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# Agri-food systems: A regional perspective in innovation capabilities \*

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## ABSTRACT

Present days, food systems are part of a global network of production, processing, distribution and consumption. Several changes in food consumption patterns boost continuous improvement and development of the food system process and new food system models according to the stage of evolution and size of economies, diversification of rural areas, the efficiency of producer organizations, export orientation and market power of different contexts. The projected human population of nine billion by 2050 has led an ever-growing discussion of the need for increased productivity in agri-food systems. The aim of this paper is analyze the main factors affecting collaboration practices between actors at the institutional level of Agri-food System in Santander Colombia. The research methodology includes techniques of content analysis and structured written questionnaires. The analysis unit consisted of a sample of eighteen actors representing universities, companies, public entities focused on issues of science and technology of the agro and associations of producers, was conducted. The main findings show the most frequent collaboration practice and the main innovation capabilities at the system level. The main recommendations focus on promoting the management of vertical, horizontal and lateral integration and Virtual collaboration.

## KEYWORDS

Agri-food systems, innovation capabilities, productivity, collaboration, RAAIS

## JEL CLASSIFICATION

O3, Q1

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## Sistemas agroalimentarios: Una perspectiva regional en capacidades de innovación

### RESUMEN

En la actualidad, los sistemas alimentarios forman parte de una red mundial de producción, elaboración, distribución y consumo. Varios cambios en los patrones de consumo de alimentos impulsan la mejora continua y el desarrollo del proceso del sistema alimentario y los nuevos modelos del sistema alimentario según la etapa de evolución y el tamaño de las economías, la diversificación de las zonas rurales, la eficiencia de las organizaciones de productores, la orientación a la exportación y el poder de mercado de los diferentes contextos. La población humana prevista de 9000 millones de personas para 2050 ha dado lugar a un debate cada vez más amplio sobre la necesidad de aumentar la productividad de los sistemas agroalimentarios. El objetivo de este trabajo es analizar los principales factores que afectan a las prácticas de colaboración entre actores a nivel institucional del Sistema Agroalimentario de Santander Colombia. La metodología de investigación incluye técnicas de análisis de contenido y cuestionarios escritos estructurados. La unidad de análisis consistió en una muestra de dieciocho actores que representaban a universidades, empresas, entidades públicas enfocadas en temas de ciencia y tecnología del agro y asociaciones de productores. Los hallazgos más destacados muestran las prácticas de colaboración más frecuentes y las principales capacidades de innovación a nivel de sistema. Las principales recomendaciones se centran en promover la gestión de la integración vertical, horizontal y lateral y la colaboración virtual.

### PALABRAS CLAVE

Sistemas Agroalimentarios, Capacidades de Innovación, Productividad, Colaboración, RAAIS

### CLASIFICACIÓN JEL

O3, Q1

## Sistemas agroalimentares: uma perspectiva regional sobre as capacidades de inovação

### RESUMO

Hoje, os sistemas alimentares fazem parte de uma rede mundial de produção, processamento, distribuição e consumo. Várias mudanças nos padrões de consumo de alimentos impulsionam a melhoria contínua e o desenvolvimento do processo do sistema alimentar e dos novos modelos de sistema alimentar, de acordo com o estágio da evolução e o tamanho das economias, a diversificação das áreas rurais, a eficiência das organizações de produtores, orientação para a exportação e o poder de mercado de diferentes contextos. A população humana esperada de 9.000 milhões de pessoas até 2050, deu origem a um debate cada vez mais amplo sobre a necessidade de aumentar a produtividade dos sistemas agroalimentares. O objetivo deste trabalho é analisar os principais fatores que afetam as práticas de colaboração entre os atores no nível institucional do Sistema Agroalimentar do Santander na Colômbia. A metodologia de pesquisa inclui técnicas de análise de conteúdo e questionários escritos estruturados. A unidade de análise consistiu em uma amostra de dezoito atores representando universidades, empresas, entidades públicas focadas em questões de ciência e tecnologia agrícola e associações de produtores. As descobertas mais importantes mostram as práticas de colaboração mais frequentes e os principais recursos de inovação no nível do sistema. As principais recomendações concentram-se em promover o gerenciamento da integração vertical, horizontal e lateral e da colaboração virtual.

