

Digital Agriculture in El Salvador

Highlights

- Agriculture employs 18.49% of the national workforce
- Coffee in El Salvador contributes 16.7% to its agricultural GDP and directly generates more than 45,000 jobs in rural areas, of which 23,500 are producers
- Droughts, floods, hurricanes, low yield production in staple crops, lack of private investment and high international prices are the primary challenges facing Salvadorian agriculture.
- Internet penetration stood at 59% and the percentage of mobile connection that are broadband (3G and 4G) is 52% of the total population of El Salvador
- To address the most agricultural challenges in El Salvador, promising ICT solutions should focus on technologies that support technical assistance, allows the visualization of existing agricultural information (weather, soils, yield and agricultural management practices), agroclimatic forecasts, a virtual community of technical assistants and an expert system of data capture and analysis.
- The Ministry of Innovation announced the Digital Agenda 2020- 2030 as the first step that will mark the beginning of the digital transformation of El Salvador, and will support the formulation and implementation of a national innovation plan for agriculture through the use of new technologies.

Introduction

Agriculture in El Salvador is known for coffee. The country continues to promote its coffee for export by focusing mainly on special and gourmet coffee qualities (Arabica and Robusta coffee)¹. For many years, the country has been a traditional coffee

¹ USDA, “Coffee sector hurting from low prices and lack of strategy.”

exporter, representing 3% of total exports, but approximately 69% of agricultural exports⁴. The main export destination for Salvadoran coffee is the United States with 45% of total sales.

Agriculture employs 18.49% of the national workforce² and contributes 4.88% of the Gross Domestic Product (GDP)³. The majority of producers in El Salvador are small farmers (82%) with plots of less than three hectares (ha). Climate risks in El Salvador include droughts, floods and hurricanes, which has led to severe economic losses throughout the agricultural sector. Agriculture in El Salvador currently lacks the contemporary technologies and decision support tools necessary to maintain and improve yields.

Digital agriculture offers a possible solution to address the challenges currently facing El Salvador. While the concept of digital agriculture is relatively new and continues to evolve, fundamental technologies such as mobile connectivity and the Internet are already available to support innovative digital solutions for the greatest challenges facing the agricultural sector. In search of the implementation of this new revolution, this profile for El Salvador characterizes the current landscape of digital agriculture. The evaluation of digital agriculture will identify and prioritize digital technologies with the greatest potential to maximize their impact on the improvement of food production in El Salvador.

Economic relevance of agriculture

In El Salvador the second-highest leading export commodity is coffee with around US\$113.4 million in annual foreign currency earnings⁴. Coffee contributes 16.7% to its agricultural GDP⁵. The coffee sector directly generates over 45,000 jobs in rural areas of the country of which 23,500 are producers⁴. At one time, the country was considered the fourth-largest producer of high-quality Arabica coffee in the world, cultivated mostly at an altitude ranging between 600 to 900 masl. Unlike Robusta, the Arabica variety is highly vulnerable to climate change, especially at the low altitude at which it is mainly grown in the country⁴. Coffee farms in El Salvador are projected to become increasingly vulnerable to a series of climatic hazards associated with El Niño, droughts, storms, strong winds, intensive rainfall, and flooding⁴.

² World Bank, “Employment in agriculture (% of total employment) – El Salvador.”

³ Trading Economics, “El Salvador – Agriculture, Value Added (% of GDP).”

⁴ Fernandez-Kolb et al., “Climate Smart Coffee in El Salvador.”

⁵ PROCAFE, “Coffee Farming: El Salvador’s Greatest Forest Reserve, a Reserve against Climate Change.”

Maize is the leading import commodity, followed by palm oil, wheat, cotton lint, and soybean cake. Because El Salvador's maize production is not large enough to meet all of the domestic demand, the country imports both yellow and white maize for essential feedstuffs for poultry.

Agricultural production systems

Much of El Salvador is relatively low-lying coastal areas, represented by mountainous terrain. The country is composed by three distinct regions: the Coastal Plain, the Central Mountain, and the Northern Mountain bordering Honduras. The predominant land cover type is cropland, followed by grassland and tree-covered areas. All area under coffee cultivation can be considered as tree-covered land taking into account that shade-grown coffee is the coffee production system in El Salvador. Total tree cover in the country has been estimated at 17.5% of the national territory, of which coffee farms represent close to 50%.

The total land area 20,720 km², 76,45% of which is dedicated to agriculture^{6,7}. This shows that the distribution of cropland in El Salvador is found in almost every part of the country. The five agricultural crops in El Salvador by harvested area are maize, coffee, beans, sorghum, and sugarcane. The amount of land harvested for maize was reported at 367,181 ha, and over the years, the maize yields have risen by 50%.

