards food production is likely to be halted. Development finance institutions should make their own efforts to demonstrate to LAC countries the high social return on investments in rural sectors and in AFSs in general.

In this regard, creating integral development solutions, tailored to the needs of countries and territories, implies integrating public policies aimed at overcoming poverty based on the digital technology revolution, which will enable new ways of organizing the work of farmers, governments and research, development and innovation centres.

A good recommendation based on a consensus between different institutions is very well received and useful for countries.

In a supply-driven international cooperation system, it is easier for international institutions to work alone, which becomes inefficient from the perspective of a country receiving multiple recommendations from many different institutions that may not agree.

Box 3.8:
The role of international organizations

1. Support integration processes, creating forums for the exchange of technical ideas as a complement to the work of the integration secretariats. These forums will allow high-level technical discussions aimed at promoting agriculture within these integration processes.
2. Contribute to the discussion of policies to support AFSs and promote long-term, sustainable and economically effective solutions.
3. Cooperate with countries of the Americas at any stage of the policy cycle for AFSs, identifying critical issues of common interest or in which various institutions have the competencies or mandate to collaborate.

If international cooperation were more demand-driven (bottom-up approaches), countries would be more likely to offer or implement incentives for multilateral institutions to coordinate or work together.

On the other hand, institutional coordination is good, but it does not have to happen all the time. In certain circumstances it may be desirable to have different approaches, even competing approaches. Some coordination between financial institutions, such as CAF-Development Bank of Latin America, the Inter-American Development Bank (IDB) and the World Bank, is good, but at the same time it is good to maintain a certain level of diversity to test different possibilities.

Institutions can play a multilateral role in influencing the adoption of good innovation practices in countries, as well as facilitating South-South cooperation through the transfer of knowledge and experiences for the sustainable development of AFSs.

Source: Arias 2017.

3.4.3 Academia and research centres

Academic institutions and research networks are essential to generate knowledge, technological developments and capacities among the actors of the territory to promote more productive, inclusive and resilient AFSs for sustainable rural development.

Facing the challenges of recovery based on productive transformation implies promoting the sustainable management of natural resources by family farmers, indigenous peoples, Afro-descendants and rural women, while promoting new ventures associated with natural and cultural heritage, such as non-timber forest products, environmental services, rural tourism and products with geographical indications. At the same time, it is necessary to develop knowledge and technologies that make it possible to improve productivity and profitability levels throughout the entire production chain of those activities in rural areas that generate important sources of employment.

It is crucial that the generation of knowledge and technological development is focused on specific territories, with powerful science and technology networks in which research centres, regional universities, relevant public actors, private companies, small producer organizations and civil society organizations participate.

This challenge implies promoting active strategies to overcome a series of barriers present in the relationship between academia, research centres and public policies to develop common languages, interests and capacities that facilitate this dialogue, as well as generating processes to promote the participation of various relevant actors. The latter implies promoting new spaces and methods of dialogue to involve more actors in the processes of generation and transfer of knowledge and technologies. At the same time, this new scenario requires greater involvement and investment by private sector companies and social organizations, as well as the participation of mediators that promote the sharing of ideas and technologies. All of this will facilitate moving from projects to potential policies.

As societies face the difficult task of implementing recovery strategies with limited time and resources, they can choose between business as usual or generating transformative change processes. Transformation offers better prospects, but will require ingenuity and research from across the range of disciplines. In this regard, another important aspect is the formation and training of human capital as a key factor to generate development and also to attract investment.

The United Nations (United Nations, 2020) has defined a series of research priorities (see Box 3.9) associated with the five pillars of the Socioeconomic Response and Recovery Framework:

1. health systems and services;
2. social protection and basic services;
3. economic response and recovery programs;
4. macroeconomic policies and multilateral collaboration; and
5. social cohesion and community resilience.

These priorities emphasize the need for research to promote gender equality, involve marginalized populations, guarantee decent work, prevent a

To advance in generating important projects, such as those aimed at strengthening laboratories to test hypotheses and innovations, carry out experiments and evaluate new instruments and processes, it is necessary to build new bridges between science, public policies and territorial development.

As stated in the United Nations report (United Nations, 2020), science represents the best opportunity in the world to build back better from the COVID-19 crisis.

digital divide, address the intersectoral challenges of the "One Health" approach (see 3.3.6), and provide inputs for global governance reforms.

The imagination, curiosity and solidarity of the global research community can lead the way to the better and brighter future envisioned in the SDGs.

The COVID-19 pandemic has highlighted the need for ambitious plans that reinvent and rebuild health, social and economic systems so no one is left behind.

Box 3.9:
Ten key research priorities for a more equitable, resilient and sustainable future

1. How can socioeconomic recovery efforts from the COVID-19 pandemic be intentionally designed to stimulate equity, resilience, sustainability and progress towards achieving the SDGs?

Capital

2. What are the best approaches to actively integrate anti-discrimination policies into emergency recovery responses?
3. What mechanisms of the health system can be used to promote access to sexual and reproductive health services, gender equality and the empowerment of women in society?
4. How can international trade and finance be improved to ensure that all countries are included in the global economy in a fair and sustainable way?

Resilience

5. How can safe access to high-quality education in schools be ensured during emergencies?
6. How can international financial institutions contribute more effectively to financial stability during global emergencies and prevent sovereign debt crises?
7. What are the best strategies to ensure safe workplaces and decent work, particularly for those workers who face the greatest risks?

Sustainability

8. How can stimulus programs promote decent work and support the transition to greener and more sustainable economies?
9. What mechanisms can allow different parts of government to work together on critical "One Health" challenges facing human, animal and environmental health, such as antimicrobial resistance, extreme weather, food insecurity, habitat destruction and water degradation?
10. How can approaches to prevent environmental degradation and preserve natural resources be better integrated into multilateral collaborations in economic areas?

Fuente: United Nations 2020.

In this task, the science of implementation, understood as the study of methods and strategies to promote the incorporation of effective interventions in practices, programmes and policies, can play a very important role; based on the examination of how certain interventions were successful in a certain context, they can be adapted to different circumstances and to other contexts.

In this scenario, governments can play a central role through regulations, taxes and incentives. For example, it is possible to subsidize research and universities aimed at studying digital and non-digital technologies that increase labour productivity and generate greater demand for employment (Acemoglu 2021).

It will be necessary to move towards the implementation of a programme in LAC similar to Ceres2030 (2020) for the formulation of evidence-based policies that lead to the transformation of the lives and incomes of the poorest farmers in the hemisphere, while protecting the environment. It is possible to achieve this by closing the information and data gap, through the generation of evidence that serves to promote innovations in agriculture and AFSs. Evidence is the basis for promoting the most promising interventions, both in terms of their expected results and their costs of implementation. To foster competitive and inclusive innovation in agriculture and AFSs, higher levels and effectiveness of investments are required, as well as adequate incentives and efficient regulations. The generation of evidence should support decision-making that maximizes results and minimizes risks and implementation costs.

Two examples illustrate how evidence can contribute to policymaking. One is the systematic review of scientific literature (Piñeiro *et al.* 2020) to determine which incentives or policy instruments are most effective for the adoption of sustainable agricultural practices and the simultaneous achievement of positive results of environmental sustainability and increased productivity and agricultural profitability, which led the authors to suggest a series of seven guidelines for the design of incentives (see Box 3.10).

The second example is the scientific evidence on the effect of the development of the dairy sector in reducing poverty and hunger, as well as on why the dairy sector contributes to global cooling and not to global warming, despite the latter being the most widely held perception (IICA *et al.* 2021c).

Governments can influence the direction of technological changes to make them more balanced and human-friendly, leading to better social outcomes (Acemoglu, 2021).

Several studies show that the total income attributable to dairy cow ownership has increased between **27 %** and **115 %**; other studies found that better dairy cow management led to substantial increases of between **46 %** and **600 %** in dairy income and in total household income (IICA et al. 2021c).

3.4.4 The role of the State

States play an essential role in the well-being of societies. To fulfil their purpose, they require a new social pact and multisectoral policies in a strategic relationship with civil society and private actors to achieve development with greater equality and sustainability.

The COVID-19 pandemic occurred amid a complex scenario for the region after seven years of low growth, with increasing poverty and growing social tensions. In addition, it deepened structural inequalities with high levels of informality, social vulnerability and low productivity, which exposed critical bottlenecks in health, education and childcare. Also, it highlighted the unjust gender-based division of labour and the social organization of childcare, with the loss of a decade in the labour

Public entities created in the 20th century will not be up to the challenge of the agenda to build back better.

