Local public-private partnerships to promote innovation in agricultural value chains: the case of cocoa in Colombia

Alianzas público-privadas locales para promover la innovación en cadenas de valor agrícolas: el caso del cacao en Colombia

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Abstract: The purpose of this study is to explore the possibility of developing more viable local public-private partnerships (LPPP) which may result in innovation in the cocoa value chain, through the agricultural innovation system functions approach. Research was conducted in two rural municipalities in the Department of Antioquia, Colombia. A focus group with stakeholders as well as directed surveys were implemented. 15 experts in the municipality of Necoclí, and 18 experts in the municipality of Caucasia participated. The data were analyzed quantitatively and the MACTOR method was used in order to determine the relationship between actors and the strategic objectives for innovation. Case studies revealed different dynamics, both from the perspective of the interests at play when actors prioritized key variables in each region, as well as their vision regarding strategic objectives to promote innovation in the cocoa value chain. Different degrees of convergence and correspondence between actors and strategic objectives in each region provided the grounds to determine the possible partnerships in the cocoa chain. Key actors with different capabilities and resources were also identified, as they could contribute to leveraging local innovation should a partnership come to be developed.

Keywords: innovation system, agricultural chain, partnerships, rural regions.

Resumen: El propósito de este estudio es explorar Alianzas Público-Privadas Locales (APPL) más factibles, que permitan promover la innovación en la cadena de valor de cacao, a partir del enfoque de funciones del sistema de innovación agrícola. La investigación fue realizada en dos municipios rurales localizados en el Departamento de Antioquia, Colombia, haciendo en cada uno un grupo focal con diversos actores seleccionados, donde participaron 15 expertos en el Municipio de Necoclí y 18 expertos en el municipio de Caucasia. Los datos fueron analizados cuantitativamente y mediante el software MACTOR para determinar la relación entre actores y objetivos estratégicos para la innovación. Los estudios de caso revelaron diferentes dinámicas, tanto desde los intereses de los actores en la priorización de variables clave en cada territorio, como en su visión con respecto a los objetivos estratégicos para fomentar la innovación local en la cadena de cacao. Los diferentes grados de convergencias y correspondencias, entre actores y objetivos estratégicos en cada territorio, permitieron determinar las posibles alianzas (APPL) en la cadena de cacao. Para ello también se identificaron actores clave, los cuales cuentan con diferentes capacidades y recursos que, en el marco de una alianza, podrían contribuir a aprovechar la innovación local.

Palabras clave: sistema de innovación, cadena agrícola, alianzas, territorio = áreas rurales.

1. Introduction

Theobroma cacao is a tropical tree and one of the most important perennial crops worldwide. Cocoa bean production constitutes a billion-dollar industry, from production to global chocolate trade, providing sources of income for around 40 million people (Teixeira et al., 2015). In Colombia, the cocoa chain has a significant economic and social impact, involving 25.000 families, with over

90% of the production coming from small-scale farmers (García-Cáceres et al., 2014). As trade globalization has created new opportunities for the cocoa chain in Colombia, new challenges have also appeared, considering that an increase in yield and production, as well as worldwide demand, have been predicted for the year 2050 (Kozicka et al., 2018).

An improvement in quality and productivity are among the challenges for the cocoa value chain in Colombia, as they are currently the main factors hindering competitiveness (Sánchez Vargas et al., 2008). Their development depends to a great extent on the harvest and postharvest operations producers implement once they have developed technical and practical capabilities and implemented the necessary technologies (Santander Muñoz et al., 2020). Some studies, however, claim that these constraints can be mitigated by overcoming some limitations currently faced by producers, such as the lack of access to markets, training, associativity, collaborative networks, and financing (Escobar et al., 2020).

Several authors have pointed out that the aspects that condition value chain performance are better understood by looking at segments of the chain such as agricultural production, inputs and services, access to credit, postharvest activities, and marketing (Schut et al., 2014; Thitinunsomboon et al., 2008). Such an approach, however, creates its own set of limitations as it fails both to offer a holistic perspective encompassing technological, social, and organizational considerations, and to consider the opportunities along the value chain. As a result, it has been suggested that in order to improve productivity and competitiveness in value chains, partnerships are required which promote cooperation for innovation, as well as the coordination of activities between actors in the chain (Anandajayasekeram & Berhanu, 2009).

Value chains may be seen, then, as an innovation system resulting from a network of actors interacting to generate value (Hall, 2006). Nevertheless, the practical application of integrating innovation system and value chain approaches proves challenging, and therefore very few cases have been documented in the literature (Devaux et al., 2018). Specifically, in relation to the cocoa value chain, no studies are documenting such a conceptual integration from an empirical perspective. Integrating both approaches also reveals how important partnerships are, as well as the possible forms of association between heterogeneous actors. To develop such an approach, innovation in the context of value chains needs to be promoted, thus contributing to enhancing value chain performance and competitiveness. Developing partnerships for innovation is a complex task, as it implies the convergence of strategic interests, particularly from the private sector, unclear expectations, and varying perceptions of benefits to be obtained on the part of the different actors.

As a result, the potential of public-private partnerships needs to be considered from the perspective of local development, as some actors have certain ties to the community and such a perspective could contribute to better capacity development (Hall, 2006). Furthermore, it should be emphasized that a local approach to the innovation dynamics of agricultural value chains requires the inclusion of local actors (Chechi & Schultz, 2019). Indeed, local considerations such as geographical conditions may influence how specific partnerships develop, which in turn determines innovation outcomes (Ayele et al., 2012).

