

Article

Social Network Analysis (SNA) for the Characterization of Peasant Organizations in Cómbita, Colombia

Paula González , Wilson González Santos *  and Laura Rubio 

Research Group CODEL, Universidad Pedagógica y Tecnológica de Colombia, Tunja 150003, Colombia; paula.gonzalez04@uptc.edu.co (P.G.); laura.rubio02@uptc.edu.co (L.R.)

* Correspondence: wilson.gonzalez@uptc.edu.co

Abstract

Social Network Analysis (SNA) in peasant organizations in Cómbita, Colombia, examines how relationships between different actors influence organizational dynamics and the circulation of knowledge. Using a mixed approach, four peasant organizations were characterized through interviews and SNA using UCINET 6.0, KeyPlayer 2.0, and NetDraw 2.192 software to identify key actors, information flows, and structural indicators. The results show that the source actors tend to be external, especially entities such as SENA, input suppliers, and technical advisors, while producers play the main role as disseminators and coordinators within each organization. The indicators of density, average degree, geodesic distance, diameter, components, and centralization show variability among the networks: Tierra de Quesos and Acuadinámica show greater cohesion and internal communication. In contrast, El Olivo shows greater connection and decentralization. However, all networks show levels of fragmentation and dependence on certain strategic actors, which increases their organizational vulnerability. The results suggest that strengthening internal ties and diversifying coordinating actors could improve the adaptive capacity of these peasant organizations; establishing the effect of these strategies on organizational sustainability will require longitudinal evidence linking network structure to concrete sustainability outcomes.

Keywords: social network analysis; structural indicators; key actors; knowledge flow; peasant organizations

1. Introduction

Social network theory embraces the fact that connections between people are important because they transmit behaviors, habits, and information, defining the boundaries of knowledge [1]. In this sense, Social Network Analysis (SNA) allows us to identify the relationships of commitment, trust, and power between the actors involved in the implementation of agri-environmental proposals, influencing the activities and decisions of these actors and, therefore, the success or problems of their implementation [2]. Social networks can be defined as sets of actors (individuals, groups, communities, organizations) that maintain relationships with each other in [3], and are based on the principle that agents and their actions are not autonomous, but interdependent [4].

Over the years, SNA has gained popularity not only in its own discipline of sociology, but also in the analysis of political and biological phenomena and agricultural issues [5].

The evaluation of social network analysis indicators becomes a valuable tool for understanding the relationships and interactions between actors participating in an organi-



Academic Editor: Jianming Cai

Received: 17 June 2026

Revised: 13 July 2026

Accepted: 20 July 2026

Published: 5 August 2026

Copyright: © 2026 by the authors.

Licensee MDPI, Basel, Switzerland.

This article is an open access article distributed under the terms and

conditions of the [Creative Commons Attribution \(CC BY\)](https://creativecommons.org/licenses/by/4.0/) license.

zational form. SNA demonstrates versatility where there are tools that allow the immensity of relationships to be visualized, with the particularity of performing a compatibility analysis between networks [6].

Peasant organizational structures play an essential role in addressing social challenges in the lives of farmers, such as the struggle for their rights and the resolution of cases that affect their lives and modes of production [7]. Formed through social, productive, and cultural relationships, peasant organizations in Colombia have been discovering, constructing, and assuming a critical and dynamic conception of territory. The community's relationships with both internal and external actors (social or institutional) should favor symmetry, reciprocity, and the role of the food community in the social and political component of the peasant organizational process, highlighting the revaluation of social practices such as the traditional solidarity organization of the peasantry [8].

In other words, communities build territories by appropriating spaces with projects that give a sense of belonging [9]. Thus, the existence of relationships and connections between participants, motivated by the exchange of experiences, knowledge, and mutual aid, is important for the formation of a network [10].

Barrios et al. [11] address the strategic role of Peasant, Family, and Ethnic Community Agriculture (ACFEC) organizations in Montes de María, a traditionally agricultural territory between Bolívar and Sucre, in the Colombian Caribbean, presenting a comprehensive analysis of the socioeconomic dynamics marked by conflict and thus building strategies for associativity, innovation, efficient resource management, and territorial equity. They conclude that ACFEC organizations have the opportunity to be a driving force for sustainable development and reconciliation in the mountains when they have empowerment tools based on collaboration and agroecological practices.

Based on the strategic nature of Ecuador's cocoa development, Plúa Panta et al. [12] analyze cocoa SMEs, where associativity emerges as a crucial response to strengthen small-scale producers and reduce inequality in the value chain, which not only enhances the global competitiveness of Ecuadorian cocoa but also promotes the economic and social growth of producing communities. Factors of change such as product distinction and quality, government regulations, credit management, and product value are recognized as having a positive influence on the production chain.

Recent studies confirm the analytical value of SNA for rural development: it has been used to identify structurally important actors for the dissemination of agricultural innovations [13], and to examine how network structure conditions the resilience and adaptive capacity of farming systems [14,15]. However, most of this literature has examined innovation diffusion or value chains at regional scales, single organizations, or networks of individual farmers. Comparative structural characterizations of several small peasant organizations with distinct production systems coexisting within a single municipality remain scarce, particularly in the Colombian context, and few studies combine key-actor identification (source, disseminating, and articulating roles) with whole-network indicators to diagnose organizational vulnerabilities. This gap limits the design of locally grounded strategies to strengthen peasant associativity.

In the municipality of Cóbbita, Colombia, peasant organizations with different production systems are the basis of the local economy: production of dairy products and their derivatives, potato production, vegetable production, and peasant markets. The research aims to study the configuration of peasant social networks in the municipality of Cóbbita, Colombia, based on SNA. The study provides indicators of the behavior of peasant organizations in a territory that contribute to their strengthening and, consequently, to economic dynamics.

2. Materials and Methods

The methodology considers two subsections that allow for a comprehensive approach to the subject of study. The first corresponds to the geographical framework, followed by the methodological design of a mixed approach, which combines quantitative and qualitative techniques in the development of the research.

