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Strategies for the adoption of innovation processes in agricultural productive units of the Department of La Guajira - Colombia: Literary review and systemic approach

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ABSTRACT

From the appearance of man to the present, food production has been a critical issue in ensuring the survival of the human species. Over the centuries, agricultural production has evolved with the domestication of plant and animal species and the emergence of technologies and techniques in production processes, affecting population growth and cities. The research seeks to describe the strategies for adopting innovation processes in the Department of La Guajira - Colombia agricultural production units. The results show that, in the last four decades, innovation strategies have begun to be discussed as a term that has evolved, going from incorporating new technologies to including elements related to efficiency, economic sustainability, sustainability, redesign of organizational structures, and the implementation of best practices that result in quality, quantity, safety and hygiene of agricultural activities. It is concluded that the studies on innovation strategies in agricultural productive units can be about phenomena that promote agricultural innovation, agricultural production models, and improvements in agricultural production processes, of which there is evidence of application in the Department of La Guajira.

KEY WORDS: Strategy, innovation strategies, agricultural innovation strategies, innovation.

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Estrategias para la adopción de procesos de innovación en unidades productivas agropecuarias del Departamento de la Guajira - Colombia: Revisión literaria y aproximación sistémica

RESUMEN

Desde la aparición del hombre hasta la actualidad, la producción de alimentos ha sido un asunto crítico para asegurar la supervivencia de la especie humana. En el trasegar de los siglos, la producción agropecuaria ha evolucionado con la domesticación de especies de plantas y animales, el surgimiento de tecnologías y técnicas en los procesos productivos, incidiendo en el crecimiento de la población y las ciudades. La presente investigación pretendió describir las estrategias para la adopción de procesos de innovación en unidades productivas agropecuarias del Departamento de La Guajira – Colombia. Los resultados muestran que, en las últimas cuatro décadas, se ha empezado a hablar sobre estrategias de innovación como un término que ha evolucionado, pasando de incorporar nuevas tecnologías hacia la inclusión de elementos relacionados con la eficiencia, sostenibilidad económica, sustentabilidad, rediseño de las estructuras organizacionales, y la puesta en marcha de mejores prácticas que redunden en calidad, cantidad, inocuidad e higiene de las actividades agropecuarias. Se concluye que los estudios sobre las estrategias de innovación en unidades productivas agropecuarias pueden ser sobre fenómenos que promueven la innovación agropecuaria, los modelos de producción agropecuaria y mejoras en procesos de producción agropecuaria, de los que se encuentran evidencias de aplicación en el Departamento de La Guajira.

PALABRAS CLAVES: Estrategia, estrategias de innovación, estrategias de innovación agropecuaria, innovación.

Introduction

Since the origin of humanity, food production has been a fundamental activity that has allowed the survival of civilization and the growth of the world population. This food production has been possible thanks to the domestication of plant and animal species that provided the first human groups with food. As a result, people abandoned their nomadic-gatherer status and gave way to the first cities, which evolved into agricultural civilizations (Wells and Stock, 2020). The human being learned to use various species of fauna and flora to satisfy many needs since they found a way to obtain, in addition to food, wool, milk, manure, and muscular strength that came from animals. Historians claim that the first agricultural

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civilizations arose in the region known as the Fertile Crescent in Mesopotamia, into which the Tigris and Euphrates rivers and their tributaries flow; and lower and upper Egypt, on the banks of the Nile River (Angelakis et al., 2020; Valipour et al., 2020). These regions witnessed the domestication of crops, the appearance of the first irrigation systems, and agriculture as a practice, approximately 11,500-8,500 BC.

Over the years, agricultural societies began to discover and implement new farming practices. Around 7500-6000 BC, crop rotation was invented, which would be evidence of primitive farming practices aimed at crop planning and conservation of resources such as land (Bray et al., 2019; Piperno et al., 2017). By 3000 BC, the first civilizations made up of sedentary inhabitants emerged (Collins et al., 2018). Subsequently, around 1000 BC, iron was introduced as a material in manufacturing tools, which made it possible to improve processes (Krivosheev et al., 2021; Murphy and Stark, 2016). Approaching the Common Era, in 180 BC, the first fishing treaty was developed in Greece by Opiano de Apamea (Costa-Pierce, 2022). During the early and high Middle Ages (700-1250 AD) the first exchanges of crops between the Far East and Europe occurred (Angelakis et al., 2022; Quiros-Castillo et al., 2020; Jarret, 2019) and for the late Middle Ages (1300-1400 AD) the advances in agriculture generate surpluses that allow the growth of cities and the population increases (Poirier, 2022).