In fact, in relation to the cocoa value chain in Colombia, it has been shown that how strategies are both understood and implemented should consider the specificities of producing regions (Escobar et al., 2020), particularly since promoting rural innovation in the cocoa value chain largely depends on local decision-making processes (Gutiérrez García et al., 2020). Nevertheless, there is still a wide knowledge gap in terms of the empirical approaches that offer a deeper understanding of the best way to manage innovation through activities that enhance performance in the cocoa value chain from the perspective of stakeholders. In this

context, the purpose of this study is to explore the most viable local public-private partnerships (LPPPs) to promote innovation in the cocoa value chain through the agricultural innovation system functions approach.

2. Analytical Framework

This analytical framework seeks to integrate the concepts of the value chain and agricultural innovation system. In this context, innovation is perceived and approached as a transformative process of both technological and non-technological (institutional, socio-cultural, normative, regulatory, cultural) change (Lamprinopoulou et al., 2014). Such a conceptual integration acknowledges the fact that agricultural problems are complex and uncertain, as they operate along with different levels of value chains, triggering social, economic, institutional, and technological transformations (Turner et al., 2015). Consequently, the functions approach to agricultural innovation systems is developed in this paper (Table 1). Seven key, empirically validated functions have been defined, which may generate a set of research variables for analysis (Busse et al., 2015; Hekkert & Negro, 2009; Wieczorek & Hekkert, 2012) when applied to agricultural value chains (Kebebe et al., 2015; Lamprinopoulou et al.,2014). From this approach to innovation systems, it is possible to understand innovation capacity development, specifically through function mapping to identify "motors of innovation" at the local level (Hekkert et al., 2007).

To better understand innovation capacities in the cocoa value chain, it is important to identify the role of actors (stakeholders) and their position when mapping functions and identifying key elements at the local level. As a result, the concept of local public-private partnerships is developed in this paper. LPPPs are critical in promoting innovation from the local to the national level for several reasons. First, because access to different levels of knowledge—resulting from cooperation between formal or informal networks at the local level—is required in order to face both change and opportunity in agricultural value chains (Hall, 2006). Second, because some stakeholders may contribute resources to fund government programs in areas where social benefits may be derived, particularly in agricultural value chains characterized by obsolete knowledge and technologies as well as limited funding and research capacities (Hartwich et al., 2005). Finally, because LPPPs result in strengthened capacities through establishing connections (in the form of relationships and arrangements between local actors) that promote innovation and different development processes in some geographical contexts (Chechi & Schultz, 2019). As a result, local public-private partnerships are understood here as public and private resources coming together to generate added value in the form of information, specialized human capital, funds, among others (van der Meer, 2002).

Table 1. Description of functions in the agricultural innovation system

F1. Entrepreneurial activities	Entrepreneurs generate potential for innovation through knowledge, network development, and the search for new markets, thus creating new business opportunities and adding value (Hekkert & Negro, 2009). This function is also defined in terms of the development of new technologies and applications at the company scale to reduce uncertainty (Audouin, et al., 2018).
F2. Knowledge development	Knowledge development drives innovation. It does not take place, however, only in formal research institutions: it needs to take into account farmers, companies, and other actors within the agricultural innovation system as well (Hermans et al., 2015)

Source: Hekkert et al. (2007); Turner et al. (2016); Hermans et al. (2019)

Table 1. Continued...

F3. Knowledge diffusion and network development	Knowledge networks are a key function to promote information exchange, which contributes to further knowledge and innovation. Other authors have highlighted the importance of platforms and networks in promoting interactive learning and innovation, as well as the distribution of roles to facilitate diffusion (Eastwood et al., 2017)
F4. Guidance of the search	This system function requires developing a vision for the innovation system to guide entrepreneurial activities and knowledge development. "Innovation agendas" are particularly important in order to determine collective priorities for subsectors and regions, which includes designing future scenarios
F5. Market formation	This function refers to developing markets for new products, or existing products with new features. It involves promoting the formation of niche markets through strategies that promote demand for new products and generate consumer awareness. It is specifically related to functions such as resource mobilization to obtain risk capital, for instance (Klerkx et al., 2010).
F6. Resource mobilization	Developing the previous functions requires resource allocation. Different types of investments are required to develop innovation including, among others, capital for the funding of basic research, subsidies for further developing technologies and innovative market concepts, but also other forms of non-financial investment
F7. Support from coalitions	The emerging of new technologies in the context of production, trade, and consumption systems often result in resistance from established actors. Advocacy coalitions can be a catalyst for this by influencing the innovation agenda and lobbying for resources and favorable institutions.

Source: Hekkert et al. (2007); Turner et al. (2016); Hermans et al. (2019)

To conclude this analytical framework, it is worth noticing that innovation capacity may be developed through LPPPs, using coordinated actions, practices, and processes aimed at mobilizing, combining, and creating resources and capabilities in the actors within the system, in order to leverage innovation in the context of joint projects along the value chain (Turner et al., 2015).

