

DIGIBUILD

D.2.1- Green sector analysis

**DigiBuild: Building
Digitalization
in the Green Sector
in Honduras and Costa Rica**





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DigiBuild: Building Digitalization in the Green Sector

I. Introduction

The reduction of the digital gap in productive areas of the green sector is key for the sustainable development of Latin America. Digitalization of the green sector would support countries to improve competitiveness, employability and productivity.

Digibuild aims to provide VETs and training providers in Costa Rica and Honduras with the capacities and skills to digitize their pedagogical approaches related to the green sector in agriculture. It will transfer the expertise of EU countries to these two countries of the Latin America region, to contribute to the accomplishment of their priorities. DigiBuild has a twin goal: a) The capacity building of VETs and training providers to digital transition with a specific focus on the green sector and, b) to empower professionals in the green sector, especially women, to act as mentors in this transition.

DigiBuild will increase the capacities of VET staff, teachers and trainers toward digitalization, and it will reinforce the link between VETs and the labor market as well as the national and regional priorities. It will enhance the attractiveness of lifelong learning and it will create synergies between VETs, trainers, professionals in the green sector and public stakeholders. Last, but not least, it will raise awareness on the twin transition, and it will create a bridge to women's equal participation in the labor market.

Objectives of the DigiBuild project

Digibuild aims to provide VETs and training providers in Costa Rica and Honduras the capabilities and skills to digitize their pedagogical approaches, mostly related to the green sector, based on the European partners expertise, global standards and market-leading technology.

To build an attractive, related to the needs of the labor market VET sector by enabling VET providers and trainers to offer digital skills and develop concrete links with the labor market in the field of the green economy

Technologically trained professionals in the green sector, agriculture and potential agriculturist. This will enable them to use technology and access services, information, investment and trade.

The analysis is based on a comprehensive study of the agricultural sector of Costa Rica and Honduras, in which the opportunity to focus a project on cocoa and coffee crops has been identified. The importance of implementing digital technologies in agriculture is highlighted to

increase productivity and environmental efficiency, as well as to promote digital transformation in agriculture. This study is based on research presented by Think Corp, Novel Group, EruTraining IICA, Defoin, UCENFOTEC and FHIA on the digital divide and the needs of the green sector.

Key points

-Technological Implementation in Agribusiness:

-Digital technologies have become essential in the design, production and marketing of goods, improving productivity and adding value in companies.

-In the agricultural sector, technologies such as the use of remote sensors via satellite, artificial intelligence and big data are positively impacting production models.

-Challenges for digitalization in agriculture include infrastructure, financing, digital skills, regulations and collaboration between various actors.

Analysis of Coffee and Cocoa Production

This document provides relevant information on cocoa production in Honduras and Costa Rica. It highlights that cocoa is an important productive activity for small producers in Honduras, with a focus on organic production. In Costa Rica, it is mentioned that cocoa production is concentrated in certain regions and organic production is promoted. Both countries face challenges in terms of access to financing, technical assistance and technology to improve cocoa productivity and quality.

The promotion of organic cocoa production in several regions of Honduras stands out, with the participation of organizations and cooperatives. Cocoa exports have experienced significant growth in Honduras, with a focus on product quality and sustainability.

In Costa Rica, cocoa production is concentrated in certain regions, with an emphasis on product quality and traceability. Organic production is promoted and the participation of producers in certification and quality programs is encouraged. This country exports cocoa to international markets, with a focus on sustainability and product quality.

Regarding the coffee sector, it stands out that it is of great importance for the economy of Honduras, with a high number of families dedicated to its production. In Costa Rica, coffee production is concentrated in certain regions and the adoption of sustainable practices is promoted. Both countries face challenges in terms of access to financing, technical assistance and technology to improve coffee productivity and quality.

Coffee is fundamental to the economy of both countries, with a high number of families dedicated to its production in various regions. It is important to strengthen the coffee value chain, with emphasis on product quality and the sustainability of agricultural practices. Honduras faces challenges such as low investment in technology, lack of access to financing and the need to renew coffee plantations to improve productivity.

Both countries, Honduras and Costa Rica, face similar challenges in the coffee and cocoa sectors, such as diseases, aging of plantations and slow adoption of technology. The need for socio-environmental certifications, access to financing and technical assistance to improve productivity and product quality is highlighted. Digitalization and traceability are key aspects to comply with international market regulations and demands, especially with the EU deforestation-free product regulation.

II. A glimpse into the sustainable agricultural sector in Costa Rica and Honduras

Costa Rica

Costa Rica's agricultural sector, often referred to as the "green sector," is a vital part of the country's economy and identity. It encompasses a diverse range of activities, from traditional crops like coffee and bananas to more modern ventures like organic farming and sustainable tourism. Here's a brief overview:

Diversity: Costa Rica boasts a wide variety of agricultural products, including fruits, vegetables, coffee, cacao, sugar cane, and livestock. This diversity contributes to food security and export earnings.

Sustainability: The country has a strong focus on sustainable agriculture practices, with a growing emphasis on organic farming, agroforestry, and conservation. This commitment is reflected in its national policies and initiatives.

Export-Oriented: A significant portion of Costa Rica's agricultural production is exported, generating substantial foreign exchange. Key export products include bananas, coffee, pineapple, and beef.

Small-Scale Farming: Most Costa Rican farms are small-scale, often family-owned and operated. This structure contributes to rural livelihoods and community development.

Tourism Integration: Agriculture is increasingly integrated with tourism, offering visitors opportunities to experience farm life, taste local products, and learn about sustainable practices.

It is indicated that the agricultural sector is of great economic and social relevance, which is reflected in variables such as the Gross Domestic Product (GDP), exports (source of foreign currency), contribution to employment, improvement of the socioeconomic conditions of the rural population, food production, among others. According to data from the Central Bank of Costa Rica, the participation of expanded agriculture in the GDP was 9.6% in 2021, of this percentage 4.5% corresponds to the primary sector and 5.1% to agroindustry. In relation to the agricultural value added, 69% corresponds to agricultural activities, 21% to livestock activity and the remaining 10% is made up of support activities (6%), forestry and timber extraction (3%) and fishing and aquaculture (1%) (Public Policy for the Costa Rican Agricultural Sector, 2023).

In relation to the above, it is of almost importance to mention the main agricultural activities of Costa Rica, together with its production for the period 2020-2021: In agro-industrial crops, coffee, oil palm and sugar cane stand out. Among the fresh fruits: Banana, pineapple and melon. In the case of basic grains, Costa Rica predominates in rice, beans and corn. And in the case of vegetables, potatoes and onions.

On the other hand, the agricultural sector occupies second place at the sector level as a job generator with a total of 238,227 employed people (11.7% of the total employed population). The group of people employed in the agricultural field is distributed as follows according to gender: 87.7% male population and 12.3% female population.

Challenges

Costa Rican producers face the following challenges to achieve sustainable production: Among the most outstanding aspects are: the need to increase efficiency and productivity in crops, the lack of access to economic resources that allow them to implement better sustainable practices (non-use of synthetic agrochemicals, efficient management of water and energy, reducing environmental impact, measures against climate change), the adoption of new technologies and training in all these aspects indicated. An understanding not only of the crop but of the business that allows us to open new markets where "being sustainable" is also profitable. In other aspects, the following factors are generally considered as challenges in the agri-food industry.

Climate Change: Costa Rica's agricultural sector faces challenges from climate change, including more frequent droughts, floods, and extreme weather events.

Market Volatility: Global market fluctuations and competition can impact the prices of agricultural products, affecting farmers' incomes.

Labor Shortages: The aging population and migration to urban areas have led to labor shortages in some agricultural sectors.

Technological Gap: While Costa Rica has made progress in adopting technology, there's still a need to bridge the gap between traditional farming practices and modern innovations.

Overall, Costa Rica's agricultural sector is characterized by its diversity, sustainability focus, and importance to the national economy. While facing challenges, the country is actively working to promote innovation, resilience, and a more equitable and sustainable future for its farmers and rural communities.

Honduras

Honduras' agricultural sector is a cornerstone of the country's economy and social fabric. It provides livelihoods for millions of Hondurans, contributes significantly to national food security, and generates substantial export earnings. However, the sector faces a complex set of challenges, ranging from climate change to market volatility, that require innovative solutions and strategic investments to ensure its long-term sustainability and prosperity. Here's a closer look at the key features and challenges of Honduras' agricultural sector:

Diversity: Honduras boasts a wide array of agricultural products, including bananas, coffee, palm oil, melons, and livestock. This diversity contributes to food security and export earnings.

Small-Scale Farming: Most Honduran farms are small-scale, often family-owned and operated, contributing to rural livelihoods and community development.

Export-Oriented: A significant portion of Honduras' agricultural production is exported, generating substantial foreign exchange. Key export products include bananas, coffee, and shrimp.

Potential for Growth: Honduras possesses fertile land, a favorable climate, and a skilled workforce, offering significant potential for agricultural growth and diversification.

Focus on Basic Grains: The production of basic grains like corn, beans, and rice is crucial for domestic food security, though Honduras still relies heavily on imports for these staples.

The population is 9.6 million Hondurans, with an annual growth rate of 1.54% and a rural population of 44%, with agriculture being one of the main sources of employment. The female population is 52%. 37% of households are headed by women. About 135 thousand women are dedicated to the agricultural sector. 30% of the population is under 14 years old. Above 35% of employment comes from agricultural, livestock, forestry and aquaculture activities (INE,2022).

The agri-food sector of Honduras, which encompasses productive and service activities, agriculture, livestock, hunting, forestry and fishing, has a strong impact on food security and in

the country's economy. The contribution of the sector to economic activity was in 2019 at an average of 13% to real GDP, with a participation of over 35% in exports and sources of employment (IDB, 2019). According to the Central Bank of Honduras, the agri-food sector represented 12.6% of real GDP by 2022 (BCH, 2023). In the composition of the Economically Active Population (PEA) of the country, that of the agri-food sector constitutes 19.6%, the majority settled in rural areas.

Honduran agricultural production maintains low average yields that can increase. Agriculture, livestock, forestry and fishing registered as of November 2022, a decrease of 1.1% due to various technical, climatic, financial factors, among others. Honduras It has a high development potential with favorable agroecological factors and advantageous location regarding the largest markets for agri-food products. The sector requires a policy public and institutional framework that guides sectoral development in a sustainable and inclusive manner.

Banana production had a positive performance, due to the harvest recovered by the renovated area on the farms of transnational companies; In addition, production increased in sugar cane, pineapple and melon crops. Also, poultry farming grew in the production of breeding birds with better performance, both in terms of the number and weight of the birds, destined to the food industry. Fishing maintained the upward trend due to shrimp production cultivated.

Honduras has managed to position itself as an important exporter of coffee, bananas, melons, shrimp, oriental vegetables, among others. Regarding exports in agricultural and livestock matters forests, in 2021 they were USD 470,522.4 million, while, in 2022, the figure is USD 730,190.1 million. The increase is due to different products from the primary sector of the economy, such as: melons, watermelons, bananas, among others. Within the manufacturing industry, agro-industrial products, such as gold coffee and crude palm oil, represented 28.9 and 13.5%, respectively (BCH, 2022).

Although Honduras has positioned itself as an exporter of agricultural products, imports of processed foods have increased in the country. Actions are required to reduce the dependence on imports for food supply, paying attention to issues of competitiveness and productivity associated with agro-industrial growth. Likewise, it requires a review of trade agreements, such as the Free Trade Agreement between the Dominican Republic-Central America and the United States of America (Dominican Republic-Central American Free Trade Agreement, DR-CAFTA, for its acronym in English), which guides the behavior of production and agricultural products market and the new trade opening with the Republic of China.

Challenges

The surveys carried out by the organizations participating in this project provided a current overview of the challenges that the country presents to achieve sustainable production of cocoa and coffee. Among the challenges that stand out in both the coffee and cocoa sectors, climate change is one of the most significant. Today, producers are unaware or find it very expensive to invest in the practices necessary to adapt to climate changes. This directly affects productivity, and the cocoa and coffee community report low productivity per hectare in these agro-industries. On the other hand, the high costs of the inputs necessary to apply on the farms and the costs of construction materials for infrastructure make it difficult for the producer to make sustainable investments. Finally, the labor shortage has had a huge impact, representing losses in productive areas. It is considered that internal and external migration has been a determining factor so that young people and adults do not have greater interest in participating in collection activities. In the coffee sector, most farms in the country are aging, a situation that is alarming due to the lack of attention and the decline in productivity reported in recent years. In summary, the current challenges in the agro-industrial chain are detailed:

Climate Change: Honduras' agricultural sector faces significant challenges from climate change, including more frequent droughts, floods, and extreme weather events, impacting yields and livelihoods.

