AGRICULTURAL INNOVATION FOR REGIONAL DEVELOPMENT
INNOVACIÓN AGROPECUARIA PARA EL DESARROLLO REGIONAL

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Abstract

Innovation is a tool that seeks, through new technologies, models and strategies, growth in a sector. Agricultural innovation is to find the different resources that significantly improve the life of small, medium and large farmers to improve the productivity of the same companies in the sector. With the use of technologies and innovations, we want to achieve more resistance of plants to pests and diseases. , increase productivity and improve quality, among others. The idea is to find strategic alliances that can generate advances to boost products and companies that work in the primary sector of the economy. The objective of this work was to explore the innovative trends of the agricultural sector in Colombia, in order to boost regional development, seeking to answer the question: what would be the main innovative trends in the agricultural sector in Colombia, which manage to boost regional development? The methodology used was qualitative, through the collection of documentary information and questions to experts on the subject. In general, it can be concluded that to carry out innovation exercises in the agricultural sector, it is necessary to focus on social, ecological, and economic dimensions that allow these changes to be generated.

Key words: Agribusiness, regional development, agricultural innovation, technology.

Resumen

La innovación es una herramienta que busca, por medio de nuevas tecnologías, modelos y estrategias, el crecimiento en un sector. La innovación agropecuaria es encontrar los diferentes recursos que mejoren significativamente la vida del pequeño, mediano y grande agricultor para mejorar la productividad de las mismas empresas

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del sector.Con el uso de tecnologías e innovaciones se quiere lograr más resistencia de las plantas a plagas y enfermedades, incrementar la productividad y mejorar la calidad, entre otros.La idea es hallar las alianzas estratégicas que puedan generar avances para dinamizar los productos y las empresas que trabajan en el sector primario de la economía. El objetivo de este trabajo fue explorar las tendencias innovadoras del sector agropecuario en Colombia, con el fin de dinamizar el desarrollo regional, buscando responder la pregunta: ¿cuáles serían las principales tendencias innovadoras del sector agrícola en Colombia, que logren dinamizar el desarrollo regional? La metodología utilizada fue cualitativa, a través de recolección de información documental y preguntas a expertos en la temática. De manera general, se puede concluir que para realizar ejercicios de innovación en el sector agropecuario, hay que enfocarse en dimensiones sociales, ecológicas y económicas que permitan generar estos cambios.

Palabras clave: Agronegocios, desarrollo regional, innovación agropecuaria, tecnología.

Introduction

The concept of innovating essentially refers to "The decision and the process of change that entrepreneurs face to advance the achievement of various objectives" (Guaitero , 2016, para. 2) and with the search for innovation, it is desired to find sustainability, efficiency, the profitability of companies in the agricultural sector and, therefore, in relation to this, regional development is defined by Vásquez (2000) cited by Ramos (2014) "as a process of growth and structural change that, through the use of existing development potential in the territory, leads to raising the well-being of the population of a locality or region" (p. 71). Consequently, innovation is a tool that generates growth in a sector or company in which the desired objectives are focused. In this case, the search for innovation in the agricultural sector is what will generate regional development.

The main motivation about innovation in agribusiness is to find the different resources that significantly improve the life of the peasant or the productivity of the same companies in the agricultural sector and find the strategic alliances that can generate that advance that manages to dynamize the products and companies working in the primary sector of the economy.

In addition to the above, the technological bias between most agribusiness and development must be recognized; This vision generates a diversity of problems that seek a solution, which is why public policies focused on companies in the agricultural sector must be increasingly expanded to solve the different problems of the sector related to innovation to achieve regional development. recognizes the need for a change in this sector to enter the new global markets for goods of agricultural origin that must go beyond just producing and consider quality and sustainability policies to achieve positive effects on regional development. Therefore, there is a need to find innovative trends in the agribusiness sector in Colombia.