3. METHODOLOGY

3.1 Regional Context

The Department of Antioquia is the second-largest producer of cocoa in Colombia, producing around 5,259 tons in 2019, which represents around 8.8% of the national production (Federacion Nacional de Cacaoteros, 2019). The rural regions of Urabá and Bajo Cauca (Figure 1) have become increasingly important in the past years, particularly due to the processes of social reconstruction that are underway, after years of being affected by the armed conflict. Nevertheless, each region has its dynamics when it comes to the cocoa value chain. In 2011, Urabá accounted for 35% of total cocoa production in Antioquia (Cámara de Comercio de Medellín, 2011). Currently, although there are no official figures, some industry representatives claim that the planted area in the region has increased.

The municipality of Necoclí, part of the Urabá region, has been selected as a study case. The selection is based on an increase in productive areas, the existence of public and private institutions developing projects to strengthen the value chain, and the presence of two producers' associations. In the Bajo Cauca region, on the other hand, the cocoa value chain and its institutional organization are still in the early stages of development, because no major buying company in Colombia has any presence in the area and strategic planning processes for the subsector are only recently being developed. The municipality of Caucasia was selected because it is recognized as the most relevant city in the region and the one where economic and

political activity concentrates. Even though there are only around 100 hectares planted to date, there is great potential, as according to the Agricultural Land-Use Plan, up to 52,727 hectares can be used for cocoa cultivation (Antioquia, 2019).

3.2 Data Collection and Analysis

A case study was used because the purpose is to contribute to an understanding of individual, organizational, or social phenomena. Furthermore, this method is used when there is no need for the sample to be statistically representative. It does, however, allow for some analytical generalization of the social phenomena being described (Yin, 1994). For this study, a case study serves as an empirical research strategy around a specific research phenomenon in a real context and using different sources of evidence (Chaves, 2010).

Phase 1. Identifying variables and actors in the region

Based on the seven innovation system functions, and secondary documentation concerning the cocoa value chain, 30 main variables were defined. Afterward, a selection process for expert actors in every region under study was conducted. In this context, an expert is defined as an individual capable of providing detailed information and suggesting scenarios in the research field of interest (Spers et al., 2013). In order to identify the experts, the technique of stakeholder mapping was used. This technique allows to categorize and select potential participants, which in turn results in the incorporation of local technical and scientific know-how (Reed et al., 2007). Even though the identification of local actors in the region was the main interest, the mapping technique considered the inclusion of external stakeholders, particularly those with knowledge of the municipality and the cocoa value chain, to broaden the understanding of the research object. Several aspects were considered for expert selection, following the parameters in the methodology proposed by Delgado-Serrano et al. (2016), from which the following were taken into account:

(i) Criteria for selection and characterization of local actors: availability, willingness, and good disposition, credibility, influence, knowledge of the region, connection to the cocoa chain, living around the area. The actors selected were: co-researchers, local authorities, farmer association leaders, private companies in the industry, cocoa industry professionals, organizations along the value chain.

(ii) Criteria for selection and characterization of external actors: public institutions at the municipal or regional level with some influence on the cocoa value chain, NGOs, and other private organizations with some influence on the industry and the municipality under study. The actors selected were: representatives of regional authorities in the industry, representatives of private companies in the cocoa value chain, scholars, and researchers.

Phase 2. Prioritizing key variables

Two focus groups were conducted in each municipality. This is a validation technique that gathers information coming from heterogeneous actors, through a participatory workshop (Rodríguez et al., 2015). Based on the 30 variables, a participatory workshop was conducted, to prioritize the variables in a Likert-type scale from 0 to 5 (0: no priority; 1: very low priority; 2: low priority; 3: moderate priority; 4: high priority; 5: very high priority). Variables receiving scores of 4 and 5 more frequently on the scale were prioritized.
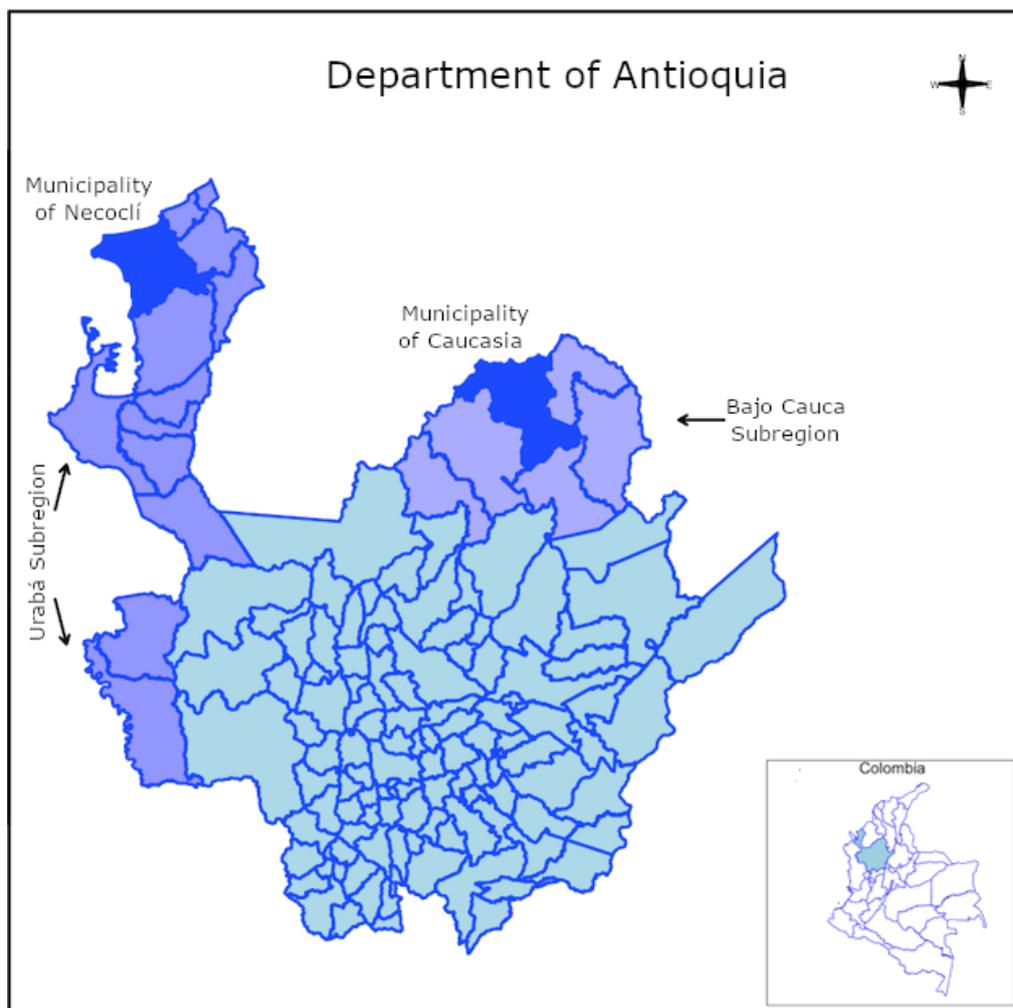
Figure 1. Location of the municipalities in this study

