Articles

Startup and Innovation Technology: Innovation ecosystems to improve agro-commercial business performance in La Troncal

Startup e Innovación Tecnología: Ecosistemas de innovación para mejorar el rendimiento de negocios agro-comerciales en La Troncal

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ABSTRACT

The following research arises as part of a project that aims to conduct a study for the implementation of emerging IT tools or startup for the business and agricultural area of the canton La Troncal, for which we have taken a mixed research methodology that will allow us through analysis of reports and studies conducted by government organizations, NGOs and interviews with business owners who provide precision agriculture services such as spraying with drones in the study area. Having as main objective a review of the current situation of the problem to identify the main innovation ecosystems needed to improve the performance of agro-commercial businesses in the Canton La Troncal.

Keywords: Innovation, Technology, Agriculture, Agribusiness, Agrocommerce

RESUMEN

La siguiente investigación surge como parte de un proyecto que pretende realizar un estudio para la implementación de herramientas informáticas emergentes o startup para el área empresarial y

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agrícola del cantón La Troncal, para lo cual hemos tomado una metodología de investigación mixta que nos permitirá a través de análisis de informes y estudios realizados por organizaciones gubernamentales, ONG y entrevistas a propietarios de negocios que brindan servicios de agricultura de precisión como la fumigación con drones en el área de estudio. Teniendo como objetivo principal una revisión de la situación actual del problema para la identificar los principales ecosistemas de innovación necesarios para mejorar el rendimiento de negocios agro-comerciales en el Cantón La Troncal.

Palabras clave: Innovación, Tecnología, Agricultura, Agrocomercio

INTRODUCTION

The covid-19 pandemic has accelerated the process of digitization of society, causing changes in areas such as health, education, labor, logistics and trade. According to an ECLAC report, the adoption of telework increased by 324%, e-commerce by 157% and online education by more than 60%. This cultural change has an impact on all aspects of society and the economy, but its adoption is limited by structural factors such as the lack of digital infrastructure and socioeconomic restrictions. Although the countries of the region have taken measures to promote the use of technologies, these actions have been limited by gaps in access and use, especially in rural and agricultural areas. Today, the agribusiness sector is facing increasing challenges to maintain its competitiveness and profitability. However, the emergence of startups and technological innovations has provided an opportunity to improve the performance of these businesses. An innovation ecosystem is an environment in which the development of new technologies and companies is fostered and collaboration among them is promoted (CAF et al., 2020).

In the context of agri-commercial businesses, innovation ecosystems can help improve efficiency in the production, processing and distribution of agricultural products. For example, one startup may develop a technology to improve crop monitoring through the use of sensors and drones, enabling farmers to make informed decisions about irrigation and fertilization. Another startup may develop an e-commerce platform to connect farmers with buyers, enabling farmers to get better prices for their produce.

In addition to improving efficiency in production and processing, innovation ecosystems can also help agribusinesses improve their environmental and social sustainability. For example, a startup can develop a technology to reduce the use of pesticides and fertilizers, which can help protect the environment and improve the health of

agricultural workers. In summary, innovation ecosystems can provide an opportunity to improve the performance of agri-commercial businesses by developing new technologies and fostering collaboration between companies. However, it is important to note that, to take full advantage of this opportunity, structural challenges that limit the adoption of technologies in the agribusiness sector, such as lack of infrastructure and lack of access to finance, need to be addressed.

Ecuador's reality does not differ much from that described in studies throughout Latin America and the Caribbean on the growing reach of technology by citizens. According to the technical bulletin of the INEC (National Institute of Statistics and Census) on information and communication technology indicators (2021) we have as results that the use of desktop computer increased from 23.3% in 2019 to 25.3% in 2020 and from 28.5% use of laptops in 2019 to 31.3% in 2020. Another important indicator shown in this study is the percentage of Ecuadorian households that have internet access with 45.5% for the year 2019 to 53.2% in 2020, similarly the study shows that the percentage of people who have a smartphone for the year 2013 was 8.7% and this increased to 58.2% for the year 2020. (Inec, 2021). We can see that these percentages continue to grow exponentially so this article formulates the research question: What innovation ecosystems are necessary to improve the performance of agro-commercial businesses in Canton La Troncal? The general objective was to identify the main innovation ecosystems necessary to improve the performance of agro-commercial businesses in La Troncal Canton, for which we have proposed to follow a mixed research methodology that allows us to represent the different quantitative data from statistical centers such as INEC and the analysis of qualitative data through the reading of the different scientific texts generated on the topic of study that were consulted in scientific databases.