### PALAVRAS-CHAVE

Sistemas Agroalimentares, Capacidades de Inovação, Produtividade, Colaboração, RAAIS

### CLASSIFICAÇÕES JEL

O3, Q1

### Introduction

The main objective of the Agrópolis MACTOR project is the creation of a collaborative working model between actors of the agri-food system of Santander Magdalena Medio and innovation capability development. This purpose sup-

poses a social and scientific impact of high level, because it is identified at a preliminary way in recent diagnoses, low levels of interrelation between actors, weakness in the existing links within the system and the absence of a model that promotes interaction and trust to improve the innovative performance as well as the quality of life of stakeholders.

According to the research background shown, the relevance of the management of agri-food systems is identified as a tool for improving innovation and the quality of life of stakeholders. Because the capacity for collaboration is manifested among diverse forms, in the practices for the relationship between actors, this research constitutes an academic contribution to the identification of the different kinds of collaboration and the relationship among actors in the way of practices associated with the capacity for collaboration.

This problematic is approached from the theoretical perspective of the theory of capacities and resources - RBV. The fundamental principles of RBV, are based on the fact that the particular performance of an organization or system is explained from the particular way in which resources are combined. In that sense, this combination of resources is considered a form of collaboration.

Recent research results highlight the importance of food systems in the context of many countries such as Sub-Saharan Africa's region, Spain specifically in Valencia, Murcia, Almeria and Danish.

In the case of Africa's food consumption patterns, these have changed dramatically over the coming decades. Rising urbanization growing incomes and an emerging middle class will increase marketed volumes of food and ramp up demand for high-value foods (dairy, meat, and fresh fruits and vegetables), processed foods, packaged convenience foods and prepared foods (Tschirely, Haggblade and Reardon, 2013).

In Spain the agri-food sectors play an important role in the economy, contributing 8.7 percent of its GDP, and more than 13.5 percent of total employment (FIAB, 2010). Agri-food businesses are playing a role in this transformation, boosted by entrepreneurship and innovation, based on local information and resources. The agri-food industry is showing more resilience in the declining economic climate observed since 2008 than other industries (OECD, 2009). The Danish economy has been rated as one of the most innovative in the world and Agriculture and food make up a significant portion of the Danish economy. It became one of the most developed sectors in the country, in spite of its size and other constraints for growing of this kind of activity.

Referring to the capabilities concept and approach, Richardson (1972) defined it as skill, experience, and knowledge, which let the firm perform as a unique entity. These capabilities encourage the firm to identify market opportunities, develop new value concept (new business concept) and meet customer's need in new markets. In this sense, several researchers highlight two theoretical approaches for ca-

pabilities: dynamic and technological capabilities (Zawislak, Carneiro, Fracasso, Reichert and Pufal, 2011).

Dynamic capability represents an approach which deals with dynamics scenarios, such as learning, where firms develop, build, transfer, adapt and make continue modifications in products or processes to meet customer's need. Being high performance in these practices, the firm sustains competitive advantage (Winter, 2003; Wang and Ahmed, 2007). In the national context, the Colombian agricultural sector is currently identified as a key element for the country's economy (DANE, 2018). However, some barriers hinder its development, among which are gaps of special interest concerning the development of the territories:

1. Public policy in Colombia has maintained an urban bias that has increased the urban-rural gaps, leaving the inhabitants of the countryside behind in their development" (CORPOICA, 2015).
2. There is "a low level of relationship between actors, in particular, between those that generate knowledge (research and technological development entities), between these and the producers, and between the institutions that provide public funds for the financing of said activities" (CORPOICA, 2015).

These gaps, make clear the need to generate innovation processes that originate from the social field, which lead the actors of the Agricultural Innovation System (AIS), to explore new ideas of the transformation of the field, where the transfer of knowledge and the interaction must be integral factors of said actions.

Specifically, the Ministry of Agriculture and Rural Development (MADR), together with CORPOICA and COLCIENCIAS, in the Strategic Plan for Science, Technology and Colombian Agroindustrial Innovation (PECTIA), identify this limitation (barrier to overcome), stating that:

In Colombia there is difficulty in consolidating an innovation system that facilitates and encourages the flow of knowledge among the different actors for knowledge management, especially due to the weak link between the knowledge-generating entities and the productive apparatus so that it is Integrate in the dynamics of knowledge and technology transfer and incorporate this knowledge to the productive units, in order to support the productive, social and environmental transformation of the country (MADR, CORPOICA and COLCIENCIAS, 2016).

