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Food Networks and Agroecology in the Province of Trento – Italy

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As the hegemonic food system is unsustainable in socio-environmental terms, over the last few decades, the search for new forms of food supply has fostered alternative food networks (AFNs). Civic Food Networks (CFNs) are a particular subset of AFNs that strongly emphasise the citizenship of the actors involved, including farmers, and their active engagement in the agrifood system. Our objective was to identify CFNs within the studied territory, evaluate farmers' participation, and answer if the CFNs are contributing to the promotion of agroecology. The research comprises a case study in the province of Trento (Italy). We used direct and participant observation, database consulting, document analysis, and interviews with key players and organic farmers linked to short food supply chains (SFSCs). We evaluated the contributions to the promotion of agroecology through ecological and socioeconomic elements: biodiversity, efficient use of resources, and self-produced food. We have identified the presence of initiatives that act by promoting discussion spaces and stimulating the construction of experiences of an SFSC. Those initiatives have provided space for the formation of new networks and created opportunities for new relationships, production, and consumption networks. However, organisational structures that favour monocultural systems and commercialisation in long chains prevail in the territory and hinder these innovations. Though the collective organisations of farmers, outside the formal cooperatives, are still developing, farmers are often individualised and with little active participation in decision-making processes within the territory. This study identified an embryonic CFN that showed positive indicators of agroecology for all the analysed aspects. However, the differences were not as significant when compared to other farmers who also participated in SFSCs. This research reinforces that there is a there is promotion of agroecoloy, from the maintenance and encouragement of short food supply chains that are proponents of agrobiodiversity, to the maintenance of family farmers' livelihoods. CFNs have the potential to empower rural actors by providing them with greater participation and autonomy in the agrifood system. However, strengthening these networks remains a challenge, as it requires stimulating social organisation and fostering the integration of various actors within the territory, including rural stakeholders.

KEYWORDS

short food supply chains, food democracy, family farming, social network analysis, biodiversity

1. Introduction

Since the second half of the 20th century, the hegemonic food system's environmental, social, and economic consequences have been increasingly apparent, examples of which include deterioration in the social conditions of farmers, poisoning of the ecosystem by pesticides, and reduction in biodiversity. This system, despite having set out to feed the world's population, did not achieve its purpose, and over 50 years after the Green Revolution there are more than 820 million people in severe food insecurity (hunger) globally (UNICEF, 2018), on top of a major crisis of mistrust in food caused by food scandals (Brandenburg, 2002; Truninger, 2013; Díaz Méndez and García Espejo, 2014).

As the hegemonic food system is undoubtedly unsustainable in socio-environmental terms, agroecological production is raising the interest of a wide range of players worldwide (Brandenburg, 2002; Howard, 2007; Gliessman, 2020). Agroecology is based on the ecology of natural systems that are efficient and resilient because ecological processes occur in them, interrelating and guaranteeing their balance. This model is based on species diversity, the maintenance of natural cycles, and nutrient recycling (Machado and Machado Filho, 2014; Nicholls et al., 2015).

Over the last few decades, the search for new forms of food supply has fostered alternative food networks (AFN). The main strategies of AFNs have been the reduction of the distance in short food supply chains (SFSC), the establishment of proximity in the relationship between producers and consumers, and the encouragement of the production of quality food with less environmental impact (Renting et al., 2012; Sbicca et al., 2019).

Analysing agroecological massification in diverse case studies across different countries, Mier y Terán Giménez Cacho et al. (2018) concluded that the social fabric constitutes the cultural medium on which agroecology grows since it provides the structure through which values, meanings, lessons learned, and horizons of political action circulate.

Agroecology can be concomitantly understood as a scientific/science focus, agricultural practice, and social movement (Gliessman et al., 1998; Guzmán Casado et al., 2000; Caporal and Petersen, 2011; Altieri, 2012). The agroecological social movement has emerged in several countries, often linked to peasant movements and connected with a diversity of social actors, institutions, and organisations. This social movement has been fundamental to achieving public policies that allow the expansion of agroecology (Caporal and Petersen, 2011).