2.1. Geographic Context

The study was conducted in the municipality of Cóbbita, located in the Central Eastern province of the department of Boyacá, Colombia [16]. The area covers 149 km², 70% of which is rural. Specifically, the research included the villages of San Rafael, San Isidro, Santa Bárbara, San Francisco, La Concepción, and the urban area of the municipality, where the peasant organizations under study are located (Figure 1).

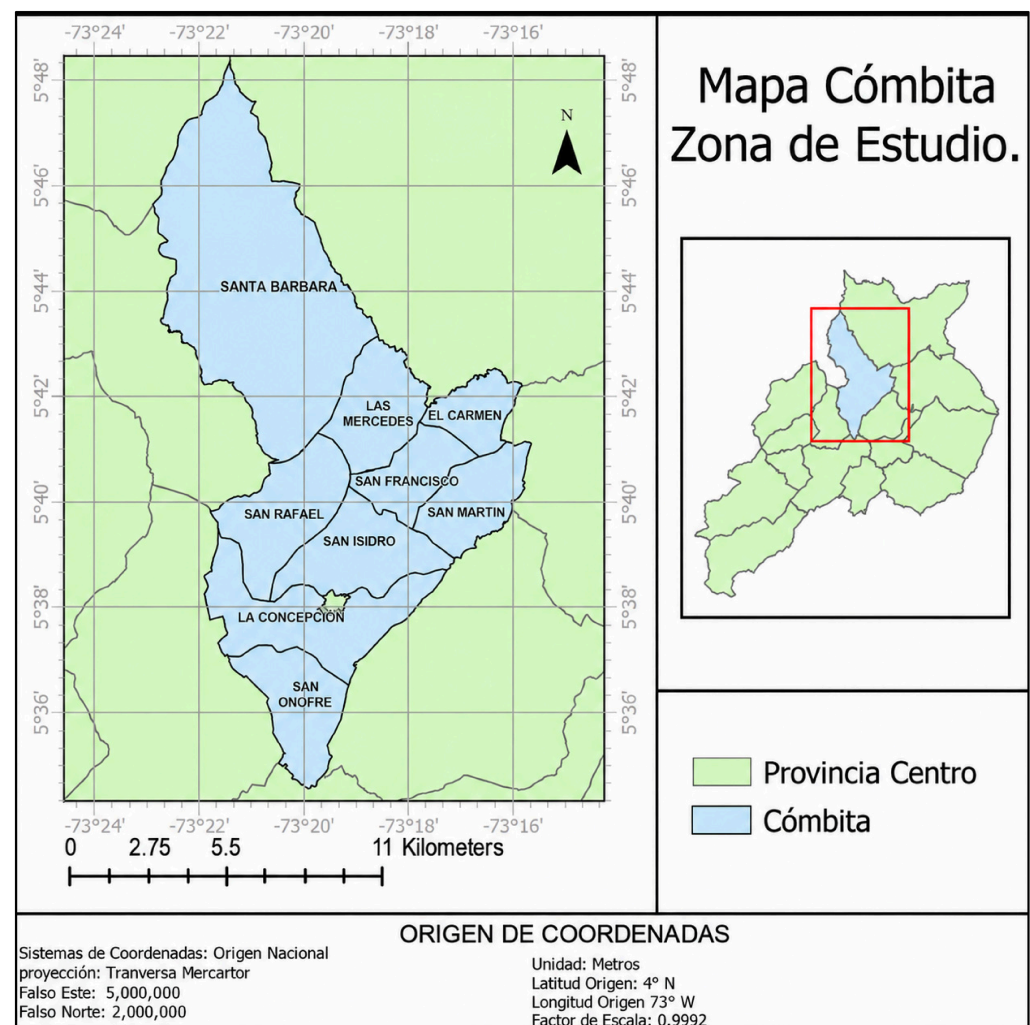


Figure 1. Area of influence of the research in Cóbbita (Boyacá).

2.2. Methodological Design

The research was mixed in nature, with qualitative and quantitative aspects, seeking to compile and analyze information in a process of identifying, characterizing, and relating actors within an organization. It used a non-probabilistic intentional sample based on the attributes in Table 1. The four organizations were identified from the records of the Chamber of Commerce of Tunja, the Secretariat of Agriculture of Boyacá, and the municipal office for agricultural promotion and socioeconomic development of Cóbbita. They were selected because, taken together, they cover the main productive activities of the rural economy of

the municipality. Fieldwork was carried out between 2023 and 2024: a structured survey, which included the name-generator questions described in Section 2.3, was administered face to face to the members of each organization who agreed to participate.

Table 1. Attributes and characteristics for the selection of the non-probability purposive sample.

Attribute	Characteristic
Origin	With a presence in one or more villages in the municipality of Cóbbita, Colombia.
Productive component	Each of the organizations has a different type of production process: dairy and dairy product production, potato production, vegetable production, and Mercados Campesinos Comunitarios.
Economic sector	The selected peasant organizations are involved in one of the main areas of the municipality's rural economy (agricultural production, primary sector processing, and marketing).

With the above in mind, Table 2 shows the characterization of the selected peasant organizations:

Table 2. Attributes and characteristics of the organizational structures of the municipality of Cóbbita.

Attribute	Cooperativa el Olivo	Mercados Campesinos	Tierra de Quesos	Cooperativa Acuadinámica
Origin	Partners in the villages of San Rafael, Santa Barbara, and Las Mercedes.	Cóbbita's main park.	La Concepción village.	San Francisco village.
Productive component	Production of roots and tubers, with emphasis on native potatoes.	Promotion, exhibition, and direct sale of agricultural and processed products from family farms.	Transformation of milk into pasteurized farm cheese, double cream cheese, curd, and quesito antioqueño.	Production of vegetables using aquaponics and cultivation of fruit trees, especially peaches and plums.
Economic sector	Agricultural sector.	Agri-food and marketing services sector.	Dairy agro-industrial sector.	Agricultural sector.