In this regard, at the departmental level - more specifically in Santander, the Agrópolis MACTOR project has been proposed as an alternative to mitigation, which hopes to “become a focus of agribusiness and food reserve for Colombia and the world, in the long term. ...”, as well as contributing to the development of the agricultural sector by making use of technology, knowledge management and skills (UIS, 2016).

It is also important to highlight that within the framework of strategic projects established in the Santander Development Plan 2016-2019, the need for the construction of the Agrópolis Santander-Magdalena Medio, as a basic initiative for sustainable development both at the level regional as a long-term national, that responds optimally and prioritized on those elements that energize the territorial system as a whole, catalyze the articulation of actors and position Santander as a pole of attraction of investment and generation of decent employment (Gobernación-Santander, 2016).

This work constitutes a contribution to the described research background, in the sense that it is not possible to identify, studies that approach the evaluation of collaboration capacity, based on the identification of related practices in agro-food systems, from the perspective of open innovation.

The main hypotheses that are assumed within the research focus on the concentration or low diversity of forms of collaboration, as an element that restricts the capacity of the actors and the system to generate better results in innovative performance. Based on the aforementioned topics, this document presents some of the results that have been obtained in the process of execution of the Agrópolis MACTOR project, which are organized as follows: (i) Conceptualization related to agri-food systems, innovation and capacities, (ii) the methodology applied to achieve said results, (iii) analysis of results, and finally (iv) some conclusions.

## **I. Agri-Food systems and innovation capabilities**

In this section, the lector can found a conceptualization about Agri-Food Systems, Innovation in Agri-Food Systems, Innovation Capabilities and Collaboration, and Capability Building.

### **I.1 Agri-Food Systems**

Existing conceptualizations of food systems have focused on describing a chain of activities from production to consumption (Toth, Rendall and Reitsma, 2015). The inclusion of socioeconomic and global environmental drivers that

interact with food system activities and outcomes, in this chain of activities, highlight in food system model of Eriksen (2008).

Thereby, an agri-food system is the set of activities that includes production, processing, distribution and consumption processes, to aspects such as recycling and waste (Pimbert, Thompson and Vorley, 2001). In this way, by connecting these activities, together with technological support, structuring of regulatory systems, it offers the basis for the construction of a local, national and international agri-food system.

Food systems are complex socio-ecological systems operating at multiple scales (Toth *et al.*, 2016) and evolve through the choices of society. Agri-food systems describe how their interactions are dynamic and vulnerable to short term situations and long term stresses like climate change (Thompson and Scoones, 2009). The main subsystems or key system activities in agri-food systems include producing, processing and packaging, distributing and retailing, and consuming food, involve the on-the-ground actors as part of food system processes. These stakeholders are embedded within social, political-economic, historical and environmental contexts (Ingram, Ericksen and Liverman, 2012).

Recent research has demonstrated how stakeholders, through their transformations in the agricultural sector and the use of the resources to produce food, bring irreversible changes in the natural environment (Caron *et al.*, 2018; Fonte and Cucco, 2017; Khatri-Chhetri, Pant, Aggarwal, Vasireddy, and Yadav, 2019; Saint Ville, Hickey, and Phillip, 2017). On the other hand, there are many studies about management practices in agri-food systems that contribute to reducing poverty and helps systems become more resilient and robust (Giraldo and Rosset, 2018; Rosset, Val, Barbosa and McCune, 2019).

### **I.2 Innovation in Agri-Food Systems**

Agri-food innovation systems are defined as: sets (Klerkx, Mierlo and Leeuwis, 2012), subsystems, or public or private networks (Press, 2000) of: institutions, stakeholders, organizations and individuals (TAP, 2017); of complex and dynamic nature (Douthwaite and Ho, 2017) interrelated and self-organized (Spielman, Ekboir, Davis and Ochieng, 2008) which together with institutions and support policies of the agricultural sector (TAP, 2017), contribute to the production, exchange and use of knowledge, new technologies, skills, products, process y new or existing forms of organization, for the generation of agricultural innovation and the creation of impact on innovation performance sector (Klerkx, *et al.*, 2012) at regional, national or global level, based on a certain degree of pre-existing capabilities.



From their nature as an innovation system, they identify as key elements: (i) the strengthening of the individual and collective capacity to innovate, (ii) the improvement of culture to support capacities, and (iii) the promotion of links and networks with innovation agents (Cohen and Levinthal, 1990).