To prevent people from starving, governments will need not only to ensure that food supplies continue, but also that the poor have enough money to buy food (Holmes 2021).

inclusion of women and a negative impact on informal workers and young people that has increased inequality. In this framework, public policies are required to face the pandemic and respond to the emergency with a transformative recovery based on equality and sustainability, which means it is necessary to move towards a welfare State that establishes universal, comprehensive social protection systems and sustainability through a new social pact (ECLAC 2021e).

The bandwagon effect (also known as the drag effect) can help mainstream the adoption of sustainable practices.

Box 3.10:
Seven guidelines for the design of incentives to promote sustainable agriculture

1. **Balancing incentives and outcomes:** When determining how large an incentive needs to be to effectively motivate a shift toward sustainable practices, consider short-term and long-term outcomes, as well as potential risks.
2. **Know your farmers:** Policymakers need to be familiar with the farmers they are trying to influence. A variety of factors, such as education, risk aversion and experience, influence farmers' willingness to be agents of change.
3. **Keep it simple:** Complex and inflexible instruments, such as regulations, are less motivating for farmers and more costly than simpler voluntary approaches.
4. **Provide additional support:** A combination of policy instruments is more effective than a single policy approach. For example, providing technical assistance to farmers can make the adoption of new agricultural practices more accessible and sustainable.
5. **Keep in mind that behavioural preferences are important:** Incentives must be designed and implemented in a way that responds to the characteristics of the target population.
6. **Prepare for a long-term horizon:** Be aware that it may take a long time before there are measurable economic and environmental effects. This means that financial support is often useful to support farmers in the short-term.
7. **Create an enabling environment:** Farmers' ability to implement sustainable agricultural practices depends on infrastructure, structural poverty, markets, and prices, among other factors. This means that policymakers and agricultural institutions should focus on adjusting and implementing policies to reduce barriers in these areas that impede farmers' ability to successfully transition to sustainable practices.

Source: Prepared based on Piñeiro *et al.* 2020.

This need for transformation in the role of the State is also reflected in the urgency of a renewal of public agricultural, food and rural institutions. On the one hand, it has become evident that food security requires good, efficient and resilient markets (see 3.3.2 and 3.3.1), but also States and institutions that provide the public goods needed to recover from the crisis at a lower cost. In this regard, a public institutional structure is needed that provides space for the collaboration and participation of companies and civil society, and that understands that today's great challenges cannot be solved within the borders of countries isolated from others, but rather multilateralism and International cooperation are powerful tools to advance national interests in concert with those of neighbouring countries (ECLAC and FAO, 2020).

To respond to the heterogeneity of rural areas and agriculture, it is necessary to focus health and social protection measures on workers in the informal sector, which is comprised mainly of women, youth, indigenous peoples and migrants (United Nations, 2020a). It is also important to maintain food programmes for children, the elderly and other people in vulnerable situations, promoting the public purchase of healthy and perishable food from small-scale agricultural producers and artisanal fishermen in the region (FAO and ECLAC, 2020d).

It is important to implement actions aimed at improving productive and management skills and capacities, so that production can respond when demand recovers, such as emergency subsidies for micro, small and medium-sized enterprises (MSMEs), especially to cover labour costs. Policies and investments should facilitate equal access to information and communication technology (ICT) tools and platforms (see Chapter 4). For larger companies, financial support could be provided with certain conditions, such as protecting employment, investing in research and development (R&D), making green investments (see section 2.4), and refraining from distributing dividends to shareholders (United Nations, 2020a). This requires promoting non-agricultural rural employment and strengthening the links between urban and rural centres through private investment, infrastructure, and greater ties between the agricultural sector and markets for goods and services.

This logic of action requires the State to advance strongly in intersectoral coordination processes, both between state institutions and with actors from the private sector and civil society within the territories and outside of them, who should be considered strategic actors in discussions about agricultural and rural development.

To move towards this objective and developing a multilevel governance model, it is possible to identify some key challenges in terms of strengthening social capital, policy management capacities and levels of decentralization of decisions. **Regarding the strengthening of social capital**, the State needs to generate mechanisms and instruments that allow dialogue with social organizations and develop capacities that enable them to strengthen capacities to be part of multi-stakeholder governance spaces. **In terms of strengthening policy management capacities** at territorial levels, the generation of integrated approaches based on existing data, information and good practices is needed to allow the collection of data, the availability of information systems and knowledge sharing at the subnational level. At the same time, it is necessary to support the development of the capacity of decision-makers at the national and local level, both in strategic and technical matters, and in

State action for recovery implies generating strategies that respond to the heterogeneity of the agriculture sector and rural areas.

For small-scale agricultural producers and artisanal fishermen in the region, it is urgent to expand social protection systems that are linked with productive programmes that allow them to improve their income.

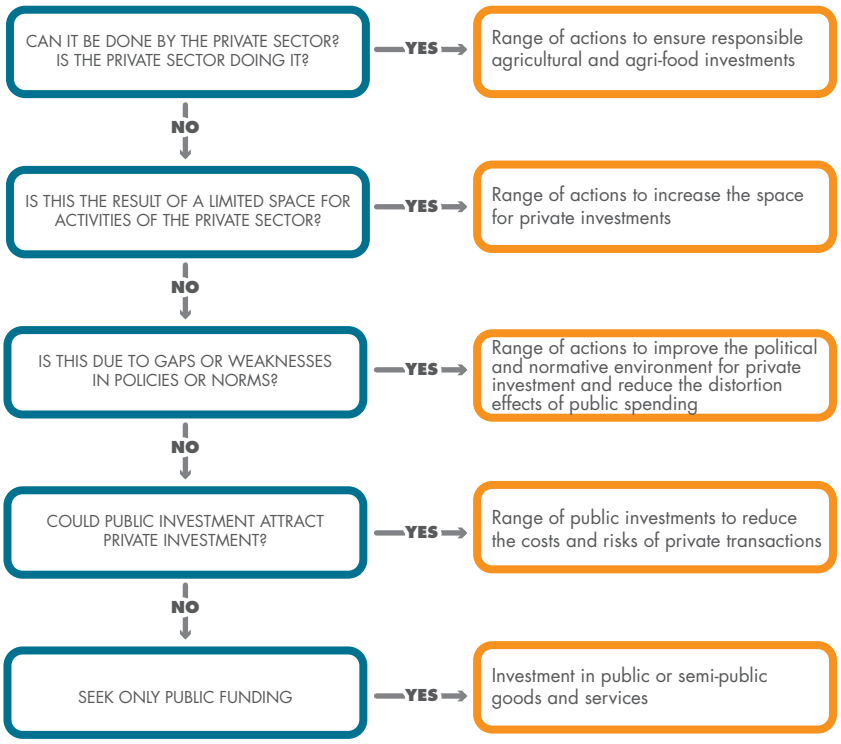
It is essential to expand rural infrastructure with public and private investment packages, as well as Internet, information and telecommunications services, which are essential for the transition towards digital agriculture (see special chapter 4) and towards more innovative rural societies.

terms of their capacities for interaction with the different actors that play a fundamental role in the generation of the goods and services prioritized by public policies. **Finally, it is necessary to strengthen decentralization processes**, as well as to provide access to sufficient resources and facilitate decision-making related to these processes, so that the design of specific policies for the territory can be effectively coordinated with policies at the national level.

As previously stated (see section 2.4), in order to face the challenge of financing and mobilizing resources, it is essential to generate synergies between private and public resources. In this regard, the World Bank promotes the Mobilizing Finance for Development (MFD) approach, through which it seeks to attract private resources to help achieve development objectives by optimizing the use of public resources, with the aim of facilitating private sector investment, creating inclusive links, promoting good governance, and ensuring environmental and social sustainability, among others (Morris *et al.* 2020). The outline in Figure 3.1 shows a structured sequence of questions designed to systematically evaluate public sector interventions (Morris *et al.* 2020).

The central idea underlying the MFD approach is to systematically determine whether sustainable private sector solutions can substitute public spending, as well as to identify the spaces for the public sector to facilitate this process.

Figure 3.1
Cascade approach of the MFD



Source: Morris *et al.* 2020.