The case is different for coffee where the area harvested has remained relatively still and decreased slightly each year (-0.8%)⁸. According to FAO data, coffee productivity has not been consistent from year to year. Between 2009-2010 there was an increase in total yields of 47.1% and later between 2012 – 2013 a decrease of 63.3% was presented. These sudden shifts in coffee production occur mainly as a consequence of price swings and the spread of pests and diseases⁴. However, coffee production also faces secondary internal problems related to the aging of coffee plantations, high debt rate of producers, high production costs, weak institutional leadership, lack of concerted efforts from the producer associations, coffee millers and exporters keeping a large share of the profits, and lack of transparency in the trading system.

People, livelihoods and agriculture

⁶ World Bank, "Land area (sq.km) – El Salvador."

⁷ World Bank, "Agricultural land (% of land area) – El Salvador."

⁸ FAOSTAT. "Crops."

El Salvador has 27.8% of its population (1.8 million people) living in rural areas^{9,10}. The indices for human development in El Salvador are high-performing, with 1.9% of the population living below the poverty line of US\$1.9 per day¹¹. 77% of people have access to potable water¹², and 88.9% have electricity¹³. Youth literacy rates are 97.98%, which indicates good educational services¹⁴. The Human Development Index rates Argentina 124th in the world at 0.67, placing it in the “medium development” category¹⁵. The Gender Development Index rates El Salvador with 0.69¹⁶. The majority of producers in El Salvador are small farmers (82%) with plots of less than three hectares (ha)

Challenges in the agriculture sector

Climate change. El Salvador becomes drier and higher temperatures arise over the past decades. The country’s annual temperature has increased by about 0.8°C and during the driest months precipitation was reduced by a third⁴. Temperatures are projected to further increase by 1.9°C and annual total precipitation is projected to decrease by 180mm under an intermediate impacts scenario⁴. Projections show that climate change will have severe impacts in low and medium altitudes, mainly where Salvadorian coffee is grown.

A series of hurricanes in 2010 accelerated the conditions for the rapid spread of coffee rust, known as “Roya”. The appearance of Roya in El Salvador resulted in a 20 to 50% loss of production or 70% of the coffee area between 2012 and 2014¹⁷ especially at low and mid-level altitudes¹⁸.

In the case of the leading import commodity, maize yields are expected to rise without climate change. Under climate change, yields rise more slowly, as rising temperatures negatively impact yields. Results from IMPACT suggest that, in a scenario

⁹ World Bank, “Rural population (% of total population) – El Salvador.”

¹⁰ World Bank, “Rural population – El Salvador.”

¹¹ Human Development Reports, “Population living below income poverty line, PPP \$1.90 a day (%) - El Salvador.”

¹² World Bank, “People using safely managed drinking water services, urban (% of urban population) - El Salvador.”

¹³ World Bank, “Access to electricity (% of population) – El Salvador.”

¹⁴ World Bank, “Literacy rate, youth total (% of people ages 15-24) – El Salvador.”

¹⁵ Human Development Report, “Human Development Data (1990-2018).”

¹⁶ Human Development Report Office, “Male : Female Human Development Indicators.”

¹⁷ USAID. “Country data sheets for coffee renovation and rehabilitation.”

¹⁸ IFPRI, “Climate Change Impacts in El Salvador’s Economy.”

without climate change, yields for maize would increase by slightly more than 50% by 2050. However, with climate change, the increase in yields by 2050 is only 30%, while under the most extreme scenario of climate change, the increase falls even further to 11%¹⁸.

International prices. As productivity losses increase due to climatic risks, prices fall as is the case with coffee. In the case of coffee, farmers lose interest in investing and managing their farms; therefore, losses in productivity increase. Even though it's possible to sell small amounts of coffee at high prices, it's difficult for farmers, particularly remote small-scale farmers to find a suitable buyer. In addition, farmers have no incentives when they face the cost of inputs, and especially the lack of government support in terms of public policies, government programs and labor availability.

Digital Infrastructure, availability and access

The 2017 ICT Development Index scores El Salvador at 3.8, up from 2016 both in terms of raw score (3.6) and in terms of overall global rank 119. As of 2019, there were 3.80 million internet users in El Salvador, and internet penetration stood at 59%¹⁹. The percentage of mobile connection that are broadband (3G and 4G) is 52% of the total population of El Salvador. The majority of Salvadorians (83%) have mobile connections that are pre-paid²⁰, which means that the users pay for telecommunication services by recharging through electronic means.