MATERIALS AND METHODS

The development of any research work requires the use of a mixed research methodology focused mainly on the study of methods and techniques of analysis and data collection, which will determine how the proposed problem will be developed. The selection of the different alternatives is not an easy task, but it is decisive in the elaboration of a research project, since it provides the correct path that will guide us to obtain valid results that respond to the expected outcomes (Alejo et al., 2020).

A mixed research approach was chosen, which allowed the analysis of data from surveys and research reports presented by non-profit organizations such as the UN (United Nations), ECLAC (Economic Commission for Latin America), governmental institutions such as INEC and the Ministry of Telecommunications, Agrocalidad, and the Ministry of Agriculture and Livestock.

The qualitative approach, is necessary to be able to address the perspectives developed regarding the topic of Startup and Innovation Technology to improve the performance of agro-commercial businesses proposed by academics in the different scientific texts developed in recent years, this will allow through deductive method where Abreu (2015) states that, "The deductive method allows determining the characteristics of a

particular reality that is studied by derivation or result of the attributes or statements contained in propositions or scientific laws of a general nature formulated previously. By means of deduction, the particular or individual consequences of the inferences or general conclusions accepted are derived" (Abreu, 2015, p. 210). For this reason, the deductive method fits our proposal in the Canton La Troncal, Cañar Province as the study scenario for this article.

To complement the information in our study, we used the technique of interviewing actors and representatives of agro-commercial businesses in La Troncal, identifying that there are two service providers in the canton that apply technology for agricultural processes such as spraying with drones.

There are many applications of the interview for the development of an empirical research that is based on interpersonal communication between the researcher and the subject or subjects of study to obtain verbal answers to the questions posed about the problem. However, it is often forgotten that what is applied in practice is not the method itself, but its methodological guide (Avila et al., 2020, pp. 62-79).

RESULTS

Innovation is a process that seeks to create something new or improve something existing. Its origins date back to the time of the Industrial Revolution, when new techniques and machinery emerged to improve production and increase efficiency. However, innovation is not only limited to technology, it can also be found in the fields of business, medicine, education, among others.

In the 19th century, economists Joseph Schumpeter and Peter Drucker focused on studying the importance of innovation in economic development, and in the 20th century, it has become a key topic in business research and development. The innovation process involves the identification of a need or problem, the generation of ideas to solve it, the evaluation and selection of the best ideas, and finally, the implementation and commercialization of the solution.(Arteaga et al., 2015)

The importance of innovation lies in its ability to improve the quality of life, create jobs and increase competitiveness in a globalized economy. It is also essential to the survival and success of companies, enabling them to stay at the forefront of their respective markets and to offer unique products and services. Without innovation, companies and economies tend to stagnate, and opportunities for progress and growth are lost.

One of the main factors for the emergence of innovation is entrepreneurship, an entrepreneur is someone who sees opportunities in challenges and seeks innovative solutions to meet market needs and contribute to the development of the future. The authors, Choez et al., (2021) consider that currently entrepreneurs who develop competencies and move nimbly in these areas such as competitiveness, technological change and innovation, during the crisis will possess a strategic advantage over their competitors in the post pandemic economy, establishing opportunities for companies to become more innovative and facing external pressures, getting out of their routines and comfort zones to become creative problem solvers through innovation.

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INEC in its document entitled "Directory of Companies and Establishments 2019" published in October. (2020) indicates that for the year 2019 in Ecuador the (DIEE) records a total of 882,766 companies of which 99.5% are related as MSMEs below is a table of growth per year of companies in Ecuador according to their size. (INEC, 2020)

Table 1*Company results*

	2012	2013	2014	2015	2016	2017	2018	2019
Microenterprise	710.919	791.896	811.444	801.040	791.047	828.711	829.711	802.353
Small Business	63.572	66.655	69.378	68.389	64.930	65.88	64.888	61.759
Medium Company	11.940	13.063	13.953	13.871	12.978	13.834	14.474	14.342
Large Company	3.552	3833	4.113	4.093	3.864	4.045	4.283	4.312
Total	789.983	875.447	898.888	887.393	872.819	911.307	913.356	882.766

Source: Observatorio de la PyME de la Universidad Andina Simón Bolívar, Sede Ecuador.