Limited Infrastructure: Inadequate infrastructure, including roads, irrigation systems, and storage facilities, hinders efficient production, transportation, and marketing of agricultural products.

Lack of Investment: Insufficient investment in research, technology, and extension services limits productivity and hinders the adoption of sustainable practices.

Market Volatility: Global market fluctuations and competition can impact the prices of agricultural products, affecting farmers' incomes and making it difficult to plan for the future.

Land Tenure Issues: Land tenure insecurity and access to land remain significant challenges for many small-scale farmers, hindering their ability to invest and improve their livelihoods.

Honduras agricultural activities are a vital contributor to the country's economy and food security. While facing significant challenges, the sector holds immense potential for growth and development. Addressing issues related to climate change, infrastructure, investment, and land tenure will be crucial for unlocking this potential and creating a more sustainable and prosperous future for Honduran farmers and rural communities.

III. Current Analysis

The information obtained through the research of the project partners and the realization of interviews with green sector professionals in Costa Rica and Honduras was reviewed to present the findings relevant to the task: **identifying the digital gaps and subsequent needs of the green sector, particularly those of coffee and cacao producers in Costa Rica and Honduras.**

Actors in the green sector are well described, along with detailed studies related to digital education in the green sector. There are two references that emphasize the needs for digital education and research on digital literacy in rural areas, which must be closely considered.

1. Technological Implementation in Agroindustry

Technological progress, specifically in the digital realm, is revolutionizing industries, markets, and societies. Today, digital technologies have become essential tools for designing, producing, and marketing goods and services across various chains and sectors of the economy. Evidence suggests that the adoption of these technologies in an industry is associated with increases in added value and productivity gains at the company level (Gal et al., 2019; Mosiashvili and Pareliussen, 2020).

It is for this reason that the change in technology is essential to address stagnating productivity, improve the productive efficiency and the competitiveness of the companies. On the other hand, technical change can also be a useful instrument to improve the environmental balance, both at the aggregate level and at the micro level, where the incorporation of technology does improve environmental efficiency, reducing consumption of goods and materials and the impact on the natural environment (ECLAC, 2021). We can say that we are facing a true cultural change because this trend affects all areas and all social sectors including the functioning of the economy and the society.

Particularly, in the agricultural sector there are a range of new technologies that promise to significantly impact production models, thanks to new trends in the collection, storage, management, transfer and analysis of large volumes of data. An example is the advances in the use of satellite remote sensing that produce data with biophysical parameters related to the development of crops that allow better calculation of their water and irrigation thus improving its productivity. Another case is the use of artificial intelligence, which through predictive analysis allows us to find patterns in environmental changes and the assistance of BigData.

The challenges for greater digitalization of agricultural systems are diverse, and include enabling elements, such as infrastructure and connectivity, as well as provision of financing, development

of digital skills, design of the framework, regulatory matters regarding telecommunications, privacy, security and promotion of competition, among other factors. Balancing the opportunities and risks that present digital technologies is a complex task that involves different areas of government, such as regulatory entities, specialized agencies, sectoral ministries, and different levels of government such as mayors, who currently develop various technology projects and have powers to oversee the deployment of networks. On the other hand, technological change also requires close collaboration between different actors such as government agents, operators of telecommunications, content companies and IT companies, among others.

Among the cases where the topic of agriculture is incorporated into digital agendas Costa Rica can be mentioned that, in its Strategy Digital Transformation, considers a specific line of action to promote transformation of the agricultural sector, with a focus on increasing productivity, will improve it in access to information and capabilities by producers, and the harnessing the potential of technologies such as drones and genetic engineering (Costa Rica, 2018). Besides, in Honduras initiatives are observed, but not within a specific agenda. Therefore, political support at the highest level is required to coordinate actions; from different government entities for the design of an instrument that guides the technological transformation of a sector that represents an important percentage of the added value of the economies of the region and which has an enormous potential in the incorporation of new technologies.

In both Honduras and Costa Rica there is an update process underway, which has its own characteristics, but also common points that allow us to think about new synergies and crossroads. This is a promising area that will likely mark the priorities for the coming years: build policies and programs that scale at the regional level to take advantage of the strengths and progress made in each country. With this we seek to propose new ideas to promote a digitalization process that accelerates the transition towards a more inclusive, more efficient and more sustainable food system.

At this point, it is important to highlight and identify some of these digital technologies that can generate an impact on agricultural development specially in both coffee and cocoa fields. Digital technologies play a very relevant role in agriculture and development rural, through the digital chain, and food chains, in the stages of data collection; Research, Development and Innovation (R+D+i); Provision of information and technology transfer; in communications between themselves rural actors; and in the production process itself. The OECD (2018), in the summary of new digital technologies aimed at agricultural and food sector identifies the main tools that make it up:

- Apps
- Platforms
- Sensors
- IoT
- Robot
- Drones
- Big data
- Cloud computing
- Artificial intelligence
- Blockchain

These technologies and equipment are useful in different areas in the agri-food systems, some directly and others through developments of other useful technologies for agriculture, such as the development of plant varieties or inputs for production.

2. Situation of Agricultural Innovation Systems

The National Agricultural Innovation Systems (SNIA's) are a set of actors who participate in the research and technology transfer process for the agricultural sector, offering various services. Within the framework of the SNIA's, one of the topics priorities is the discussion on the responsibility of the State in the provision of extension services. In countries where the SNIA is supported by some instrument legal there is no evidence that the relationships between institutional actors are greater or more effective than in other countries where a legal framework for the System has not been established.

In relation to the SNIA's, it can be concluded that:

- The international context continues to change at great speed, in economic, commercial, as well as in the technological aspects relevant to agriculture.
- There are positive changes in the agriculture of the countries, with evident innovations that contribute to greater competitiveness; but there is also postponement in some sectors.
- It is worth mentioning that political interest in agriculture is limited, with few exceptions, despite declarations of good will.
- Non-agricultural policies have increasing influence on agriculture, international trade and food distribution.
- SNIAs are becoming more diverse, more complex, more guided by private goods, internationalization and the consequent greater relations of market.

In general, some of the problems and solutions that stand out in the development of actions or implementation of policies that ensure the use of agricultural technologies are the following:

Problems	Solutions
-Low supply of technologies for agricultural development.	-Generate and provide an offer of technologies with characteristics of high productivity, high nutritional value and resilience.
-Limited knowledge of agricultural technologies by producers and service providers.	-Disseminate knowledge and technologies to promote innovation and sustainable development of the agricultural sector.
- Weak rationalization of research services and development; innovation and technology transfer.	- Articulate generation and extension services for innovation and sustainable development of the agricultural sector.
-Low institutional capacity to respond to a model of Based Results Management.	-Reduce the institutional gap to respond to a model of Management by Results.

Table 1: Problems and solutions that stand out in the development of actions or implementation of policies regarding agricultural technologies

An interesting topic raised by the research and interviews made by ThinkCorp is the different digital technologies that have been used by each sector and which ones are currently used; this goes hand in hand with our objectives. Also, in this review it is pointed out that the coffee segment has an emerging focus on digital traceability and certification which makes them highly receptive to our endeavors. Some coffee or Cacao-oriented apps include SAT-Café, Cacao Móvil, Coffee Cloud and the most relevant one for our objectives Coffee-Trak-In, a private, still on development, initiative to track coffee plantations for certification to comply with EU regulations. Based on the same sources we can infer that the main actors for digitalization are pretty much the same in both countries: private companies, academic institutions, state institutions, non-state public entities, somehow, with little differences in terms of their predominance across countries. ThinkCorp also included some critical descriptions on connectivity in the green sector as it is the major vehicle for digitalization, a good description of sources of digitalization in governmental-communication regulation in agriculture.

In Latin America, especially in the case of Honduras, the development of applications has been

mostly focused on the educational area, especially at the beginning of the COVID-19 health crisis, which was strongly reinforced, transforming academic contexts (Medina, 2022). However, efforts have been made towards climate adaptation and remote sensing to understand access coverage to services, as well as inappropriate land use and misleading waste dumping (Corrales & Ochoa, 2017). Nevertheless, UNACIFOR has been one of the entities concerned with making advances in digital competence topics (Romero & Fernández, 2023). Among the most notable examples, we can mention the DISAGRO application that manages all AgritecGEO services related to the collection, processing, and communication of timely decisions through active and passive sensors on farm management topics, satellite images, smart climate, connectivity, and forecast models in support of government entities like SAG and in joint work on projects like SoilFER for soil productivity optimization (DIGER, 2024; SAG, S.F) and SIMPAH and INFOAGRO.

In the industrial capital of San Pedro Sula in Honduras, efforts have also been made to strengthen the agricultural sector, with IICA using drones for monitoring and strengthening food security in mid-2020 in pursuit of meeting the sustainable development goals set by the UN (La Prensa, 2023). Among the main platforms developed by government agencies are those of SAG (SIMPAH), IHCAFE (IHCAFE Mobile), and the Forest Sector Geoportal of Honduras from the ICF.

There has been extensive development of apps mainly for the coffee value chain: some examples are those developed by Lutheran World Relief (LWR) and IHCAFE for technical assistance to bring extension technicians closer to coffee producers. Likewise, SAT-Café is an application developed by FAO and used in Honduras to monitor risks associated with coffee rust, Cacao Móvil, developed by Lutheran World Relief and aimed at advising producers. Available for El Salvador, Nicaragua, Honduras, Guatemala, Ecuador, and Peru. Coffee Cloud aimed at pest and disease management in coffee and meteorological alerts. Available in El Salvador, Guatemala, Honduras, and Costa Rica (Cruz et al., 2021).

In Europe, we find well-established and well-known digital tools such as Prismab, a leading application in the agricultural sector that offers an advanced irrigation management system. Its main focus is to provide farmers with crucial information for precise and efficient irrigation. Likewise, Manna Irrigation Intelligence is an innovative solution that stands out in the agricultural industry for its unique focus on monitoring and managing irrigation using satellite data and hyperlocal weather information. Agricolum offers a wide range of functionalities ranging from field notebook management with access to real-time data and weekly forecasts to data import from the CAP (Common Agricultural Policy) and connection with the list of phytosanitary products authorized by the Ministry of Agriculture, Fisheries, and Food of the Spanish Government, Agroptima allows farmers to import CAP data and connect with the list of

phytosanitary products authorized by the Ministry of Agriculture, Fisheries, and Food. With these features, Agroptima has become an essential tool to improve efficiency and profitability in modern agriculture. CampoGest, developed by Hispatec, is a leading agricultural application specialized in real-time management of treatment recommendations, fertilization plans, farm, and crop management, PlantCare is an agricultural application designed to help farmers in pest and crop management. This application stands out for its ability to provide farmers with detailed information about plant health products and their specific application for pest control (ENIIT, S.F. 2023).

Results according to surveys of the implementation of technology in production processes

When analyzing the data obtained regarding the implementation of the technology, the participants surveyed mention that a variety of cell phone applications have been used to carry out certain practices in the field, especially to learn more about the guidelines for agricultural practices that should be carried out. On the other hand, the free resources available on the web are widely used by a self-taught community. It is important to highlight a comment that mentioned that it was easier for the producer to access those platforms that do not require a username or password. Information search engines and video platforms such as YouTube are widely used. This suggests that these technologies are accessible and easy to use for agricultural producers. Other technologies mentioned include:

- WhatsApp consultations: This provides an interesting data point as there are now communities on this social network that allow the dissemination of mass messages, providing good reach for the sector. It also requires only a basic internet connection.
- Geopositioning applications: Programs like the European Union's Copernicus provide great support to farmers for weather and soil forecasting.

This suggests that these technologies are also being used to learn and support productive processes but are not as popular as websites, smartphone applications, and online training.