At the dawn of the Modern Age, the encounter between pre-Columbian cultures and Europeans (1500 AD) allowed the sharing of agricultural knowledge and techniques, as well as the exchange and migration of plant and animal species from different continents (Mahony and Endfield, 2018). Subsequently (1600-1850 AD), there were changes in land tenure due to social changes, which increased productivity; In the same period, the migration of the peasant population to the cities began (De Jong, 2016). In the 19th century, agricultural activities participated in the innovations of the time, such as mechanization, a revolution in biology, and the creation of the first farms to raise fish (Alberti et al., 2018; Olmstead and Rhode, 2018; Robles-Ortiz, 2018).

Entering the 20th century, during the decades 1930-1970, the so-called Green Revolution was launched, which brought with it a significant increase in productivity and world population through the development of artificial fertilizers and pesticides; in that same period the first

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transgenics appeared, improving the seeds of various plant species (John and Babu, 2021). In the present century, genetically modified foods are present in most countries. Still, a new march in agricultural innovation is beginning, which is accompanied by industry 4.0 technologies, such as blockchain, robotics, artificial intelligence, internet of things, among others; At the same time, the need to protect the environment with more sustainable and sustainable modes of production becomes clear (Hernández-Aguilera et al., 2020; Agrimonti et al.; 2020; John et al., 2020).

In the current century, the knowledge, and innovations that agribusinesses must have available must be generated and flow correctly to the agricultural production units that require it, to improve their processes and production models and solve problems or situations that they present; However, this knowledge has been slowly implemented, unlike other sectors that have a more excellent attitude and dynamism towards changes (Finco et al., 2018). This trend is more noticeable in developing countries than in developed countries, generating obsolete modes of production, inefficient use of resources and inputs, low productivity, and environmental degradation, among other problems (Rohov et al., 2021). This situation of inequality accentuates poverty in the poorest regions of the world, causing adverse social phenomena such as violence, hunger, and widespread poverty (Sánchez-Villegas et al., 2021; Perez-Ruiz et al., 2020).

In the case of Latin America, a region that appears as the one with the most significant inequality in terms of income in the world, the poverty figure increased because of the COVID-19 pandemic (see Graph 1). According to the Economic Commission for Latin America (CEPAL), the pandemic will increase poverty in the region by 2.5%, reaching 214.7 million in total or 34.8% (CEPAL, 2022); a trend that is higher in rural areas, since it stood at 45.7% in 2019, according to the World Labor Organization (ILO, 2020). For Colombia, the outlook is not rosier since poverty has passed 31.7%. to 39.8% between 2019 and 2020, extreme poverty also increased from 12.8% to 19.2% in the same period (ECLAC, 2022).

In that order and according to the National Administrative Department of Statistics (DANE, 2022), in the department of La Guajira poverty is above the national average, standing at 66.3% in 2020 and 67.4% in 2021, being one of the departments with the highest incidence of this indicator. This trend accelerated during the pandemic and continued in subsequent years. The rural population of the department is the most affected, being half of its population. The