Phase 3. Setting strategic objectives

The variables prioritized were turned into strategic objectives, based on which some possible and consistent scenarios were designed in order to set some goals, and to set the stage for future public policy (Coates, 2000). This stage was developed by the research team, after processing the data obtained from the regions. Afterward, an online survey was conducted among all the actors in the different municipalities. First, the influence of every actor in the list was determined through a Likert-type scale from 0 to 4 ("no influence" to "strong influence"). Participants were also asked to define their position concerning a given strategic objective, using a Likert-type scale from 0 to 4 (from slightly agree to strongly agree), and from 0 to -4 when the actor slightly disagrees or strongly disagrees with a given objective.

Phase 4. Applying the MACTOR method

The MACTOR method (Matrix of Alliances and Conflicts: Tactics, Objectives, and Recommendations) is designed to help actors decide how to implement a given policy based

on alliances and conflicts (Godet, Monti, Meunier & Roubelat, 2004). This method improves data processing for every actor involved, particularly in terms of their vision concerning strategic objectives. It also allows determining the power relations between them, to identify dominant relationships and autonomous actors (Godet, 2000).

Consequently, the MACTOR method assesses important relationships between actors, thus determining which of them are key actors. From the analysis, a Direct Influence Matrix (DIM) was defined, where the actors are characterized and classified according to the position they occupy in the system. Furthermore, an Actor-Objective Matrix (AOM) was defined in order to establish the position of an actor concerning the objectives, as well as the possibility to develop partnerships to achieve them. Finally, an actor convergence graph was designed (Godet et al., 2004; Godet, 2000).

Phase 5. Exploring Partnerships between Actors

According to the MACTOR results, some possible connections between actors are posited in the form of key public-private partnerships, aimed at responding to the strategic objectives determined for each municipality. For that purpose, the roles and capacities of actors were also considered, which in the end serve as innovation catalysts.

4. RESULTS

15 experts from the municipality of Necoclí (in the Urabá rural region) and 18 experts from the municipality of Caucasia (in the Bajo Cauca rural region) participated in the focus groups and participatory workshops. These experts represented both local and external actors who have some role to play in the cocoa product chain. The diversity of actors allowed for different opinions to be incorporated, among them those of scholars, professionals in rural extension programs, government and non-government entities, trading companies, farmers' associations, universities, and other educational and community-based institutions. Some of the 30 variables selected by the research team were prioritized through a participatory workshop in each municipality (Table 2). These results also indicate that different variables were prioritized in each municipality, as well as different functions within the innovation system, which reflects the specific interests at play on the part of most actors in every region looking to leverage innovation in the cocoa value chain at the local level.

Table 2. Variables prioritized in each municipality.

Innovation System Functions	Variables prioritized by actors	Local prioritization	
		Municipality of Necoclí	Municipality of Caucasia
Entrepreneurial activities	Entrepreneurial activities in other components of the cocoa value chain		✓
	Entrepreneurial activities with product innovation	✓	✓
	Entrepreneurial activities with innovation in market access	✓	✓
Knowledge development	Developing new knowledge on smart agriculture		✓

Source: Prepared by the authors

Table 2. Continued...

Innovation System Functions	Variables prioritized by actors	Local prioritization	
		Municipality of Necoclí	Municipality of Caucasia
Knowledge diffusion and network development	Innovation in rural extension methods	✓	
Resource mobilization	Strengthening technical and agro-business capabilities among the rural youth	✓	✓

Source: Prepared by the authors

4.1 Strategic objectives and partnerships between actors in the municipality of Necoclí

The prioritized variables were turned into strategic objectives, designed as scenarios that may become part of the region's future plans (Table 3). In Necoclí, three functions of the innovation system were prominent. As a result, four objectives were defined, so that they may become motors of innovation in the cocoa value chain at the local level.