Finally, given the complexity and multisectoral nature of public policies and interventions, in order for the State to carry out its task more coherently, it is useful to take into account some basic principles. In 2019, the Council of the Organization for Economic Cooperation and Development (OECD) adopted the Recommendation on Policy Coherence for Sustainable Development, which provides certain guiding principles organized in three pillars:

1. **A strategic vision to implement the 2030 Agenda for Sustainable Development (2030 Agenda) and the SDGs in an integrated and coherent way.** Three principles under this pillar are to build leadership and political commitment; define, implement and communicate a long-term strategic vision; and improve policy integration.

2. **Effective and inclusive governance and institutional mechanisms** to address policy interactions across sectors and align actions across levels of government. Three principles under this pillar are to ensure coordination between government entities, include sub-national levels of government, and involve stakeholders.

3. 3. A responsive and adaptable set of tools to **anticipate, assess and address national, transboundary and long-term policy impacts.**

It is necessary to analyse and evaluate the impact of policies and financing (particularly in developing countries), as well as to strengthen monitoring, reporting and evaluation systems to collect evidence.

3.4.5 Endogenous solutions

Strengthen capacities and provide financial support for local actors to identify innovative solutions to territorial problems.

As has been proposed, the participation of the different actors in the strategies is essential to advance towards the transformation of the AFSs and rural areas.

In this regard, it is necessary to strengthen local organizations, as well as to stimulate them to develop and use all of their available resources and to play an active role in the search for endogenous solutions to their problems or in taking advantage of development opportunities.

Regarding the model of endogenous solutions, particularly with regard to improving the connectivity of the inhabitants of rural sectors (see special chapter 4), it should be noted that connectivity strategies have often not been designed together with those who live in these places and according to their conditions and needs. Regarding this situation, three main causes can be identified: the centralism that prevails in the region at the time of decision-making; the extrapolation of urban solutions to the rural environment; and a perspective that considers connectivity as a technical issue rather than a development topic and a social problem (Ziegler *et al.* 2020).

In a similar vein, the concept of "co-managed platforms" is proposed, which focuses on the need to lower costs and increase the quality of public programmes. Along with taking into account the fiscal restrictions experienced by all countries, it is necessary to increase the relevance of many of these programmes, making them more adapted to reality, as well as promoting their ownership by farmers. Both criteria – relevance and

The demands of the COVID-19 pandemic on the State and, therefore, the fragility of the fiscal situation requires a new balance between the State, companies and civil society based on the generation of new relationships and types of public instruments.

The State plays a key role in strengthening social capital, stimulating participation and promoting the empowerment of local and territorial actors.

ownership – are essential requirements to improve the quality of these programmes (Sotomayor *et al.* 2019, ECLAC *et al.* 2019). All this highlights the need to promote the involvement of the actors of the territories in the policy alternatives promoted by the State.

Although it is important to involve the various territorial actors in development processes, it is also important is to consider the extra-territorial actors linked to territorial dynamics, since they can play a key role in the development of rural territories, both due to their linkages with productive chains and marketing networks, as well as the role they play in the social coalitions that emerge and become dominant in the territories (Berdegué *et al.* 2015, Fernández *et al.* 2019). A good example of the coordination of various actors for territorial development is the actions taken by the associations of municipalities (*mancomunidades*) in Honduras (see Box 3.11).

The mancomunidades are local territorial entities, created under the authority of the municipalities, which are subject to public regulation and are exclusively responsible for programmes, projects and services of priority interest, which allow their members to jointly address problems that cannot be faced individually.

Box 3.11: Mancomunidades in Honduras

The Mancomunidad de Municipios del Centro de la Paz (MAMCEPAZ) is made up of seven municipalities in the department of **La Paz: La Paz, Cane, San Pedro Tutule, Santa María, San José, Chinacla and Marcala**. It has an area of influence of 907 km2 and a population of 130,000.

The main objective of the mancomunidades is to promote sustainable development through a participatory process aimed at solving a series of problems that affect the municipalities and enhance the use of existing resources. Each municipality incorporates financial resources into its annual budgets so that the mancomunidad can operate with the necessary human resources and cover its operating costs.

In the implementation of its actions, the mancomunidad involves public actors, international cooperation organizations, civil society and organized groups, rural savings banks and SMEs, among others.

The mancomunidad has received financing for various projects from international organizations such as the World Bank, the Inter-American Development Bank and the KfW Development Bank of the Federal Republic of Germany, among others, as well as from national public organizations, for an amount of USD 111 332 000.

Source: Own elaboration.

DIGITALIZATION OF AGRICULTURE

DRIVING AND ACCELERATING A POST-PANDEMIC DIGITAL TRANSFORMATION

4.

The digital transformation of agriculture could make a significant contribution to achieving sustainable and inclusive agri-food systems (AFSs), for which it is imperative to agree on public and private promotion agendas.

4.1
DIGITAL AGRICULTURE AS THE BASIS FOR TRANSFORMING AGRI-FOOD SYSTEMS: BENEFITS AND RISKS

Digital transformation is inevitable and brings not only benefits, but also risks (exclusion, conflict).

Agricultural digitalization could make a significant contribution to the positive transformation of AFSs, a requirement for achieving the Sustainable Development Goals (SDGs). Digital agriculture has the potential to contribute to achieving nine SDGs: 2, 6, 8, 9, 11, 12, 14, 15 and 17 (UN Global Compact and Project Breakthrough 2019).

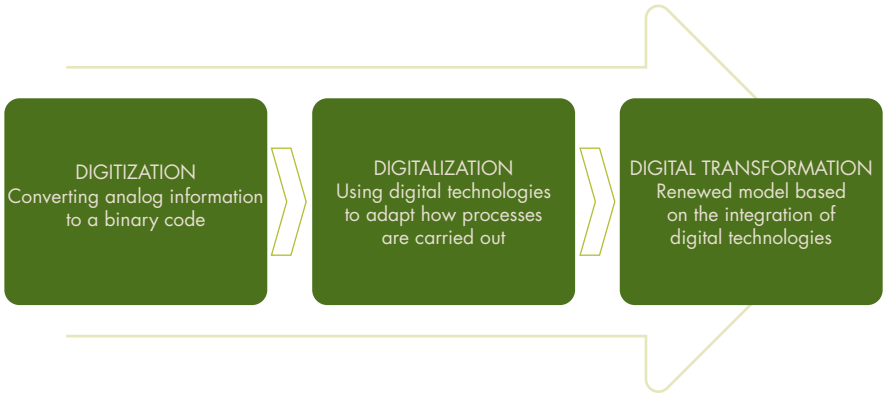
Precision irrigation systems (for example, the spatial-temporal optimization of irrigation based on soil humidity sensors, weather forecasts and mathematical models) produce savings of up to **60 %** in water usage across different production systems.

Digital technologies can be defined as the array of IT-based equipment, tools and systems. They encompass a multiplicity of devices and innovations (sensors, applications and algorithms, actuators, communication networks, etc.) that together offer an endless number of possible solutions and benefits. The benefits of digital technologies include that they enable the efficient generation and processing of large volumes of data, thereby strengthening learning, decision-making and operating processes. Moreover, they maximize the connection between people and devices, enhancing communication and interaction. In recent decades, digital technology development has skyrocketed due to the exponential evolution of computational capacities and IT and electronic development. Consequently, the availability of and access to technologies that are transforming different spheres of human life, including agriculture, are on the rise.

Digital agriculture (DA) is understood as the incorporation of digital technologies into the processes and stages of farming. Smart farming and agriculture 4.0 are often used as synonyms of digital agriculture. According to the classification of the Organization for Economic Cooperation and Development (OECD), digital technologies with possible applications for agriculture include digital platforms, sensors, the Internet of Things (IoT), robots, drones, big data, cloud computing, artificial intelligence and blockchain (OECD 2018). The incorporation of these technologies entails the generation of information (based on data collection and processing) and indicators that allow for the monitoring, analysis, planning and smart control of agricultural production, transformation, distribution and marketing processes. The availability of digital technologies for agriculture has risen significantly in recent years, driving agricultural digitalization.

Incorporating digital technologies into a value chain triggers progressive modifications (Figure 4.1) that have the potential to completely transform the chain (Wollenberg *et al.* 2016). First, digital technologies allow for *digitization*—the coding or digital conversion (to a binary code) of analog information (such as physical journals vs. spreadsheets). Second, *digitalization* implies using digital technologies to adapt (optimize, facilitate, etc.) how a process is carried out (e.g., online bank transactions). Last, *digital transformation* can be defined as the renewal of a value chain's model or strategy (public or private products or services) based on the integration of digital technologies and a focus on the preferences and needs of people and organizations (producers, consumers and governments). Recent examples of digital transformation can be seen in the entertainment, housing and passenger transportation industries. The digital technologies available today for the different processes and stages of farming have the potential to digitally transform the AFSs.