The main objective of this research is to explore the innovative trends in the agribusiness sector in Colombia, in order to boost regional development; Having described the foregoing and taking into account the low level of innovation in this sector, a research question is posed: what would be the main innovative trends in the agricultural sector in Colombia, which would boost regional development?

Innovation for growth

Innovation is a characteristic element that drives the development and growth of the regions, which has factors in different sectors and in the economic, social, environmental dimensions, and others such as cultural, political, technological, and what is of interest in this writing, the agricultural sector to stimulate the regional development of the country. Regarding innovation in agriculture, for example, Trigo, Mateo and Falconi (2013) point out that this:

> It has played a determining role in economic and social development throughout modern history. It was innovation in agriculture that made possible the release of labor for industrial development in the second half of the 19th century, as well as the consolidation of markets for new products from emerging sectors (p. 8).

Due to the above, at present the different indicators in which the economic, social, political and institutional aspects can be included point to a change and mainly to the relationship of the agricultural sector with society, in order to reach the end of the long period where show minimal benefits, where a position is given in development strategies.

Now, there are multiple ways of seeing innovation as a path to development, since the opportunities arise in various forms. Industrial agriculture, for example, is a tool that allowed the transformation of agriculture on a technological scale from the decade of the eighties. As Cáceres (2015) points out, this allowed a significant advance due to its nature since: "it is based on the application of a technological package made up of three main components: (a) direct sowing, (b) transgenic crops and (c) agrochemicals" (p. 4). Here are some concepts:

a. Direct sowing: Consists of "placing the seed in contact with the soil, eliminating earth movement and leaving stubble on the surface" (Perrachón, 2004, p. 54).
b. crops: Also called "biotechnological or genetically modified (GM) crops, they are the result of the application of recombinant DNA technology in agriculture. These types of organisms constitute the transfer of foreign genes (transgenes) of any biological origin (animal, plant, microbial, viral) to the genome of cultivated plant species" (Chaparro, 2011, p. 231).
c. Agrochemicals: "They are substances widely used in agriculture, such as insecticides, herbicides and fertilizers" (Avalos, 2009 cited by Sánchez, 2010, p. 19).

Ramírez, Ruilova and Garzón (2015) point out that innovating implies:

> Putting current technology to work with ideas to apply them in new contexts so that they produce improvements in productivity or quality, for this, knowledge must be generated, systematized, shared and improved. This logic can

> be applied to the agricultural sector, which has begun to adapt technologies to improve food production, which, in the current situation of humanity, represents a major concern (p. 53).

Consequently, a key aspect in the development of the agricultural sector is going to be mentioned; this is the intensification of agricultural production, which according to the FAO is defined as "the increase in production per unit of resource, which can be land, work , time, fertilizer, seed or capital" (Ramírez *et al*., 2015, p. 27), this increase is proportional to the population increase that represents an additional boost, both in production and quality.

Now, in this context we also talk about sustainable intensification which, in the words of Ramírez *et al.* (2015), search:

> Increase food production from existing agricultural land while minimizing pressure on the environment. It is a response to the challenges of the growing demand for food from a growing world population, in a world where land, water, energy and other inputs are scarce, overexploited and used in an unsustainable way (p. 56).

Likewise, they recall that all actions aimed at such intensification of food production are linked to sustainability in order to obtain consistency in the sufficient supply of food production (Ramírez *et al.*, 2015).

In addition to the above, the development of agribusiness has included a "set of changes in the way in which the factors of production are combined and in how the production process is organized" (Cáceres, 2015, p. 7), specifically in the management of agribusiness and according to the main transformations that "have been: (a) the Taylorization of the productive process, (b) the outsourcing of productive activities and (c) the leasing and increase in the productive scale" (Cáceres, 2015, p. 7). These concepts are defined below:

a. The Taylorization of the agricultural production process: it is defined from Taylor (1911) cited by Cáceres (2015) as the "approach that promotes the segmentation of the production process in order to improve the way in which production factors are assigned, to achieve greater productivity and efficiency" (p. 7). This is achieved from "positivist science and a mechanistic approach" (p. 7) since what is sought is "to organize the production of a scientific way and rationally allocate the productive factors" (p. 7).

b. The outsourcing of productive activities is the hiring of other subjects in order to carry out activities "sowing, fertilization, ground and/or aerial spraying and harvesting" (Cáceres, 2015, p. 8) or other field tasks.

c. Leasing and increasing the productive scale: consist of the expansion made by producers with greater production capacity on land that they do not own, taken in the form of leasing in order to increase the productive scale and their profits (Cáceres, 2015).