After conducting the survey and applying the MACTOR method, responses from 10 heterogeneous actors were processed, as detailed in Figure 2. In the graph, the most important convergences between actors around strategic objectives may be observed. Such convergence could contribute to leveraging the cocoa value chain at the local level. It is evident that the national training service, SENA, with its constant presence in the region, is the most relevant actor, given that other public and private actors and organizations have important bonds to this institution. As a result, SENA is a key referent when it comes to achieving strategic objectives. At this level, UDEA (Universidad de Antioquia), FEDCA (Fedecacao) which represents industry leaders, CCOM (the local Chamber of Commerce), CMM (Corporación Mundial de la Mujer, a local NGO providing funding and training for people in the region), and ASITAPUR (the local association of cocoa producers).

Table 3. Strategic objectives in the cocoa value chain in the **Municipality of Necoclí**

Innovation Function		Strategic Objectives
Entrepreneurial activities	1	Different innovative entrepreneurial activities focusing on product transformation will be developed in the municipality, including cocoa-based derivatives, cosmetics, syrups, liquors, among other alternatives. This will be achieved through rural extension training programs focusing on capacity development, identifying local young innovators, fostering women's participation, and identifying learning styles and preferences among producers.
	2	Different market-oriented entrepreneurial activities will be developed in the municipality. Small businesses will have the ability to promote their products through technological platforms, social networks, client-engagement strategies, and negotiation skills to participate in business roundtables as a result of the implementation of rural extension training programs for entrepreneurs.

Source: Prepared by the authors.

Table 3. Continued...

Innovation Function		Strategic Objectives
Knowledge diffusion and network development	3	Extension programs in the area of agriculture will include innovative methodologies, focusing on capacity development. This will lead to improved use of technology in the cacao sector, which will, in turn, contribute to producers' associations reaching over 80% of Premium cocoa production and to at least 50 organic cocoa certified producers.
Resource mobilization	4	The program "Joven cacaotero emprendedor" will encourage entrepreneurial activities by young cocoa growers to develop different technical, agro-industrial, and organizational capabilities around cocoa production and transformation. As a result, by the year 2030, young cocoa producers will have drawn at least 10 business plans for cocoa-related companies and will submit them to different funding sources supporting rural entrepreneurs.

Source: Prepared by the authors.

The convergences resulting from this analysis provide an understanding of the possible partnership networks among actors around strategic objectives set for the region. An actor such as SENA will hold a position of power as a key actor, which the other actors will require to reach common goals. As a result, SENA has a set of resources at its disposal that allow it to leverage rural entrepreneurial processes, as well as training programs to develop capacities in a rural context. On the other hand, it can be observed that actors occupy a certain position concerning the proximity to the strategic objectives that are closer to them, regardless of the convergences around objectives seen as a whole (Figure 3). This figure also takes into consideration that those actors that refused or failed to vote to occupy a neutral position (0 scores) about the objectives defined for this municipality.

Important actors along the chain, which have the role of buyers and distributors of the product once it has been transformed, such as Casa Luker and Compañía Nacional de Chocolates (CNC), distanced themselves from the four strategic objectives defined for the municipality. As a result, these two actors, important for the chain though they are, cannot be part of a public-private partnership to promote innovation in the cocoa value chain at the local level. Given the distance they took from the strategic objectives, convergences with other actors involved proved to be weak.

From the graph, it is also evident that two objectives seem isolated, and occupy very neutral positions, as they remain distant from all actors. Innovation in rural extension programs, which corresponds to the "knowledge diffusion" function, and developing capacities for the rural youth, part of the "resource mobilization" function (Table 3), constitute then strategic objectives for which actors do not correspond with their interests. As a result, no public-private partnership can be foreseen to develop innovation in these functions. On the other hand, Figure 3 shows that different public and private actors are more closely positioned within the quadrants corresponding to the variables "entrepreneurial activities with market innovation", and "entrepreneurial activities with product innovation", and with their corresponding strategic objectives. In other words, somehow interests on the part of actors gravitate towards the "entrepreneurial activities" function.