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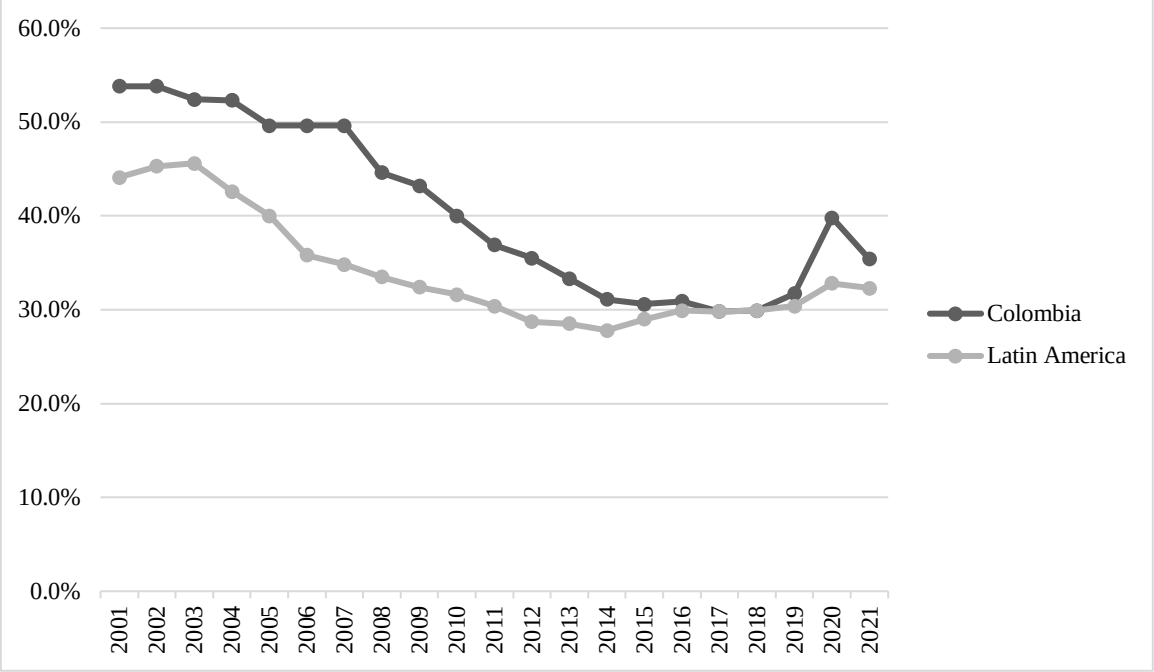
department has seen its rural population increase in the last four decades, going from 70% in 1985 to 50% in 2021, which is evident in its capital Riohacha, which went from 60.7% to 68.4%. in the same time interval (DANE, 2021). This population has its main livelihood in the countryside; however, many practices are neither sustainable nor sustainable.



Graph 1. Percentage of the total population living in poverty in Colombia and Latin America, period 2001-2021 (ECLAC, 2022).

Finding practices aimed at improving the productive units' processes would allow increased production and generate economic surpluses that help to overcome structural problems in this region. Since each unit is an organization, it is an entity with different resources and situations; these actions must be relevant to those conditions. Therefore, the agricultural productive units of the department of La Guajira must find knowledge translated into innovative efforts that improve their activities or solve difficulties that reduce their capacity and productivity. If this is not done, the department's agricultural production will continue to suffer from problems that will impede the progress of the department of La Guajira. For this reason, the following question arises: what are the strategies for adopting innovation processes in the agricultural production units of the department of La Guajira - Colombia?

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1. Strategy and innovation

After finding ways to differentiate themselves from the sector and/or industry competitors, companies seek ways to preserve the competitive advantages obtained and accumulated. Managers often begin to ask themselves critical questions about the direction of the organization they lead; they consider all the implicit factors in the different contexts in which they work, the stimuli received from abroad, and the trust among the members of the organization. organization of what the future will bring. This is a process in which actions and strategies that change the ways of doing things begin to be devised, seeking to improve and correct situations that are not in keeping with the times and contemporary trends. The strategies planned must meet a series of conditions that vary from one organization to another, but inevitably all must be innovative.

The term strategy has different meanings, depending on the context in which it is used. In the business context, it has been used since the 1960s (Ramírez and Ríos, 2020) to achieve objectives or find solutions to problems. According to Dess et al. (2011), the business strategy seeks to obtain and evolve competitive advantages to increase the company's profitability and overcome the performance of competitors and rivals in the sector. Subsequently, Dess et al. (2011) state that business strategy has four essential attributes, which are:

(a) Orientation towards goals and objectives refers to the organization's effort to comply with the mission and vision outlined. For this aspect, each organization must work, correctly integrating each functional area to achieve those purposes (Antequera et al., 2021).

(b) Respond to multiple interest groups in decision-making since partners, people, groups, and organizations have dissimilar requirements and needs, but that depends on the company's success. Focusing on a single interest group creates distortions, affecting the organization's inability to achieve the goals set (Rondinelli and London, 2003).

(c) The demand for the inclusion of short - long term perspectives is facing the present and presenting a vision of the company's future (Senge, 1996; Van Beuren and Safferstone, 2009).

(d) Recognize the adjustments that correspond to effectiveness and efficiency, that is, establish the difference between directing the actions to the needs of the organization instead

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of wasting efforts and performing the same activities at lower costs compared to its competitors or a period of the previous time (Antequera et al., 2021).