Due to the importance of innovation to productivity growth in the agri-food sector, several studies addressed to firm's level innovation and very few studies have attempted to measure farm-level innovation. At farm level productivity and innovation, the term ecological intensification was probably first used to describe a double approach which, on the one hand, uses all possible measures favouring soil fertility maintenance and, on the other hand, establishes the integration of crop and livestock production with forestry on the same parcel of land with the objective to have an agro-sylvo-pastoral system Wezel, Soboksa, McClelland, Despesse and Boissau, (2015) stated that the goal of ecological intensification in agriculture is "further intensification of production systems that satisfy the anticipated increase in food demand while meeting acceptable standards of environmental quality.

Several studies identify factors as drivers and by its positive impact on innovation such as development policies in favor of promoting the economic diversification of rural areas and efficiency of producer organizations (Fearne, García Álvarez-Coque, López-García and Sánchez, 2013). Organizational factors such as vertical integration as well as contractual arrangements (Karantininis, Sauer and Furtan, 2010) specifically the degree of network linkages and the export orientation of the firm. Besides, the organization size and market power are important determinants of innovation (Karantininis *et al.*, 2010).

Thus, agri-food systems are changing as a result of the effects of the factors, like the complex and dynamic interactions in socio-economics, politics and environmental dimensions: climate change, the concentration of production, industrialization, among others (Pimbert *et al.*, 2001). As well as, transformations that international systems have had, including the universities role in a new production and innovation model, besides, the important role that has taken the creation, management, and appropriation of knowledge (Zerda Sarmiento, 2013, 2016).

### 1.3 Innovation capabilities

The innovation capability is recognized as one of the main aspects leading to a competitive advantage amongst firms. Innovation capability is a special asset of a firm. This capabi-

lity refers to a firm's ability to develop new products and/or markets, through aligning strategic innovative orientation with innovative behaviors and processes (Wang and Ahmed, 2007). Thus, innovative capability encompasses several dimensions.

Several studies focus on BRICS countries, highlights an approach for innovation capabilities and building innovation capabilities. For example, Lema, Quadros and Schmitz, (2015) taking into account connections in value chains and propose explanatory factors for innovation capabilities, which have their origin in the old powers (Europe and USA). To understand the build-up of innovation capabilities in Brazil and India, it examines their linkages with firms in Europe and the USA. It shows how the organizational decomposition of the innovation process emanating from the old powers contributes directly and indirectly to the build-up of innovation capabilities in the new powers (Lema, *et al.*, 2015)

On the other hand, focus on R & D activities analysis on developed countries, several studies, deepens on organizational routines and activities from the perspective of the innovation process of low- and medium-technology (LMT) industries, specifically in the packaged food sector. This deepening arises from the question, how the innovation process in the packaged foods sector of the UK food industry depends on a learning-by-doing, by using and by interacting (DUI) mode of innovation including activities such as technology adaptation and the use of external firm sources. Some findings support the view that LMT industries rely on non- formal R&D activities, such as firm interaction and shared experiences (Trott and Simms, 2017).

The relationships among R&D and other innovation activities, patents granted and sales of product innovations influenced by various specified characteristics of a NIS are investigated at the national level and tested on data for 14 EU nations in 1992 and 1996. The statistical results show patents to depend on sales of product innovations. Furthermore, both national innovation outcome indicators depend on largely the same macro- and micro-economic conditions while they differ in additional explanatory conditions, namely governmentally regulated institutional conditions for patents and firm-specific characteristics for sales of product innovations (Faber and Hessen, 2004).

### 1.4. Collaboration and capability building

Firms build capabilities by reflecting on the value of the work performed and applying integrative principles that allow multiple processes to be synchronized (Soosay and Sloan, 2005). The antecedent of collaboration suggests that

competencies are formed when there is leverage from the skills and expertise of each partner (Vlachopoulou, Manthou and Folinas, 2002). Collaboration can be described as an inter-organizational relationship type in which the participating parties agree to invest resources, mutually achieve goals, share information, (Stank, Daugherty and Autry, 1999) resources, rewards (Phillips, Lawrence and Hardy, 2000) and responsibilities as well as jointly make decisions and solve problems (Spekman, Kamauff and Myhr, 1998).