Mier y Terán Giménez Cacho et al. (2018) have found that markets contribute more to agroecological movements when embedded in networks whose unifying elements are environmental and social values. According to the same authors, though the development of AFNs is not a necessary condition for the adoption of agroecological practices by farmers, markets are a strategic sociopolitical arena for scaling agroecology. Likewise, the adopted market arrangement is a key aspect to enlarge its contributions to food-system transformation.

It is argued that the theoretical approach of AFNs is insufficient to analyse the social movement around food and explain the activist nature of stakeholders in food, social, and environmental issues (Renting et al., 2012; Sbicca et al., 2019). In this context, the so-called Civic Food Networks (CFNs), in addition to opposing the hegemonic food system, emphasise the citizenship characteristic of players' actions around the food system, articulated in the axes of production, distribution, and consumption (Renting et al., 2012).

Civic Food Networks represent innovations that promote practices with the potential to foster more sustainable and agroecological food systems, although, in the debate on food networks, some studies have pointed out critical aspects of these initiatives. For example, regarding the economic and environmental sustainability approaches, one of the main criticisms that frequently emerges from the literature is that of not dismantling the pre-existing social inequalities, but rather perpetuating them, consolidating and legitimising phenomena of individualism and mistrust in market initiatives (Goodman et al., 2012; Marsden and Morley, 2014). These food movements could favour wealthy segments of society while causing the outcomes of food network initiatives to be restricted to commercial products, rather than channel socioeconomic development (Tregear, 2011).

Starting from this dilemma, Civic Food Networks – the main object of this research analysis – emerge from the concept of AFNs as a complementary category and highlight the role of civil society in the control and management of food (Renting et al., 2012). By approaching the civic perspective, the CFN concept highlights how the relationship between consumption and citizenship can be an agent of political and socio-environmental transformations (Portilho and Barbosa, 2016).

The ethical values and qualities of the alternative food networks have been captured by mainstream companies that use slogans as a commercial strategy, but who in reality are weakening social movements and reinforcing the hegemonic food system (Goodman et al., 2012). There is an ongoing discourse competition in which agribusiness responds to agroecological movements with labels such as "organic," and "transgenic free" – which, in turn, forces social movements to make increasingly fine and political distinctions between true agroecology and corporate greenwashing (Martinez-Torres, 2006; Rosset and Martínez-Torres, 2012).

Given the existing criticisms about alternative food networks, it is necessary to understand if these new market arrangements, which are being driven by the advancement of the food movement discourse, are contributing to more sustainable food systems. In this research paper, the aim is to identify the agroecological practices present in alternative food networks, to understand whether these can be considered Civic Food Networks, and to answer whether and to what extent Civic Food Networks contribute to the promotion of agroecology.

Studies have described the emergence of a citizen movement centred around food, led by consumers who are building new arrangements for production and consumption. These consumers seek to have greater knowledge, participation, and control over the processes that involve their food (Renting et al., 2012; Rossi et al., 2013). Similarly, studies conducted in other territorial contexts indicate the role and organisation of farmers in the development of collaborative networks for marketing in short food supply chains (Souza et al., 2021).

The concept of CFNs that guides this work is an understanding based on Renting et al. (2012), in which Civic Food Networks are the result of the citizenly articulation of diverse social actors, such as institutions, social organisations, farmers and consumers, acting throughout the food system (production, distribution, and consumption). The term Civic Food Networks highlights the citizenship aspects of these food networks, which are manifested in the greater participation of actors (farmers and consumers) in the food system, short food supply chains, the local control of food production, distribution, and commercialisation, the self-organisation and autonomy of the actors, and, therefore, the greater empowerment of citizens in the design of the food system (Renting et al., 2012).