For their part, Thompson et al. (2018) argue that business strategy is more related to achieving organizational objectives and goals, which are understood as action plans. The authors define a company's action plans as what emerges after evaluating a range of options, which requires the commitment of managers to stick to that plan and provide the necessary resources to execute it. In this way, the strategy sets the course to follow to achieve different ends, whether to achieve a position in the market, implement process improvements, and/or overcome industry rivals.

Thompson et al. (2018) that the strategy must be adjusted to the reality of each company, differentiating it from the strategies followed by rivals; that is, the strategies must lead to obtaining competitive advantages. Likewise, the strategy can be both proactive and reactive. In the first case, they constitute deliberate measures to improve the financial performance of the company; in the second case, responding to strategies undertaken by industry rivals, variations in consumer trends, implementation of new technologies, new market opportunities, changes in the political and/or economic climate and other unforeseen events. Therefore, the business strategy consists of measures to improve conditions in the internal environment and responses to situations that come from the external environment (Ríos et al., 2020).

Lansiti and Levien (2004), conceive the strategy from an ecological point of view, making a simile between a company and a living organism. Lansiti and Levien (2004) compare companies with living beings and species since these have vital processes that are essential for the existence of life in the company, such as commercial management, administrative management, internal logistics, production processes, etc. production, among others and depending on each company; likewise, living beings have systems that allow them to feed, reproduce, interact with their environment, etc. The authors continue making their comparison at the ecosystem level, since just as a living being interacts with others of the same species or other organisms, companies maintain relationships with others within an ecosystem in this economic and social case. This comparison between biology and/or ecology with business sciences helps to understand the importance of paying attention to the events that occur inside

organizations since, as in a living being, a failure in an internal organ can cause the collapse of all living things. Likewise, incongruous problems or situations within a department can weigh down and even seriously affect a company's organizational performance. Therefore, each company's internal departments or divisions must work jointly to achieve the objectives, while non-compliant situations that may occur internally are addressed.

Although the authors equate companies in biology, ecologically, companies as beings do not survive in isolation within an ecosystem. In this way, if an ecosystem is contaminated or affected by situations beyond everyone's control, this can cause the extinction of a species. In this sense, the authors urge not to ignore the events of the external environment or ecosystem, since companies are not self-sufficient entities but rather coexist with other organizations in political, economic, and social contexts that are constantly changing (Lansiti and Levien, 2004).

In finding competitive advantages, managers must use innovative resources for the organization and the rest of the industry; innovation is the key to finding these new paths. Innovation is the necessary means to develop dynamic capabilities and obtain competitive advantages. Innovating opens possibilities that range from modest corporate achievements to big business. This process must come from a careful study that results in the opportunities that are in the external environment and, at the same time, the discovery of potentialities and strengths, as well as clients and new users, analyzing their expectations, values, and needs; being at the same time a virtuous cycle of value creation and transmission.

In organizations, some aspects mean areas of opportunity and improvement, represented by unforeseen events, the need to improve processes, non-conformity situations, changes in market trends, consumption, the appearance of new technologies, changes in the political and/or socioeconomic environment, among others, that test sustainability, dynamic capabilities and accumulated competitive advantages. Prahalad and Hamel (1994), Barney and Zajac (1994), and Drucker (2002) affirm that these moments and/or spaces are the opportunity to imagine new ways of doing things or developing new products.

Innovation has several positive results, such as obtaining competitive advantages, better performance, and value creation; however, it implies a high degree of organizational creativity for it to become optimal. Ferrer-Serrano et al. (2022) argue that the harmony achieved between

generating capabilities and unique resources and innovation leads to competitive advantages and simplified business processes. This helps to create new products and services that satisfy consumers' requirements, needs, and desires; therefore, organizations must be flexible, abandoning rigid structures that take away space for creativity (Sameti, 2022). Melander and Arvidsson (2022) argue that the correct direction of the organization, in which managers inject dynamism, fosters collectivity, cooperation between different departments, collaboration with other companies, and opens spaces for new ideas to arise and adapt to the new realities that occur in the business world, even in constantly changing environments.

2. Innovation strategy management systems

In organizations, managers must promote mechanisms for imagination and creativity to generate ideas aimed at improving processes, products and services, business management, and others. For this, companies will tend to be flexible, communicative, and efficiently transmit knowledge, abandoning rigid and stagnant structures that detract from change and new ideas. In this sense, senior management must create spaces that favor systems for creating and implementing innovation strategies. Likewise, administrators will have to be aware that the new knowledge will come from within the company or will be born from within it, so their job will also be to identify it, decode it, internalize it, store it, transmit it, and transform it, to achieve the goals. previously set organizational goals.