IV. Current state of the cocoa and coffee sector in Honduras and Costa Rica

With the general information provided by the Latin American partners of the DigiBuild project, a comparison is made below with current data between Costa Rica and Honduras in the areas of cocoa and coffee, the specific sectors within the green sector that the DigiBuild project aims to address.

Regarding the coffee sector. Costa Rica produced 550.9 TM of coffee in 2021. The green sector is the second largest employer and has the largest poverty index in the country. A gender description in agriculture points out that there is a large gap where women are in every way underrepresented in agriculture. In the coffee sector in particular just two proposals directed exclusively to women have been listed in the summary. Coffee plantations are declining, and the generational overlap is small. Digital applications are present in the coffee sector and IA has been used to estimate plant populations and shade. The use of GPS and drone technology are other examples of digitalization in this sector in Costa Rica.

In the case of cacao production, men dominate the sector by 79%. One way to overcome this gap could result from strengthening leadership and training of women. In this area women are perceptually better represented in Honduras than in Costa Rica by 23%. The main causes involved in the intensification of gender inequalities in the agricultural sector are similar between both countries, among them are:

- Institutional management
- Administrative management
- Marketing and markets
- Access to land
- Access to financing
- Capacity building
- Technical assistance
- Technology gap
- Climate variability

In Costa Rica the digital gap analysis done by the partners reveals three different stages or levels and it also states the possible general but also the socio-economic factors that encapsulate them. And these findings are perfectly applicable to Honduras. The first level is knowing whether the study unit - people, households, companies, territories or countries - has or does not have access to a certain technology or a set of technologies. The second level refers to its level of use; However, this measurement is more complex since a measurement of the capacity to use the technology must be defined. As a third level, the quality of the technology is considered; that is,

to analyze the wide range of mobile phones, computers, tablets or other types of devices with very different capabilities (University of Costa Rica, 2023).

Costa Rica exported 79,200 TM and 800 TM whereas Honduras exported 315,490 TM and 1,332 TM of coffee and cacao beans, respectively, in 2022. Both countries have large and well represented family groups of farmers devoted to their production. Both countries are very much alike in terms of farming, organization, social structure, markets and needs, and in both countries, women are underrepresented in virtually every aspect of the value chain. But what is more important: for both countries and both products the UE market is very important.

Likewise, similarities have been identified in the coffee sector between Honduras and Costa Rica referring to the main challenges of the sector:

- Significant disease impact
- High impact for low prices
- Subsistence risk for monoculture areas
- High aging of coffee plantations (more than fifty years old)
- Low percentage of generational integration of young people-older adults
- Slow adoption of cutting-edge technology and tools of the fourth industrial revolution
- Reduced renovation of a coffee park, a higher percentage of new varieties, more resistant to pests and diseases, which help with climate adaptation and resilience.
- Increasingly prolonged cyclical low-price crises

In the case of Costa Rica, the country has a high penetration of ICTs compared to other countries in the international system. For the year 2019, Costa Rica was positioned as the third country on the continent with the highest internet access in homes (86%), also in mobile telephony, Costa Rica was the country with the highest penetration in the world (169 lines per 100 people), surpassing technological powers such as Singapore, Finland and South Korea. Despite the previous data, the country still faces the great challenge of reducing the digital divide between socioeconomic groups (Vargas, 2022).

As commented in the State of the Nation Program (2020), after the pandemic caused by Covid-19, it was demonstrated that good connectivity is a fundamental right of all people. For this reason, specific public and private actions are required to improve Internet access for many people who, due to their socioeconomic level and/or geographic location, do not have this possibility.

Honduras has a recognizable base of high-quality genetic materials. This work of research and promotion of good materials has been promoted by the Fundación Hondureña de Investigación

Agrícola (FHIA), being a reference for the entire region. The cocoa value chain in Honduras has a system of technical assistance services for the cultivation of cocoa in agroforestry systems, operating in coordination between the bidders and demanders, through the National Technical Assistance System SINATEC. The strengthening of organizations and cooperatives has been decisive for the increase in production of quality cocoa.

Cocoa in Honduras represents a very important productive activity for small producers. Cocoa production is concentrated in the northwest, Atlantic coast and Olancho, totaling approximately 4,468 ha. in traditional agroforestry systems, established by some 3,469 producers. In recent years there has been promotion of production of organic cocoa and currently there are seven producer organizations that are starting with this type of production in the departments of Gracias a Dios, Olancho, Colón, Atlántida, Cortés, Yoro, Santa Bárbara and Olancho, with approximately 1,600 hectares of cocoa.

During the period 2011-2015, the total value of cocoa exports registers increased with an average annual growth rate of 46%. In 2013, the Exports practically doubled compared to 2012, reaching USD 554,706.12. However, in 2015, the value of cocoa bean exports reached USD 1,301,439.96. This export dynamic is due to the combined growth that exports to Central America and exports to Europe have suffered, which are the ones that register higher profitability.

The cocoa value chain in Honduras is made up of input suppliers, producers, collectors, marketers and buyers - some located in the area of influence of production and others outside of it - as evidenced in the supply chain value map that arise from different institutions, organizations, programs and support projects, both for the provision of services as well as for technical assistance and training.

Coffee is of almost importance to the Honduran economy; more than 102 thousand families are dedicated to their production in 15 of the 18 departments of the country, representing 30% of agricultural GDP and 5% of GDP total. This agricultural sector generates more jobs than any other and is in first place in activities productive foreign exchange generators. Honduras is currently the fifth largest producer of grain in the world.

Efforts to improve the functioning of the coffee value chain are carried out from several public and private institutions with a common need: to have information that allows them to evaluate correctly the dynamics of this productive sector, to design and implement public policies for collective benefit. In 2016 IHCAFE registered a total of 102,047 producers of which 18% are women. The total of the cultivated area is around 415,214 mz with average yields of 18 qq/mz. 60% of The farms are located between 900-1300 meters above sea level, 30% at more than 1300

meters above sea level and 10% less than 900 meters above sea level. The coffee is grown under an agroforestry system, with 95% of the area planted with shade from different species.

Coffee production in North, Central America and the Caribbean Harvest 2016/2017 to 2020/21

Country	Harvest Year					% Region	% Worldwide
	16/17	17/18	18/19	19/20	20/21		
Mexica, CA and the Caribbean	26,504	28,362	28,233	25,571	25,0333	100%	11%
Honduras	9,726	9,861	9,330	7,736	7,826	31%	3%
Mexico	4,742	5,849	5,675	5,197	5,217	21%	2%
Guatemala	4,805	4,870	5,226	4,704	4,565	18%	2%
Nicaragua	3,333	3,446	3,755	3,811	3,457	14%	2%
Costa Rica	1,789	2,036	1,861	1,920	1,891	8%	1%
El Salvador	796	991	993	862	783	3%	0%
República Dominicana	538	538	562	524	489	2%	0%
Haiti	446	447	452	452	450	2%	0%
Cuba	134	148	167	170	163	1%	0%
Panama	157	136	172	150	150	1%	0%
Jamaica	24	25	23	30	26	0%	0%
Trinidad & Tobago	15	16	17	15	16	0%	0%

*thousands of 46 kg bags

Table 2: Coffee Production in North, Central America and the Caribbean (IHCAFÉ 2021)

Current needs of the cocoa and coffee sector in Honduras and Costa Rica

In both Honduras and Costa Rica, cocoa and coffee are fundamental crops that generate employment, contribute to GDP and are vital to local economies. The need to strengthen these sectors is highlighted to guarantee their sustainability and competitiveness at the national and international level. Improving access to financing, specialized technical assistance and the adoption of sustainable practices are priority needs for the continued development of the cocoa and coffee sector in Honduras and Costa Rica.

Challenges include lack of access to financing, limited technical assistance, and the need to adopt sustainable practices to address the impacts of climate change and international competition. The opportunities lie in the promotion of technological innovation, the improvement of the value chain and the opening to international markets that demand sustainable and high-quality products.

In terms of marketing, the challenges indicated are: the need to consolidate public-private partnerships, standardize to achieve minimum volumes together, add value to the products (not only commercialize the crop, but also processed products). Have access to markets that recognize the value of sustainable practices and pay prices. The cost of intermediation is also a critical issue to address, so having options for direct connection with the market is important. Price management, standardization to achieve volume as a whole and achieve the required minimums.

In Honduras there is a lack of consumer culture of cocoa products, which harms the demand for a variety of derived products such as chocolate, drinks and desserts, which are not consumed in the desired volume. In addition, many cocoa producers depend on a cooperative or association that buys their harvest, and prices are usually not the most favorable. These cooperatives depend on a single buyer, and the lack of competition and options in the country prevents producers from enjoying benefits from competitive prices. Of course, climate change has greatly affected the productivity of the farms, and by failing to obtain a desired volume, a direct negotiation with the buyer cannot be carried out. On the other hand, in the coffee sector, 60% of coffee production is marketed through intermediaries, which greatly affects the establishment of competitive prices. It is necessary to identify direct markets, without intermediaries. Furthermore, it has been detected that many producers are unaware of the quality of their production, and without knowledge of negotiation, many sell quality coffee at low prices. Competition in the sector is increasing, and only a small number of consumers can identify quality in coffee.

In conclusion:

Competition (according to 38% of participants) and Buyers at good prices (28%) indicate the need to strengthen value chains and improve access to profitable markets for sustainable products. These are common challenges in any market, and for sustainable products, competition with conventional products can be particularly strong.

- Intermediaries can inflate product prices without proportionately benefiting producers. This reduces farmers' profits and affects equity in the distribution of benefits.
- Finding buyers willing to pay fair prices is an ongoing challenge. The pressure to reduce costs can lead buyers to offer low prices, harming producers.
- Ensuring that producers receive fair payment for their products is essential for the economic sustainability of the agro-chain.
- The most pronounced challenge is the high investment cost and the low marketing price: The disparity between high investment costs and low marketing prices affects producers' profitability.
- Poor infrastructure, including storage, transportation, and distribution, is a significant obstacle to the efficient marketing of products.

- Lack of access to markets (19%) suggests the need to develop strategies to connect producers with national and international buyers.
- Logistical and policy limitations prevent many producers from directly accessing international markets, affecting their ability to obtain better prices.
- The political and economic stability of the country directly impacts producers' ability to market their products efficiently.
- Market price volatility creates uncertainty and complicates the planning and management of production and marketing.
- Strong local and international competition forces producers to constantly improve their practices and products.
- Producers must be willing to adapt their products to meet the changing demands of the global market.

Monitoring the effects of COVID-19 in the agricultural sector

Given the current situation of COVID-19, and as a territorial support tool, Las Mesas Agroclimatic Techniques (MTA) promoted by the CGIAR Research Program on Change Climate, Agriculture and Food Security (CCAFS) and its partners have been crucial to mitigate the negative effects of the pandemic.

MTAs have addressed issues such as the effects of the pandemic on agriculture and food security of the region and what will happen to the millions of inhabitants of rural areas who depend on agriculture, as well as the measures that can be taken to reduce the effects. Between these measures are:

Appropriate communication channels: Digital tools have proven to be an effective way to disseminate agro-climatic information and recommendations for the agricultural sector during the pandemic.

Encourage local agricultural practices: to address the lack of access to fertilizers and others traditional inputs. It is important to continue implementing practices such as the use of traditional biological inputs, low-cost agro-ecological practices and the use of local resources to satisfy the nutritional needs of crops. Guarantee inputs: encourage social programs to provide seeds and other inputs priority agricultural crops. Diversify and encourage production: Emphasize the importance of cereal production to avoid shortages such as corn, sorghum, beans, vegetables.

Through these spaces for dialogue, it is possible to support the decisions of the agricultural sector, thanks to identification of impacts and the recommendations generated, farmers can take informed decisions to maintain the productivity of your crops, combat climate change, but especially at this time continue to provide food to the population in the middle of the health crisis effect of COVID-19. The Agri-Food Technical Tables are carrying out a fundamental role in diagnosing impacts and in generating recommendations.