To develop different innovative entrepreneurial activities in the area of product transformation, presented as strategic objective 1, it is evident that SENA, the National Training Service, constitutes the closest actor and the most related to this objective. It becomes a key actor since it provides training and continuing education programs, funding management for entrepreneurial activities, and it has a very good institutional image.
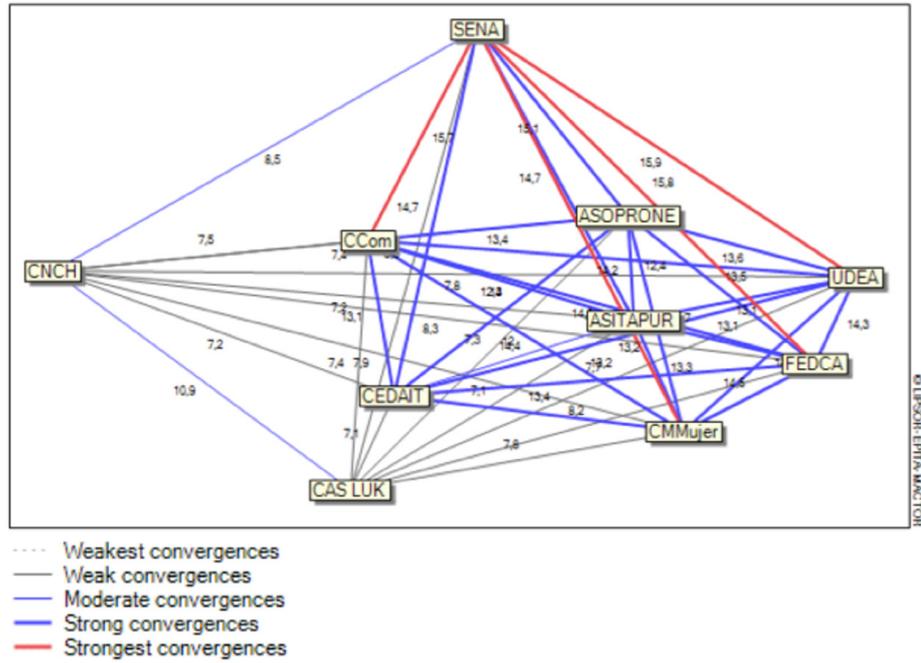
Figure 2. Convergence graph among actors concerning strategic objectives for innovation in the municipality of Necoclí. Source: Prepared by the authors.
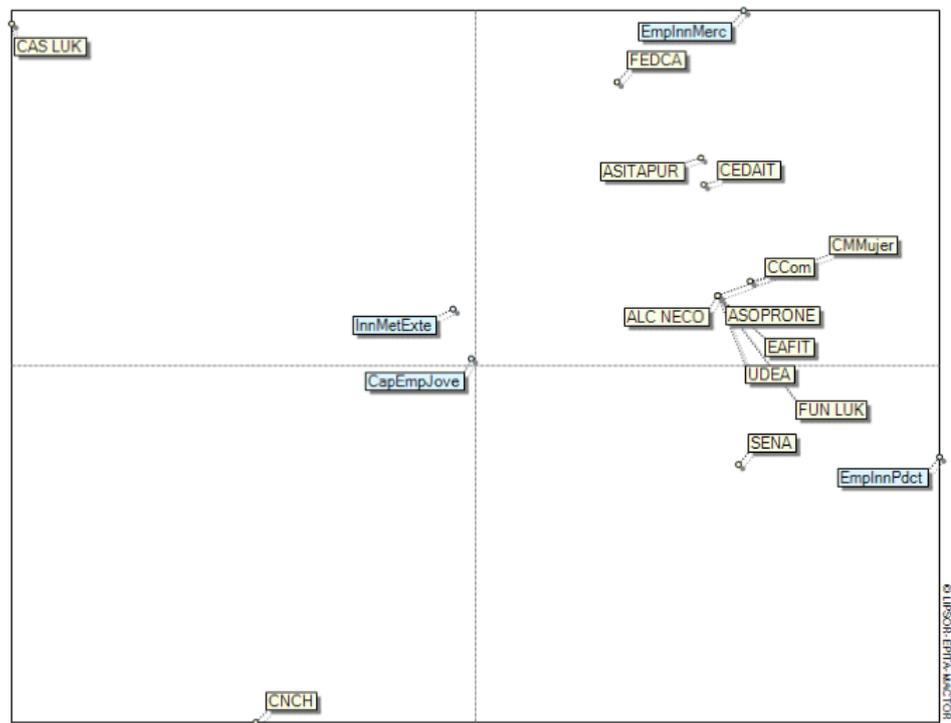

Figure 3. Correspondence graph between actors and strategic objectives for innovation in the municipality of Necoclí. Source: Prepared by the authors.

Likewise, a group of actors occupying intermediary positions in the graph could enter a public-private partnership, since some of them have the strongest convergences with SENA (Figure 2). Among them, we find the local chamber of commerce, Corporación Mundial de la Mujer, and Universidad de Antioquia. Other actors, on their part, are closer to strategic objective 2, oriented towards the development of innovative entrepreneurial activities in the market. The one closest among them is FEDECACAO (the National Federation of Cocoa Growers) representing industry leaders. The other two actors that are close are CEDAIT (a research center within Universidad de Antioquia) and the local producers' association, ASITAPUR.

For an eventual partnership, it should also be mentioned that these actors exhibit strong convergences concerning all the objectives as a whole (Figure 2). This is not a minor detail, since, in order to achieve strategic objective 2, capacities in the field of information and communication technologies need to be developed by the producers. In this case, the FEDECACAO organization is an actor that institutional supports industry producers and may leverage funding. CEDAIT, as a unit of Universidad de Antioquia, develops training processes with cocoa producers in the regions, and as a result, may also bring important capacities to the partnership. Finally, the producers' association, ASITAPUR, which exhibits strong convergences with these actors, may be used to develop pilot tests concerning the development of abilities for market innovation.

4.2 Strategic objectives and partnerships between actors in the municipality of Caucasia

In Caucasia, five strategic objectives were defined, to leverage innovation in the cocoa value chain at the local level (Table 4). Strategic objectives 3 and 4 set a difference concerning the previous study case. Based on the entrepreneurial activities function, it is strategically important to promote entrepreneurship in all the segments along the value chain, including a multi-sector approach to the chain at the local level.