2.3. Network Construction and Analysis

SNA, using UCINET 6.0, has established itself as a key tool for analyzing interconnections, information flows, and collaboration patterns in rural organizations, offering an interpretation that strengthens and revitalizes their socioeconomic structures. Using Keyplayer 2.0, and based on questions about who producers turn to for problem solving or knowledge acquisition, actors are identified according to their importance and their focus in the network is given a name.

UCINET 6.0 and NetDraw 2.192 are used to represent networks where the nodes are actors, the links are their connections, the flow is the direction of the relationship, and the attributes are the characteristics that distinguish each actor [14].

For each organization, the network boundary was defined following a realist approach due to the set of actors comprises the members of the organization, identified from its membership roster, plus the external actors (technical advisors, input suppliers, public and private institutions) whom members nominated in response to the two name-generator questions of the survey: "Who is the person, organization, or event you learn from or turn

to when you have problems related to cultivation?” and “Who have you learned from, sought advice from, or asked questions of—that is, who do you turn to for information and knowledge to implement the practices, technologies, and innovations you use in your production unit?”

The responses were tabulated, for each organization, in an actor-by-actor relational matrix in which a directed tie indicates that the row actor turns to the column actor for information or knowledge, these ties were weighted according to the strength of the relationship reported by the respondents. The resulting networks are therefore directed and weighted. For the calculation of the whole-network structural indicators reported in Section 3.2 (density, average degree, geodesic distance, diameter, components, component ratio, and centralization), the matrices were dichotomized, as is standard practice for these indicators. The matrices were processed in UCINET 6.0; source, disseminating, and articulating actors were identified with KeyPlayer 2.0; and the networks were visualized with NetDraw.

The study was conducted with the informed consent of all participants. In accordance with the ethical commitment of the research, the identities of individual participants are anonymized throughout the article: each node is identified only by an actor code (Actor 1, Actor 2, and so on) in the figures, tables, and text. Only one large public institution, the National Training Service (SENA, for its acronym in Spanish), is identified by name, given its public nature; the remaining actors are private individuals or belong to small organizations and are therefore not named.

3. Results

Using KeyPlayer 2.0 software and the responses to the two name-generator questions described in Section 2.3, the source actors who are the origin of the information and knowledge, as well as being the most referred to, are identified, as well as the collector or disseminator actors, who are those who have connections for accessing information and knowledge [17].

The networks formed by the UCINET 6.0 program algorithm are reflected using NetDraw software and according to Trujillo [18]; the nodes or actors are the individuals or groups of individuals who share a common goal; the size of the networks is the sum of all the nodes or actors in the network; the links are the connective ties that exist between two or more nodes in the network (represented by lines); The flow indicates the direction and sense of the link between members of the network, which can be bidirectional (mutual flow) or unidirectional (directed flow). The attributes are the characteristics of the actors or nodes in the network, which allow each of these actors to be identified within the network.

In the case of the selected organizations, four figures created by NetDraw can be viewed. In the networks, the size of each node indicates membership in the group (the larger figure represents the members and the smaller figure represents the actors referred to by the members). Producers and traders are represented by circles; agricultural engineers, extension workers, teachers, instructors, and individuals offering technical assistance are represented by squares; input suppliers are represented by triangles; and public entities, private companies, and educational institutions are represented by the hourglass symbol. In the case of gender, blue is used for male, pink for female, and green for public entities, private companies, and educational institutions (Figures 2–5).

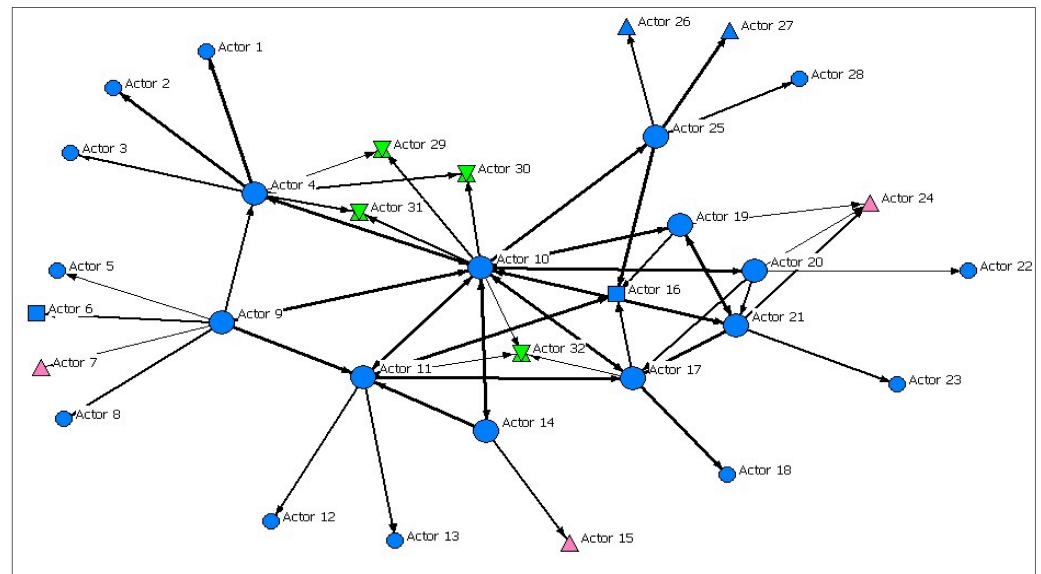


Figure 2. Social network of the Cooperativa Integral El Olivo (32 nodes, 58 ties). Node shape indicates the type of actor, color indicates gender or institutional nature, and size indicates membership (larger nodes are members; smaller nodes are actors referred to by members). Labels are anonymized actor codes; key actors are listed in Table 3. Created with NetDraw.