Research conducted in southern Brazil (Miranda et al., 2021; Souza et al., 2021; Pugas et al., 2023) contrasts with studies carried out in the European context (Brunori et al., 2012; Rossi et al., 2013; Forno et al., 2019). European studies emphasise consumer organisations within Civic Food Networks, in contrast to Brazilian studies, which highlight a trajectory of rural actors as the basis for establishing short food supply chains and promoting agroecology.

In the northern part of Italy, the region studied in this research, the consumer movement around food is consolidated through GAS (*Gruppi di Acquisto Solidale*, or Solidarity Purchase Groups), which are grassroot initiatives where consumers come together to purchase food directly from local farmers and producers (Forno and Graziano, 2014; Forno et al., 2019). It is important to highlight that Civic Food Networks are networks that encompass various actors within the agrifood system. Thus, in this study, taking into consideration CFNs as networks that also include organised farmers, we aim to analyse the existence of such networks in the study area. Our focus is on identifying and understanding Civic Food Networks where farmers play an active and organised role alongside other actors within the agrifood system.

2. Methodology

This research consisted of a case study, and its fieldwork followed a two-stage research design that aimed to evaluate the elements of citizenship in food networks in the analysed territory. It also set out to analyse whether there are elements of Civic Food Networks in the food network initiatives in the Province of Trento, and to what extent CFNs contribute to the promotion of agroecology. Data collection was conducted from April to July 2018, and from November 2020 to April 2021.

The research was first conducted with local stakeholders linked to a short food supply chain and to agroecology, which contributed to understanding the specific characteristics of the Province of Trento.

The instruments used in this first stage were: information and documents consultation, direct and participant observation, and interviews with 11 key actors to key actors in the manuscript of different actions related to agroecological agriculture in the Province of Trento. The observations were carried out during the meetings of the *Nutrire Trento Project*, organised by the municipality of Trento and the University of Trento, which started in 2018 and established a discussion space for a food policy by stakeholders of the local food system. Besides providing space for observation, this project also contributed to a database for the collection of information and documents.

In the second stage of the investigation, the data were collected through a structured questionnaire applied to 19 agroecological family farmers in the Province of Trento and adhered to the map of *Nutrire Trento*. This map pinpointed small farmers who marketed short food supply chains and voluntarily joined the project platform. All farmers on the map linked to agroecological[1] production were contacted and 19 of them participated in the research. This selection criterion was used due to the understanding that the participation in a short food supply chain of agroecological food, coupled with the adhesion of these farmers to the platform of the *Nutrire Trento Project*, would be a starting point to identify alternative food networks/Civic Food Networks involving farmers. It is important to emphasise that the study does not aim to study only the networks related to *Nutrire Trento*.

The questionnaires had three main areas: characterisation of farmers and farms, investigation of production and supply chain practices, and investigation of the relationships that these farmers had with organisations and institutions and with other farmers.

This study was reviewed and approved by the Ethics Committee on Research of the University of Santa Catarina. The participants provided their written informed consent to participate in this study. For the analysis of the data, we used indicators of agroecology and social network analysis.

For the analysis of quantitative data, we used measures of mean dispersion, standard deviation, and quartiles.

2.1. Agroecology indicators

In this section, we present the variables and indicators that were used in the present research to evaluate the promotion of agroecology. We chose to use indicators because agroecology is a broad concept and the construction of indicators allows us to delimit the research, and also to compare the results with those of other case studies. The study was based on the case study of Rover et al. (2020), but the indicators were adapted for the present research. Next, we point out the elements of agroecology that allowed us to arrive at these indicators.

The concept guiding this work is the one presented by Gliessman et al. (1998), in which agroecology is defined as the application of principles and concepts of ecology in the management and design of sustainable agroecosystems, establishing alternative models to the agroindustrial (hegemonic) pattern of production.