Likewise, we should talk about the professionalization of field activities and highlight the importance of the role of decision-making for the development and focus on innovation in the agricultural sector.

Development, for example, refers to the

1 Researchers, developers, promoters, extensionists, agricultural producers and entrepreneurs (Ramírez, Ruilova & Garzón, 2015, p. 74).

positive economic transformation, which in turn favorably impacts the social, political and cultural sphere of the human being (Ramírez, Ruilova & Garzón, 2015). It must be understood that investment in research and development is needed to seek strategies that promote growth, innovation and technology in order to create balance and equity in the different agribusinesses and production systems. Agricultural technological innovation is the set of elements such as "universal knowledge, exploration, reproduction, experimentation, adaptation, combination, propagation, protection and expansion" (Ramírez *et al.*, 2015, p. 74), which serve the personnel involved[1] to achieve an improvement of production techniques, as well as design solutions to all those difficulties that may arise in the socioeconomic, ecological and cultural spheres present "in the internal and external level of their productive realities; all this through research to reach agricultural technological innovation" (Herrera & Gutiérrez, 2011 cited by Ramírez *et al.*, 2015, p. 74).

Now, in terms of innovation or research, it is said that they are decisive for agricultural technological development since they lead to sustainable development together with other aspects such as "climate change, poverty reduction, the concern of high energy consumption non-renewable, solving the unsustainable growth of the urban population, increasing productivity and competitiveness" (Ramírez *et al.*, 2015, p. 75), which deserve all the attention in order to achieve the solution of said problems in a sustainable way.

Consequently, the R+D+i formula is the key to agricultural technological development, which aims to increase its competitiveness in production systems through strategies such as "the use of production chains, value chains, agribusiness" (De Schutter & Vanloqueren 2011; Cuellar 2015, p. 15), which allow us to give way to a new way of improving productivity, since R&D&i does not only consist of:

> Increase production yields, but also refers to giving added value, to manufacturing and launching new and improved products on the market, seeking to work on better quality products where intelligence has no limits to creativity and where innovation allows breaking paradigms that they face unimagined challenges through methods that perfect products (De Schutter & Vanloqueren 2011; Cuellar 2015, p. 15).

It is for the above that it is necessary to give way to productivity, knowledge and creation in favor of development, keeping in mind the "human talent articulated with other aspects such as innovation" (Ramírez, Ruilova & Garzón, 2015, p. 82) , in order to have a strengthened sustainable development in the future with technological innovation that allows the optimization of productive resources in favor of solidity and greater performance in the "agricultural companies and the rural sector of our towns, giving optimal outputs and improving the quality of life of the inhabitants of the area" (Botella & Suárez, 2012, cited by Ramírez *et al.*, 2015, p. 82).

Consequently, based on agricultural technological innovation, it is intended to produce a diversity of products such as coffee and cocoa through hybridization of clones, in order to obtain a product with greater resistance and quality, while increasing the reflected productivity, for example, in the shortening of harvest times, in the

development of seeds of "corn, rice, granadilla, banana" (Ramírez *et al.* , 2015, p. 83) among others, as well as: "Through the introduction of genes that allow crops such as chili to resist attacks by *Phytophthora*, *Fusarium, bacteriosis,* in the Amazon region of Colombia" (p. 83). Finally, this technological innovation is aimed at technification and improvement in all senses of agricultural activity that allow the country to offer added value in its agricultural products.