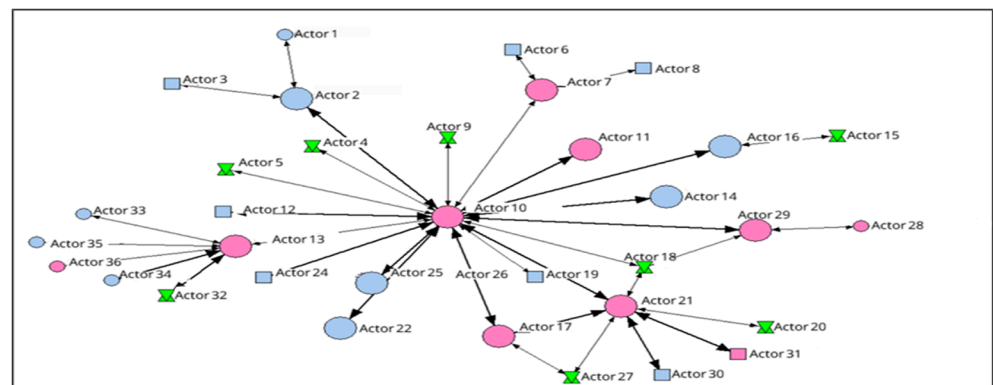


Figure 3. Social network of Mercados Campesinos Comunitarios (34 nodes, 42 ties). Node shape indicates the type of actor, color indicates gender or institutional nature, and size indicates membership. Labels are anonymized actor codes; key actors are listed in Table 3. Created with NetDraw.

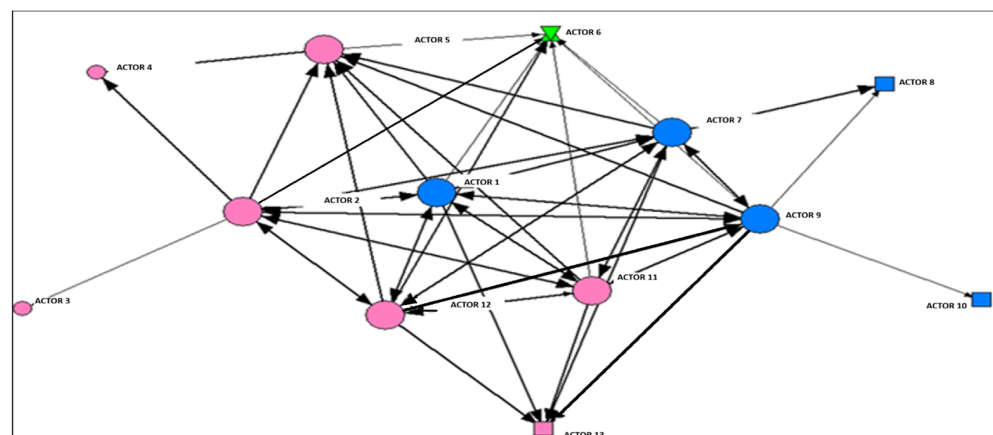


Figure 4. Social network of Tierra de Quesos (13 nodes, 55 ties). Node shape indicates the type of actor, color indicates gender or institutional nature, and size indicates membership. Labels are anonymized actor codes; key actors are listed in Table 3. Created with NetDraw.

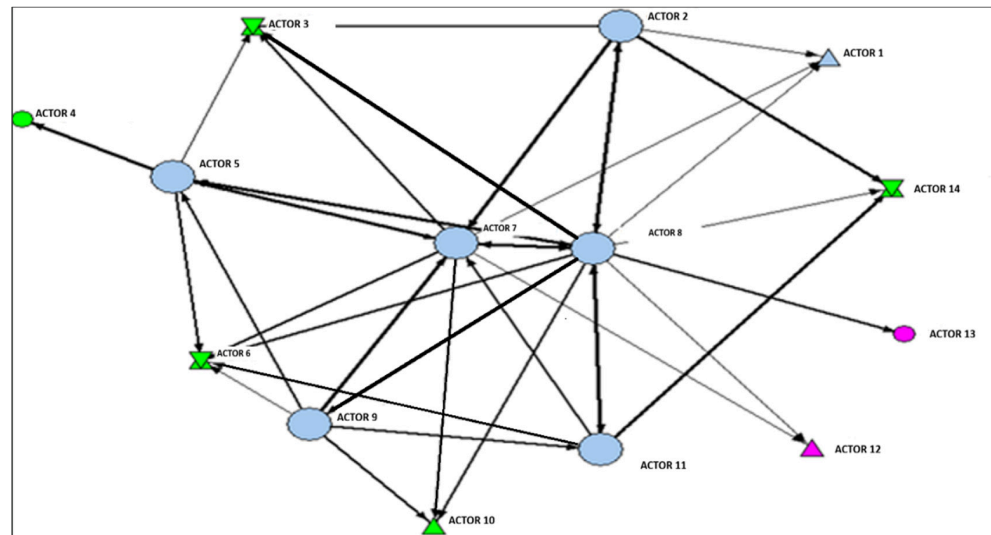


Figure 5. Social network of the Cooperativa Integral Acuadinámica (14 nodes, 38 ties). Node shape indicates the type of actor, color indicates gender or institutional nature, and size indicates membership. Labels are anonymized actor codes; key actors are listed in Table 3. Created with NetDraw.

3.1. Key Players

The following are the source actors and disseminating actors, responsible for generating and transmitting information within the network. Table 3 relates each actor code cited in this section to its category within the network, so that readers can link each code to its type of actor.

Table 3. Actor codes cited in the text and their categories, by organization. Personal identities are withheld in accordance with the informed-consent agreement of the study; only the public institution SENA is identified by name.

Organization	Code	Category	Role in the Network
Cooperativa Integral El Olivo	Actor 10	Member (producer)	Source and disseminating actor
	Actor 16	Input supplier (external)	Source actor
	Actor 24	Technical advisor (external)	Source actor
Mercados Campesinos Comunitarios	Actor 27	Private producers' association (external)	Source actor
	Actor 10	Member (trader/producer)	Source and disseminating actor
	Actor 18	SENA, public training institution (external)	Source actor
Tierra de Quesos	Actor 9	Member (cheese producer)	Source and disseminating actor
	Actor 2	Member (cheese producer)	Source and disseminating actor
	Actor 6	SENA, public training institution (external)	Source actor
Cooperativa Integral Acuadinámica	Actor 1	Member (producer)	Source actor
	Actor 12	Member (producer)	Source actor
	Actor 6	SENA, public training institution (external)	Source actor

3.1.1. Source Actors (Harvest)

Cooperativa Integral El Olivo:

Percentage of nodes harvested: 37%

Key players: Actor 10, Actor 16, and Actor 24.