For agroecology, a key point for the resilience and sustainability of agroecosystems is biodiversity. Monocultures generate losses in biodiversity and cause a general change in agroecosystems. When a biological chain with monoculture is interrupted, the whole biome is attacked, because individuals and species that are interrelated are destroyed. De Boef et al. (2007) list the types of biodiversity, namely, the genetic diversity in agriculture that is perceived in the diversity of cultivars and breeds, the diversity of species in agriculture, and the natural biodiversity that is characterised by the diversity of agroecosystems.

To stimulate beneficial processes in agroecosystems, agroecological practices involve processes such as nutrient cycling, conservation and habitat management techniques for crop biodiversity, improvement of soil structure and health, water conservation, biological pest control and natural disease regulation, diversification, mixed cultivation, inter cultivation, crop mixtures, and waste management (Reijntjes et al., 1992; Altieri, 1999; Wezel et al., 2014, 2020; Nicholls et al., 2020).

1 There are differences between organic and agroecological production (Niederle et al., 2013). However, we use organic production as an initial reference and, in cases indicated by key stakeholders, non-certified agroecological farmers were also interviewed. This methodological choice is relative only to the choice of the sample, but the verification of the promotion of agroecology occurred on the basis of indicators of agroecology, beyond institutionalised organic certification.

Agroecology comprises the ecological premises and the socioeconomic elements that encompass significant human aspects and their interactions (FAO, 2009; Altieri, 2012). Thus, it is important to highlight that family farming has been recognised as a category that constitutes a social basis for agroecology since it is responsible for much of the world's food production. It provides diversified food that is cultivated in production systems that preserve natural resources and is less dependent on systematic energy and material input or external technologies (McIntyre et al., 2009; Altieri, 2012; FAQ, 2019). In this way, the maintenance of dignified livelihoods for family farming and the processes that favour political and financial autonomy, as well as the preservation of the cultural identity of family farmers, contribute to the promotion of agroecology.

In the hegemonic food system, farmers are dependent on external resources, which decreases their autonomy vis-à-vis the system, and at the same time increases the cost of production (Andrioli and Fuchs, 2008; Van der Ploeg, 2008; Machado and Machado Filho, 2014). This dynamic increases the concentration of capital for the large conglomerates that own the technologies and the production of these inputs, making the end product more expensive for the consumer and reducing the producer's income. The monopoly of technologies, inputs, and also of credit, processing, and supply chain structures deepens social inequalities and brings economic risk to the farmer who wants to produce outside this system (Andrioli and Fuchs, 2008; Van der Ploeg, 2008; Machado and Machado Filho, 2014).

Schneider and Gazolla (2005) point out that, to this day, food production for personal use and consumption self-produced food, is a fundamental element of family agriculture, playing a key role in its social reproduction. It is also a strategy for giving those producers autonomy to face the markets and food security, as well as preserving their cultural identity. Through production for self-produced food in all the manuscript, the farmer gains greater resilience to withstand market fluctuations and greater farm autonomy (Gazolla and Schneider, 2007). Duval et al. (2008) discuss the relationship between agroecology and production for self-produced food, emphasising that family farming is more conducive to a diversified production that ensures a more varied and nutritious diet, besides being associated with a production system that preserves genetic variety and values traditional practices.

We designed the analytical framework for the evaluation of the promotion of agroecology descriptors (Table 1). The categories and variables cover ecological aspects, namely, biodiversity, resource efficiency, agroecological practices, and socioeconomic aspects including production for self-produced food. The results of descriptors and indicators will come from different data collection tools (semi-structured interviews, questionnaires, as well as direct and participant observations).

TABLE 1 Analytical framework.

Variables	Indicators
Biodiversity	• Number of species, varieties/breeds, and traditional varieties/breeds cultivated (agrobiodiversity) • Native vegetation (%)
Resources efficiency	• Use of their autonomous inputs • Use of agroecological management (practices)
Production for self-produced food	• Perception of importance • Relevance in family feeding (%)

Source: created by the authors.