Around the 1980s, authors such as Petro (1983) and Tichy (1983) began to describe how American companies overcame the impasses and problems of an economy slowing down, finding the impetus in innovation and productivity. that they required. Using these tools meant a change in the economic paradigm, from an economy based on production to another that gives more value to knowledge. This change implied adapting business, organizational, productive, information, and remuneration systems and structures; we were entering a post-industrial era. Authors such as Thompson and Little (1985) and Elliott (1986) would reach these same conclusions and identify changes because of the irruption of new technologies.

Entering the next decade, the consolidation of new communication and information technologies in the business world would radically change the structure of many businesses,

generating new synergies and knowledge management systems. This change is described by authors such as Cavaye (1996), LeBlanc et al. (1997), and Metz (1998), who describe how computers and the Internet facilitated communication relationships between consumers and companies, managing commercial activities, customer service, extended warranty services, among others. These new technologies represented low costs, high levels of quality, faster times for product development, and optimizing the operation of existing value chains.

For their part, Orlikowski (1996), Watson and Rosborough (1996), Clarke (1999), Echeverri-Carroll (1999), and Camisón and Lapiedra (1999) go beyond describing changes in production systems that incorporate new technologies represents. to optimize processes with further communication and information technologies, but also identify transformations in organizations, where they move away from paradigms of stability, bureaucracy, and control patterns towards flexibility, self-organization, and permanent learning, maximizing performance and results obtained in the companies. In addition to the above, Orlikowski (1996) indicates that these changes occur at micro levels but are considered at a macro level; they account for differences organizational and business culture seen in the 1990s.

The new century brought approaches that were not limited to business activities but instead recognized the need to establish cooperative relationships between other entities, which would later give rise to the concept of the triple helix company-state-academy (Melamed-Varela et al., 2019; Ramírez et al., 2021), which highlights the importance of these working together to increase the growth and economic progress of society. This finds support in what was expressed by Grady and Gratt (2000), Lee (2000), and Cooke (2004), where the State would provide the political and legal conditions so that companies can carry out their activity of security and stability, the academy in particular, universities would train the best human resources and participate in development and innovation, contributing these elements to companies and state institutions.

In this period, new approaches emerged which recognized the need to promote innovation, arguing that it would not appear without reason but that it would have to be pursued inside and outside the organization, taking advantage of the existing resources or incorporating new elements into the organization. company system. For their part, authors such as Martins and

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Terblanche (2003), Cummings (2004), and Kanter (2004) focus on enunciating the need for organizations to have an organizational culture that stimulates creativity and innovation, finding that to obtain it, they must foster strategy, structure, support mechanisms, behavior that encourages innovation, and open communication.

However, what about innovation that comes from outside the organization? This case is addressed by various authors, including Sutcliffe and Weber (2003), Beth et al. (2003), and Lüthje et al. (2003), who affirm that often, companies must go for the knowledge and human resources that they do not find in their organization to meet the knowledge needs that are not found within the company since all the necessary resources must be provided. Sufficient inputs and resources to meet the corporate objectives that have been outlined. Although Sutcliffe and Weber (2003) go in the direction of pointing out the need to find these resources outside the company, they clarify that it is much more relevant to have talent that knows how to interpret those volumes of information and knowledge that the organization requires and that there is not always the need to go out and make significant investments that risk the structure and finances of the company. In this sense, it is seen how in this decade, there is talk of accumulating knowledge and strategic human resources to add value to the activities and value chain of the company.

Authors such as Adner (2006), point towards the management and creation of spaces that enable the result of knowledge and changes that favor organizations, calling them innovation ecosystems. For this author, innovation ecosystems are spaces in which more than one company coexists, whose departments, subdivisions, or operations are interrelated, generating cooperative and collaborative relationships beneficial to the members of the chain value and pushing the industry towards innovation. adoption of best practices. By the 2010s, innovation and business management trends revolved around companies' responsibility concerning the environment, social progress, and sustainable economic growth. In this sense, authors such as Compston (2010), Melville (2010) and Theeyattuparampil et al. (2013) coincide in affirming that innovation must be sustainable and sustainable, in addition to achieving the objectives previously set.