Mercados Campesinos Comunitarios
 Percentage of nodes harvested: 29.41%
 Key players: Actor 27, Actor 10, and Actor 18 (SENA).

Tierra De Quesos
 Percentage of nodes harvested: 76.93%
 Key players: Actor 9, Actor 2, and Actor 6 (SENA).

Cooperativa Integral Acuadinámica
 Percentage of nodes harvested: 64.29%
 Key players: Actor 1, Actor 12, and Actor 6 (SENA).

3.1.2. Disseminating Actors (Diffuse)

Cooperativa Integral El Olivo:
 Percentage of nodes reached: 68.75%
 Key players: Actor 10, Actor 9 and Actor 25.

Mercados Campesinos Comunitarios
 Percentage of nodes reached: 76.47%
 Key players: Actor 10, Actor 13 and Actor 21.

Tierra De Quesos
 Percentage of nodes reached: 100%
 Key players: Actor 9, Actor 2, and Actor 7.

Cooperativa Integral Acuadinámica
 Percentage of nodes reached: 100%
 Key players: Actor 5, Actor 6, and Actor 7.

To identify the disseminators in a network, the following algorithm is applied:

$$R = \frac{\sum_j \frac{1}{d_{mj}}}{N}$$

In networking literature, the letter R is used as an abbreviation for reach. Considering that the distance d_{mj} from the last node to any other node is 1, and N is the total number of nodes [19].

3.2. UCINET 6.0 Indicators for Social Network Analysis (SNA)

Table 4 shows the results of the different indicators for the SNA in the four peasant organizations under study. These indicators quantify the structural patterns that can be observed in Figures 2–5: the sparse configurations of the Cooperativa Integral El Olivo (32 nodes and 58 ties; Figure 2) and Mercados Campesinos Comunitarios (34 nodes and 42 ties; Figure 3) correspond to low densities (0.058 and 0.037) and a high number of components, whereas the compact configurations of Tierra de Quesos (13 nodes and 55 ties; Figure 4) and the Cooperativa Integral Acuadinámica (14 nodes and 38 ties; Figure 5) correspond to higher densities (0.353 and 0.209) and shorter geodesic distances.

Table 4. UCINET 6.0 whole-network indicators for each organization, calculated on the directed, dichotomized matrices.

Attribute	Cooperativa el Olivo	Mercados Campesinos	Tierra de Quesos	Cooperativa Acuadínámica
N° of nodes	32	34	13	14
N° of links	58	42	55	38
Density	0.058	0.037	0.353	0.209
Average Degree	1.813	1.235	4.231	2.714
Geodesic Distance	2.180	1.979	1.257	1.564
Diameter	3	3	2	3
Components	24	30	8	9
Component Ratio	0.742	0.879	0.583	0.615
Centralization	0.342	0.509	0.379	0.654

4. Discussion

4.1. Key Players

According to Cuevas et al. [20], sources of knowledge and information can be of many different types, with a special focus on tacit knowledge that is relevant to producers, who subsequently share it with their peers. Taking into account the results of source actors from each of the organizations, it can be seen that this choice is made based on the number and strength of the links that each of them receives. Their selection also affirms the diversity of the network's sources of information, since the source actors are producers, professional technical advisors, public entities, and even suppliers of inputs, covering a percentage of flows to them with a wide reach that has its knowledge among the actors in the network.

Source actors are nodes that other actors turn to for consultations related to one or more topics of common interest to the network [21]. The results show that these nodes are the main source of information within the social network, as the links flow towards them, indicating their ability to generate solutions and being the ones most often approached when there are problems with crops, processing, or the marketing of products.

According to Valente [22], there are individuals who are preferred when there is a need or doubt, and they can be constituted as agents of change both in the behavior of other members of the community and in their decisions within the organization. In this sense, as Daza [23] states, the particularity of turning to SENA is that it offers training processes across its programs that promote job and entrepreneurial skills. This promotes a flow of knowledge and skills within the organization that benefits the network and the municipality economically.

As for disseminators, Zarazúa et al. [24] assert that disseminators are individuals who are in a position to spread information to the majority of the network. In different organizations, these actors are the main nodes within the network that have the ability to connect with other types of individuals to spread knowledge. Likewise, the importance of these disseminators in the network is fundamental to understanding how information, ideas, and influence spread. According to Martínez et al. [21] “an actor can fulfill several roles in a network” (p.57) and, according to the actors chosen by the software and with a high percentage, merchants and producers are transmitters of information as well as receivers of concerns, fulfilling a dual key role in the dynamics of their own organization.

According to Rendón et al. [19], the diffuser is also the individual who is located close enough to access other members of the network, where their existence is valued for their potential to transmit and they are identified based on their position to access the largest number of actors to promote flows.

Diffusion actors are fundamental during the early diffusion of new ideas and behaviors, as they provide access to other parts of the network that would otherwise be disconnected, as well as links to external and non-redundant sources of information [25].

On the other hand, the results show that the elimination of articulators could destabilize the network, leaving loose nodes or reducing relationships within the network. A linking actor may be the main subject of eventual separation if the network does not have reciprocal links between all nodes. As stated by Teja et al. [26], the disappearance of a relevant actor, even if they are not the most central, can have consequences for the fragmentation of the network.

Adding to the above, Tapella [27] describes articulating elements as those that occupy a strategic position, due to their activity, prestige, the current situation, etc., in order to unite several groups or rearticulate the network; they also act as intermediaries that facilitate communication, collaboration, and integration between different actors, groups, or entities. Their function is to act as a filter or bridge of information, linking actors or subnetworks, characterized by being a bridge with relationships in various directions, which could cause the fragmentation of a network [28].

4.2. UCINET 6.0 Indicators for Social Network Analysis (SNA)

4.2.1. Density Indicator

Density is a network property that refers to the volume of interconnections between nodes in networks [29]. Tarifa and Ibarra [30] also state that density is the way to determine whether a network has high or low connectivity, which is why it is expressed as the percentage resulting from the ratio between the number of existing relationships and the number of possible relationships.