Methodological note

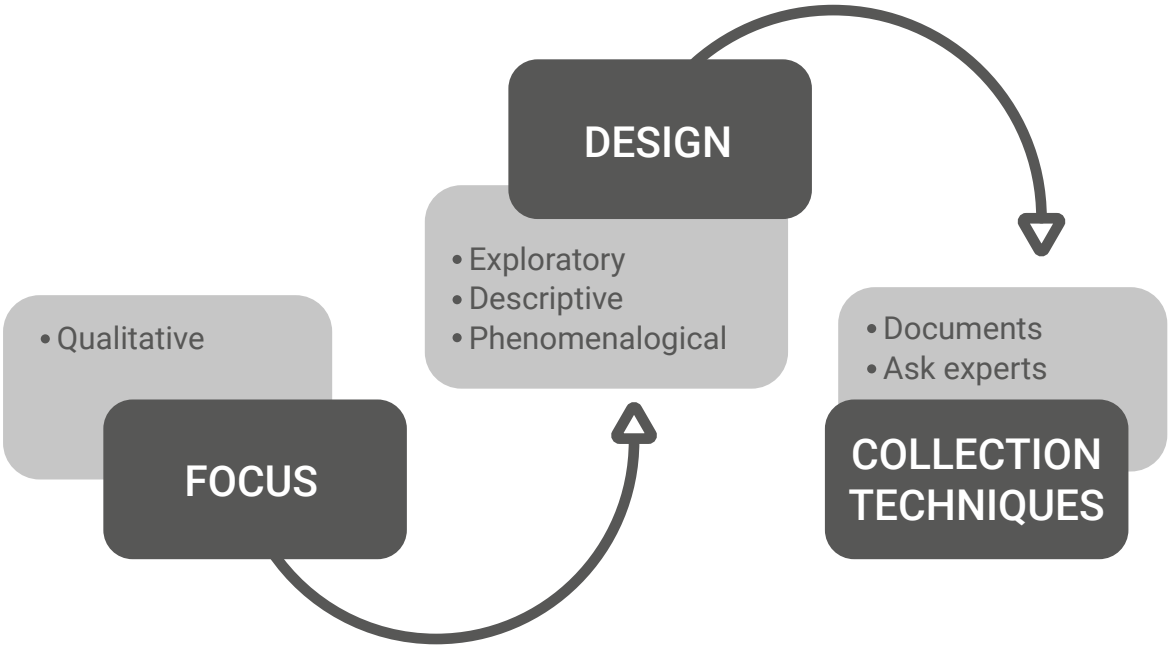
The methodological structure to analyze the aspects related to agricultural innovation for regional development is part of the qualitative approach that, due to its definition and area of action, explores and describes the events and then analyzes the information with results and conclusions that allow understanding the phenomenon that is studied as it happens Hernández, Fernández and Baptista (2014). This will allow adapting the purpose of the research and more open approaches can be handled, leading us to more understandable environments and clearly extracting appropriate meanings.

The important link in the investigative section of the qualitative approach needs to provide enriched information to give structure to the research case and it is the descriptive design that will provide opinions and tendencies of the different experts who were asked a single open question: In your opinion, which Are the innovative trends in the agribusiness sector in Colombia to boost regional development?

The description of the results by the experts within the descriptive design and in relation to the phenomenological, which will provide the basis for the research as an essential part of the experiences that the participants have had in common with the phenomenon in agribusiness and project management. agricultural, represents a diversity of experiences, both common and different. This helps to categorize and synthesize the factors that are sought to be analyzed in the research question.

The stage in the phenomenological framework as the first measure within the investigative work is descriptive. It supposes informing through practical material to understand and relate the ideas and opinions of the experts; As a second measure, a categorical structure of classification and understanding of important aspects such as the environmental, economic and social dimension is defined, to then move on to the last stage of discussion of results.

Figure 1: Methodological design.



Source: Own elaboration (2020).