Legislation and opportunities for coffee and cocoa producers in the EU

Most policies pretty much define how the EU is managing to shape their foreign green sector providers towards a more sustainable, organic, environmentally friendly and a fair-trade system. Most EU policies are aiming towards organic suppliers, and this is something we should consider now to define our possible future target group. From their summary we can anticipate that the International Trade Centre (ITC) will play a key role in the oncoming 2025 deforestation-free regulation and only digitally literate producers and/or digitally supported producers are going to be able to trace their farms proving they are able to export to the EU afterwards. To aid in compliance with these new regulations, the EU through the International Trade Centre (ITC), supports pilot projects aimed at preparing small businesses in the cocoa and coffee sectors. These projects provide technical assistance and guidance on implementing the required sustainability practices effectively. This support is crucial as it helps small producers not only comply with stringent EU regulations but also capitalize on the growing market demand for sustainable and ethically produced goods.

Defoin shared cases of study of digitalization in Spain emphasizing on the technological requirement processes and tech-providers. Something notable for discussion are the references in which has been proven the improvements on the green sector by digitalization of certain processes and how these can be extrapolated for our goals. However, it also highlights one of the great problems in the implementation of digital innovation: unequal access to the Internet and digital technologies, the potential for farmers to become overly reliant on technology, and the erosion of traditional agricultural knowledge, the urgent need for an appropriate governance approach to ensure that digitalization proceed, and crafting policy measures is the high level of uncertainty surrounding the impacts and future trajectory of digitalization.

Defoin also elaborates about EU agricultural policy and how this may affect future trends. “Digital technologies like artificial intelligence, 5G, cloud and edge computing, and the Internet-of-Things can help policymakers cope with climate change and preserve the environment more effectively. Digitalization also opens up new possibilities for remote monitoring of air and water pollution and tracking and optimizing energy and natural resources”

Certifications

There are several certifications in the coffee sector; the most applied are those of a socio-environmental type, which contain specific regulations to apply in the farms in the production stage, in the beneficiary (product traceability and assurance of quality), and in social aspects (prohibition of forced and child labor and decent wages), which they favor farm owners and workers, to the environment and adjacent communities.

Technology

In the coffee and cocoa sectors, it is necessary to implement a set of technologies necessary to ensure productivity. The level of technology used by producers is defined based on the number of practices of agricultural products relevant to the crop, plus the access to technical assistance and training processes. Of course, producers prioritize fertilization of cultivation over other practices, including pest and disease control, and pruning. The difference in performance obtained (qq/mz) does not depend on a single variable or practice, but it is the result of the interaction of all, and of aspects related to the conditions of the estate; Within these, the soil fertility, the rainfall regime of the area and the management that the producer provides to the farm.

Technology practices include:

- Fertilization
- Agricultural amendments.
- Tissue management.
- Shadow management.
- Pests and diseases control
- Weed control

Limitations

Some limitations include the high cost of production, lack of technical assistance in production and commercialization, limitations in access to agricultural financing, and the effects of climate change. These challenges have been exacerbated by adverse complementary and situational factors: the contraction caused by the COVID-19 pandemic, global inflation, and the Russia-Ukraine war conflict, which resulted in increased oil prices, subsequently raising fuel and fertilizer prices and causing inflationary pressures on energy and food. A positive effect has been the growth in the production of bio-inputs, especially organic fertilizers, in the country.

Access to financing and technical assistance for production, adding value, and marketing products are prioritized as major needs. There is an implicit need to invest in appropriate technology to adapt to climate and to add value. The lack of updated data—for instance, the last

National Agricultural Census was in 1993—and the absence of a system providing agricultural, livestock, climatic, and agri-commercial data, etc., influence the low growth of the sector. On the other hand, there is potential to strengthen alliances and coordination between different institutions at the grassroots level to achieve greater impact and effectiveness in the use of funds. The scenario of the agri-food sector highlights the need for public and private investment to increase productivity and to mitigate the impact of climate change and the effects of rising costs of external services and inputs.

Below are the most critical limitations in the cocoa and coffee sector:

1. Production limitations

- a. There is no formal credit and inadequate conditions for banking.
- b. Insufficient technical assistance services.
- c. Dependence on a single buyer.
- d. Training is based on supply and not on demand and little availability of technologies.
- e. Poor access conditions to the farms.
- f. Fertilizer prices increase up to 15% annual.
- g. Poor organization prevents increasing production and economies of scale.
- h. Traditional production and resistance to adoption of good practices.
- i. Low educational level.

2. Limitations in internal marketing

- a. Limited access to financing for infrastructure.
- b. Lack of drying and fermentation structures.
- c. Structures with poor warehouse conditions.
- d. Low purchasing volumes with organizations or producers and absence of long-term commercial relationships.
- e. There is a lack of uniformity in grain quality.
- f. Low transport capacity of the product during the peak of harvest.
- g. High cost of vehicle maintenance.
- h. Social insecurity.

3. Limitations on external marketing

- a. There is a lack of accurate forecasts regarding the quantities and prices to be marketed.
- b. Volatile prices and low promotion of Honduran coffee/cocoa.
- c. High financing interests.

4. Limitations on prosecution

- a. Lack of credit to purchase equipment.

- b. There is limited access to cutting-edge technology to achieve the lowest possible cost and a more environmentally friendly process.
- c. Infrastructure needs to be improved.
- d. Little access to training programs.

5. Limitations in roasting and fermentation process.

- a. Low capacity for innovation and development products and cup lines.
- b. Lack of financial products to acquire coffee or chocolate preparation equipment.
- c. There is no innovative industry packaging.

To increase productivity, it is necessary to generate new knowledge; in this regard, national and local research conditions and capacities oriented towards performance must be improved. The establishment of these plots must be coordinated by actors in the territory so that it becomes a strategy managed from within the farm.

It is necessary to create a local infrastructure development plan; there are initiatives by commercial houses aimed at promoting solutions for drying, such as small solar dryers and other support infrastructure. However, these efforts are geared towards product sales rather than the development of producers. Through this plan, access to specialized technical assistance could be ensured.

Sector planning must focus on facilitating resources for specific aspects, such as fertilization and preventive pest control. The study shows that those who invest in an orderly manner achieve better yields. In companies and community associations, infrastructure development should be oriented towards more extensive use to scale up production.

The agricultural sector has great potential to consistently be the main driver of the national economy through trade within the country and with international markets. Food production must meet the supply needs of the national market and ensure food and nutritional security. In this regard, promoting the consumption of national products will be encouraged through actions that foster awareness and a sense of belonging among the population, accompanied by awareness campaigns.

The growth of international trade involves seeking strategies for niche competition, differentiation, and added value for both traditional and emerging products being promoted. Efforts will be made to shift from exporting raw materials to exporting to differentiated markets, taking advantage of inter and extra-regional international trade schemes, as well as existing trade agreements.

V. Digital Gaps

As a result of the rise of Information and Communication Technologies (ICTs) in the 21st century, sectors of society have suffered drastic changes in their operating dynamics. However, such strengthening of technologies has not occurred equitably for people; On the contrary, they have been positioned as a new expression of inequality that affects the full development of the human rights of the communities. According to the Research Report “New approaches for measuring and decomposing digital divides in Costa Rica” (IICA, 2022), the digital divide is conceptualized as *“the inequality between individuals, households, companies and geographic areas at different socioeconomic levels with respect to the ICT access and the use of the Internet for a wide variety of activities.”* (p.3).

It is important to mention that the digital divide is a multidimensional (and therefore multicausal) phenomenon, where the following factors can be taken into consideration for its analysis:

Income	Access to ICTs is conditional on prior access to the sufficient and necessary means for them. Technologies, particularly the newest ones, tend to be expensive, which represents a significant barrier for lower-income people or households.
Geography-Rural Area	Urban areas tend to be those that concentrate the highest population densities, making it much more viable to make investments in large telecommunications, as well as connectivity plans and programs.
Age	There is a contrast between the groups of young people who have grown up under the context of the technological revolution with respect to the older adult population; which generates exclusion for the latter in their insertion or training for the use of technologies.
Digital gender gap	Evidence of this is the low participation rates of women in careers related to science, technology, mathematics and engineering.
Language	Much of the content available on the Internet is available in English, so it is an important filter for those people who do not know this language.
Education level	There is a correlation between formal education and the ability to

	efficiently use ICTs. Therefore, formal education has a direct impact on people's digital literacy.
The job	In many countries, Internet access is only available in workplaces and Internet cafes, which are far from affordable for all budgets.
Physical integrity	There is a danger of digital exclusion that leaves out populations with disabilities, so guaranteeing access to technology for this population is of great importance.

Table 3: Factors to consider regarding the Digital Gap in the Green Sector

The findings show that main actors for digitalization and the needs for digitalization are very alike. Technology availability is larger in the countryside in Costa Rica but in general it is highly possible to find homogenous target populations in both countries due to the importance and distribution of the crops, mostly coffee, in both countries. There are several digital gaps that can be pointed out like soil analysis tools, weather forecasting, pest/disease monitoring, local and international price forecasting, production networks, coffee bean quality monitoring tools, apps for climate-smart agricultural practices.

Digital Literacy

It is essential to promote greater adoption of information and communication technologies (ICT) and digital agriculture among small farmers, especially among women and youth. Technologies – from smartphones and precision agriculture to e-commerce, blockchain and drones – can help farmers make better decisions, boost agricultural productivity, manage resources more efficiently and increase competitiveness.

Among other examples, it stands out that the use of climate-smart digital solutions can contribute to reducing greenhouse gas emissions and increasing the region's resilience to climate change by improving the management of its watersheds. Digital technologies can also drive innovation and agricultural entrepreneurship, creating attractive job opportunities, especially for young people, in value chains.

It is necessary to implement technology components in information and communication, this means formalizing the systematic use of ICT, providing incentives for their development for priority value chains and providing training to improve digital literacy. For a successful scale-up of ICT, the value chains in question, the profile of potential users, the existing institutional structure and the telecommunications infrastructure must be taken into account.

Based on the provided information, here's a breakdown of how technology is being used to learn and support production processes:

According to the analysis carried out on the surveys implemented with the various actors in the cocoa and coffee chain in Honduras and Costa Rica, certain specific findings stand out regarding the levels of digital literacy among farmers. Among which it stands out that, although today it is more accessible than ever for a farmer to have access to the internet and a smartphone, the reality is that the availability of a stable and quality connection continues to be a challenge in many rural areas. Although technology has democratized access to information and digital tools, the lack of telecommunications infrastructure limits the potential of digitalization in the agricultural sector. The digital divide persists, and the quality of the internet connection becomes a crucial factor so that farmers can take full advantage of the opportunities offered by technology.

Among the types of available technologies used in rural areas are:

WhatsApp queries: Being a basic communication application, it is common in any area due to its low connection data consumption. This demonstrates the power of social media to spread information and connect with experts.

50% of respondents use websites to learn and get support. This suggests a high level of accessibility and ease of use for agricultural producers.

Smartphone apps: 42% of respondents use smartphone apps. This indicates a growing trend in the use of mobile technology for agricultural information and support.

Online training: 42% of respondents use online training. This highlights the growing adoption of digital learning platforms for agricultural knowledge.

Geolocation applications: The use of geolocation applications is very common. This shows the increasing use of technology for climate and soil forecasting, which is crucial for efficient agricultural practices.

Overall, the data suggests that technology is playing an increasingly important role in supporting learning and agricultural production processes. The use of websites, smartphone applications and online training is particularly prevalent, indicating a growing trend towards digitalization in the agricultural sector.

The following strategies are proposed with the objective of increasing agricultural productivity in Costa Rica and Honduras through technology:

1. Strengthen digital infrastructure:

Expansion of internet coverage: Prioritize investment in telecommunications infrastructure to increase internet coverage in rural areas. This involves building transmission towers, installing fiber optics, and promoting wireless technologies like community Wi-Fi.

Improve the quality of the connection: It is not only about having access to the internet, but also about guaranteeing a stable and quality connection. This involves investing in technologies that enable greater connection speed and signal stability, especially in areas with challenging geographic conditions.

2. Train farmers in the use of technology:

Digital literacy programs: Implement specific training programs for farmers, focusing on the use of digital tools such as mobile applications, online learning platforms and websites.

Practical workshops: Organize practical workshops that demonstrate how to use technology to improve crop management, access to market information, water resource management and early detection of pests and diseases.

Incentives for technology adoption: Offer financial or in-kind incentives to farmers who adopt digital technologies, such as discounts on the purchase of devices or free access to information platforms.