Considering that networks should be compared taking into account their similarity in terms of the number of nodes, the results of the Cooperativa Integral El Olivo are contrasted with those of Mercados Campesinos Comunitarios. In this case, the organization formed by potato producers has greater cohesion and existing relationships within the network than Mercados Campesinos, which is made up of different types of traders and producers. Similarly, when comparing the Cooperativa Integral Acuadinámica with Tierra de Quesos, it is concluded that cheese producers have greater interconnection in their relationships than vegetable producers.

4.2.2. Average Degree Indicator

This is the simplest measure of SNA: it is the arithmetic mean of the individual degrees of each actor that forms the network [31]. The degree centrality of an actor is the number of other actors to which it is connected; that is, it is adjacent.

Taking the above into account, it can be seen that Tierra de Quesos and Cooperativa Integral Acuadinámica have the highest average degrees, in contrast to Cooperativa el Olivo and Mercados Campesinos, which have the lowest. In this context, Tierra de Quesos stands out as the most cohesive network, while Mercados Campesinos shows the least cohesion, which translates into a considerably lower level of connectivity than the other networks.

4.2.3. Geodesic Distance Indicator

The geodesic distance is the number of relationships in the shortest path from one actor to another. This indicator allows us to identify the most central actors in terms of the overall structure of the network. High scores indicate greater local centrality [32].

Given that this indicator is based on the distance between actors, there is a noticeable similarity between the geodesic distance of the Cooperativa Integral El Olivo and that of the Mercados Campesinos Comunitarios, as well as between Tierra de Quesos and

the *Acuadinámica Integral Cooperative*. This indicates that *El Olivo* and the *Mercados Campesinos Comunitarios* have longer communication paths, in contrast to *Tierra de Quesos* and the *Acuadinámica Integral Cooperative*, which have shorter communication paths, suggesting that they are more compact and cohesive networks.

4.2.4. Diameter Indicator

The diameter is the longest distance in the network, taken from the shortest distances between each pair of nodes in which there is a path [33].

According to the above, the *Tierra de Quesos* network has the lowest capacity to form relationships outside the network; that is, it only has direct or immediate relationships, since the diameter is 2, meaning that the flow of information is short. In contrast, organizations such as the *Cooperativa Integral el Olivo*, *Mercados Campesinos*, and the *Cooperativa Acuadinámica* have a diameter of 3, meaning there are three extensive nodes where knowledge can be directed.

4.2.5. Component Indicator

The component ratio also identifies the groups in the network that are open or closed to other groups in the network. It has values ranging from 0 to 1, where 0 = all actors are in a single component and 1 = all actors are isolated [34].

Along the same lines, we find that, considering the size of each network, the number of components in the four networks is very similar, indicating that each is characterized by having more unconnected regions or subgroups. Thus, the component ratio confirms this assertion, as this indicator presents values ranging from 0.5 to 0.9, which means that most actors in the four networks are isolated, leading to greater fragmentation of the network and less integration among the actors that comprise it.

4.2.6. Centralization Indicator

According to Zarazúa [35], the centralization index reflects the presence or absence of actors around the concentration, whether of decisions or information, and is expressed as a percentage. A centralized network shows one actor or a small group of actors controlling or significantly influencing the rest.

In addition to the above, the centralization indicator for the *El Olivo Integral Cooperative* network and the *Tierra de Quesos* network shows the independence of each of the individuals in the network and the low influence of a single actor in the organization. Based on the centralization of *Mercados Campesinos* and the *Cooperativa Integral Acuadinámica*, it can be deduced that there are one or two actors who significantly influence the network.

Thus, SNA shows that the *Cooperativa Integral El Olivo* and *Tierra de Quesos* have greater connectivity according to their density indicator. Similarly, *Tierra de Quesos* and the *Cooperativa Integral Acuadinámica* are the networks with the greatest cohesion, given that their average degree and geodesic distance values indicate their high level of compactness. However, the diameter of the networks indicates that the *Tierra de Quesos* organization is the network with the least capacity for external agents to access knowledge. Similarly, *Mercados Campesinos* and the *Cooperativa Integral Acuadinámica* depend on one or two actors, demonstrating centralization, which leads to greater fragmentation of the network and less integration among its actors. Likewise, according to the component indicator, most of the actors in the four networks are isolated and at risk of dissolution.

Sustainability results from the synergistic interaction among the social, environmental, and economic dimensions. Its achievement is strengthened through the articulation of collective efforts and collaborative action among stakeholders. In this regard, greater cohesion among peasant associations contributes to reducing risks and enhancing competitiveness (economic dimension), promoting information exchange, social inclusion, and the

strengthening of social capital (social dimension), as well as fostering the collective and responsible management of natural resources (environmental dimension). As evidenced by the social network analysis indicators, the strong and cohesive ties observed in the *Integral El Olivo* and *Tierra de Quesos* cooperatives support more effective collaborative governance processes. This relational structure positively influences the sustainability performance of both organizations and their territorial context by facilitating coordination, collective decision-making, and the implementation of actions aimed at sustainable development.

5. Conclusions

Each organization was characterized by identifying key actors, indicating the direction of knowledge and information flow within the network. Thus, the main source actors are often external, such as the public institution SENA, which provides educational training and promotes job skills; suppliers of inputs and technical advisors, due to their ability to explain tacit knowledge; and private producer associations that have solutions to production problems. However, producers, i.e., the members of the organizations, are the main actors disseminating information and are also the ones who articulate the network.

The calculation of the SNA indicators identified the density, average degree, geodesic distance, diameter, components, component ratio, and centralization of the organizations, indicating that, depending on the size of the network, the *Cooperativa Integral El Olivo* and *Tierra de Quesos* have greater interconnection in the relationships between members and are also the most independent and decentralized, making them more difficult to dissolve. However, *Cooperativa Integral Acuadinámica* and *Tierra de Quesos* prove to be the most compact, so their communication paths are the shortest. Nevertheless, there is a high risk of fragmentation of the four networks due to the reach between actors.