Figue 4.1
Concepts related to digitalization



Source: Prepared by the authors.

Targeted spraying (i.e., herbicide application to weeded areas only using optical sensors, actuators and software) yields savings of up to **80 %** in herbicide use in Argentina's extensive farming (CREA 2021).

4.1.1 Potential benefits of digital technologies

Incorporating digital technologies into AFSs offers substantial potential benefits (see the examples of digital commerce in Box 4.1 and technical assistance and rural extension in Section 4.2). Digital technologies can generate benefits across the economic, environmental, social and governance dimensions of agriculture and rural areas (Rolandi *et al.* 2021). The potential benefits of digital technologies are fundamentally associated with increasing efficiency and reducing information asymmetries and transaction costs (Schroeder *et al.* 2021).

Accordingly, given the multiplicity of points of entry across the AFSs, the incorporation of digital technologies results in increased production and resilience, reduced environmental impacts and negative externalities, increased transparency and improved communication and integration of actors, as well as better living conditions, rural employment, access to food and consumption habits[6]. The benefits of digital technologies are not limited to the processes of production, transformation, marketing, distribution and consumption of agricultural products, however, as they also promise to improve how policies and government agricultural programs are designed and executed (OECD, 2021b).

[6]For a summary of the positive (and negative) impacts of digital technologies, see Porciello *et al.*

Box 4.1:
Potential for E-commerce to transform the AFSs: The case of two Chinese digital platforms

Digital technologies promise to revolutionize how agricultural products are sold, by shortening circuits and generating unprecedented feedback between supply and demand. Digital commerce (E-commerce), in general, and of agricultural products, in particular, are growing rapidly, more so in the wake of the COVID-19 pandemic. Digital platforms that specialize in agricultural products are already in use with a large number of users, producers and transactions. The two paradigmatic cases below, PINDUODUO and ALIBABA, are digital platforms that combine trade, financing and technical support, thereby creating virtuous circles.

- PINDUODUO is China's largest agricultural trading platform. Founded in 2015, it has 788 million users paying for services and 12 million farmers operating as suppliers. The mobile-based platform incorporates an interactive search model, offering an easy-to-use, enjoyable buying experience (Pin model: buy with just four clicks). PINDUODUO interacts with the entire value chain: it works with farmer cooperatives offering online courses to leverage the digital economy (it created the Duo Duo University, which works in alliance with the Agricultural University of China). It also allies with local governments to offer technical assistance (Duo Duo Farm). In the offline system, the wholesaler set the price, but in the digital system, the farmer does. Moreover, it reduces the carbon footprint and produce arrives faster, fresher, safer and cheaper.
- ALIBABA is China's largest digital commerce platform. It consists of a financial entity (Ant Group), ALIBABA University and a tourism agency for rural areas. It allows producers to sell directly using a co-distribution-based logistics network that encompasses associated warehouses and three million couriers (as well as allied institutions). The platform coordinates with government programs, such as the "Development Plan for Digital Agriculture and Rural Areas 2019-2025", promoted by the Ministry of Agriculture and Rural Affairs and by the Office of the Central Cyberspace Affairs Commission.

These experiences provide a better understanding of the role of digitalization in the food systems transformation process. Digitalization gives rise to economies of scale and fulfills an amplifying role: it creates a virtuous circle with a systemic impact. Connecting producers with consumers creates a decentralized food production system—a marketplace with plenty of available information and a new power balance. The value segment that traditionally fell to intermediaries is now distributed among producers, consumers and the digital platform.

In 2020, sales on PINDUODUO totaled **USD 256 trillion**, of which **USD 42 trillion** were food products. In 2020, sales on PINDUODUO totaled **USD 256 trillion**, of which **USD 42 trillion** were food products.

Digitalization improves the producer's price by **30 %** and generates savings of up to **75 %** for consumers.

ALIBABA is associated with the Ministry of Agriculture's low-rate microloan program (approximately **30,000** yuan) that serves **7 billion** small-scale farmers, **80 %** of which are first-time borrowers. The program targets farmers born after 1990.

Digitalization also generates a technology selection process (Arthur 2009) as it impacts not only farm management, i.e., primary production, but also of the entire chain. The complementarity of the innovations (trade, logistics, technical assistance, training, credit, tourism, etc.) generates a second virtuous circle as it streamlines the entire system. Producers adapt to the rules and conditions defined by the platform, which requires the rapid expansion of skills and knowledge through training inside the platform itself (learning by doing). The creation of decentralized systems that favor local production and consumption reduces the environmental impact, becoming a third positive circle.

Both platforms are based on the generation of positive network externalities (Katz y Shapiro 1992), which are created when a consumer buys a product and obtains a plethora of benefits based on the number of other consumers who have bought compatible products. These network externalities arise when consumers want to communicate directly amongst themselves.

Source: IICA *et al.* 2021b.

China's E-commerce experience is viable because it quickly reaches the scale at which the platform becomes profitable, but several questions arise when viewing it from the perspective of Latin America and the Caribbean (LAC): Is it necessary to be that big? At what threshold does it become viable in the region? Are there any operating models that are adaptable to our region's reality and scale?

As previously mentioned, the introduction of digital technologies to agriculture could have **significant social impacts** (Rolandi *et al.* 2021, Klerkx *et al.* 2019). Digital technologies offer a true opportunity to equalize development opportunities by facilitating the support and integration of disadvantaged peoples and businesses due to their location, scale, gender, etc. (such as digital technical assistance). On the other hand, digital technologies offer an opportunity to reconnect young people with rural activities by offering opportunities for development and contributing to making rural life more comfortable; in turn, young people can accelerate the digitalization process (Trendov *et al.* 2019, IICA *et al.* 2021a). Likewise, the advancement of digital agriculture contributes to building capacities that are supplemented with the provision of other services like education, health and financing, thereby expanding the potential positive and inclusive impact.

The potential benefits of digital technologies in the social dimension could quickly become a threat if the availability of and access to technologies and related skills are limited or unequal.

4.1.2 Risks of digital technologies in agriculture

In addition to the substantial potential benefits, the application of digital technologies to agriculture **implies considerable risk**, Firstly, digital technologies could exacerbate the inequalities existing within the rural community and accelerate to an extreme the exclusion of those who are unable to incorporate them. Secondly, digital technologies produce changes in the roles and relationships of stakeholders, leading to shifts in power relations (OECD 2018, Scholz *et al.* 2018) that could create conflict and the exclusion of those who are unable to adapt (for example, the recent conflicts seen in the passenger transportation industry). Thirdly, while digitalization could increase the productivity of the labor force, the automation of operating and cognitive tasks (using robots and artificial intelligence, respectively) could lead to the displacement and exclusion of workers (Acemoğlu 2021). Lastly, there is the risk of violating the rights of ownership and privacy of agricultural agents associated with the traffic and use of technology-generated data. To mitigate these risks, advanced, concrete action must be taken to address the risk factors (such as through access to technologies, capacity-building, legal frameworks, etc.).

According to the IDB-INTAL indicator based on the McKinsey Global Institute methodology, between **40 %** and **60 %** of agricultural employment in the region could be automated (Estevadeordal *et al.* 2018). These percentages vary from one country to another, but the potential for automation is highest in Peru and Mexico.

Generic platforms allow for widespread, albeit segmented, reach and a significant reduction in the costs of services as compared to traditional mechanisms that require a personal presence.

The work of PxD in Africa and Asia is proof that digital agricultural extension can increase the adoption of appropriate agricultural management practices, improve yields by **4 %** on average and improve farmer income. The results suggest that digital extension is highly profitable, with point estimates that indicate a benefit-cost ratio of between **6:1** and **10:1** (Fábregas *et al.* 2019).

Box 4.2:
Technical assistance and rural extension 4.0

Digital technologies promise to strengthen and exponentially streamline the processes of technical assistance and rural extension. The growing availability of generic (Facebook, Instagram, WhatsApp, Telegram, Zoom, etc.) and specialized platforms (such as consulting platforms) for mobile devices has enabled the creation of channels of communication between farmers, extensionists, etc., early warning systems, trainings and more.