The table indicates that both SMEs and large companies suffer variation in operations each year. The same INEC report tells us that MSMEs sold 46,921 million in 2019, representing 27.7% of the total sales generated by all companies in Ecuador.

An important process for the current growth of innovation in Ecuador's SMEs is the process of digital payments, which play an important role in financial inclusion, as they allow people to access additional financial services such as credit and insurance, improve savings and risk management capacity, and help to better withstand financial shocks. In addition, digital payments allow governments to reach a larger proportion of the unbanked population, and are especially beneficial for micro, small and medium-sized enterprises (MSMEs) by enabling them to attract more customers and develop online business activities. In general, digital payments create a more level playing field between large and small commercial enterprises. (IDB Lab; World Economic Forum, 2022)

For the World Economic Forum, (2022) there are key principles that can help overcome the obstacles to the growth of digital payments in LAC (Latin America and the Caribbean) such as :

- Establishing good regulatory practices to reduce market barriers and promote innovation
- Stimulate collaboration between the public and private sectors
- Explore e-commerce agreement to ensure the security of cross-border digital payments
- Facilitating innovation and the development of new technologies

(IDB Lab; World Economic Forum, 2022).

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Innovation ecosystems.

To answer our initial question of our work on innovation ecosystems are needed to improve agribusiness performance we must begin by noting the models of innovation ecosystems found in the literature review.

For Jackson (2011), as cited in (Finquelievich et al., 2017) The difference between a biological ecosystem and an innovation ecosystem is that the former refers to a set of relationships between life, habitat and residents in an area, while the latter refers to complex relationships in the economy that promote the development of technology and innovation. The key elements in an innovation ecosystem include material resources and human capital, such as students, professors, researchers and companies, which are part of institutional entities such as universities, companies and funding agencies.

Currently, the most economically prosperous cities are those that have managed to create urban environments that function as innovation ecosystems. These environments promote the circulation and transfer of knowledge to the economic system and society in general. As a result, knowledge-intensive companies with a global vision and strong growth, willing to learn constantly, develop. This has a positive impact on the economy of the regions involved, on the development of university research centers and on society in general, which becomes more receptive to innovation and better prepared to act in the Knowledge Society.

In the paper entitled Species in the Wild: a typology of innovation ecosystems, Klimas & Czakon (2021) using a critical analysis of systematic literature reviews and a thematic analysis, identify 34 different types of innovation ecosystems intentional (deliberate, planned), emergent (implicit), orchestrated (hierarchy), collectively coordinated (heterarchy), emergent, developmental, mature, declining, dead, corporate-dominated, university-dominated, meta-organizational, centralized, decentralized, egocentric (firm-centric; center-based), microscopic, mediocopic, macroscopic, radical innovation-centered, incremental innovation-centered, pioneering innovations-centered, high-tech, multi-platform, urban/innovation districts, local, regional, national, international, global, digital (just clicks), successful (strong), promising, profitable, and sustainable. (Klimas & Czakon, 2021, p. 275)

With these results Klimas & Czakon (2021) extend their classification to a total of 50 types of innovation ecosystems by adding the following complementary types as:

"self-coordinated, symmetric, asymmetric, ecocentric, disruptive innovation-focused, social innovation-focused, medium-tech, low-tech, single-platform, bricks-and-clicks, unsuccessful (weak), unprofitable and unsustainable". Depending on the extent to which innovation co-creation relationships are exploited through innovation processes implemented by IE actors (innovation ecosystems), they aggregate into: (1) co-discovery; (2) co-development; (3) co-implementation; (4) co-delivery; (5) co-diffusion; and (6) multi-stage co-innovation." (Finquelievich, Feldman, & Girolimo, 2017, p. 275)

For our research, we will take the types of ecosystems mentioned above that we have considered best suited to our study.

The first within the category of criteria classified as genesis and existence of the innovation ecosystem and within the criterion of governance typology we have the Orchestration type innovation ecosystem (hierarchy), described as an ecosystem orchestrated by the dominant actor, generally a producer. In Ecuador there are large companies that lead the agribusiness markets, leaving little room for small and medium enterprises that emerge in this environment. An environment that, according to the article in the electronic newspaper primicias (2019) indicates that in general more than half of the local entrepreneurship does not manage to overcome the barrier of 3 years and attributes among the possible causes the absence of innivation, low profitability and difficulty in accessing credit as the main causes. (Pensantes, 2019)

The second within the category of innovation ecosystem rank criteria under the spatial rank typology we have the urban/innovation district ecosystems, which are characterized by the physical sense, the structure of the IE does not extend beyond a city or industrial district, where there is municipal and state leadership of this type of ecosystem, so they take a long time to reach a degree of maturity.