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Parallel to the current that advocates sustainability and sustainability, new technologies of the so-called industry 4.0 emerge, which optimize the transmission of information, generation of new knowledge, automation, commerce, marketing, logistics, and various operations; These technologies are blockchain, big data, artificial intelligence, internet services such as wikis or social networks, optimization of communication networks and the internet, the internet of things, etc. In this sense, Hrastinski et al. (2012), Fichman et al. (2014), Zavolokina et al. (2016), and Nevo et al. (2016) detail different uses and applications that new technologies have in various sectors, making use of the opportunities and facilities they offer, to carry out open innovation in all organizational fields and thus reinvent or make possible new ways of selling, providing support. and customer service, dispensing with being physically in a place to operate economically, among others. According to Rios et al. (2019), this has meant changes in the elements and resources, optimizing them in time, space, and availability for external and internal clients so that they all work in an integrated way to obtain competitive advantages.

Integrating Aires are present for the beginning of the 2020s, conceiving innovation as the choice of strategies, actions, and measures relevant to solving situations and problems that are weighing down the productivity and performance of the company but which takes into account the sustainability of each idea, environmental and social sustainability, the use of new technologies that accelerate and maximize the implementation processes of these measures (De La Fuente-Mella et al., 2022). At the same time, the events and facts that happen outside the organizations must be considered to respond to the strategies that rivals and competitors take so that their position in the industry is recovered.

Authors such as Ehls et al. (2022) conceive innovation as a constant process that must be integrated into organizations so that it can be quickly identified in the organization or respond to events in the external environment. According to Ehls et al. (2022), the organization must anticipate changes and transformations to prepare the company for such events so that administrators can make precise decisions about the direction of their organizations; using strategic foresight. Strategic foresight devises strategies in contexts of uncertainty to consolidate positions in the market or future markets and advance in achieving socioeconomic objectives. Gebhardt et al. (2022) point to integrating industry 4.0 with sustainability,

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conceiving them as complementary. Likewise, these authors maintain that this convergence opens new possibilities in developing products and services and new lines of research and application in new areas that transcend business and academic activity.

3. Innovation strategies in agricultural productive units

Having addressed the general issues that have constituted studies on innovation and innovation systems over the last decades, the context of agricultural production units has been different in terms of changes developed and implemented in the industry, varying between regions, types of businesses, and new practices implemented. In this context, agricultural activities press to find solutions in innovation that solve problems related to the lack of resources, expansion of cities, excessive population growth, climate change, and changes in each country's political and socioeconomic climate, among others. others. However, the literature shows that agricultural productive units have slowly adopted the advances developed, requiring the support of the State, academia and research centers, and the business sector.

De La Fuente and Suárez (2008) point to these needs who advocate taking measures that go decisively to solve or mitigate the problems of environmental degradation that affect agricultural production. To achieve this, De La Fuente and Suárez (2008) suggest finding modes of production that resemble natural biological processes. Guirado et al. (2014) but including human activities as an essential factor to consider when developing cleaner production models.

In this sense, studies of phenomena that promote agricultural innovation have focused on recognizing the main features of efficiency, sustainability, and sustainability of agricultural production units, after implementing organizational changes focused on improving operational aspects, logistics, marketing, and research. In this section, several proposals have emerged that are directed toward the sustainability and sustainability of the processes carried out in the sector. The suggestions range from production models that achieve maximum efficiency in production, the reuse of inputs, reverse logistics, and circular economy, among others. The studies advanced by Zhang et al. (2021) lead towards agriculture with a double purpose: to provide food and capture greenhouse gases, which constitutes a clear proposal for sustainability and efficiency in the use of resources. For their part, Jacquet et al. (2022), promotes pesticide-

free agriculture and propose a new paradigm for food production that is summarized in five strategies:

(a) Redesign farming systems to improve measures taken to protect or preserve from disease.

(b) Diversify biocontrol strategies and related business models.

(c) Incorporate functional biodiversity and evolutionary ecology elements in terms of phytosanitary management.

(d) Implement new technologies related to better agricultural machinery and digital technologies.

(e) Public policies and private initiatives that achieve transfer to agricultural production free of pesticides.