2.2. Network interactions

To understand the food network and its interactions, we used the knowledge and interpretations regarding the field of study of social networks. Social network analyses are ways of thinking about social systems with a focus on the relationship between their entities; part of the power of this concept is that it provides a mechanism of indirect connection between different parts of a system that can affect one another (Borgatti et al., 2013).

The complex structures of social networks can be assessed through some parameters, among which are the different types of relationships present in a network, and measures such as connectivity (cohesion) and the greater or lesser centrality of the actors (*Ibid.*). One of the most basic measures of connectivity is density, which consists of the number of ties in the network, expressed as a proportion of the number of possible ties (Borgatti et al., 2013). Density measures allow us to compare the intensity of the different relationships that occur in a network. Crespo et al. (2014) show that, within a given territory, there are a variety of different relationships that overlap. The authors also highlight that social networks that have multiple dimensions (multiplexity), combining different types of relationships (e.g., business relationships, friendship relationships, kinship, etc.) are networks that favour adherence to collective actions.

The centrality measures allow us to analyse the importance of individual actors in the network structure and their influence on the networks. Betweenness centrality refers to the ability that an actor has to connect with other actors within the network (Borgatti et al., 2013). Using the centrality measures, we are able to bring to light asymmetries in the distribution of power and to characterise these networks as more or less centralised networks (Crespo et al., 2014).

Farmers' interactions with one another and their connection with institutions and organisations in the territory were also investigated. To analyse interactions among farmers, the methodology was to ask them which five farmers they had the most frequent contact with and what types of relationships existed between them. From the answers, a directional matrix was built between the 19 farmers interviewed and the farmers mentioned, which was then plotted in the form of a graph.

We chose to use an open-ended method, as described by Borgatti et al. (2013) because we wanted to identify whether these social interactions existed in the networks studied, rather than starting from a previously known network. We applied the fixed-choice of five citations per farmer because this way we could focus on the most relevant existing interactions. This choice brings us a sample of the existing relationships from the 19 farmers interviewed.

The relationships investigated were: exchange of information about agroecological production practices, friendship, collaboration for commercialisation, joint participation in groups or associations, participation and social organisation (through co-management of resources, development of projects for the territory, and construction of public policies), and exchange of seeds. The density of each type of relationship was measured by calculating the total number of possible ties, considering that each farmer could nominate up to five farmers.

To investigate the activities of organisations and institutions, farmers answered which ones they were a part of at the time. The networks between farmers and institutions/organisations formed a

matrix of farmers by institutions and organisations, which was also illustrated in the form of a graph.

A measure of intermediation (betweenness centrality) was applied, allowing us to understand which institutions/organisations have a greater capacity for intermediation, as well as how they interconnect through the farmers. All graphical illustrations and measures were processed in UCINET software (Borgatti et al., 2002).

Based on the information obtained from the analysis of network interactions and the complementary information from the local stakeholders and farmers, we tried to understand the elements of citizenship, identifying the elements of participation, self-organisation, and autonomy of the actors (farmers and consumers) in the food system and the local control of production, distribution, and commercialisation of food.

3. Findings

The province of Trento is characterised by its agricultural farms, which cover most of the territory and therefore have significant importance in the landscape and the conservation of natural resources and biodiversity in the region.[2] In its majority (97.2%), the farm units are conducted mostly by family labour. The main crops of the territory are grapes and apples, which together account for more than 81% of the province's agricultural area. This monoculture trend extends to organic agriculture, where, also, about 80% of the organic cultivated area is composed of the aforementioned crops (ISPAT, 2014).

The Province of Trento used to have diversified subsistence agriculture, involving vegetables, grain, and animal production. Agriculture was done using traditional methods and with typical features of mountain farming. With the worsening of the economic crisis after the two World Wars, agriculture was rebuilt through monoculture and commercialisation by cooperatives in long chains aimed at external supply beyond the Province.