As such, digital technologies are an input to improve and supplement the current processes of assistance and extension. While the vast majority of digital innovation is aimed at farmers (see below), a number of developments exist that are dedicated to strengthening rural extension systems. By improving the coordination between multiple actors, digital technologies are able to increase the productivity of extensionists, ensure the quality and management of programs and allow for communication between the different levels and platforms. One example is AgReach by the University of Illinois (for more information, see UOI n.d.).

Mobile phone-based technical assistance for small-scale producers improves their productivity, profitability and sustainability.

Experiences have shown the value of digital technologies in rural extension. One such experience is promoted by Precision Development (PxD), a global non-profit that has pioneered the use of digital technologies in agricultural extension, offering farmers custom agricultural consulting by mobile phone.

The model promoted by PxD uses technology, data science and behavioral economics to provide specific information to farmers in order to improve their productivity, profitability and environmental sustainability. One distinctive feature of the model is that it continually experiments, repeats and gathers evidence on the impact of the interventions to improve its services.

PxD currently operates in nine countries across Africa and Asia. In late 2020, it reached 3.8 million farmers with a range of services that provided custom information on crop optimization, plague management, input use and environmental management. The program grows rapidly as countries find innovative ways to use new technologies to share information with farmers.

In 2021, PxD activated a team in Colombia alongside the Inter-American Institute for Cooperation on Agriculture (IICA) and is in the process of implementing agreements with a number of governments across Latin America.

Source: Prepared by the authors.

4.2
THE INCIPIENT AND IMPENDING DIGITALIZATION OF AGRICULTURE IN LAC

Despite the growing availability of digital technologies, the digitalization of agriculture in LAC is still incipient and unequal. The COVID-19 pandemic accelerated the process and exposed existing gaps.

Agricultural digitalization is inevitable; what is unknown is how dynamic and inclusive it will be. As with other spheres of life, the availability and incorporation of digital technologies in agricultural processes continue to grow, inevitably giving rise to a digital transformation. While the process of agricultural digitalization has been underway for years (with the arrival of the first digital technologies), for a number of reasons it has recently gained speed (such as the growing availability and improvement of technologies; improved access to devices and connectivity, although with significant gaps; advances in the digitalization of sectors related to agriculture; COVID-19, restrictions, etc.). **The path, speed and impact of the process in the future will depend on the actions that are deployed**, in both the public and private spheres in an effort to drive it (see section 4.3 below).

Despite the growing availability of digital technologies and their potential benefits, the digitalization of the agri-food system is still incipient and unequal. Consequently, current use of the multiplicity of digital technologies available to agricultural chains is low in general (even in very competitive countries, chains and segments) and significant heterogeneities exist (Deichmann *et al.* 2016, Loukos and Arathoon 2021, Trendov *et al.* 2019, Sotomayor *et al.* 2021). From a general perspective, the global comparative study conducted by McKinsey Global Institute (MGI) (Gandhi *et al.* 2016) shows over and over again that agriculture is the least digitized industry. Along the same line, the recent study by Sotomayor *et al.* (2021) shows the existence of partial, unequal use between the countries and producer sectors in LAC with small-scale family farmers being the most disadvantaged. Table 4.1 presents some indicators of digital technology use in the rural sector of LAC.

The recent work of Loukos and Arathoon (2021) concludes that the smart farming pilots in LAC have generated promising results, such as an increase of between **50 %** and **80 %** in production and a reduction of between **20 %** and **40 %** in costs, but that they were widespread in only a few cases.

In recent years in Argentina, sales of monitors for harvesting and sowing machines and satellite markers for sprayers have grown consistently. Based on theoretical calculations, the yield of almost the entire extensive farming area could be mapped. However, according to the 2018 National Agricultural Census (INDEC 2021), approximately only **4 %** of production units practice precision agriculture.

Table 4.1
Summary of the status of illustrative indicators of access to and use of digital technologies in the rural sector of LAC

Theme	Indicator	Overall	Illustrative cases/Details		
Infrastructure	Electrical coverage in rural areas	65 to 98 %	Brazil	84.0 %	North: 70.3 % South: 92.2 %
	Families with mobile phones	75 % +	Chile	93.0 %	Smart, 72 % Basic, 21 %
			Colombia	89.0 %	Smart, 56 % Basic, 33 %
			Peru	84.0 %	Smart, 41 % Basic, 42 %
	Rural population with access to a meaningful connectivity	37 %	Honduras	19.6 %	
			Paraguay	29.5 %	
			Brazil	46.9 %	
	Cost of Internet	0 % of countries under recommended threshold	12 % of the income of the first income quintile (20 % of the population with the lowest income)		
			5 % a 25 % of the income of the first income decile (10 % of the population with the lowest income)		
	Rural population access to 4G	17 %	Ecuador	10.8 %	
			Brazil	18.5 %	
			Costa Rica	25.6 %	
Skills	Rural population with specific digital skills	17.1 % or less of individuals have specific skills	14.10 %		Send emails
			8.60 %		Use spreadsheet formulas
			7.70 %		Connect and install new devices
	Internet use in rural areas	26.2 % don't know what it is	Argentina	26.0 %	Don't know how to use it
		37.6 % don't know how to use it	Ecuador	36.0 %	Don't know how to use it
			Peru	52.0 %	Don't know how to use it
Use	Rural population daily internet use	48.6 %	Brazil	73.0 %	
			Paraguay	40.0 %	
			Honduras	5.5 %	
	Rural population smart device use	46.7 %	Costa Rica	62.1 %	
			Peru	51.3 %	
			Ecuador	40.0 %	
	Farmer technology	N/A: Limited or heterogeneous data	Uruguay	25 %	Uses variable sowing in agriculture
			Brazil	79 %	Uses satellite images
				70 %	Uses internet for production tasks
				10 %	Uses electronic machinery
			Argentina	4 %	Practices precision agriculture
			Chile	5 %	Employs practices of precision agriculture

Note: Where information is unavailable (the information is relatively limited or heterogeneous, primarily regarding use), the indicators for different countries selected at random are shown to illustrate the range of situations.

Sources: EMBRAPA *et al.* 2020, Loukos and Arathoon 2021, IICA *et al.* 2021b, Ziegler *et al.* 2020, Embrapa 2020, Iorio and Sanin 2019, INDEC 2021, IBGE n.d., Mehrabi *et al.* 2021, Fábregas *et al.* 2019, After Access 2017, ECLAC 2020e, Berger *et al.* 2019, Sotomayor *et al.* 2021.

4.2.1 Reasons for an incipient, unequal digitalization

There are a number of reasons behind the slow, unequal incorporation of digital technologies into agricultural chains (Shang *et al.* 2021, Loukos and Arathoon 2021, Sotomayor *et al.* 2021). Some of these are related to the very nature of agriculture, which involves a multitude of actors with very diverse characteristics (scales, capacities, cultures, etc.) undergoing dissimilar processes of use. Other than factors specific to the activity, there are a series of factors that act as a barrier to the advancement of agricultural digitalization (Box 4.3). TAll of the factors described are manifested differently across the different territories, chains and producer segments, etc. Embrapa *et al.* (2020) shows the different limitations experienced by Brazilian farmers of different scales. Having a detailed diagnosis of the most relevant factors in each case is essential for designing policies and interventions aimed at accelerating and driving digitalization.

Agriculture encompasses a series of inevitable physical processes naturally anchored to the territory, preventing or limiting full virtualization or automation.

The tug of war between disadvantaged and advantaged stakeholders could act as a barrier to the advancement of inclusive digitalization.

The political and socioeconomic instability prevalent in some countries of LAC limits the prioritization of digitalization in the political agenda.

Box 4.3:
Main barriers to the advancement of digitalization in agriculture and other activities, which assume different forms and importance based on the territory, chain or producer segment.

- **Usability and utility of technology:** While the number of available technologies has increased, many fail to pass the pilot phase and have room to: (a) improve the benefit-cost ratio to be more attractive and convenient for users; (b) adapt to the real needs of users and contexts; (c) adjust operability for ease-of-use and compatibility with other technologies.
- **Availability and affordability of technology:** While the cost of devices and applications tends to fall, their incorporation in agriculture still poses some restrictions (such as producers with very low income and the relatively high cost of technologies). In turn, in some contexts of LAC, the devices or tools necessary for digital agriculture are still not fully available.
- **Available infrastructure:** Digital technologies require the existence of communication networks that guarantee meaningful connectivity, which are still very limited in the rural sector of LAC. While many solutions are being developed that can operate offline, others require a connection.
- **User skills:** Digital technologies require knowledge and skills not necessarily available to many farmers and agricultural professionals, even at public and private support organizations. Age and level of education are often linked with technology skills.
- **Available incentives:** The existence of policies and conditions that promote and support digitalization processes are essential for dynamic, widespread incorporation.
- **Conflicts of interest:** The incorporation of digital technologies entails reconfiguring how certain processes are performed and recorded, inevitably affecting the roles and relationships of different stakeholders.