Various authors refer to inter-organizational collaboration as joint ventures (Doz and Hamel, 1998), networks inter-organizational alliances (Dickson and Weaver, 1997), strategic alliances (Vyas, Shelburn and Rogers, 1995), consortia (Aldrich and Sasaki, 1995), partnerships and inter-firm cooperation. For firms seeking to innovate within their supply chain it is important that in entering into relationships, the firms that need to innovate ensure the relationship allows them to acquire additional knowledge and build capabilities that add to their innovative capacity.

The firms that need to innovate ensure the relationship allows them to acquire additional knowledge and build capabilities that add to their innovative capacity. The main types of collaboration for building innovative capability according to Sossay *et al.* (2011) are referred to as i) strategic alliances, ii) joint ventures, iii) cooperative arrangements, iv) virtual collaboration and v) vertical, horizontal and lateral integration.

Between this types of collaboration, highlights several practices such as: i) strategic alliances (share knowledge, disseminate new technologies, to penetrate new markets); ii) joint ventures: (ensure economies of scale in manufacturing, looking for a new market, marketing strategies); iii) cooperative arrangements: (sharing of resources, either tangible or intangible, pursuit of business goals, redesigning of process and products) iv) virtual collaboration (use of information networks, trust-building between parties, skills sharing for access to global markets) and v) vertical, horizontal and lateral integration (producing similar products or different components of one product, association to share resources, reduce logistics and administration costs for individual organizations).

## 2. Methodology

The agricultural innovation system approach has been less explored in developing countries in Latin America. Most frequently research works, include analysis in Africa through implementation of systemic diagnosis by mean of methodologies such as RAAIS (Rapid Appraisal of Agricultural Innovation Systems) for a whole understanding of internal

and external conditions, including the innovation capacity of agricultural systems and it's a support system (Barrett, Feola, Krylova and Khusniddinova, 2017). It underlines that understanding complex problems as innovation capacity in the agricultural system context, requires integrative analysis.

RAAIS is a diagnostic tool that combines multiple methods of data collection. Building on existing experiences with rapid appraisal approaches and (participatory) innovation systems analysis, based on criteria for selecting methods as diversity and hardness, the possibility of outsider analysis, include stakeholder analysis at different levels, and the level of detail provided for the specific problem (Schut *et al.*, 2015).

It is also important to note that the combination of different types of data collection methods and tools provides internal and external validity for search results (Rohrbeck, 2010). Depending on the problem under review and the resources and time available, different types of data collection methods for RAAIS can be used, based on the above criteria for method selection.

In this paper, research methodology includes methods and tools of mixed, qualitative and quantitative methods, and develops and adapted tools of RAAIS methodology for participatory diagnostic construction.

In Figure 1 you can see in an illustrated way the path that has been followed to achieve the results presented in this document. In the first place, it started with the problematic that frames the Agrópolis MACTOR project, which is little articulation of actors (that are part of the agri-food system), taking as context Santander Magdalena Medio.

Second, it has been essential for research, to propose the dimensions that support the synergy of activities in the agri-food system; these are socio / cultural, economic, infrastructure, environmental, political, and science - technology and innovation.

Now, having clear the orientation offered by each of the dimensions, actions were proposed from the research field, which refers to strategies that methodologically support the process of obtaining results.

Therefore, as a third step, the application of both qualitative and qualitative methods was proposed. In contrast to the qualitative elements, the methodology called RAAIS was used, in such a way that an approach was made to actors of the system under study. While at a quantitative level, and based on the meeting with the actors, an instrument was applied, it was oriented to recognize the practices or factors related to capacity building and innovation.