Agricultural cooperatives and the local state played an important role in this reconstruction and made it possible for many families to continue on and return to agriculture, in a context where the farms were fragmented by hereditary laws and resulting in small areas. Despite the recognition of the importance of the support that the province and the cooperative system have given to agriculture, it has been shown from interviews with actors in the territory that this system supports intensive, monocultural agriculture and long supply chains. It is also clear that the strength of this highly consolidated system creates difficulties for those who wish to maintain a different type of production and commercialisation.

In contrast to long supply chains in the territory, alternative food networks, such as the GAS (*Gruppi di Acquisto Solidale*, or Solidarity Purchasing Groups), have been developing. The Solidarity Purchasing Groups are consumer groups organised for collective purchasing and mobilised for recurrent food purchasing in large quantities. A total of 33 GAS have been identified in the Province of Trento and they are distributed fairly widely in the territory, especially in the areas with the largest urban concentrations, namely, the municipalities (*comuni*) Trento and Rovereto and their surroundings.

The widespread distribution and presence of GAS in the territory indicates a strong movement of consumers and a significant channel for short food supply chains. However, it does not necessarily guarantee the effective participation of other actors in the agrifood system. In the Trentino territory, other initiatives have been identified that strengthen Civic Food Networks, involving a diversity of actors, including rural stakeholders. Below, we will describe the elements of the Civic Food Network in Trento and its development over time.

3.1. The components of the civic food network of Trento and its history

3.1.1. *Nutrire Trento project* and CSA *Naturalmente*

In 2017, Trento's municipal government (*comune*) started a process that aimed to develop policies and support actions to increase sustainable food production through a specific public notice. In this context, the *Nutrire Trento Project* was created as a collaboration between the city government of Trento and the Department of Sociology and Social Research of the University of Trento (DSRS/UniTN). The latter set up a multi-stakeholder Roundtable discussions in the territory, with the aim of coordinating existing local food initiatives and expanding them to include civil society. Participating players include farmers, trade unions, consumers, institutions, associations, schools, universities, and research institutes.

The first product of this project was the development of an interactive map of short food supply chain initiatives that interlinked the supply and demand of food in the territory. With the involvement of the university in this project, its work is not restricted to the promotion of short food supply chains but also aims to investigate which relational and institutional stakeholders favour or prevent sustainability and the activation of innovative practices. Despite the centrality of *Nutrire Trento* among the interviewed farmers, recurring participation in the project's regular meetings is more predominant among students and researchers than farmers.

Nutrire Trento consolidated a multi-stakeholder discussion space on the local food system, which has pushed other initiatives in the course of the 4 years of the project up to when this research was conducted. As an example, the CSA[3] *Naturalmente* developed from the relationships established in a pilot project that emerged during the pandemic, the *Nutrire Trento phase 2*.[4] After the end of the *phase 2* project, the farmers involved, together with the municipality of Trento and the University of Trento, decided to think of alternatives for the demands and challenges identified and to give continuity to the networking capital acquired

2 Total agricultural area of 408,864 hectares, corresponding to 66% of the province area (620,686 hectares) (ISTAT, 2013).

3 *Community Supported Agriculture* - Term set out in the *European CSA Declaration* adopted during the 3rd European CSA Meeting in 2016 in Ostrava, Czech Republic. Available at: https://urgenci.net/wp-content/uploads/2016/09/European-CSA-Declaration_final-1.pdf.

4 *Nutrire Trento Project phase 2* emerged from the discussion tables at the *Nutrire Trento Project* as an experimental project bringing together 65 consumer families and 13 producers, from March 9 through May 18, 2020 (9weeks), for direct sale and home delivery.

between farmers and consumers. The formation of the CSA counted on the technical assistance of a researcher from Libera Università di Bolzano, located in the neighbouring province of Bolzano, who was working on a project for the implementation of a CSA in another region of the Trento[5] territory. CSA *Naturalmente* was established as the second CSA initiative in the Province of Trento.