Source: Prepared by the authors.

The Rural Meaningful Connectivity Index (RMCI) analyzes whether people have: (a) regular, permanent internet access; (b) appropriate devices to connect; (c) access to enough permanent data to perform daily activities; and (d) adequate speed to satisfy their needs.

Vitón *et al.* (2019) map over **450** new Agtech startups in LAC, of which **84 %** are located in Brazil and Argentina. However, the development of ecosystems and the level of investment (risk capital needed for startups) are still inferior to other areas (Loukos and Arathoon 2021).

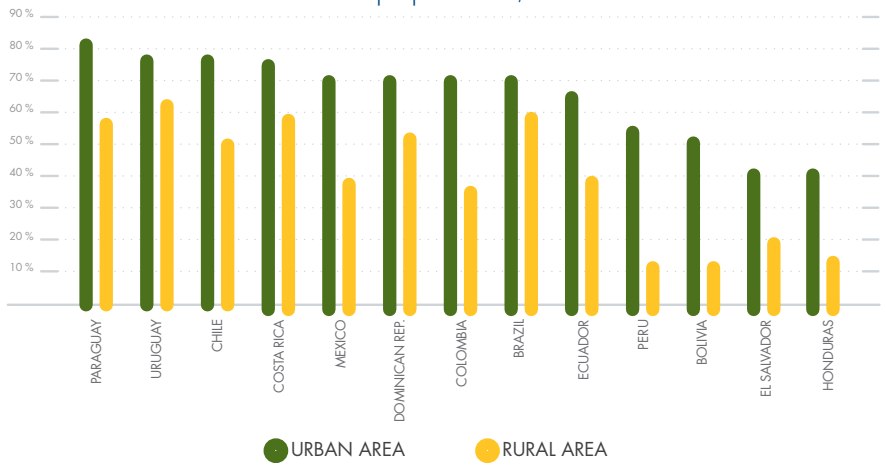
The **scarcity of sectoral and territorial promotion and support policies** for agricultural digitalization has limited the process in recent years in LAC. With some exceptions, digitalization policies are still a rarity in the region today (Ziegler *et al.* 2020, Sotomayor *et al.* 2021). En ECLAC *et al.* (2011) dedicates a chapter to the potential benefits of information and communication technologies (ICT) in agriculture, posing the need for policies that stimulate the development of financially viable and sustainable technological solutions. It mentions that these policies should address recommendations that are still valid today: expand the provision of connectivity; implement motivation and education mechanisms to overcome resistance and demonstrate utility; develop digital skills; and generate reference cases. The validity of these challenges —coincidentally mentioned in recent forums and publications by IICA, FAO and ECLAC— underscore the need to prioritize the deployment of robust policies aimed at driving and accelerating agricultural digitalization within the post-pandemic framework.

Given the scarcity of policies or strategies to promote the digitalization of agriculture, the **rate of advance was conditioned on the expansion of access to technologies and technological capabilities.** In that respect, a recent study by Ziegler *et al.* (2020) shows that 63 % of the rural population still lacks access to meaningful connectivity, an enabling factor for many digital technologies. In turn, while the cost of connectivity has come down, that coupled with the cost of devices is still an important barrier to widespread use in rural areas (GSMA 2020, After Access 2017). IICA's Cycle of Forums on the Digital Divide raised the point that elevated taxes on electronic devices and equipment is one factor that affects affordability. Lastly, existing technological capabilities are still very limited. Another recent study by IICA *et al.* (2021a) points out that 17 % or less of rural inhabitants have some basic digital technology skills. Similarly, the results of After Access (2017) show limited Internet use skills (and access) in rural areas, especially among native populations. Figures 4.2 and 4.3 and Table 4.1 present indicators of access to and use of technology.

The consolidation of **technology innovation ecosystems**[7] (especially digital) has made an increasing contribution to the process of agricultural digitalization in LAC. The advance of digital technologies defines a new model of technological development, which reinforces the importance of private-sector stakeholders. Part of this is the rise of startups that use existing underlying technologies (geolocation, mobile phones, satellite images, etc.) to offer a growing number of solutions, establishing themselves as a pillar of digital transformation. The emerging model facilitates the involvement of stakeholders in the development process, streamlining the adaptation and use of the solutions. New actors also arise that drive the process, such as startup accelerators and incubators. **Without a doubt, these ecosystems need to gain strength in order to dynamize the digitalization process.**

[7]The term refers to the community of stakeholders that interact and collaborate in generating an environment suitable for the creation and development of digital technologies.

Figure 4.2
Internet user population in rural and urban areas as a percentage of the total population, 2017.



Source: CAF and ECLAC 2020, based on data from ECLAC.

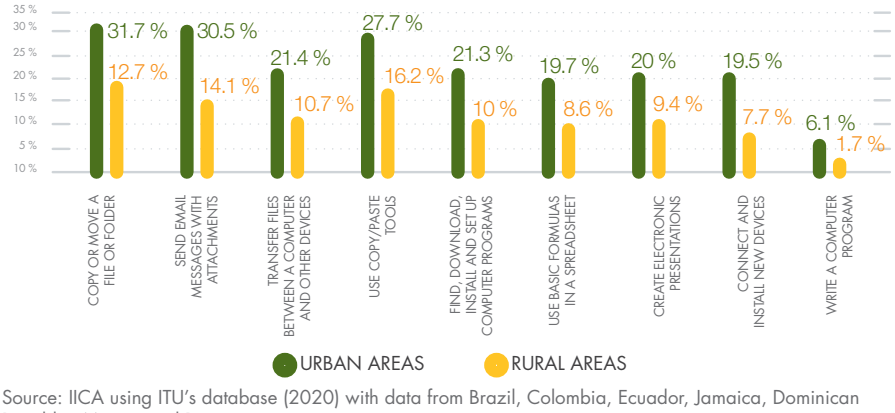
63 % of the rural population does not have access to meaningful connectivity.
17 % or less possess basic technology skills.

4.2.2 Acceleration of agricultural digitalization at the hands of the pandemic

The **COVID-19** pandemic is causing a disruption in the digital transformation process across all spheres of life and **AFSs** are no exception. The pandemic has significantly accelerated the process of digitalization and has caused the advances that were expected to take years to come about in a matter of months. The mobility restrictions imposed as a means to manage the health crisis have necessitated the virtualization and, in some cases, automation of many tasks due to the impossibility for temporary workers to be mobilized, among other reasons. In this way, digital technologies have become indispensable in sustaining some form of economic and social dynamic, even though some restrictions were necessarily relaxed given agriculture's status as an essential activity.

The mobility restrictions imposed in response to the pandemic necessitated the virtualization and automation of some agricultural processes as a means to prevent the mobilization of workers. However, the measures were later relaxed given the impossibility to carry out all the necessary tasks.

Figure 4.3
Average percentage of the rural and urban population in LAC that possesses a specific digital skill



Source: IICA using ITU's database (2020) with data from Brazil, Colombia, Ecuador, Jamaica, Dominican Republic, Mexico and Peru.

Agri-food exports from LAC grew by **2.7 %** during the first year of the COVID-19 pandemic (see Section 3.3.2 regarding commerce).

This situation revealed the convenience of digitalizing different processes, but also exposed the gaps that exist in terms of access to technologies and technological capabilities, as well as the impacts generated by those gaps (IFPRI 2021). The disruption caused by the pandemic catalyzed a cultural change with regards to everything digital (decreasing fears and prejudices surrounding technology, modifying consumption habits, etc.), which has made it possible to project the sustained acceleration of the digitalization process in the future (see Box 4.4 about closing the digital divide).

As mentioned in previous chapters, despite the sharp drop in economic activity as a consequence of the pandemic, the agri-food sector has shown notable resilience in comparison to other sectors. As such, agriculture has positioned itself as a key sector for the post-pandemic recovery. Nonetheless, as proposed in Chapter 3, it is now more important than ever to develop and apply knowledge and technologies, especially digital, to the agri-food sector to face the challenges of recovery with a transformed production.