There are also the studies carried out by Valoppi et al. (2021), which were focused on circular production models and whose purposes are economic sustainability and ecological sustainability, which incorporates elements such as the use of all products and by-products generated by agricultural operations and activities, the implementation of green logistics and reverse logistics. The results of the research carried out by Spicka (2022) lead in a similar direction, whose purpose seeks to reduce the impact on waste generation in the agricultural industry of raw materials through circular economy and collaborative economy strategies, which can lead to the creation of farming clusters and value chains that encompass companies from various sectors.

On the other hand, there are studies about agricultural production models, which focus on organizational and management aspects of farming organizations, focusing their efforts on transforming administration, marketing, logistics, suppliers, and customers, among others. In this section, there are studies carried out by Vargas-Canales et al. (2018), García-Sánchez et al. (2018), Blandi et al. (2018), Polita and Madureira (2022), and de la Cruz Santos (2022); which focused on describing the main characteristics related to innovation systems and their interaction with the activities carried out in the productive units. For its part, the compilation by Giua et al. (2021) focuses on adopting information management systems on farms,

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emphasizing the adoption of digital technologies and the barriers to implementing them within agricultural organizations.

Likewise, analyses such as those of Martin (2021) emerge, which call for generating public and private institutional mechanisms that help smaller producers to implement technologies that enhance food production and the economic returns that derive from these measures. In this same type of study, the results obtained are highlighted, demonstrating the quality of the significant changes and substantial improvement that allowed the economic sustainability of these businesses.

Finally, the studies on improvements in agricultural production processes are differentiated; they are the most recurrent since they include literature that describes changes and improvements in practices, whose purpose is to improve the productivity and operability of agricultural production units so that these changes are reflected in economic growth. In this sense, Hamdan et al. (2022) describe how practices such as seed storage, selective breeding of species, and the implementation of breeding by mutation, which are considered conventional, managed to increase food production in what was called the Green Revolution; however, the authors alert that this model is finding a limit and call on research centers and agricultural producers to turn towards the genetic revolution, which manages to improve species through the combination and manipulation of DNA.

Added to this are the analyzes developed by Fu et al. (2021), which makes a complete breakdown of the requirements, objectives, and tasks involved in the modernization of the rural and agricultural sector in developing countries, determining ways, forms, and measures in agroindustry engineering of the 21st century. At the same time, the authors call for the implementation of strategies for the reactivation and revitalization of the rural sector, the development of rural and agricultural extension systems that provide relevant technologies and knowledge to agricultural production units and encourage the creation of knowledge creation systems scientists in agricultural engineering, achieve the correct implementation of rural industries as a transition model of agricultural communities towards urbanization and sound land use planning (Fu et al., 2021).

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For those who study innovation strategies in agricultural production units, these can be approached from studies of phenomena that promote agricultural innovation, agrarian production models, and improvements in agricultural production processes (see table 1). The investigations that study phenomena that promote innovation revolves around ecological issues, ranging from efficiency and economic sustainability to the territories' environmental sustainability. On the other hand, research directed toward agricultural production models focuses on finding new ways of producing and growing economically by reorganizing organizational elements and factors. Finally, the studies related to improvements in agricultural production processes are those that are most related to agricultural work. In all cases, the goals will always be to increase production and economic growth, maximizing the use of available resources.

Innovation strategies in agricultural production units		
Type of study	Concepts	Indicators
Studies of phenomena that promote agricultural innovation.	They seek to know the causes that motivate agricultural innovation, such as the search for efficiency and sustainability.	Efficiency, sustainability, sustainability.
Studies about agricultural production models.	They conceive innovation as the reconfiguration of agricultural production systems.	Reconfiguration, redesign, organizational management, human resources.
Studies on improvements in agricultural production processes.	Agricultural innovation is the implementation of improvements in practices that enhance productivity.	Agricultural practices, productivity, operability, economic growth.

Table 1. Operationalization of the studies of innovation strategies in productive agricultural units.
Source: Own elaboration (2022).

4. Innovation strategies in productive agricultural units of the Department of La Guajira - Colombia

The productive agricultural units of developing countries face various challenges, ranging from the progressive increase of the population and finding efficiency in the use of resources. Population growth and climate change affect the availability of resources necessary for food production, such as water and fertile land, putting pressure on agricultural organizations to carry out their activities more efficiently. In the department of La Guajira, the situation of this sector has been diverse, varying from territories in which seasonally the climate can present arid and hot temperatures to others in which the weather, water currents, and fertile lands are available to perform agricultural activities. However, all the units need specialized technical assistance and support from the public and private sectors to strengthen their business units and incorporate technologies that improve their operations. In this sense, the department of La Guajira shows features that indicate innovations that arise from the need to face structural problems such as poverty and hunger, which have been aggravated by environmental degradation and, more recently, by the consequences of the COVID-19 pandemic. The rural population, today parity in the territory in quantity with the urban population, has been the most affected.