3. Develop technological solutions adapted to local needs:

Specific mobile applications: Develop mobile applications that provide relevant information to farmers in Costa Rica and Honduras, such as climate forecasts, market prices, crop management advice, and access to extension services.

E-commerce platforms: Encourage the use of e-commerce platforms so that farmers can sell their products directly to consumers or wholesale buyers, avoiding intermediaries and obtaining better prices.

Smart irrigation systems: Promote the adoption of smart irrigation systems that optimize water use, reduce waste and increase irrigation efficiency.

4. Promote collaboration between key actors:

Public-private alliances: Promote collaboration between the government, the private sector and civil society organizations to develop and implement technological solutions in the agricultural sector.

Farmer networks: Promote the creation of farmer networks that share experiences, knowledge and technological solutions.

Innovation centers: Establish agricultural innovation centers that serve as spaces for research, development and technology transfer.

5. Monitor and evaluate the impact of interventions:

Continuous evaluation: Implement a monitoring and evaluation system to measure the impact of interventions on agricultural productivity, technology adoption and farmer well-being.

Adjustments and improvements: Use evaluation results to adjust strategies and improve the effectiveness of interventions.

Successful implementation of technology in the agricultural sector of Costa Rica and Honduras requires a comprehensive approach that addresses the specific needs of farmers, digital infrastructure, and training. By investing in these areas, the project can contribute to increasing productivity, improving the quality of life of farmers and promoting sustainable agricultural development.

Skills and Knowledge needed by the Productive Community.

- Technical knowledge in sustainable agricultural practices: This was the most selected competency, highlighting the importance of training producers in sustainable production methods such as organic farming, soil conservation, and integrated pest management.
 - Management skills for planning and implementation: Emphasizes the need for producers to have strong skills in planning, budgeting, organization, and decision-making to effectively implement sustainable practices.
 - Ability to adapt to climate change and new technologies: Stresses the importance of flexibility and continuous learning to adapt to environmental changes and adopt new sustainable technologies.
 - Systemic thinking in the agricultural value chain: Highlights the need to understand the interrelationships between different actors and processes in the agricultural value chain to make sustainable decisions.
 - Leadership to inspire others to adopt sustainable practices: Underscores the crucial role of leaders in promoting sustainable production among other producers, communities, and value chain actors.
- Gender equity in agricultural production: Indicates the importance of promoting the equitable participation of men and women in decision-making and the development of the necessary capacities for sustainable production.
- Good communication skills to share information: Highlights the need for effective communication to disseminate knowledge about sustainable practices, collaborate with other actors, and market sustainable products.

Deforestation-free regulation

Both countries will have to solve the oncoming 2025 deforestation-free regulation which will require for any coffee or cacao farmer to geo-locate and size its property, trace its production and demonstrate that it did not cut forest for its establishment before 2020.

By promoting the consumption of ‘deforestation-free’ products and reducing the EU’s impact on global deforestation and forest degradation, the new Regulation (EU) 2023/1115 on deforestation-free products is expected to bring down greenhouse gas emissions and biodiversity loss.

The Regulation is part of a broader plan of actions to tackle deforestation and forest degradation first outlined in the 2019 Commission Communication on Stepping up EU Action to Protect and Restore the World’s Forests. This commitment was later confirmed by the European Green Deal, the EU Biodiversity Strategy for 2030 and the Farm to Fork Strategy.

Background

On 29 June 2023, the Regulation on deforestation-free products entered into force. The main driver of these processes is the expansion of agricultural land that is linked to the production of commodities like cattle, wood, cocoa, soy, palm oil, coffee, rubber, and some of their derived products, such as leather, chocolate or furniture. As a major economy and consumer of these commodities linked to deforestation and forest degradation, the EU is partly responsible for this problem, and it wants to lead the way to solving it.

Under the Regulation, any operator or trader who places these commodities on the EU market, or exports from it, must be able to prove that the products do not originate from recently deforested land or have contributed to forest degradation.

The Regulation on deforestation-free products repeals the [EU Timber Regulation](#). As of 29 June 2023, operators and traders will have 18 months to implement the new rules. Micro and small enterprises will enjoy a longer adaptation period, as well as other specific provisions.

Objectives

The new rules aim to:

- avoid that the listed products Europeans buy, use and consume contribute to deforestation and forest degradation in the EU and globally
- reduce carbon emissions caused by EU consumption and production of the relevant commodities by at least 32 million MT per year

- address all deforestation driven by agricultural expansion to produce the commodities in the scope of the regulation, as well as forest degradation

Research, development, and innovation play a fundamental role in achieving a competitive and sustainable agriculture, as they enhance productivity, encourage resilience in the agricultural sector, improve the availability, quality, and safety of products, and increase the sustainability of natural resources and the environment. According to Frédéric Goulet et al. (2019), since the Green Revolution, the adoption of technological innovations by farmers—improved seeds, mechanization, fertilizers, pesticides—was massive among well-resourced farmers. Today, agriculture and food production face an era of accelerated change driven by advances in natural sciences, electronic communication, the digital economy, and the bioeconomy.

Honduras requires greater investment in scientific research across all links of the value chain. To achieve this, the roles assigned to DICTA, complemented in the field by FHIA, academia, and other research centers, are pivotal. This sub-objective proposes applied, rapid, and participatory research that responds to the urgent needs of the sector. It aims to promote and strengthen agricultural and food science and technology, including the development of new products.

The digital traceability and certification platforms will require:

1. Farmer's organizational skills
2. Access to networking
3. Access to technology (Drones, cellular, computers)
4. Knowledge on geo positioning and farm measuring
5. Learn to use digital tools like certain phone applications (several under construction)

In the IICA study *Rural Connectivity in Latin America and the Caribbean (2020)*, the central problems that characterize the digital divide in rural areas were identified. Firstly, the scarcity of data on the situation of rural connectivity appears as a determining factor, since most of the available information does not differentiate between urban or rural areas, as well as the availability of specific infrastructure information on a national scale. It is scarce in Latin America and the Caribbean. On the other hand, socioeconomic difficulties and disincentives for investment are a central problem. In the region, one of the main barriers is the cost of mobile and fixed broadband service; For example, for the population in the first income quintile the cost represents between 14% and 12% of their income respectively.

In this same analysis, attention was drawn in order to understand that, to overcome the connectivity gap and its intensification in the rural area, intervention by various sectors and actors of the political system is necessary (IICA, 2020). Under this logic, it is essential that States

take a leadership role in this multiplicity of agents, to coordinate the agendas and frameworks of action of each one.

Given that many farmers have varying levels of technological literacy, the product should be user-friendly and intuitive. Ensure the product can be accessed on basic mobile phones. Without a doubt, access to the internet and other technological devices has become an essential mechanism for the full development of the rights of all people; a situation that was even more evident with the Covid-19 pandemic. However, this access responds to a new expression of inequality; which intensifies depending on variables such as geographical area, economic situation, gender, age, among others. Therefore, it is crucial for International Cooperation to articulate its operational approach in the construction of affirmative actions aimed at reducing this digital divide; to improve people's daily lives in an increasingly technological and globalized context.

Best Practices in EU

The single most important practice required from the EU is to identify and grant access to the digital platform that would serve as a pivotal reference or center of alignment to judge the farms or areas under approval.

At this point, it is important to highlight the actions carried out by the EU to strengthen the capacities of producers to connect with science and technology. The concept of Agricultural Knowledge and Innovations Systems (AKISs) has grown within the last decade in the European Union (EU), with increased visibility and recognition, as it became more and more clear that the linear research model was failing. AKIS is a useful concept to ‘describe a system of innovation, with emphasis on the organizations involved, the links and interactions between them, the institutional infrastructure with its incentives and budget mechanisms’ (EU SCAR, 2012, 2016). Over the years, AKIS evolved from a primarily academic concept to a broader approach for agricultural knowledge, policy and sectors. Awareness on the importance of strengthening AKISs increased, to better connect science and practice and to boost knowledge exchange and innovation for the benefit of European farmers and foresters. This has been reflected in the European Innovation Partnership on Agricultural productivity and sustainability (EIP-AGRI2) which was launched in 2012, setting the framework conditions for EIP-AGRI Operational Groups and at the same time supporting the evolution and progression of EU AKISs.

Implementation of the interactive innovation model (2014-2020)

In the 2014-2020 period, the European Commission (EC) implemented new tools to stimulate innovation and development of knowledge useful for practice. The European Innovation Partnership for agricultural productivity and sustainability EIP-AGRI is a major policy and networking initiative designed to speed up innovation on the ground. The EIP-AGRI is entirely

based on the interactive innovation model. This model promotes targeted collaboration between a set of actors (e.g. farmers, foresters, advisors, entrepreneurs, end-users of project results, consumers, researchers, etc.) to make best use of their complementary types of knowledge (scientific, practical, organizational, etc.) in view of co-decision and co-creation all along the project of solutions/opportunities which are ready to implement in practice. The interactive innovation model aims at increasing projects' impact through starting by identifying the end-users' needs and creating co-ownership during the project for all involved. The model also pays great attention to fully developing all ways to communicate on the project and disseminate the developed solutions and opportunities with all means and at all levels (geographical, sectorial, working with multipliers joining the project, etc).

Stepping-up efforts to promote innovation and improve the value of existing agricultural knowledge, knowledge and innovation would have a key role in helping farmers and rural communities to meet substantial challenges. These include ensuring long-term food and nutrition security, bolstering environmental care and climate action and strengthening the socio-economic fabric of rural areas. Although agricultural research delivers new knowledge and there is already a substantial amount of knowledge available to answer these challenges, it tends to stay fragmented and insufficiently applied in practice. Moreover, the agricultural sector itself has considerable and under-used innovation capacity. On average, twenty years separate the start of research from the mainstream application of its outcomes in agriculture. The insufficient or too slow uptake of new knowledge and innovative solutions in farming, by small and medium-sized farms, hampers a smooth transition towards a more sustainable agriculture as well as the farm sector's competitiveness and sustainable development. The 2030 Agenda for Sustainable Development leaves just ten more years to provide effective solutions. Therefore, all actors involved must simultaneously step up their efforts to develop new knowledge and innovative solutions. A conducive environment for quicker innovation and better valorization of existing knowledge to achieve the CAP objectives and deliver on international commitments has to be set up across the EU, in an inclusive way.

VI. Women's participation in value chains

It is essential to analyze an intersectional gender approach in both sectors, with the purpose of promoting the equal participation of women in the coffee and cocoa sector in the different activities of the value chain through access to strategic resources (knowledge, experience, machinery, tools, agricultural inputs, land, transportation, technologies, money, among others) and support on fiscal issues and adaptation to climate change. During the analysis of the interviews, it is recognized that in both sectors there are more women who desire or manage to transform raw materials into a final product, there is a greater number with interest in the areas of

marketing and commercialization of their products. On the other hand, it is recognized that both coffee and cocoa are sectors where it is recognized as a male sector, where women are associated with administrative, care or collaboration tasks for their husbands or families.

Women, being in a masculinized sector, must be constantly demonstrated to make it visible that they have the capabilities and skills to perform at work. Despite inter-institutional efforts aimed at reducing gaps; There are still aspects that drive gender inequalities in the sector. An example of this is the use of the time that women allocate to care and household work, since it is greater than the time dedicated by men. This is why it is important to emphasize the implementation of workshops to strengthen leadership and technical capacities; in order to reduce this gap.

Here are some detailed strategies that could be implemented within the project:

1. Targeted Training and Capacity Building:

- **Tailored Programs:** Develop training programs specifically designed for women farmers, addressing their unique needs and challenges. This could include topics like financial literacy, leadership skills, access to resources, and technology adoption.
- **Mentorship and Networking:** Establish mentorship programs where experienced women farmers can guide and support younger women entering the sector. Facilitate networking opportunities for women farmers to share knowledge and build connections.

2. Equal Access to Resources and Technology:

- **Financial Inclusion:** Promote access to microfinance and credit programs specifically for women farmers. This could involve working with existing microfinance institutions or developing new programs tailored to their needs.
- **Technology Adoption:** Provide targeted training and support to women farmers on using technology for agricultural practices, market access, and business management. This could include training on mobile apps, online platforms, and digital tools.
- **Land Ownership and Inheritance Rights:** Advocate for policies that promote equal access to land ownership and inheritance rights for women. This could involve working with government agencies and local organizations to address legal and social barriers.