Currently available digital technologies offer huge opportunities for the sustainable and inclusive development of agriculture in LAC.

Box 4.4: Closing the digital divide.

Within the framework of the cycle of forums on the digital divide organized by IICA in February and March of 2021, over 30 specialists from different countries and fields (State, business, civil society institutions, international cooperation organizations) analyzed the challenges and actions needed to close the digital divide. The primary conclusions and emerging recommendations were the following:

- A wide range of technologies are available to digitalize agriculture. The challenges lie in how to adapt the technologies to the specific context and, first and foremost, how to incorporate and fully use those that are available.
- Meaningful connectivity, to which access is still very limited in rural areas, is a necessary factor to take full advantage of digital technologies.
- Full use of digital technologies requires skills that are not necessarily intrinsic and, as such, must be developed. Skills training, from beginner to advanced levels, is a decisive factor in reducing the digital use divide.
- Closing the divide requires the development of active, urgent policies. Connectivity must be addressed in State policy and may require regulatory reforms.
- Closing the divide requires collaboration between multiple actors. The public and private sectors and civil society play a key role in different aspects.

Fuente: IICA 2021a.

4.3 RECOMMENDATIONS FOR PROMOTING DIGITAL AGRICULTURE

To drive and accelerate agricultural digitalization and prevent the process from becoming fragmented and incomplete, it is essential to establish agreements and agendas that guide the actions of diverse actors, as well as to promote new actions.

4.3.1 General aspects of promoting the digital transformation of agriculture

The slow, fragmented advance of agricultural digitalization is characteristic of the initial stages of deep transformation processes that impact diverse actors spread across the territory. However, as commented in the previous section, the digitalization process of agriculture (and other sectors) is inevitable and will likely begin to accelerate at a remarkable pace. In this context, **it is indispensable and imperative to drive the process to ensure it takes place dynamically, organically and inclusively** (in other words, as agile and comprehensively as possible). This is likely the **most opportune time** to design and implement strategies aimed at promoting the digital transformation of agriculture and AFSs.

To accelerate and promote agricultural digitalization while preventing the process from becoming fragmented and incomplete, it is indispensable to **cestablish agreements and agendas**, that create a framework to guide and propose actions for that purpose (as well as the many actions already in process by different actors). These agendas must be designed at the country level—without losing sight of the regional scale—on the basis of joint work and consensus among all relevant public and private actors. The design scope could be based on **existing spaces and structures** or could possibly establish a **specific space** for that purpose, such as committees or roundtables for promoting digital agriculture. Creating agendas for digitalization and determining the effective authorities is, without a doubt, part of the challenge in renewing the institutional structure as posed in Chapter 3.

Agendas to accelerate and promote agricultural digitalization must establish priorities (priority actions, chains and actor segments) and concrete goals; generate and make commitments and foster spaces for exchange and joint work among actors (based on the goals established); project and promote investment; propose the implementation of incentives and credits (to develop technologies, for acquisition and use); coordinate technical support mechanisms and capacity-building; and establish conditions to generate market competition for the goods and services needed for digitalization.

Promoting digitalization, based on joint planning between public and private actors, will allow for faster attainment of the many benefits highlighted in Section 4.1.1, as well as minimization of the risks of inequalities, exclusions and conflicts between actors or chains, the loss of competitiveness and markets, etc.

One example of a digital promotion agenda is found in the E-LAC initiative coordinated by ECLAC and CAF. For agriculture in particular, see the recent initiative in Brazil (Box 4.5).

It is essential that any plan and action to drive digitalization to be backed by a thorough diagnosis of the barriers or limitations to the prioritized situations.

Box 4.5:
Public sector actions to promote the digital transformation of agriculture

Public sector initiatives in the region promote using new technologies effectively in the agri-food sector, seeking to expand the database of businesses and individuals that incorporate digital innovations. These initiatives seek to:

- Incentivize innovation (by providing funds for research, subsidies for adopting innovations, capacity-building, strategic alliances, etc.);
- Improve coordination between the sector's demands and the solutions offering (grant funds, awards, coordination roundtables, hackathons, etc.); and
- Develop platforms or multi-actor alliances to consolidate an innovation ecosystem.

Two noteworthy experiences:

Brazil's Agro 4.0 Chamber brings together the primary stakeholders in developing solutions for Brazilian agriculture and in disseminating innovative solutions to the challenges facing the rural environment. The Chamber has an action plan for the period encompassing 2021-2024 that focuses on four priorities: develop technologies and promote innovation; professional development; strengthen value chains and supplier networks; and expand connectivity in rural areas (for more information, see MCTI and MAPA 2021).

The AgTech Challenge, sponsored by Uruguay's Ministry of Livestock, Agriculture and Fisheries (MGAP) under the umbrella of the Agtech Roundtable, is organized around seven areas in which the agricultural sector demands solutions that can be developed by SMEs and startups (insurance, livestock, forest monitoring, fresh produce chains, etc.). The contest supports proposal development and the implementation of one such proposal. The MGAP initiative promotes active collaboration between public policy and private efforts, especially startups, to generate and adopt innovations for the agri-food sector (for more information on the AgTech Challenge, see MGAP 2021).

Source: IICA 2021a.

Over **50** institutional actors from the public and private sectors and producer organizations participate in Brazil's Agro 4.0 Chamber under the direction and coordination of the Ministry of Agriculture, Livestock and Food Supply (MAPA) and the Ministry of Science, Technology and Innovation (MCTI).

A recent study shows that Argentine Agtechs employ an average of **10** people (including the founders), of which **80 %** have completed or started university studies. In turn, **28 %** of startup income is derived from exports from companies that were created on average in 2015 (Lachman *et al.* 2021).

It is recommended that **two core objectives** be considered in designing agendas to drive digital agriculture: the first is to **promote the development of technologies adapted to the specific context** sector, territory, etc.) to ensure a growing supply of relevant, useful solutions for stakeholders. This requires the creation or strengthening of technology innovation ecosystems that not only contribute to expanding the solutions offering, but that also favor the development of technology companies, often local, with a high potential for scalability. The second is to **facilitate the means and processes for incorporating and using the technologies available to the fullest extent.** This encompasses actions aimed at tearing down or closing the existing digital divides described in box 4.4, by placing special emphasis on the most disadvantaged territories and sectors with the goal to provide equal opportunities.

Promoting digital agriculture requires the **involvement of and coordination between all stakeholders** tied to the development and use of technologies. Kernecker *et al.* (2021) points out that collaboration is particularly important for digitalization and spotlights three important roles: developers, supporters and users (in addition to the role of the States, which we will discuss below). In turn, the nature of the digitalization process, which establishes new technology development and incorporation models (see Section 2), poses the need for an evolution of the roles that are traditionally held by the different actors, such as public R+D institutes and rural extension services, and how they collaborate. Table 4.2 summarizes the main roles available for different actors and these are analyzed in depth in the following subsection.

A number of recent publications and forums underscore that, given their nature, addressing the different barriers to digitalization requires a coordinated effort between public and private actors.

Table 4.2
Possible stakeholder roles that are important in developing and using digital technologies in agriculture

Stakeholder	Main role	Details
Governments - political offices (local to national)	Promote and facilitate	Incorporate digitalization into State policy, offering credits and incentives for development, access and use of digital technologies. Lead the creation of agendas, from local to national. Spearhead the development of infrastructure and underlying technologies and/or regulations and incentives for private actors. Digitalize government services.
Governments – technical offices (extension agencies, research and technology institutes)	Promote and assist	Prioritize the digitalization agenda, focusing on developing knowledge and underlying technologies, close interaction with public and private stakeholders (especially developers) and creating reference teams for support and training.
Learning centers (universities and learning and research institutes)	Promote and assist	Contribute to developing knowledge and underlying technologies in close collaboration with private developers. Promote dialog and cooperation among actors and coordinate capacity-building programs.
Private developers	Focus and accompany	Focus development on user needs, seeking close interaction with government technical offices, learning centers and users, and commit to providing support for using the solutions.
Private organizations (chambers, associations)	Facilitate	Facilitate interactions between actors, especially developers and users, creating spaces for exchange, testing and sharing experiences. Facilitate capacity-building processes.
Multilateral technical cooperation and financing organizations	Guide, connect, finance	Raise awareness of the need for transformation and guide the design of related strategies, promoting and coordinating cooperation efforts between countries and stakeholders.