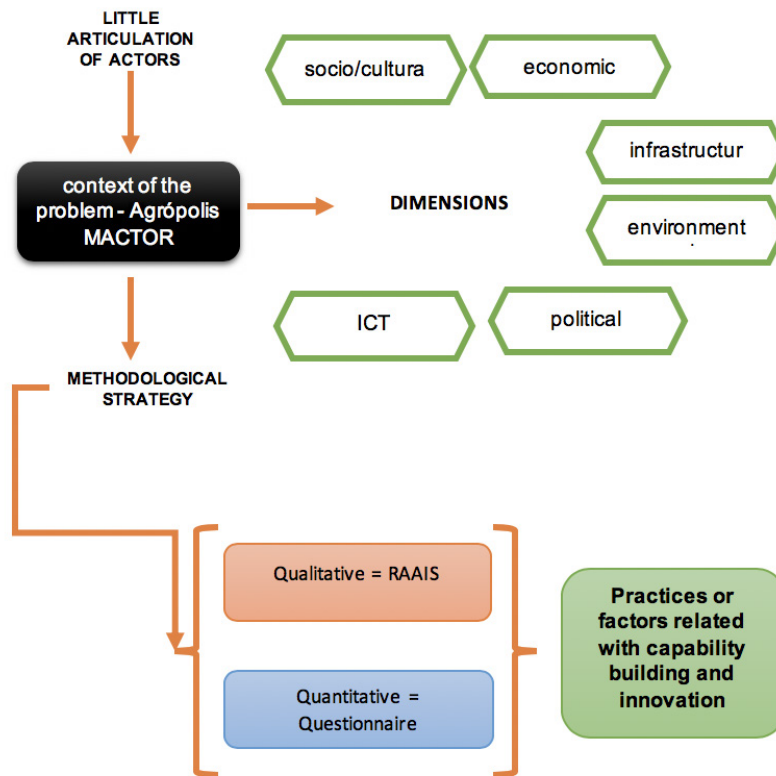


Figure 1. Methodology Process.  
Source: The authors.

Research conducted within the qualitative paradigm is characterized by its commitment to collecting data from the context in which social phenomena naturally occur to generate an understanding that is grounded in the perspectives of research participants (Bryman, 1988). The qualitative approach was implemented by systematic review principles and techniques of content analysis. The quantitative method included a questionnaire with a sample of eighteen dots, conducted between practitioners and researchers from universities, companies, public entities focused on issues of science and technology of agro, and associations of producers. The findings identified the main innovation capabilities from a collaborative capacity perspective.

This research aims to build an understanding of the factors and examine the relationships that are generated within the system under study, using mixed methods, which according to Chacón and Eslava (2017) and Gómez (2015), lead to generating results on research approaches very close to reality, this is due to the use of both qualitative and quantitative methods. In that sense, and based on the agri-food systems approach, which is visualized in a reality associated with the complexity derived from the dynamics generated in the interaction of its components, Terrado (2018) gives importance to qualitative models, that landed to the study

of the territory (seen as a system for the purposes of this research) allow to study the complexity of the relationships that are generated between the elements that act in a given context. On the other hand, quantitative methods also from their nature seek to contribute to the phenomena of reality in different contexts (Gómez, 2015). Thus, the purpose of this process is to generate confidence in the results by providing explanations of the literature and, when relevant.

## 2.1 Data collection and analysis

Employing questionnaires, interviews and content analyses, this paper provides a greater understanding of the relationship between practices for innovation capabilities and support factors, including internal capabilities of collaboration.

### 2.1.1. Multi-stakeholder workshops

Multi-stakeholder workshops focused on the analyses of collaboration capacity between actors of the agricultural system from Santander Colombia were developed (Lamprinopoulou, Renwick, Klerkx, Hermans and Roep, 2014). A participatory workshop methodology encourages different groups of stakeholders to identify, categorize and report



collaboration types. The call for the workshop covered stakeholders representing national, regional and local levels, including local and regional governments, universities, farmers and NGOs.

To keep the data collection manageable and to stimulate interaction and debate, the workshop was proposed and implemented for a maximum of 50 participants (Barrett *et al.*, 2017); maintaining at least of six representatives of the different project dimensions: socio/cultural, political, environmental, ICT, infrastructure and economics. The workshop was designed to take place over approximately four hours with a team consisting of a facilitator and a note taker who had the task of capturing discussions between stakeholder groups.

A standardized process for facilitation was designed and implemented previously for the training of the facilitator team.

A crucial element in the workshops was the use of questionnaires for collaboration activities data collection. At the start of the workshop, one questionnaire for each of the stakeholders was given. In this, the collaboration activities list according to Sossay (2010) was provided for analyzing collaboration, starting with five categories: alliances, joint ventures, cooperative arrangements, virtual collaboration, and vertical, horizontal and lateral integration.

### 2.1.2. Secondary data collection

Secondary data are written data with relevance for the analysis of the complex agricultural problem, the innova-

tion capacity of the agricultural system or the functioning of the agricultural innovation support system (Vanlauwe *et al.*, 2014). For this purpose, policy documents, prior project proposals and reports, and organizational information were included.

For the sampling of secondary data, key agricultural documents were included, such as regional and national planning documents, agricultural policies and relevant scientific literature. The knowledge of the secondary data was verified during the validation activities with the interested parties.