Results and discussion

Below are the key elements compiled from the responses of the experts who were selected by criteria assigned by the authors of the research, due to their experience in this field.

The analysis of georeferenced information, real-time climate data, the use of sensors in crops and animals, and data processing through artificial intelligence technologies will help the development of a more precise and efficient agribusiness with less uncertainty than under traditional techniques. With the above, comes the more specialized training of the actors in the field that is not only based on their experience, but also on an education that is now accessible to them at different levels and that allows access to information and knowledge. Currently, a producer with Internet access has information available about techniques, diseases, fertilizers, access to electronic commerce for the purchase of supplies and equipment, and the sale of products. Likewise, producers have access (free and paid) to mobile applications and software that provide help in the execution of the different production stages. The massification of these techniques and technologies, together with training, will allow a greater development of the national agribusiness.

From the environmental dimension, one of the innovative trends within the agribusiness sector in Colombia is the use of clean technologies in the post- harvest link and/or benefit of agricultural products, which have

been based on the use of techniques such as recycling , substitution, recovery and revaluation, all of them focused on a much more comprehensive, agroecological and environmentally responsible management at the time of conditioning the different agricultural raw materials that will be used for direct consumption or as intermediate products for agribusiness. In a complementary way, the use of by-products and waste generated during this stage stands out from this trend, by using them to generate energy, biocomposites, biofuels, biocomposites, among others, such as:

1. Emerging agricultures.
2. Agroecology as a strategy to mitigate food insecurity.
3. Promising crops.
4. Medical cannabis and by-products.
5. Bio-inputs for pest and disease management.
6. Agricultural species tolerant to adverse weather conditions.
7. Empowerment of agriculture in the production links.
8. Agribusiness.

Regarding innovation, one of the innovative trends in the agribusiness sector is aligned with certifications for agriculture; the organizations of the sector must contribute to sustainability thinking about the positive impacts that are generated in each of the dimensions (social, environmental and economic). Something that has been discussed with the Escazú Agreement (CEPAL, 2018), in which Colombia is still in the process of signing and which seeks to guarantee the full and effective implementation in Latin America and the Caribbean of the rights of access to information socio-environmental, public participation in those decision-making processes in the environmental environment and access to justice in the socio-environmental field, as well as the application and strengthening of capacities and cooperation, guaranteeing the protection of the right of each person, of present and future generations, to have a sustainable development and to live in a healthy environment. In a few words, this trend seeks, among other things, to make visible the transformations and contributions of agricultural companies and industries to their collaborators, families and territories.

Conclusions

It is concluded that agricultural innovation in Colombia needs the integration of social, environmental and economic dynamics. The greatest measures of innovation processes are associated with the use of new technologies or seed varieties that enhance productivity and reduce economic losses in the production process; Currently, innovation in agriculture is associated with promoting the use of old processes such as agroecology and urban agriculture to improve the biodiversity of species. In order to increase the income of farmers, different certifications must be implemented that are an added value. to expand the customers of the products.

Innovative processes in the agricultural sector would provide regional development

and competitiveness in companies, and this would be a determining factor for the expansion of efficiency and growth. For the materialization of these processes, a way must be found to reach producers to provide a extensive training on the benefits that this generates. A first step is the understanding of the innovation processes, and hand in hand with this, experimentation with obtaining good results would be the main thing to start adopting innovative tools in companies. farmers in our region.

The great transformations of the world are changing the way of producing in what concerns the agricultural sector; An agricultural innovation is sought to put aside the daily uncertainties associated with how difficult it is to produce with quality, safety, and competitiveness. The different ways of innovating in these regions are limited by the diversity of the actors involved (suppliers of inputs, the large agricultural companies, the state, the plaintiffs, etc.), also highlighting that in this sector there is a bias in infrastructure, in poverty, in inequality and very important in education, and that the majority of peasants in the country produce in family businesses that have economic limitations to access the innovation that the market demands to produce, is a concern regarding what derives the advance of the sector in the development and in obtaining that so-called agricultural innovation.

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