Table 4. Strategic objectives in the cocoa value chain in the Municipality of Caucasia

Innovation Function		Strategic Objectives
Entrepreneurial activities	1	Different innovative entrepreneurial activities will be developed in the municipality, including organic and Premium cocoa production, product transformation, including cocoa-based derivatives, cosmetics, syrups, liquors, among other alternatives.
	2	Different market-oriented entrepreneurial activities will be developed in the municipality. Small businesses will have the ability to promote their products through technological platforms, social networks, client-engagement strategies, and negotiation skills to participate in business roundtables as a result of the implementation of rural extension training programs for entrepreneurs.
	3	Different multi-sector entrepreneurial activities will be developed in the municipality, involving agro-industry, tourism, education, the cosmetic industry, and the healthcare sector. Entrepreneurial activities will be fostered through technical and logistical services, and input supply, among other elements related to the cocoa value chain.
Developing new knowledge on smart agriculture	4	A smart agriculture model will be promoted for cocoa in the municipality of Caucasia. This will result in 20 cocoa farms being certified according to agricultural good practice codes, and in their incorporating some digital management technologies to improve decision-making processes, which in turn will result in better information collection, storage, and analysis.

Source: Prepared by the authors.

Table 4. Continued...

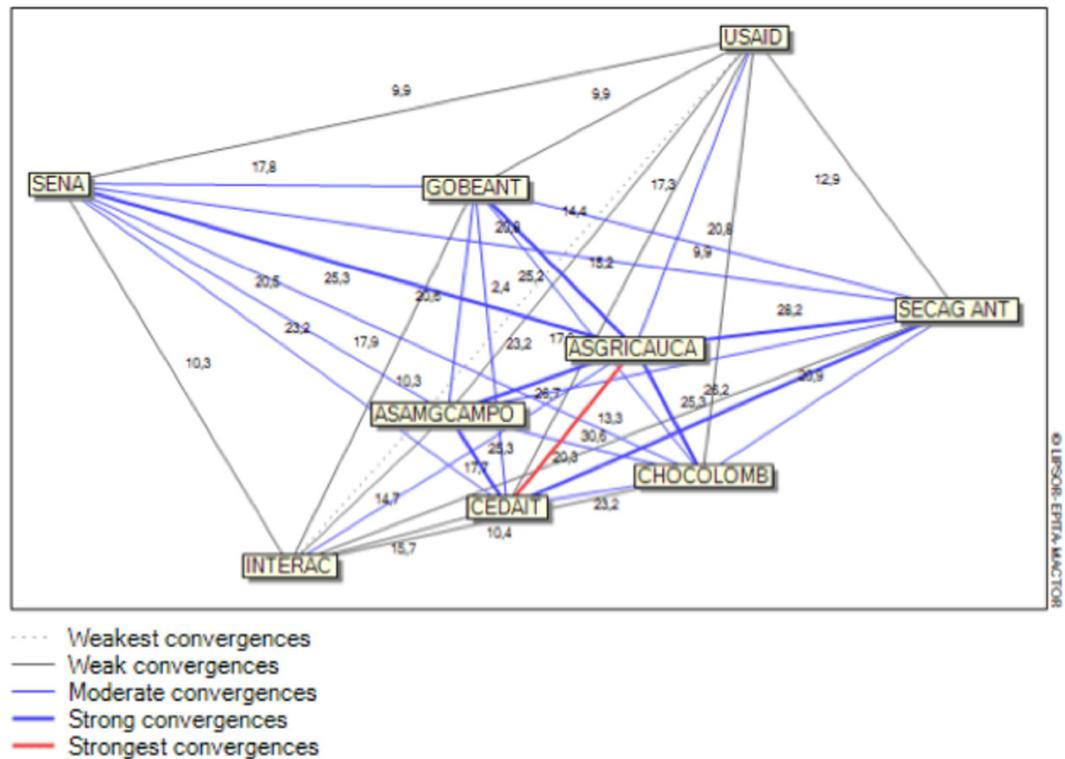| Innovation Function		Strategic Objectives
Resource mobilization	5	The program "Joven cacaotero emprendedor" will encourage entrepreneurial activities by young cocoa growers to develop different technical, agro-industrial, and organizational capabilities around cocoa production and transformation. As a result, by the year 2030, young cocoa producers will have drawn at least 10 business plans for cocoa-related companies and will submit them to different funding sources supporting rural entrepreneurs.

Source: Prepared by the authors.

The function "knowledge of smart agriculture" was also prominent. It requires a process of incorporating technologies in a given number of cocoa-producing farms. Responses from the actors surveyed in the municipality revealed no disagreement with the strategic objectives that had been defined. In other words, there is potential for the development of public-private partnerships to promote innovation along the value chain, as there is complete correspondence on the part of the different actors. Even though most actors manifested agreement around this objective, however, the strongest level of convergence was detected between CEDAIT (the research center at Universidad de Antioquia) and the cocoa producers' association ASGRICAUCA (Figure 4). Consequently, based on the strong convergence as evidenced in the graph, a partnership for promoting local innovation in the corresponding strategic objectives, this partnership may be fostered.

Nevertheless, to leverage the strategic objectives and promote innovation in the cocoa value chain in this municipality, other partnerships between actors with strong convergences may be promoted, so that their respective capacities may be brought together. As seen in the graph, the local producers' association ASGRICAUCA plays a major role given the strong convergences it showed with other actors. Relevant among these are public entities such as the Department of Antioquia Governor's Office and the Office of the Secretary of Agriculture and Rural Development. These actors have a prominent role in formulating agricultural public policy and in organizing the value chain in the region.