During the last decade, an urban model has flourished that promotes the economy and revitalizes the sectors in which it is being carried out. Innovation districts, so called because of their limited geographical scale and their emphasis on the exchange of ideas and knowledge as the machinery of a country's economic development, combine new modes of labor and domestic distribution, new partnerships between public and private organizations to operate in the city and, above all, new ways of collaboratively linking institutions and companies that traditionally competed with each other in a small local market. (Gzyl, 2015)

The existence of innovation districts is based on processes and qualities that have always accompanied the city as an effective means of association and human exchange.

Another important reference to the types of innovation is made by (Barreras et al., 2015) in which he quoted Revilla (2008) who defines in his text that innovation "consists of the commercial application of an idea" and refers to two types of innovation the first using as a criterion the degree of novelty of the innovation and the following classification by the nature of the innovation.

By the degree of novelty of the innovation (Roldán et al., 2016) we have three types:

- Incremental
- Radical
- Disruptive.

Incremental innovation involves small changes focused on increasing the functionality and performance of the service or product, which, although insignificant in isolation, can build a permanent basis for progress when they occur gradually and cumulatively.

Incremental innovation in our agribusiness companies can contribute to this continuous change according to the technological growth of the region. According to the branch.com portal, by February 2022, 77% of the 18 million Ecuadorians are internet users, there are 15.91 million cell phones in the country and 81% of the population are

active users of social networks. (Social & Hootsuite, 2022).. This same study shows that the population in the year 2021 to 2022 grew by +1.3% while cell phones connected to the internet in Ecuador grew by +6.1%. Therefore, it is essential to think that companies must have this continuous change in terms of technological growth, which for agribusiness companies implies greater investments due to their geographical location where they must operate usually in cantons next to the productive sectors of agriculture.

Regarding radical innovation (Barreras et al., 2015),who in his work cites (Schumpeter, 1996, p.122) indicates:

"Both radical innovation and incremental innovation are relative in a temporal or chronological sense, since the degree or magnitude of novelty. In the case of radical innovation, there is a temporary rupture that gives way from the non-existent or old to the existing or novel, which implies, in Schumpeter's words, a process of "creative destruction" that develops "from within, uninterruptedly destroying the old and continually creating new elements".

In Ecuador, radical innovation needs to be driven by public policies and investment incentives for the company. The problems of lack of infrastructure for the development of the agricultural sector are mainly focused on achieving the highest productivity of crops, for this reason, when talking about technology in agriculture, it is usually about genetic material (seeds), leaving aside the adoption of information and communication technologies to directly improve the operations and processes of agricultural work. (Hugo & Zambrano, 2019)

Finally, disruptive innovation involves direct technological and behavioral changes, following the market rather than a particular factor. As the origin of the word disruptive (Ledo et al., 2019) mentions in his text "The word disruptive is of French origin "disruptif" and English "disruptive", and is used to define a decisive or abrupt change. Then, that technology that brings about profound changes in processes, products or services is a disruptive technology and generally entails a strategy of introduction, to consolidation and displaces the previous technology".

As disruptive innovations in the agricultural and agro-commercial sector, in the use of spraying with drones, one of the problems that has always impacted the agricultural sector is the high costs of hiring the spraying system through airplanes, as mentioned by (Boza, 2021) "Specialized airplanes for modern aerial fumigation in the market range between USD $500,000 and USD1,5000,000 per airplane, depending on the specifications and characteristics it has. These high operating costs for the companies that provide this service imply that the final costs of the service for farmers are very high for the profits that their crops represent.

The alternative of spraying using a drone system greatly reduces operating costs, in this respect. (Boza, 2021) mentions that specialized drones for agriculture in the market currently range between USD$20,000 and USD$24,000 depending on the characteristics and specifications of the drone, the cost of acquiring 8 drones to provide

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a service up to 2000 hectares would reach USD$192,000. This represents lower operating costs for the companies and therefore lower service costs for the farmers.
Regarding efficiency, a drone will generate less waste and greater precision in reaching crops such as those we have in our study area, which are detailed in the following image.
Illustration 1. *Area sown per hectare*

Source: www.ecuadorencifras.gob.ec continuous area and agricultural production surveys ESPAC.
As the image illustrates, about 27 thousand hectares of the province of Cañar are destined for the cultivation of sugar cane, 5 thousand for the cultivation of cocoa and 3 thousand for the cultivation of bananas, with the highest concentration in the canton of La Troncal.
The same ecuadorencifras portal that uses a business intelligence tool, powerbi, shows us the following graph for the province of Cañar.