## 3. Results

Following the methodology presented and the data obtained as a result of the literature review and the application of the information collection instrument, a set of practices were identified that contrast the experiences of business professionals, public agricultural science and technology institutions, and associations of several subsectors and productive chains. Considering its importance for the development of innovation capacity, the questions in the questionnaire focused on identifying these practices aimed at collaboration between the actors of the food system of the Santander region in Colombia. For the structuring of the instrument, the list of practices presented in Table 1 was taken into account.

This list of practices facilitated the process of identifying the types of collaboration that are generated in the dynamics of the interactions of the actors that belong to the food system of the Santander region.

Table 1.  
Description of practices and type of collaboration

Practices related with capability building and innovation	Type of collaboration
Share infrastructure or equipment Spreading new practices or technologies	Strategic alliances
Develop new products-services Find access to public or private business networks	Joint ventures
Products or processes redesign Develop contractual arrangements	Cooperative arrangements
Collaborate virtually by ICT means Use virtual information networks to maintain contact with partners	Virtual collaboration
Partnerships to reduce logistics costs Buy articulately to have bargaining power costs in quality, technical or financial assistance shared	Vertical, horizontal and lateral integration

Source: Adapted from Sossay and Sloan (2005).

Thus, a percentage analysis of the adoption of the level of collaborative activity is presented, based on the evaluation of 18 data collected and classified in the ranges presented below:

- From 0% to 40%: Low Adoption of Collaboration Activity.
- From 41% to 70%: Acceptable Adoption of Collaboration Activity.
- From 71% to 100%: High Adoption of the Collaboration Activity.

Table 2.

Frequency obtained of the practices

Practices related with capability building and innovation	Percentage
Spreading new practices or technologies	78%
Information sharing.	72%
Develop new products-services.	67%
Share infrastructure or equipment.	56%
Use virtual information networks to maintain contact with partners	44%
Products or processes redesign	44%
Collaborate virtually by ICT means	44%
Other activities	39%
Find access to public or private business networks	39%
Develop contractual arrangements	33%
Partnerships to reduce logistics costs	28%
Costs in quality, technical or financial assistance shared.	28%

Source: The authors

In this sense and as observed in Table 2, at a low level of adoption of the collaborative activity (0% to 40%), the following proposed activities are found:

- Seek access to public or private business networks (39%).
- Other activities (such as Research, Characterization of the social base, Meetings with representatives of the rural area, Development of agro-industrial units for post-conflict, Technology evaluation, Technology diagnosis, Analysis of technological portfolio for Agrópolis MACTOR and Supports with resources to companies, which total 39%).
- Develop contractual agreements (with 33%).
- Ally to reduce logistics costs (with 28%).

- Share costs in quality, technical or financial assistance (with 28%).
- Buy articulately to have bargaining power (with 0%).

At a level of Acceptable Adoption of the Collaboration Activity (41% to 70%), the following proposed activities are identified:

- Develop new products - services (with 67%).
- Share infrastructure or equipment (with 56%).
- Redesign products or processes (with 44%).
- Collaborate virtually through ICT (with 44%).
- Use virtual information networks to maintain contact with partners (with 44%).
- At a High Adoption level of the Collaboration Activity (71% to 100%), there are:
- Disseminate new practices or technologies (with 78%).
- Share information (with 72%).

Besides, from the review of the literature, on documented experiences at a scientific level, factors are identified that direct the capacity for innovation in food systems, which, in turn, can influence the implementation of the proposed practices. These factors include: non-formal R&D activities, such as the interaction of the company and shared experiences, ii) adaptation of technology and the use of external sources of the company, iii) Strengthening of links between companies, iv) links with companies from other countries, v) degree of network links for export orientation, vi) intensification, integration of agricultural and livestock production and vii) export orientation.

On the other hand, factors that do not favor the construction of innovation capacity in food systems are identified, such as i) a strong negative correlation between market concentration and innovation, and ii) the reduction of innovation by increasing the power of retailers in agri-food companies. Regarding export orientation, several studies were found confirming that export-oriented companies tend to innovate more since the variable sales of exports are significant and positive. On the other hand, market power stands out as both a positive and a negative driver of innovation in food systems. It is identified that, although competition in the market stimulates the generation of new products, their concentration and the excessive power of market-related actors, it turns out to be negative for food systems.

The comparison between the factors identified in the conceptual analyzes and the results of the participation of professionals in the food system of Santander, shows coincidences in the development of new products-services, sharing infrastructure or equipment and sharing information. These activities are framed in the logic and objectives of the mar-

ket mainly and are characterized within the types of collaboration of strategic alliances and joint ventures.