3. Promoting Women's Leadership and Decision-Making:

- **Leadership Development:** Support women farmers in taking leadership roles within their communities and agricultural organizations. This could involve providing training on leadership skills, communication, and advocacy.

- Representation in Decision-Making Bodies: Encourage the participation of women farmers in decision-making bodies at the local, regional, and national levels. This could involve advocating for quotas or other mechanisms to ensure their representation.
- Gender-Sensitive Policies: Work with government agencies and other stakeholders to develop and implement gender-sensitive policies that promote women's participation and empowerment in the agricultural sector.

4. Addressing Gender-Based Violence and Harassment:

- Awareness Campaigns: Conduct awareness campaigns to address gender-based violence and harassment in the agricultural sector. This could involve working with local communities, schools, and organizations to promote gender equality and respect.
- Support Services: Provide access to support services for women farmers who experience violence or harassment. This could involve partnering with organizations that offer legal aid, counseling, and other forms of assistance.

5. Monitoring and Evaluation:

- Gender-Disaggregated Data: Collect and analyze gender-disaggregated data to track the progress of the project in achieving gender equity. This data can be used to identify areas where interventions are needed and to measure the impact of the project on women farmers.
- Regular Assessments: Conduct regular assessments of the project's gender equity outcomes and make adjustments as needed. This will ensure that the project is effectively addressing the needs of women farmers and promoting their empowerment.

By implementing these strategies, the project can make a significant contribution to achieving gender equity in the agricultural sector of Costa Rica and Honduras. This will not only benefit women farmers but also contribute to the overall sustainability and productivity of the sector.

VII. Conclusions and Recommendations

After an exhaustive review of the state of the green sector mainly in Costa Rica and Honduras, focusing the analysis on a vision of the need for a digital change in this sector, some conclusions and recommendations are proposed below for those involved in the green sector, especially focused on the coffee and cocoa sectors, as well as for the agents involved in the digital change of this sector.

-Knowledge and innovation have a key role to play in helping the farmers and rural communities meet challenges of today and tomorrow.

-Policy makers, farmers, researchers, advisors, associations and media need to step up their efforts to develop new knowledge and innovative solutions. Moreover, a conducive environment across the EU for quicker innovation and better valorization of existing knowledge to achieve the CAP objectives and deliver on international commitments needs to be set up.

-The European Innovation Partnership for agricultural productivity and sustainability (EIP-AGRI) is a unique policy framework to support interactive innovation projects at local and transnational level.

-Therefore, it is essential to build stronger Agricultural Knowledge and Innovation Systems (AKIS) to boost initiation and development of innovation projects, to disseminate their results and to use them as widely as possible.

-Successful AKIS strategies include four main groups of actions: Enhancing knowledge flows and strengthening links between research and practice; Strengthening all farm advisory services and fostering their interconnection within the AKIS, Enhancing cross-thematic and cross-border interactive innovation; Supporting the digital transition in agriculture.

-Incorporate the Gender Perspective in All Stages of the Project: It is recommended to integrate the gender perspective transversally in the planning, implementation and evaluation of the project. This includes ensuring equity in the distribution of resources, facilitating access to training and leadership opportunities for women, and adopting gender-sensitive policies and measures.

-Strengthen Collaboration with Key Actors: It is suggested to strengthen collaboration with civil society organizations, government institutions, and other relevant actors to promote the effective implementation of the proposed strategies. Working in partnership will amplify the impact of

interventions aimed at promoting gender equity in the agricultural sector and guarantee the long-term sustainability of the efforts made.

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VIII. Appendix

The development of the surveys implemented with the different actors in the cocoa and coffee chain of Honduras and Costa Rica are presented below. The execution of these surveys was carried out by all Latin American partners involved in the DigiBuild project: FHIA, IICA, UCENFOTEC and ThinkCorp.

8.1 Survey Summary by FHIA

To carry out the surveys, the suggested questions were taken into account. As a result, it was possible to obtain general data on the current perception of sustainable production in the cocoa and coffee value chains in Honduras. On the other hand, it also details the inclusion of technology in production processes. The participants are representatives of the different sectors of the value chain of each area. This meets the requirements established for carrying out this exercise.

Sample Description:

- 100% are labour market representatives from the cocoa and coffee sector in Honduras. 60% are from the coffee sector and 40% from the cocoa sector.
- 60 % of the respondents are women and 40% are men.
- 100% of the respondents play a participatory role in the cocoa or coffee value chain.
- 60 % represent the research, technical assistance and professional in the green sector
- 10% represents the public stakeholder (1 coffee / 1 cocoa).
- 55% represents the productive sector.
- 20% of the respondents are organizations or institutions that ensure the participation of women in different productive areas.

What is the main challenge you face to obtain sustainable production?

Among the challenges that stand out in both the coffee and cocoa sectors, climate change is one of the most significant. Today, producers are unaware or find it very expensive to invest in the practices necessary to adapt to climate changes. This directly affects productivity, and the cocoa and coffee community reports low productivity per hectare in these agro industries. On the other hand, the high costs of the inputs necessary to apply on the farms and the costs of construction materials for infrastructure make it difficult for the producer to make sustainable investments. Finally, the labor shortage has had a huge impact, representing losses in productive areas. It is considered that internal and external migration has been a determining factor so that young people and adults do not have greater interest in participating in collection activities. In the coffee sector, the majority of farms in the country are aging, a situation that is alarming due to the lack of attention and the decline in productivity reported in recent years.

What is the main challenge that your agricultural chain faces in marketing its product?

In the country there is a lack of consumer culture of cocoa products, which harms the demand for a variety of derived products such as chocolate, drinks and desserts, which are not consumed in the desired volume. In addition, many cocoa producers depend on a cooperative or association that buys their harvest, and prices are usually not the most favorable. These cooperatives depend

on a single buyer, and the lack of competition and options in the country prevents producers from enjoying benefits from competitive prices. Of course, climate change has greatly affected the productivity of the farms, and by failing to obtain a desired volume, a direct negotiation with the buyer cannot be carried out.""

In the country, 60% of coffee production is marketed through intermediaries, which greatly affects the establishment of competitive prices. It is necessary to identify direct markets, without intermediaries. Furthermore, it has been detected that many producers are unaware of the quality of their production, and without knowledge of negotiation, many sell quality coffee at low prices. Competition in the sector is increasing, and only a small number of consumers can identify quality in coffee.

What benefits are obtained from producing sustainably?

Among the benefits is productivity, which generates profitability while carrying out climate change mitigation activities, and also allows family members to be involved and raise awareness among the family group regarding actions for environmental protection. In the end, everything comes down to economic benefits. Since the markets require specific guidelines to obtain better prices. In conclusion, implementing sustainable practices generates PROFITABILITY, CARBON CAPTURE, RESILIENCE TO THE VARIETY OF CLIMATE CHANGE, CONSERVATION OF NATURAL RESOURCES, WATER AND SOIL.

How do national and international markets value sustainable production in marketing?

There are better prices in the international market, however it is best to carry out the negotiation process directly with the market since intermediaries reduce the economic benefit. The national market has little values the implementation of sustainable practices, the economic benefit is minimal.

What experience have you had with competency-based teaching?

In both areas, the practices carried out in the field have been very useful since the "learning-by-doing" process is an essential methodology to learn the agronomic management of cocoa and coffee beans. To strengthen the acquired capacities and skills, participation in forums, exhibitions, virtual and in-person training have been helpful in updating sustainability practices.

What are the skills that you consider valuable in your agricultural chain to obtain sustainable production?

First, it is essential to know the agronomic management of cocoa and coffee, in order to implement practices that can improve productivity. It is essential to know the topic of soil nutrition to make necessary investments. It is important to be clear about the concepts of sustainable production, and what it really implies, since they are not only environmental practices, but also entail social actions.

How many times have you taken an online course? (0, 1 to 3, 4 to 6, more than 6)

100% of participants have taken an online course more than 6 times.

How many times have you taught an online course? (0, 1 to 3, 4 to 6, more than 6)

40% of participants have had the opportunity to teach an online course more than 6 times.

In what practices is technology used to learn or support production processes? (WhatsApp consultations, online training, web pages, geopositioning applications, cell phone applications)

A variety of cell phone applications have been used to carry out certain practices in the field, especially to learn more about the guidelines for agricultural practices that should be carried out. On the other hand, the free resources available on the web are widely used by a self-taught community. It is important to highlight a comment that mentioned that it was easier for the producer to access those platforms that do not require a username or password. Information search engines and video platforms such as YouTube are widely used.

What initiatives do you know in your agricultural chain that motivate the inclusion of women, people with special needs or indigenous groups in production processes?

The best known are those executed by international organizations that implement social projects such as USAID, SWISSCONTACT, GIZ, NOYMAN FOUNDATION, RIKOLTO among others. There are national initiatives that carry out projects to benefit women such as REDMUCH in cocoa and AMUCAFÉ in the coffee sector.

Survey results

The responses and reactions of the respondents to each of the questions described are detailed below. The 20 participants are actors in the different coffee and cocoa value chains in Honduras.

8.2 Survey Summary by THINK CORP

Introduction

The following is a detailed analysis of the responses to the interview conducted with 32 individuals regarding the use of technology in the green sector of Honduras. The analysis includes demographic information, statistics on the responses to each question, and a general analysis of the findings within the following themes:

- Challenges for sustainable production
- Obstacles for the commercialization of agro-chain products
- Benefits of sustainable production
- Valuation of sustainable production in national and international markets
- Assessment from the experience with competency-based education

Compilation of valuable competencies in the agro-chain aimed at achieving sustainable production

- Scope of education in the field, whether online or in-person
- Use of technology in production processes, inclusion of women in the agro-production chain

Methodology

Interviews were conducted through a “Google Form” as a method for collecting responses for each interview and subsequent audience segmentation and analysis oriented towards the green sector in the areas of education, commerce, and production.

Link: A Google Sheet is provided with all the original responses from the interviewees and a Google Doc with the diagrammed text of each question and collected response.

Results

The results of the conducted interviews are presented below.

Demographic Information

Average Age: 38 years. 62% of the respondents are in the age range of 31 to 45 years old.

Gender: 62% of the respondents were male and 38% were female.

Job Positions:

Company / Organization	Amount	Percentage
Manager	9	28%
Producer	6	19%
Director	2	6%
Advisor	2	6%
Accountant	1	3%
Teacher	2	6%
INTERNATIONAL MARKET MANAGER	1	3%
CEO	1	3%
Field supervisor	1	3%
Lawyer	1	3%
Owner	1	3%
Technician	1	3%

Biologist	1	3%
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Companies:

Company / Organization	Amount	Percentage
Livestock Companies	6	19%
Coffee plantations	6	19%
Nonprofit organizations	3	9%
Financial Institutions	2	6%
Universities	2	6%
Agribusiness companies	1	3%
Agricultural technology companies	1	3%
Government entities	1	3%

Based on the information collected, and as an additional comment to the interview, many of these positions in the mentioned companies or organizations must educate their subordinates or coffee producers about the different forms of commercialization and digital communication that exist.

This means that in this field, people educated in the green sector are always open to sharing their knowledge with those who do not have it.

For example, those working in financial institutions educate farmers in areas such as financing and how they can use the income obtained from the sale of their production for investment or maintenance of investment loans that help them maximize their production.

Question 1: What is the main challenge facing the green sector in achieving sustainable production?

The most frequently mentioned response, high investment cost (according to 41% of participants), indicates that the initial investment in sustainable practices and technologies is significant.

The transition to more sustainable practices often requires substantial investments in infrastructure, technology, and training. This can be an obstacle for many producers, especially small-scale farmers. The costs associated with sustainable production, such as organic fertilizers and clean technologies, are high. At the same time, selling prices may not reflect these additional costs, thus reducing profitability. The lack of skilled labor and high labor costs are recurring challenges. This includes both the number of available workers and their training and competence. The difficulty in accessing markets that value and pay for sustainable products also affects producers' profitability.

Following closely, the lack of environmental awareness (according to 25% of participants) suggests the need for educational and awareness campaigns to promote understanding of the benefits of environmental care for sustainable production.