According to GSMA Intelligence assessment of key enablers and drivers of mobile connectivity, mobile network infrastructure index scored 34.5 out of a maximum possible score of 100.

Institutions for Digital Agriculture

Non-governmental sector. The Consejo Salvadoreño de Café (CSC) currently administers the coffee producers of the country, facilitates channels for the government to benefit from this staple crop, also monitors production, generates official statistics. In identifying needs and interests regarding a digital tool to source, analyze and translate data into a platform that can show information mainly on production areas, vulnerability maps that show current and vulnerable areas to climate change and Roya

¹⁹ Digital 2019. "El Salvador."

²⁰ GSMA Intelligence (Q4 2018 and January 2019)

monitoring maps. This web platform would include specific timely and context-specific information to help farmers make better decisions for their farms. This instrument would facilitate government decision-making. CSC currently send emails with coffee price information, however this information reaches a small number of farmers.

CSC originated a coffee school (Escuela de café), resulting in an interesting and a necessary approach to continue to impulse the growth of the coffee sector for the youth population. However, aspects that limits its coverage are the costs and extensive trajectories between the urban sector and rural area. An identified alternative is to have virtual sessions for most of the training programs at lower costs, benefiting the youth that have access to internet. The coffee school lacks partnerships with universities to certify the professors or link the universities to the coffee school.

Public sector. Centa-Café is responsible in conducting agricultural research and technical assistance for farmers in El Salvador. The institution has excellent human capital, with capable and experienced amount of professionals and agricultural technicians. As the institution is mostly financed by projects this generates great instability in terms of their permanence in the institution. Its agricultural technicians are digital literate, and easily identify the need to strengthen their capabilities in data analysis and the importance of digital technologies in agriculture to support and facilitate the generation of agricultural recommendations in terms of what, when, where and how to plant.

Academia sector. The academia sector requires the creation of a digital agriculture component in the curriculum programs of agricultural oriented careers to enable the emergence of a new generation of young digital literate professionals in agriculture in El Salvador. Professionals in areas related to agriculture must have a strong background in data analytics and knowledge in digital technologies applied to agriculture.

Challenges for Digital Agriculture

Digital technology solutions. Although El Salvador institutions like Centa-Café has a team of extension technicians' professionals, this is not enough to reach Salvadorian farmers. ICT solutions should be focused on providing a digital technology solution to support technical assistance through a data and model-driven advisory service to enhance adaptive capacity of farming systems to climate change. Given the status on climate change projections in El Salvador, the farmers require timely agroclimatic forecasts to prepare for any climatic hazard and have access to a virtual community of technical assistants to easily reach for agricultural recommendations. It also remains a challenge for farmers to visualize agricultural information of their farms. Requirements on strengthen skills in professionals or entities for interpreting data and results is crucial to start building a digitally literate generation on both youth and agronomists.

Private support. The private sector has not been strongly involved in technology transfer, Research and Development (R&D), which reflects in farmers not having access to integrating cutting-edge technologies. Tech entrepreneurs, incubators, and accelerators could be the forefront of digital agriculture startups so that small-scale farmers can have access to agricultural digital technologies. The central role of the private sector in El Salvador can start enabling an environment of innovation in digital agriculture to favor small-scale farmers and regional expansion of entrepreneurs. The private sector is significant in being a main supplier of inputs, labor and network and the effective delivery of knowledge transfer and technology.

Agricultural research. Since the coffee sector contributes to a fair amount to its agricultural GDP, it is important for policymakers to take action. On the production side, the government could invest more in agricultural research that would seek to deliver actionable information through the use of digital tools that would help farmers plan what, where, when and how to plant. In addition to providing knowledge on yield and quality limiting factors, favorable/unfavorable climate patterns and optimal site-specific management practices.

Policies avenue

The Ministry of Innovation announced the Digital Agenda 2020- 2030 as the first step that will mark the beginning of the digital transformation of El Salvador, and the main components that will work are focused on Digital Identity, Digital Governance, Modernization of the State, Innovation, Education and Competitiveness. Within the area of innovation, the government supports the formulation and implementation of a national innovation plan for agriculture through the use of new technologies.

In addition, the Digital Agenda will facilitate the generation of new ICT-based entrepreneurship and plans to guarantee greater national connectivity, coverage and access to telecommunication infrastructure. Improve the supply of services in the local market and promote the deployment of 4G and 5G mobile phone technologies in the national territory.

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