This study has limitations that should be made explicit. The sample is limited to four small networks (13–34 nodes) selected through non-probability purposive sampling, so the results are not statistically generalizable beyond the organizations studied. Since SNA results are sensitive to missing actors and ties, the absence of members who did not participate in the survey may affect the reported indicators. The analysis is cross-sectional and descriptive: it characterizes the structure of the networks at one point in time, but it does not establish causal links between network structure and organizational outcomes. Accordingly, the relationship between the structural properties identified herein and the adaptive capacity or sustainability of the organizations is proposed as a hypothesis rather than demonstrated. Future research should adopt longitudinal designs that link structural indicators with concrete sustainability outcomes (economic performance, adoption of sustainable practices, and organizational permanence), incorporate inferential and comparative techniques (centrality comparisons, cohesion and subgroup analysis, and brokerage roles), and extend the comparison to other municipalities in the region.

Although the present study is limited to a quantitative characterization of peasant social networks, consistent with its research objectives, future studies should explore in greater depth the implications of the observed network structures for territorial development processes. In particular, further research is needed to examine how collaborative governance influences sustainability outcomes at both the organizational and territorial levels.

Author Contributions: Conceptualization, P.G., W.G.S. and L.R.; methodology, P.G., W.G.S. and L.R.; investigation, P.G., W.G.S. and L.R.; resources, P.G., W.G.S. and L.R.; data curation, P.G., W.G.S. and L.R.; writing—original draft preparation, P.G.; writing—review and editing, P.G., W.G.S. and L.R.; supervision, P.G., W.G.S. and L.R.; project administration, L.R.; funding acquisition, P.G., W.G.S. and L.R. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: This study was waived from ethical review by the Institutional Review Board of the Pedagogical and Technological University of Colombia in accordance with Article 11 of Resolution 8430 of 1993 (Colombian Ministry of Health), as the research was classified as minimal-risk and did not involve medical intervention or vulnerable populations.

Informed Consent Statement: Verbal informed consent was obtained from all subjects involved in the study, as written consent was not required under Colombian regulations for minimal-risk research (Resolution 8430 of 1993).

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. Araújo, U.P.; Mendes, M.d.L.; Gomes, P.A.; Coelho, S.d.C.P.; Vinícius, W.; Brito, M.J.d. Trajetória e estado corrente da sociometria brasileira. *Redes Rev. Hisp. Para Análisis Redes Soc.* **2017**, *28*, 97–128. [\[CrossRef\]](#)
2. Giglio, E.M.; Luiz, A.J.B.; Najberg, E. Analysis of public policies' implementation for environmental management in Brazil: The contribution of social network theory. *Agroalimentaria* **2012**, *18*, 87–101.
3. Martins, J.W.L.; Braga, N.L.; Baião, D.C.; Matos, T.G.R.; Carvalho, R.G.d.; Maciel, R.H. Redes sociais de trabalho entre agricultores de um município do estado do Ceará. *Interações* **2022**, *23*, 1235–1253. [\[CrossRef\]](#)
4. Etxabe, I.; Valdaliso, J.M. Social Network Analysis: Not Merely a Visualisation Tool? Insights from the Study of Business Networks and Groups in Biscay, 1879–1913. *Rev. Hist. Ind.—Ind. Hist. Rev.* **2025**, *34*, 69–98. [\[CrossRef\]](#)
5. Álvarez, E.; Martínez Bautista, H.; López Torres, B.J. Análisis de redes organizacionales con herramientas multicriterio y análisis de componentes principales. *Redes Rev. Hisp. Para Análisis Redes Soc.* **2025**, *36*, 134–147. [\[CrossRef\]](#)
6. Ma, H.; Wang, M.; Li, J.; Liu, H. Public Space Optimization Strategy Through Social Network Analysis in Shenzhen's Gongming Ancient Fair. *Land* **2025**, *14*, 1267. [\[CrossRef\]](#)
7. Thamrin, M.H.; Nasution, N.F. Understanding Social Challenges: Perspectives on the United Nations Declaration on the Human Rights of Peasants and Rural Working Peoples. *J. Peasant. Rights* **2024**, *3*, 1–9. [\[CrossRef\]](#)
8. Méndez-Villamizar, R.; Gamboa-Delgado, E.M.; Muvdi-Nova, C.J.; Sánchez, X.L.; Mendieta, N. Food Communities and Peasant Farms: Strategies for Food Sustainability. *Rev. Econ. E Sociol. Rural RESR* **2024**, *62*, e263747. [\[CrossRef\]](#)
9. Prada, D.F.S. Construcción de territorialidad desde las organizaciones campesinas en Colombia. *POLIS Rev. Latinoam.* **2016**, *15*, 1–16. [\[CrossRef\]](#)
10. Silveira, G.B.; Farina, M.C.; Santos, I.C.d. High-Technology Based Startup in Agribusiness Sector: Mapping Linkages, Products and Services. *Rev. Econ. E Sociol. Rural* **2023**, *61*, e246210. [\[CrossRef\]](#)
11. Barrios Meléndez, J.M.; Mestre Gómez, F.d.J.; Cantillo Orozco, A.S.; Marrugo Salas, L.M.; Del Río Cortina, J.L.; Pérez Morón, J.M.; Castro Porto, M.P. *Empoderando a las Organizaciones de Economía Agropecuaria Campesina, Familiar, Étnica y Comunitaria en los Montes de María. El Papel Estratégico del Administrador de Empresas en la Agenda de Desarrollo Regional*; Ministerio de Ciencia Tecnología e Innovación: Bogotá, Colombia, 2024.
12. Panta, K.A.P.; Hernandez, J.A.E.; Palma, C.M.C.; Jiménez, I.E.T. Cadena de valor sostenible: Pymes cacaoteras ecuatorianas. *Código Científico Rev. Investig.* **2024**, *5*, 939–962. [\[CrossRef\]](#)
13. Ncube, X.; Pittock, J. Application of Social Network Analysis in Determining Innovation Information Exchange at Irrigation Schemes in Zimbabwe. *Int. J. Water Resour. Dev.* **2025**, *41*, 447–465. [\[CrossRef\]](#)
14. Labeyrie, V.; Ouadah, S.; Raimond, C. Social Network Analysis: Which Contributions to the Analysis of Agricultural Systems Resilience? *Agric. Syst.* **2024**, *215*, 103832. [\[CrossRef\]](#)
15. Bruce, A.; Jackson, C.; Lamprinopoulou, C. Social Networks and Farming Resilience. *Outlook Agric.* **2021**, *50*, 196–205. [\[CrossRef\]](#)
16. CORPOBOYACÁ. *Consolidacion de La Propuesta Del Sistema Municipal de Areas Protegidas- Municipio de Cómbita*; Corporación Autónoma Regional De Boyaca, Subdirección De Planeación Y Sistema: Tunja, Colombia, 2012.
17. Gallegos, N.A.; Martínez, J.A.O.; Martínez, E.G.G.; Ávila, J.A.; Rodríguez, M.M.; Cortés, H.S. La intervención en red para catalizar la innovación agrícola. *Redes Rev. Hisp. Para Análisis Redes Soc.* **2017**, *28*, 9–31. [\[CrossRef\]](#)
18. Trujillo, H.M.; Mañas, F.M.; González-Cabrera, J. Evaluación de la potencia explicativa de los grafos de redes sociales clandestinas con Ucinet y NetDraw. *Univ. Psychol.* **2010**, *9*, 67–78. [\[CrossRef\]](#)
19. Rendón, R.; Jorge, A.; Manrubio, M.; Cárdenas, J.R. *Identificación de Actores Clave Para la Gestión de la Innovación: El Uso de Redes Sociales*; Universidad Autónoma: Madrid, Spain, 2007.