In this way, innovations are seen that have been motivated by the need to incorporate practices that seek economic sustainability and sustainability, since the department has faced prolonged periods of drought, typical of the climate of subregions of the territory. Food producers in the department of La Guajira have implemented technologies that have allowed them to take advantage of alternative sources of water and energy, the first being storage systems and the search for water resources in wells and groundwater sources. At the same time, they have innovated in implementing food and fertilizers, incorporating circular economy processes that complement livestock activity with agricultural activity. Another no less important point is energy since the region's grid system is unreliable. However, this has led to a commitment to renewable energy sources such as solar energy, which is abundant in the department.

On the other hand, the productive agricultural units of the department of La Guajira have also focused on implementing improvements that transform their production models,

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understanding that there are technologies and organizational models that address problems related to commercial, administrative, and logistical management, among others. Here it is possible to see how associations and unions arise that provide greater bargaining power for customers and suppliers. This has allowed them to combine and unite resources, elements, and capacities, strengthening their business models. Likewise, we are beginning to see how food producers in the region implement information and communication management technologies, allowing them to approach new markets. However, connectivity problems persist that must be addressed by the public sector and private initiatives to strengthen each producer's dynamic capacities and competitive advantages in the guajira territory possesses.

Finally, improvements in production processes have allowed companies and agricultural production units in this territory to gradually promote changes that benefit aspects such as productivity, quality, safety, and hygiene. This has been possible thanks to the accompaniment provided by higher education institutions, research centers, state entities, foundations, non-governmental organizations, private initiatives, business development institutions, and those that provide agricultural technical assistance. The agribusinesses of La Guajira are incorporating new technologies such as agricultural machinery, information, and communication technologies, correcting incongruent situations, biosafety conditions, cultivation, harvesting, post-harvest, raising, breeding, capture, and slaughter, among others.

The preceding describes some of the agricultural innovation strategies being developed in the department of La Guajira, making it possible to note that these initiatives seek to respond to the problems that hinder the activities carried out by agribusinesses. However, it is necessary to accompany these organizations to deliver the relevant knowledge, techniques, and technologies to answer each unit's problems. Implementing innovations without contemplating the actual needs of agricultural production units would mean wasting resources on wrong actions.

Conclusion

After analyzing theoretical referents and classical-current disciplinary intellectual production through the history of the strategy and innovation study variables, their

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convergence, and their contextualization in productive agricultural units, it can be extracted that: (1) since the appearance of the human being, it was agriculture that allowed the emergence of civilization, through the domestication of animals and vegetables, which affected the growth of the population and the formation of the first cities. Different cultures incorporated techniques, such as using the force of animals in various tasks, crop rotation, and irrigation districts. At the same time, geographic exploration triggered technological advances and the diversity of animal and plant species to cross over to different regions of the planet.

(2) Strategy and innovation converge in the search for competitive advantages that allow companies to obtain economic sustainability, solving problems and situations that reduce economic performance. Historically, innovation strategies have been mutating, moving from incorporating new technologies and reconfiguring the organizational structure towards information and knowledge management models, sustainable and sustainable production models, and digital economies emanating from industry 4.0.

(3) In the case of agricultural productive units, studies on innovation strategies have focused on three significant areas: studies of phenomena that promote agricultural innovation, studies on agricultural production models, and studies on improvements in production processes. agricultural production. The first has focused on the causes that motivate agricultural innovation, such as the search for efficiency and sustainability. The second considers that innovation is also reconfiguring agricultural production systems. Finally, for the third, agricultural innovation incorporates improved practices that enhance productivity.

(4) Regarding the innovation strategies in productive units of the department of La Guajira, it is evident that these have arisen reactively to provide answers to the problems of these organizations. These problems have been of a socioeconomic and environmental nature, which requires the articulation of the agribusinesses of the territory with public sector institutions, companies, and private initiative organizations, universities, and research centers so that a system of rural extension that provides the technical, technological, and cognitive tools required by the department's food producers.

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