Source: Prepared by the authors.

A key role of multilateral technical cooperation and financing organizations is to facilitate international financial aid to develop the necessary infrastructure, technologies and capabilities.

4.3.2 The critical, non-delegable role of the State

The digitalization of AFSs should be established as State policy and be supported by plans and agendas over time.

States have a **non-delegable responsibility and a critical role in promoting agricultural digitalization** (OECD 2018, Schroeder *et al.* 2021, FAO and ECLAC 2021). The States must ensure a sustained and coordinated digitalization process (between public and private actors at both the local and national levels) that is, above all, **equitable and inclusive.** The States can be precursors in pushing digitalization agendas, generating the spaces for dialog and collaboration necessary for their creation. In turn, based on the agreements made, the necessary conditions and incentives must be created to deploy the actions included in the agendas (Loukos and Arathoon 2021). In summary, the extent to which digital technologies can accelerate the transformation of AFSs is determined by the commitment of governments to creating the necessary conditions.

The State must commit to undertaking its non-delegable actions, such as investing on its own and in association with private actors in cybernetic infrastructure and other public assets and implementing promotion mechanisms and incentives.

The digitalization of the State itself (digital government) is part of the essential and necessary role the State must play to drive the process of digitalization. The digitalization of declarations, certifications, authorizations, permits and other State processes is not only a requirement for the comprehensive digitalization of the chains, but also forces the digitalization of different stakeholders, generating a technology selection process (Arthur 2009). That said, the latter must be done in a systemic and assisted way to avoid the exclusion of those who face difficulties in accessing or using technologies. Finally, the digitalization of the State, in tandem with the digitalization of the chains, not only streamlines processes (decreasing administrative and transaction costs), but also allows for the generation and analysis of data that enables the improved transparency and efficiency of State governance.

In the framework of the development of emerging technologies, and particularly digital technologies, the **leading role of private developers** (especially small startups with the potential for scalability) **will likely remain steady or increase.** Private developers will play a key role in creating specific solutions, often driving the **enhancement of underlying technologies** or knowledge usually developed by the public sector. Private developers are set apart by their agile customer-oriented development and direct interaction with users, both aspects that can streamline the generation and use of solutions. The States, however, need a stimulating organizing framework for action to create the conditions necessary to express and focus the following: proposed priorities; incentives for developing solutions for disadvantaged chains and producers; incentives for interaction with State technical offices and value chains, etc. In turn, the sector's corporate commitment is needed to promote digitalization (for example, the predisposition to collaborate with the chains and State technical offices; participation in capacity-building programs; commitment to solutions that encompass disadvantaged producers and chains, etc.).

Brazil's AgTech census maps more than **1,100** AgTech start-ups, with only a handful located in regions with predominantly small-scale farmers (Sotomayor *et al.* 2021).

4.3.3 Recommendations for action (from the perspective of the State)

A range of actions are possible within the framework of an organizing agenda to accelerate and drive digital agriculture. However, all actions must address three aspects in response to the key objectives recommended for these agendas (see Section 3.1) and that, coincidently, are considered barriers to dynamizing the digitalization process (see Box 4.4: Closing the digital divide): (1) expand

access to meaningful connectivity in rural areas; (2) promote solutions adapted to the context but scalable to the supranational level; and (3) develop the skills necessary to take full advantage of the different digital options available. Box 4.6 lists some actions to include as part of the digitalization promotion agenda..

While this report suggests that now is the perfect time to implement promotion plans and initiate actions, the complex, post-pandemic socioeconomic context strongly restricts the ability of the States (central administrations) to deploy resources, despite the fact that digitalization will continue to play a primary role in mitigating the impacts of the health crisis (CAF and ECLAC 2020). LAC's economy has been particularly affected by the pandemic (7 % drop in GDP), necessitating a fast recovery and the building of resilience to other possible shocks given the importance of agriculture for the region's economy and the global provision of food (see Section 2.1 on the impact of the pandemic and IFPRI 2021). Box 4.7 explains the concept of endogenous solutions as a possible option to leverage digitalization (and expand connectivity) in times of crisis.

In a context of budget and financial restrictions, a determining factor would be the design and coordination of low-cost and distributed-cost mechanisms that enable plans and actions aimed at breaking down barriers and promoting digital agriculture.

Box 4.6:
Suggested actions for agricultural digitalization promotion agendas

- Create institutionalized spaces with relevant actors (by chain, region, etc.) to **discuss and establish agendas** and commitments to promote digital transformation and support and monitor execution.
- Establish **investment priorities** (in light of the gaps described, especially connectivity) and explore available public-private and international investment **mechanisms**.
- **Incentivize competition** among developers and service providers in rural areas as a mechanism to improve and cut costs. Design regulatory and/or tax mechanisms that contribute to reducing the cost of technologies and/or dynamizing private investment.
- In collaboration with stakeholders (producer organizations, incubators, etc.), design and implement mechanisms to promote the **consolidation of innovation ecosystems** (national and district) and **incentivize the use** of available technologies.
- Define and implement a regulatory **framework for the use** of digital technologies that ensures respect for intellectual property, data ownership and user privacy.
- Promote the formation of **reference teams or networks** for technical assistance and capacity building based on the skills available or to be developed in public research and transfer organizations, but in association with private actors (especially developers).
- Analyze, document and disseminate the **benefits and costs** associated with implementing promising technologies in support of the processes aimed at incorporation based on the joint work of public research and transfer organizations and developers.
- In conjunction with research institutes and producer organizations, promote or support **co-meeting and working spaces** between technology developers and users and involve startup promotion organizations, such as accelerators and incubators.

A key action is to promote the digital transformation of AFSs, in general, and agriculture, in particular, as a priority of the State's agenda (State policy) and that of key stakeholders from the production and technology systems.

Explore international financing mechanisms associated with the SDGs to drive the process of agricultural digitalization, given the contribution digital agriculture could make to attaining those objectives.

- Propose and support generic and specific **skills-building programs** (i.e., use of specific technologies) to incorporate and use the digital technologies available, possibly incorporating them into high school or university-level studies.
- Identify and catalyze **concrete digitalization opportunities**, prioritizing high-impact chains and cases (such as implementing a digital payment system, digitalizing a specific government service or application, etc.) and convening technology vendors and users to work together to that end.

Source: Prepared by the authors.

Box 4.7:
Endogenous solutions: A viable option for expanding connectivity in times of crisis. The Colombian experience

The COVID-19 pandemic impacted the population's ability to mobilize, to access services platforms and exchange information, in addition to relationships and collective life. In isolated rural communities, this situation was overcome by implementing projects that combined radios with digital technologies and included the active participation of the local communities.

The NGO Colnodo promotes small-scale projects in Colombia, alongside cooperatives, neighborhood groups, municipalities and other NGOs. The goal is to promote communication between producers and rural inhabitants by connecting community radio and digital systems to produce proprietary content (general information, interviews, etc.) that facilitates business and access to services (banking, technical assistance, online shopping), as well as friends and family networks.

The local community shares the costs of the infrastructure, handles all maintenance and organizes training programs to build capabilities and skills. These are known as endogenous solutions as they are organized by the community itself based on the combination of resources, technologies, knowledge and local and extraterritorial public policies. Thanks to their low cost, they are a possible mechanism to address the digital divide in the context of restrictions.

The digital solutions are adapted to the different contexts. There are a number of technologies available to connect radios to the digital world. In this case, low-cost technology is always used based on each context and situation. In some cases, that may be fiber optics; in others, it could be long-range wireless technology (free or licensed bands), along with cheap computers and equipment and freeware (Chamorro 2021).

This case is important because it represents a community solution to an existing divide and directly impacts all the families living in the territory. The program is relevant, essential and organized by the community itself. For this reason, they are called endogenous solutions (Ziegler *et al.* 2020), as they connect the community with the global system and are often not recorded in the statistics.

This type of experience could be seen as an example of a co-managed services platform consisting of diverse public and private resources, regulations, technologies, services and instruments. With the existence of coherent strategies (by territory and productive chain), these resources are applied under a specific logic, assigning an active role to farmers and other rural actors. They are instruments comprised of variable cost buckets with flexible, differentiated public and private contributions. The technology style combines local resources, traditional techniques and modern technologies, scientific knowledge and public policies from international entities to optimize the use of available resources and generate an amplifying and multiplying effect. Promoting and supporting these types of experiences can contribute to closing the digital divide in times of crisis.

Source: IICA 2021a.

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