On the other hand, the Chocolates Colombia (CHOCOLOMB) organization brings together different small cocoa producers' organizations in the region. It is currently considered to be the main cocoa buyer both at the municipal level and in the Bajo Cauca region. Chocolates de Colombia is a strategic actor in consolidating a partnership and in promoting innovation, as it contributes to strengthening producer competitiveness, as it is part of a national network of organizations of small cocoa producers in Colombia.

Finally, there is strong convergence between the ASGRICAUCA producers' association and SENA, concerning the strategic objectives. Similar to the previous study case, the training service can develop capacities related to training, rural entrepreneurship management, and initial funding for entrepreneurs. Consequently, such a convergence may bring actors together to establish a local partnership to promote innovation. In this geographical context, the cocoa product chain is in the process of consolidating and developing an organization. Results have not shown certain interests on the part of some of the actors, and as a result, viable scenarios emerge in order to generate local partnerships to promote innovation.

Source: Prepared by the authors.
Figure 4. Convergence graph among actors concerning strategic objectives for innovation in the Municipality of Caucasia.

5. DISCUSSION

Three important elements for analysis can be concluded from the results of this study. First, at the methodological level, focusing on agricultural innovation system functions allowed to identify "motors of innovation" at the local level. Variables prioritized by actors themselves were turned into strategic objectives for the cocoa value chain. This is a novel approach to innovation system functions and may be distinguished from related work in functional approaches applied to agriculture (Minh, 2019; Turner et al., 2016, 2017; Lamprinopoulou et al., 2014; Eastwood et al., 2017).

Consequently, a functional approach in our study resulted in a clearer understanding of the positions that different actors presented concerning the strategic objectives that had been established for every municipality. This points to the importance of promoting adaptive management in the agricultural innovation system, which encourages actors to reflect on their positions concerning local needs (Klerkx et al., 2010). Furthermore, a functional approach also underscores the need to analyze actor roles concerning the functions that some of them may develop in a context of collaboration, to foster innovation and opportunities for technological and institutional change (Hermans et al., 2013).

Second, results confirm that comparative case studies reveal different dynamics, from the perspective of generalized interests on the part of actors in prioritizing key variables in every region, and also from the perspective of their specific position concerning the strategic objectives to promote innovation in the cocoa value chain at the regional level. As a result, it

was possible to analyze convergences between actors and objectives, to define multiple forms in which they could be related to developing specific configurations in each region, through a local public-private partnership (LPPP) approach. For instance, the results of this study show that local and external actors present in every region showed major differences in terms of the convergences between actors and functional strategic objectives, particularly when it comes to the strongest convergences. This means that in developing local public-private partnerships, every specificity needs to be considered, as they may be conditioned, among other aspects, by the degree of familiarity between local and external actors and how they relate to each other (Chechi & Schultz, 2019).

The results of this study concerning the specificities of viable LPPPs coincide with the study by Audouin et al. (2018), for whom agricultural innovation system functions must be analyzed at the local level, taking regional specificities into account, a process they refer to as specializing the innovation process in agriculture. Furthermore, they coincide with findings from approaches that highlight the importance of location-based analysis (Wellbrock & Roep, 2015), and specifically with a decentralized approach to innovation in value chains, where both local and external actors get together to identify problems and prioritize solutions (Pamuk et al., 2014). Although there may be contexts with more favorable conditions to generate public-private partnerships, either because actors have been working together or have worked together before (Ayele et al., 2012), evidence has been offered for the need to identify common interests so that actors themselves may strengthen collective action (Devaux et al., 2018).

Finally, the third element for analysis is related to promoting innovation in the cocoa value chain through the development of innovation capacities. From this perspective, our study considered both the convergences among actors to foster the development of relationships around strategic objectives and the mobilization of different types of resources that every actor may bring to the table in the context of LPPPs. In fact, some authors agree that to promote innovation, actors need to incorporate resources such as funding, infrastructure, institutional resources based on incentives, human resources, resources acquired through knowledge, among others (Turner et al., 2015).

Future research may focus on the analysis of different factors that promote or hinder the development of local public-private partnerships (LPPPs) to promote innovation in value chains, trying to determine what variables or factors—other than convergences and correspondences between actors and strategic objectives—may influence this relational framework to promote collective action (Narrod et al., 2009).

6. CONCLUSIONS

In this study, we have explored the possibility of developing more viable local public-private partnerships (LPPPs) to promote innovation in the cocoa value chain, through the agricultural innovation system functions approach. Research findings showed different dynamics in every rural municipality concerning the cocoa value chain. Of note is the fact that some variables have been prioritized, and the differences in the innovation system functions. As a result, there were also differences in the strategic objectives specific to each local level. Based on the perspective of specific actors and the position they assumed, the MACTOR analysis contributed to determining the existing relationship between actors and strategic objections in each region. The respective convergences and correspondences were thus established, which allowed exploring possible local public-private partnerships (LPPPs). In turn, through the MACTOR method, key actors and their respective capacities and resources were identified, which, once they have been brought

together in the context of an LPPP, may contribute to leveraging innovation, if convergences between them are determined to be strong or very strong. On the other hand, this study highlighted the importance of identifying and understanding the dynamics among actors at the local level, which points to the need to develop public policies to promote innovation that are relevant for rural regions. A major condition to achieve this is both to bring actors together to identify and prioritize problems and to develop a better understanding of their interests concerning the local strategies and solutions to the problems in a given value chain.

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