Another significant challenge is the generation of self-consumption renewable energy (according to 19% of participants), highlighting the importance of finding accessible solutions for clean energy generation in rural areas, where productions are often located.

The lack of access to modern and efficient technology prevents many producers from becoming more sustainable. This includes machinery, advanced cultivation techniques, and resource management systems.

The scarcity of financial resources limits producers' ability to invest in more sustainable practices. Access to affordable financing is crucial.

Climate change and agricultural diseases (according to 15% of participants) highlight the need for education on how to develop strategies to adapt to the effects of climate change

and protect crops from diseases. Climate change exacerbates difficulties in agricultural production, such as the emergence of new pests and diseases and adverse weather conditions.

Land degradation and water scarcity are severe problems affecting sustainable production. Agricultural practices must adapt to be more resilient to these changes.

Other Challenges Mentioned:

Lack of Knowledge: Many producers do not have adequate knowledge about sustainable production practices. Education and training are essential to overcome this obstacle.

Environmental Awareness: There is a lack of awareness about the importance of sustainability among both producers and society in general. Increasing this awareness is crucial for driving significant changes.

Information and Education: There is a need for educational programs that teach producers how to implement sustainable practices and the long-term benefits of these practices.

Government Support: The lack of government support, both in terms of policies and funding, is a major challenge. Producers need incentives and subsidies to adopt sustainable practices.

Lack of Incentives: Without economic incentives, it is challenging to motivate producers to change their practices. Subsidies for sustainable practices and penalties for unsustainable practices can be effective.

Waste Management: Proper waste management and the creation of reuse chains are essential for sustainability. This includes the management of organic waste and the reduction of the use of plastics and other non-biodegradable materials.

Efficient Use of Natural Resources: Efficiency in the use of resources such as water and land is fundamental. Practices that improve efficiency and reduce waste are necessary.

All the challenges mentioned are complex and interrelated in achieving sustainable production. Addressing these challenges must be done from a multifaceted approach that includes:

Education and Training

- Access to Technology and Financing
- Government Support

Collaboration between producers, governments, educational institutions, and the private sector will be essential to achieve a successful transition to more sustainable practices.

Question 2: What is the main challenge facing the agro-chain in marketing products?

Competition (according to 38% of participants) and Buyers at good prices (28%) indicate the need to strengthen value chains and improve access to profitable markets for sustainable products. These are common challenges in any market, and for sustainable products, competition with conventional products can be particularly strong.

- Intermediaries can inflate product prices without proportionately benefiting producers. This reduces farmers' profits and affects equity in the distribution of benefits.
- Finding buyers willing to pay fair prices is an ongoing challenge. The pressure to reduce costs can lead buyers to offer low prices, harming producers.
- Ensuring that producers receive fair payment for their products is essential for the economic sustainability of the agro-chain.
- The most pronounced challenge is the high investment cost and the low marketing price: The disparity between high investment costs and low marketing prices affects producers' profitability.
- Poor infrastructure, including storage, transportation, and distribution, is a significant obstacle to the efficient marketing of products.
- Lack of access to markets (19%) suggests the need to develop strategies to connect producers with national and international buyers.
- Logistical and policy limitations prevent many producers from directly accessing international markets, affecting their ability to obtain better prices.
- The political and economic stability of the country directly impacts producers' ability to market their products efficiently.
- Market price volatility creates uncertainty and complicates the planning and management of production and marketing.
- Strong local and international competition forces producers to constantly improve their practices and products.

- Producers must be willing to adapt their products to meet the changing demands of the global market.

Fair prices (15%) highlight the importance of establishing mechanisms that guarantee fair prices for sustainable products that reflect their environmental and social benefits.

In conclusion, addressing these challenges—maintaining product quality, managing production and marketing costs, overcoming logistical and infrastructural barriers, ensuring fair and stable prices, and adapting to market demands and climate changes—requires a holistic approach that integrates:

Technological improvements

- Government support
- Access to international markets
- A more equitable distribution of benefits along the value chain

Education aimed at resolving these challenges, targeted at producers, intermediaries, governments, and other key actors, is essential to overcome these obstacles and achieve more efficient and equitable marketing of agricultural products.

Question 3: What benefits are obtained by producing sustainably?

Through this question, the main benefits of producing sustainably were identified in three areas: Economic, Environmental, and Social.

Economic Benefits (68.75%)

- **Higher Long-Term Profitability (25%)**
 - Greater profitability
 - Better price and access to different markets
 - Increased sales and higher demand
 - Better processes with higher profit margins
 - Cost reduction
- **Access to New Markets (18.75%)**
 - Access to international programs/certifications
 - Better price and access to different markets
 - More sustainable and environmentally friendly products
 - Regulatory compliance
- **Regulatory Compliance and Certifications (15.625%)**

- Regulatory compliance
- Access to international programs/certifications
- International certifications
- **Increased Sales and Demand (9.375%)**
 - Increased sales and higher demand
 - Higher demand due to ecological products

Environmental Benefits (50%)

- **Ecosystem and Soil Improvement (18.75%)**
 - Improve the ecosystem and soils
 - Better environment, healthy food
 - Improvement in soil and water quality
 - Renewal of our land
- **Reduction of Carbon Footprint (12.5%)**
 - Reduction of carbon footprint in production processes
 - Fewer CO₂ and greenhouse gas emissions
 - Pollution reduction
- **Conservation of Natural Resources (12.5%)**
 - Healthier ecology, implementation of beneficial systems
 - Protect the environment by generating food for livestock
 - Efficient use of available resources
 - Reduction in the need for extractive industries

Social Benefits (37.5%)

- **Education and Environmental Awareness (18.75%)**
 - Teaching environmental protection
 - Generating more ecological campaigns and brands
 - Information about sustainability
- **Community Support (9.375%)**
 - Support for the community and the planet
 - All people involved in the production chain can have more comfortable lives
- **Improvement in Quality of Life (9.375%)**
 - Better environment, healthy food
 - Food security, better quality of life
 - Greater resistance to pests and more balanced production

The benefits mentioned by the interviewees require education and training on practical solutions to minimize them, such as:

- **Implementation of sustainable technologies** in the use of water, energy, and other inputs. Renewable energy, for example.

- **Financial incentives and environmental regulations** for the knowledge of those involved in the value chain.
- **Existing markets and certifications** for their processes and production centers.
- **Monitoring and evaluation of their productions** to show them how to innovate.

Question 4: How do national and international markets value sustainable production in marketing?

Through this question, the evaluation of different perspectives and realities experienced by the interviewees was conducted:

Valuation in the International Market

- The responses indicate that international markets, especially in Europe, highly value sustainable production. These markets recognize eco-friendly and organic products, allowing them to be marketed at higher prices. It is mentioned that sustainable production is more profitable and attractive to global consumers.
- Sustainable products tend to achieve better prices in international marketing. International markets offer better opportunities and access to exclusive markets due to the growing demand from conscious consumers and strict regulations.

Valuation in the National Market

- In the national market, opinions are divided. Some indicate that sustainable products do not have a good position due to the country's economic situation and the preference for lower prices. Others suggest that the products are moderately valued or not given their true importance.
- Although some national consumers value sustainable production for the quality of the product and its process, in general, there is a long way to go to obtain better pay for sustainable products locally.

Impact on Marketing

- Sustainable products can benefit from price guarantees through contracts and improve their marketing due to the quality of the product and the production process.
- Sustainable production generates a positive and attractive image for environmentally concerned consumers. This can translate into higher demand and a willingness to pay premium prices.

Regional Contrasts

- **Europe vs. Latin America:** European markets highly value sustainable production, while in Latin America, there is no significant additional value. In Europe, there is a clear appreciation for sustainable products, while in Latin America, the focus remains on price.

Based on the collected responses, it is recommended to develop educational campaigns to increase awareness of the benefits of sustainable production among national consumers on the following themes:

- **Promotion of Local Markets**
- **Support Policies** (Visibility of existing policies and constant updates on new ones)
- **How to Access International Markets?**

Question 5: Have you had experiences with competency-based education, either providing or acquiring knowledge?

- 44% of respondents have had experience with competency-based education, indicating a moderate interest in this educational approach.
- The remaining 56% have not had experience, suggesting an opportunity to promote and train actors in the green sector in competency-based teaching methodologies.
- For sustainable production, the key competencies identified in subsequent survey questions could serve as a framework for designing competency-based education programs. There is significant room for improvement in current programs.

Question 6: What competencies do you consider valuable in the agro-chain for sustainable production?

In answering this question, respondents provided their insights based on their experience regarding the skills and knowledge necessary for sustainable production.

- **Technical knowledge in sustainable agricultural practices (according to 81% of respondents):** This was the most selected competency, highlighting the importance of training producers in sustainable production methods such as organic farming, soil conservation, and integrated pest management.

- **Management skills for planning and implementation (according to 75% of respondents):** Emphasizes the need for producers to have strong skills in planning, budgeting, organization, and decision-making to effectively implement sustainable practices.
- **Ability to adapt to climate change and new technologies (according to 69% of respondents):** Stresses the importance of flexibility and continuous learning to adapt to environmental changes and adopt new sustainable technologies.
- **Systemic thinking in the agricultural value chain (according to 66% of respondents):** Highlights the need to understand the interrelationships between different actors and processes in the agricultural value chain to make sustainable decisions.
- **Leadership to inspire others to adopt sustainable practices (according to 59% of respondents):** Underscores the crucial role of leaders in promoting sustainable production among other producers, communities, and value chain actors.
- **Gender equity in agricultural production (according to 47% of respondents):** Indicates the importance of promoting the equitable participation of men and women in decision-making and the development of the necessary capacities for sustainable production.
- **Good communication skills to share information (according to 44% of respondents):** Highlights the need for effective communication to disseminate knowledge about sustainable practices, collaborate with other actors, and market sustainable products.

Question 7: How many times have you taken an online course on the topic?

- The results of this question indicate that the majority of respondents (68%) have taken 1 to 3 online courses on the topic.
 - This suggests a high demand and interest in online training on technology and its application in the agro-industry.
- 17% of respondents have never taken an online course on the topic, which could indicate either a lack of Internet access or a lack of interest in learning about this topic in this manner. If the reason is due to a lack of internet access, it creates a barrier for providing online training on the topics mentioned in the interview.

- 15% of respondents have taken more than 6 online courses on the topic, indicating a strong interest in learning about this topic and taking advantage of available online training opportunities.

Question 8: How many times have you taught an online course?

The majority of respondents (83%) have never taught an online course. However, within the interview, they mentioned that they have shared knowledge in the field on these topics and have taught farmers the importance of educating themselves on commercial, production, pricing, and legal topics.

This suggests that most people who use technology to learn or support production processes do not use it to teach others due to the various limitations the sector faces in accessing electricity and the internet.

17% of respondents have taught 1 to 3 online courses, indicating that some individuals are using their experience to help others learn about this topic when given the opportunity.

Question 9: For what practices is technology used to learn or support productive processes?

The most commonly used technologies to learn or support productive processes are websites (mentioned by 50% of respondents), smartphone applications (mentioned by 42% of respondents), and online training (mentioned by 42% of respondents). This suggests that these technologies are accessible and easy to use for agricultural producers. Other technologies mentioned include:

- WhatsApp consultations (33%): This provides an interesting data point as there are now communities on this social network that allow the dissemination of mass messages, providing good reach for the sector. It also requires only a basic internet connection.
- Geopositioning applications (25%): Programs like the European Union's Copernicus provide great support to farmers for weather and soil forecasting.

This suggests that these technologies are also being used to learn and support productive processes but are not as popular as websites, smartphone applications, and online training.

Question 10: What initiatives do you know of in your agro-chain that promote the inclusion of women, people with special needs, or indigenous groups in production processes?

The most mentioned initiatives are training (mentioned by 33% of respondents) and government support programs (mentioned by 25% of respondents). This suggests that these initiatives are the most important for promoting inclusion. Other initiatives mentioned include:

- Support from international organizations (such as FAO and the World Bank) (8%)
- Awareness of the importance of inclusion (8%)
- Non-discrimination policies (8%)

This suggests that these initiatives are also important for promoting inclusion but are not as well-known as training and government support programs.