20. Cuevas-Reyes, V.; Espejel, A.; Rodríguez, A.; Sosa-Montes, M. Redes Sociales y Actores Relevantes Para La Difusión de Innovaciones y Conocimiento En Los Territorios Rurales. *Span. J. Rural Dev.* **2014**, *V*, 1–14.
21. Medrano, J.C.M.; Valencia, K.V.C.; Bernal, L.C.M. *Análisis de Redes Sociales: Una Herramienta Para la Extensión Agropecuaria*; Editorial Agrosavia: Vía a Mosquera, Colombia, 2021.
22. Valente, T.W. Network Interventions. *Science* **2012**, *337*, 49–53. [[CrossRef](#)] [[PubMed](#)]
23. Daza Acosta, J.L. Revisión Sistemática de Literatura Para el Análisis de la Pertinencia de los Programas de Formación de Nivel Tecnológico del Centro Agroempresarial y Acuicola Sena Regional Guajira. Master's Thesis, Universidad Simón Bolívar, Caracas, Venezuela, 2020.
24. Zarazúa, J.A.; Solleiro, J.L.; Cárdenas, R.A.; Ibarra, R.C.; Medel, R.R. Esquemas de innovación tecnológica y su transferencia en las agroempresas frutícolas del estado de Michoacán. *Estud. Soc. Rev. Aliment. Contemp. Desarro. Reg.* **2009**, *17*, 38–71.
25. Claudio Pruna, D.R. Red de Innovación Agrícola Para Productores de la Parroquia San Lorenzo de Tanicuchi. Master's Thesis, Universidad técnica de Cotopaxi, Latacunga, Ecuador, 2021.
26. Teja Gutiérrez, R.; Almaguer Vargas, G.; Rendón Medel, R.; López Lira, N. Redes y Análisis Organizacional: Roles, Posiciones y Poder de Fragmentación de las Relaciones Sociales y Comerciales (Networks and Organizational Analysis: Roles, Positions and Power of Fragmentation of Social and Commercial Relationships). *Rev. Glob. Neg.* **2014**, *2*, 11–39.
27. Tapella, E. *El Mapeo de Actores Claves en Evaluación Participativa*; UNC/IAI: Chapel Hill, NC, USA, 2007.
28. López-Giraldo, L.A.; Franco-Giraldo, Á. Revisión de enfoques de políticas alimentarias: Entre la seguridad y la soberanía alimentaria (2000–2013). *Cad. Saúde Pública* **2015**, *31*, 1355–1369. [[CrossRef](#)] [[PubMed](#)]
29. Vivas, J.R. Análisis de redes sociales de la información sociobibliométrica. *Psico-USF* **2004**, *9*, 77–85. [[CrossRef](#)]
30. Tarifa, H.R.; Ibarra, M. *Descripción de Una Red Social Usando UCINET 6*; Facultad de Ciencias Forestales UNSE: Santiago del Estero, Argentina, 2018.
31. Borgatti, S.P.; Mehra, A.; Brass, D.J.; Labianca, G. Network Analysis in the Social Sciences. *Science* **2009**, *323*, 892–895. [[CrossRef](#)] [[PubMed](#)]
32. Forga, J.M.P.; Valiente, G.C. La centralidad de las administraciones públicas en las redes sociales del turismo industrial. Una comparación entre el Bages-Berguedà y el Haut-Rhin. *PASOS Rev. Tur. Patrim. Cult.* **2013**, *11*, 513–524. [[CrossRef](#)]
33. Navarro Sánchez, L.A.; Salazar Fernández, J.P. Análisis de Redes Sociales Aplicado a Redes de Investigación en Ciencia y Tecnología. *Sínt. Tecnológica* **2007**, *3*, 69–86. [[CrossRef](#)]
34. Kuz, A.; Falco, M.; Giandini, R. Análisis de Redes Sociales: Un Caso Práctico. *Comput. Sist.* **2016**, *20*, 89–106.
35. Zarazúa Escobar, J.A. Esquemas de Innovación Tecnológica y su Transferencia en las Agroempresas Frutícolas del Estado de Michoacán: Una Perspectiva Desde las Redes Sociales. Doctoral Dissertation, Universidad Autónoma de Chapingo, Texcoco, Mexico, 2007.

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.