#### 4. Discussion

The influence of collaboration and collaborative capacity emerges as a precursor to capacity building for innovation together with associations. These collaborative efforts have been traditional among large, small and medium enterprises, and universities or research centers. Several countries, such as Finland, Belgium, and Germany, lead these activities worldwide.

In this sense, it is assumed that innovation capacities can be built from the perspective of collaborative networks generated from the holistic vision of agri-food systems, understanding in turn, that this perspective must assume the complexity associated with the reality of the interactions between the stakeholders that make up this system. In this way, the identification of collaborative practices contributes to the formation of strategic alliances that promote research, development and innovation activities, and the marketing of key products and services in Santander.

Considering the importance of the agricultural sector in Colombia as a developing country, and the performance and participation of the domestic group product (GDP) of the agricultural sector in the Santander region, the participation of this sector in GDP is equivalent to 6.3%, and generates 1.7% of jobs in the region and 13.3% of total industrial production. Additionally, Santander's agricultural activity is concentrated in five products in which it occupies the following places in the national total: cane "panelera" (first place), potato (fourth place), palm oil (second place) and cassava (eighth place).

Taking into account the above, it is relevant to start from the diagnosis of the collaboration practices of the current networks in the sector in Santander and the factors that influence these practices that allow proposing alliances with a focus on the development of innovation capacities in the system agri-food of the region (Figure 2).



Figure 2. Key elements that influence innovation capacity  
Source: The authors

In this way, it is estimated that the development of innovation capacities will be influenced by the level of adoption of the collaborative activity carried out by the stakeholders.

In the case of the Santander region, according to Table 2, it is identified that spreading new practices or technologies (78%) and information sharing (72%) have a high level of adoption of the collaborative activity, which suggests that the sector gives importance to the generation of alliances to share information and knowledge, in contrast to technical activities, such as Buy articulately to have bargaining power, which represents a frequency factor of 0%. Links and networks are positioned as drivers of the construction of the capacity for collaboration.

Likewise, i) the reduction of logistics and quality costs, ii) shared technical or financial assistance, iii) components of vertical, horizontal and lateral integration; They are the lowest frequency factors. This situation contrasts with the findings of the success factors of capacity building of food systems in Denmark (Karantininis, et al., 2010), where integration has been decisive for this industry is consolidated as a leader in the European region.

Therefore, there is a need to consider the willingness of stakeholders to generate alliances that allow knowledge sharing and jointly build innovation capabilities for the agricultural sector; understanding the relevance of the sector in the economic development of the region.

#### 5. Conclusions

The aim of this paper is analyze the main factors affecting collaboration practices between actors at the institutional level of agri-food System in Santander Colombia. Main research results, verify the relevance of the application theoretically supported by the resource-based vision, in order to advance in the understanding of the limitations for the development of capacities in agri-food systems in countries with emergent economies such as Colombia.

The main types of practices with high levels of adoption, within the actors of the agri-food system of Santander are, i) Spreading new practices or technologies and ii) Information sharing that belong to the types of collaboration of Strategic Alliances.

The factors that most affect the collaborative practices among actors in Santander's agri-food system are related to the low trust between actors and the current levels of connection between them. These factors limit the use of practices such as Partnerships to reduce logistics costs and buy articulately to have bargaining power costs in quality, technical or financial assistance shared.

These research results, verify the pertinence of the application theoretically supported by the resource-based vision, in order to advance in the understanding of the limitations

for the development of capacities in agri-food systems in countries with emerging economies such as Colombia. The scope of the objectives achieved in this research constitutes an academic contribution to the implementation of analysis of agri-food systems in Colombia, and is delimited from other identified results, in which this approach has low levels of implementation and analysis from an empirical perspective, involving the stakeholders of the different domains of the regional systems. It is recommended to deepen the investigation of the influence of universities as intermediary actors within the processes of collective and individual capacity building among actors in agri-food systems.

This research is based on the validity of the construct, by selecting the practices as well as the collaboration typologies, based on an analysis and selection of papers within the largest database of articles, Scopus with quality criteria based on citations. The reliability of the research results is supported by the implementation of a methodology based on a framework for the analysis of innovation capacity in agricultural systems in countries with emerging economies such as Colombia.

### Conflict of interests

The authors have no conflicts of interest to declare.

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