Additional Observations

- Some respondents mentioned that the participation of women, people with special needs, and indigenous groups in production processes is still low (33%). This suggests that there is a long way to go to achieve inclusion in the Honduran agro-industry.
- Others mentioned that there is a growing interest in inclusion and that efforts are being made to promote it (25%). This is a positive sign that steps are being taken to address this issue.
- Some challenges for inclusion were mentioned, such as machismo, lack of education, and difficulties with fieldwork (25%). These challenges need to be addressed to achieve true inclusion in the Honduran agro-industry.

Conclusions

The responses to this survey suggest that technology is increasingly being used to learn and support productive processes in the Honduran agro-industry. However, much remains to be done to promote the inclusion of women, people with special needs, and indigenous groups in these processes. Training initiatives and government support programs are important for promoting inclusion, but efforts are also needed to address the challenges of machismo, lack of education, and difficulties with fieldwork.

It is recommended to continue with training initiatives and government support programs to promote the inclusion of women, people with special needs, and indigenous groups in production processes.

General Conclusions from the Interviews:

In analyzing the survey responses on the use of technology in the green sector of Honduras, several critical areas affecting sustainable production, product marketing, the benefits of sustainability, market valuation, and necessary competencies in the agro-chain were identified.

Challenges for Sustainable Production:

- The main challenge identified is the high initial investment cost in sustainable practices and technologies. The lack of affordable financing, skilled labor, and access to markets that value sustainable products are significant barriers. Additionally, the lack of awareness and knowledge about sustainable production exacerbates these challenges. To address these issues, it is recommended to:
 - Education and Training: Implement educational programs to increase awareness and knowledge of sustainable practices.
 - Access to Financing: Facilitate access to affordable financing for small producers.
 - Government Support: Promote policies and incentives that support the transition to sustainable practices.

Challenges for Product Marketing in the Agro-Chain:

- The main challenges include competition, obtaining fair prices, lack of market access, and poor infrastructure. Intermediaries also play a negative role by inflating prices without proportionately benefiting producers. To overcome these challenges, it is recommended to:
 - Strengthen Value Chains: Improve infrastructure and logistics to facilitate efficient marketing.
 - Develop Market Strategies: Connect producers with national and international buyers.
 - Establish Fair Prices: Implement mechanisms that guarantee fair prices for sustainable products.

Benefits of Sustainable Production:

- The benefits of sustainable production span three main areas: economic, environmental, and social. Economic benefits include higher long-term profitability, access to new markets, and regulatory compliance. Environmental benefits encompass ecosystem improvement, carbon footprint reduction, and natural resource conservation. Social benefits include environmental education and awareness, community support, and quality of life improvement. To maximize these benefits, it is recommended to:
 - Implement Sustainable Technologies: Use renewable energies and efficient resource use practices.
 - Financial Incentives and Regulations: Provide incentives and regulations that promote sustainable production.
 - Monitoring and Evaluation: Continuously evaluate practices to innovate and improve.

Valuation of Sustainable Production in Markets:

- International markets, especially in Europe, highly value sustainable production, while in the national market, positioning is low due to economic conditions and

preference for lower prices. To improve valuation in both markets, it is recommended to:

- Educational Campaigns: Increase awareness of the benefits of sustainable production among national consumers.
- International Certifications: Obtain certifications that validate sustainable practices and facilitate access to premium markets.
- Promotion in Local Markets: Collaborate with local retailers and distributors to promote sustainable products.

Valuable Competencies in the Agro-Chain:

- The key competencies identified include technical knowledge in sustainable agricultural practices, management and planning skills, the ability to adapt to climate change and new technologies, systemic thinking, leadership, gender equity, and effective communication. To develop these competencies, it is recommended to:
 - Develop Training Programs: Implement continuous training programs in sustainable agricultural practices and resource management.
 - Promote Leadership and Communication: Foster leadership and effective communication skills.
 - Encourage Innovation and Adaptability: Encourage the adoption of new technologies and sustainable production methods.

Inclusion of Women:

- The inclusion of women, people with special needs, and indigenous groups in production processes is still low, but there is a growing interest in inclusion. Training initiatives and government support programs are crucial for promoting inclusion. It is recommended to:
 - Continue with Training Initiatives: Expand training opportunities for women and marginalized groups.
 - Address Inclusion Challenges: Tackle obstacles such as machismo and lack of education to achieve true inclusion in the agro-industry.

8.3 Survey Summary by IICA and CENFOTEC

Summary of interviews Green Sector – Costa Rica

Introduction

30 interviews were conducted with people linked to the green sector in Costa Rica, mainly linked to cocoa and coffee crops.

The summary of the findings identified around the needs to be able to carry out sustainable production, use of technology in production, as well as exposure to courses or training online or using technology will be shown.

Methodology

Interview through a Google form as a method of collecting answers for each interview and subsequent analysis and segmentation of audiences oriented to the green sector in the areas of education, commercial and production.

Results

Below are the results of the interviews conducted.

Demographic Information

_Gender:

Male	Female
83.3%	16.6%

Age

Between 26-35 years old	Between 36 and 45 years old	Over 45 years of age
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25.8%	32.3%	41.9%
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Area of expertise:

Area of expertise in the green sector	Quantity	Percentage
Agricultural technician	11	37%
Teacher	7	23%
Agricultural Project Coordinator	5	17%
Producer	4	13%
Consultant	2	7%
Government Entity Representative	1	3%

In Costa Rica, the role of "technician" is a position that both government and private institutions have. The technician is a person who supports the agrochains in their work, they are key to sharing, training and implementing best practices. It is considered a role closely linked to teaching.

Questions & Answers

What do you consider to be the main challenge faced by the producer to obtain sustainable production in Costa Rica?

Among the most outstanding aspects are: the need to increase efficiency and productivity in crops, the lack of access to economic resources that allow them to implement better sustainable practices (non-use of synthetic agrochemicals, efficient management of water and energy, reducing environmental impact, measures against climate change), the adoption of new technologies and training in all these aspects indicated.

An understanding not only of the crop but of the business that allows us to open new markets where "being sustainable" is also profitable.

What is the main challenge that your agro-chain faces to market its product?

In terms of marketing, the challenges indicated are: the need to consolidate public-private partnerships, standardize to achieve minimum volumes together, add value to the products (not only commercialize the crop, but also processed products). Have access to markets that recognize the value of sustainable practices and pay prices.

The cost of intermediation is also a critical issue to address, so having options for direct connection with the market is important.

Price management, standardization to achieve volume as a whole and achieve the required minimums.

What benefits do you think are obtained by producing in a sustainable way?

Among the main benefits mentioned: more efficient production without detriment to environmental resources, better income for the producer, product differentiation, stability and resilience of the productive unit.

New markets are opening up, opportunity for diversified production.

Have you had experiences with competency-based teaching? (Either as a student or as a facilitator)

No	Yes
20%	80%

What are the competencies that you consider valuable in your agro-chain to obtain sustainable production?

- Soft skills
 - Adapting to change
 - Creative Thinking
 - Conflict resolution
 - Self-instruction

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- Teamwork
- Leadership

- Technical skills
 - Fermentation, drying, roasting
 - Technology Management
 - Good water management
 - Good soil management
 - Agroforestry
 - Productive diversity
 - Regeneration
 - Preparation of organic and biol fertilizers

- Administrative powers
 - Risk Management
 - Cost management, sales price
 - Knowledge of the agrichain and the functions of each link
 - Planning

How many times have you taken an online course?

0 times	1 time	3 times	More than 3 times
10%	7%	27%	56%

People who have not taken an online course have 2 experience as producers and 1 as a teacher.

How many times have you taught an online course?

Of the 18 people with technical and teaching roles, who are the people visualized to provide training and accompany producers, 75% have taught an online course.

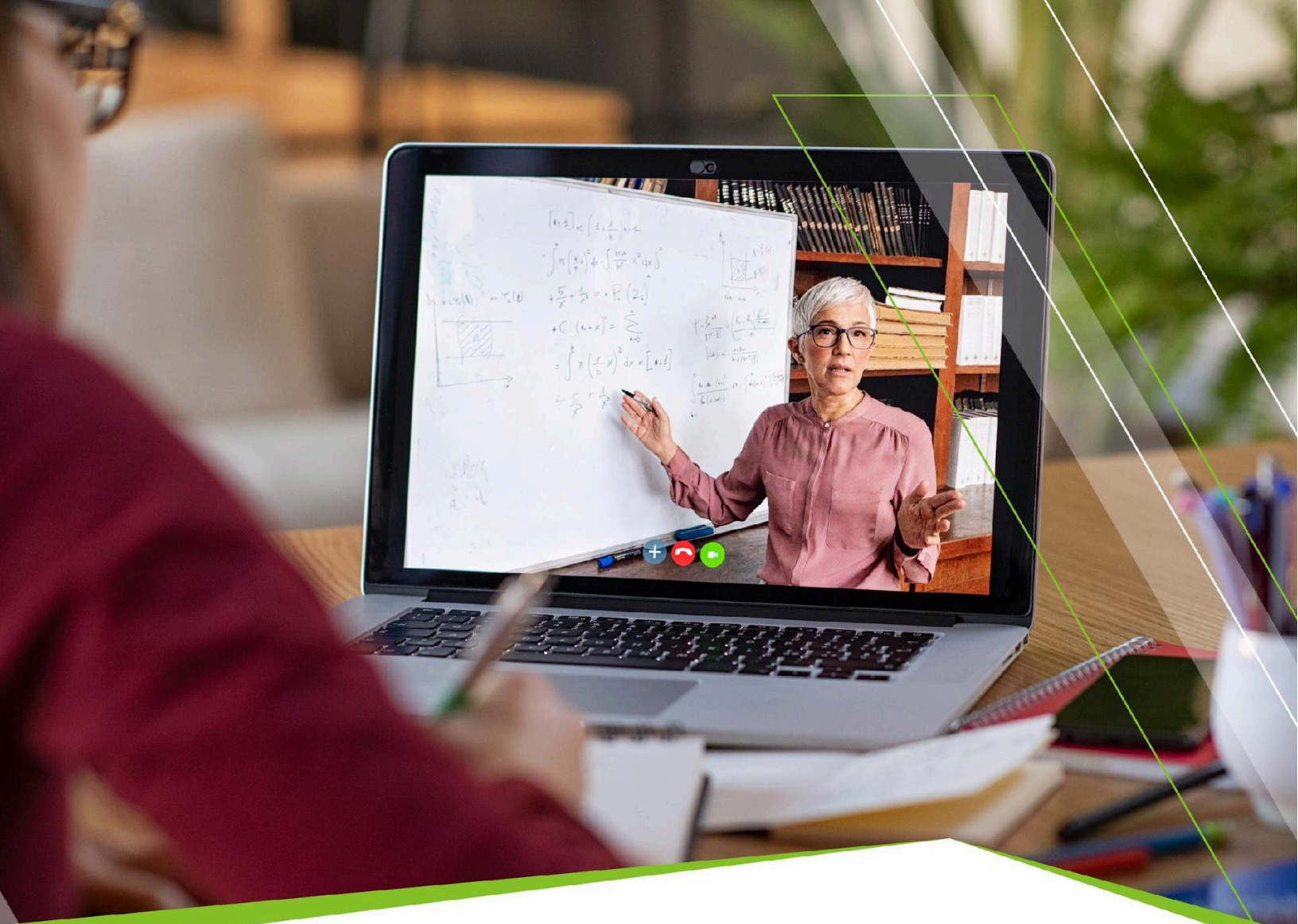
In what practices have you seen technology used to learn or support production processes?

This is the summary table of the main practices observed

Internship	Quantity
Online Trainings	30
WhatsApp Inquiries	27
Cell phone apps	23
Geopositioning Applications	10
Websites	10

What initiatives do you know in your agro-chain that motivate the inclusion of women, people with special needs or indigenous groups in production processes?

- Cocoa Project in Sixaola, ASOPAC, OSACCOOP
- Project Our CoopeTarrazú Legacy
- Grano de Oro School
- Regional cocoa platforms, training programs and technical advice from public universities
- International Cooperation Projects and implementation of institutions such as MAG and ICAFE
- Regional Solidarity Market, National Forum of Rural Women
- Fairtrade in cocoa



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