Illustration 2. *Relationship between production and sales.*

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Source: www.ecuadorencifras.gob.ec continuous area and agricultural production surveys ESPAC.

The graph illustrates that the only crop whose demand is equal to its production is bananas, while sugar cane has a significant difference between production and demand, whose main purpose is the sugar mills, while the planting of sugar cane for other purposes such as the production of alcohol has a slight balance.

Another agricultural activity in the sector of the province of Cañar is cattle raising, and the ecuador in figures portal shows the following results.

Illustration 3. *Cattle activity by province.*

Source: www.ecuadorencifras.gob.ec continuous area and agricultural production surveys ESPAC.

The graph shows that the province of Azuay is the main cattle producer in the highlands of Ecuador and the province of Cañar is in eighth place in this activity.

Main problems of drone spraying implementation.

The interview conducted with the two companies that are dedicated to the service of fumigation with drones in the canton of La Troncal, coincide in the problem that implies the demand for this service in the agricultural sector of the canton of La Troncal.

The main drawback is the lack of operational capacity due to the lack of unmanned aerial vehicles, but the problem with acquiring more drones is that the window for spraying in the winter season is limited due to the intensity of the rains in the region.

Another problem is the lack of awareness of farmers regarding the advantages in efficiency and cost of acquiring this type of service for their crops, where the cost of the service alone, not counting the cost of the product, is between $18 and $20 dollars per hectare.

The entrepreneurs interviewed recommend that in order to expand the demand for this service, the capacity of the drone fleet should be increased, with more capital to have more batteries available at the time of spraying and to undertake a promotional campaign of demonstration spraying to socialize the advantages of this service to farmers.

Artificial intelligence and its applications in agriculture.

ICTs have caused a change in today's society, both in the service and production sectors. These technologies also have an impact on the agricultural field, improving food production and marketing. Artificial intelligence, robotics, blockchain, drones, high performance computing and internet of things are some of the technologies that are being used to increase efficiency and sustainability in agriculture, as well as ensuring the safety of agri-food products. (Fernandez, 2020)
The main application of artificial intelligence for the agricultural sector can be found in the so-called precision agriculture.
For (Isabel Cisternas, 2020) Agricultural production is closely related to the efficient use of water and soil, and precision agriculture, through the use of information technologies, enables efficient management of these resources.
Applications such as digital image processing is a tool that helps early detection of pests and diseases in crops such as cereals, fruit trees, roots, leaves and tubers, which reduces economic losses in the agricultural sector. Worldwide, approximately 40% of crops are discarded due to diseases and pests. Many of these diseases produce visible symptoms and characteristics in plants during growth. However, due to the lack of adequate crop technologies, the diagnosis of diseases and pests is often based on human inspection, which can generate errors due to the subjectivity of individuals, allowing to reduce costs of agricultural processes and obtain greater effectiveness. (Gómez-Camperos et al., 2022).

CONCLUSIONS

The agricultural industry has undergone a major change in recent decades, moving from traditional agriculture to modern agribusiness. The production of products such as cocoa, bananas, sugar cane and other foods has diversified and modernized, with high-tech agricultural machinery the sector is focused on the production of high quality food and economic sustainability.
Implementing an innovation ecosystem in the agricultural sector and agribusiness requires several factors to be aligned, such as a strategic vision and a focus on the development of new technologies for agricultural practices, a solid technological infrastructure, including high-speed internet access, mobile devices and sensors. Another factor is a skilled workforce and an innovation-oriented corporate culture.

According to the data analyzed, there is no collaborative community of farmers, researchers, companies and governmental organizations that maintains a synergy to share knowledge and resources through adequate policy and regulation to support innovation in agribusinesses that do not have access to financial incentives or subsidy programs to adopt innovative technologies.

Having developed the study, we believe that the most appropriate innovation for the agro-commercial sector in La Troncal canton could be incremental, adopting strategies to identify the specific needs and problems of farmers and the agro-industrial sector, and focus research and development of solutions that address these problems to create training and education programs for farmers and other members of the sector, to improve their skills and knowledge in innovative technologies.

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