As a recent initiative, on the occasion of the interviews with farmers (March/April 2021), it was to start its first food deliveries. It involved 12 farmers from the Province of Trento and 40 consuming families who would buy regularly, with the commitment to maintain an active relationship for a period of 1 year. The initiative encountered organisational difficulties linked to the collectivisation of the farmers because, in the territory, there are no pre-existing social networks among the farmers.

3.1.2. Solidarity economy law and solidarity economy market

The province of Trento has been a pioneer in Italy in the creation and implementation of a law promoting the solidarity economy. Provincial Law 13/2010[6] establishes the creation of a permanent coordination allocated in the province's council, as well as a specific fund for the promotion of the solidarity economy. In practice, the main action to promote the solidarity economy, resulting from this initiative, is the Solidarity Economy Street Market, an experience that promotes direct sales from artisans and farmers of Trento Solidarity Economy, weekly, in the city centre. The farmers' street market takes place in a very central location, but it does not usually receive an intense flow of people. Currently, the market has approximately five farmers' stands. Though it is an institutionalised initiative, it does not have a high impact on the number of farmers or the flow of consumers.

Despite its small scale, the Solidarity Economy street fair is a consolidated initiative and current participant farmers perceive the initiative as a place for strengthening relationships with consumers and other farmers. During March and April of 2020, the city's markets, including the Solidarity Economy Street Market, were closed due to the COVID-19 emergency. In this context, four farmers had come together to deliver their products. Through this organisation, farmers were able to create more convenient delivery logistics, and eventually formed the informal group L.E.N.A., named after the initials of the participants' names. Even with the return of the in-person market in June of the same year, L.E.N.A remained active until the date of the questionnaires (1 year later, in March/April 2021).

The farmers reported that the collaborative experience for commercialisation has strengthened bonds of friendship and a sense of belonging, promoting other types of collaboration, generating mutual knowledge, and building collective solutions.

3.2. The institutions and organisations linked to the interviewed farmers

To understand the territorial context in which farmers are situated and their relationships, we studied their interactions with organisations and institutions within the territory. In Figure 1, we see the organisations and institutions linked to farmers who are involved in short food supply chains of agroecological food and were interviewed in this research project.

The largest organisations/institutions and farmers represented are those with the highest degree of betweenness centrality, i.e., those with the greatest intermediation power with the others through the connection between the farmers who are part of the various organisations and institutions. Intermediation concerns the greater capacity of these actors to be connected directly or indirectly (through other players) with the other actors in the network.

The organisations/institutions with greater intermediation power are linked to organised consumer groups (*Gruppi di Acquisti Solidale* - GAS and *Trento Consumo Consapevole*), farmers trade unions (*Coldiretti Trentino Alto Adige - Coldiretti*, *Federazione Trentina Biologico e Biodinamico*-F.T.Bio and *Confederazione Italiana Coltivatori Trentino* - C.I.A), and public administration and its initiatives (*Nutrire Trento, Economia Solidale Trentina*), as well as to Trento University (*Nutrire Trento* and *CSA Naturalmente*).

Participation in trade unions, though highly present among farmers, is not related to the formation of networks found among farmers, as trade unions do not constitute important spaces for the collective and participative mobilisation of interviewed farmers. The most referenced trade union among farmers is *Coldiretti Trentino Alto Adige*, and it holds this central position because it is responsible for organising farmers markets in public spaces. These farmers markets involve a larger number of farmers and reach a wide range of consumers. Moreover, these markets have highly centralised management, and farmer participation is closely regulated. For instance, to participate in the market, farmers are required to sell specific products that have already been registered.

3.3. The farmers involved in civic food networks

The relationship among farmers was assessed by asking the interviewees which other farmers they had the most frequent contact with. Each farmer could indicate up to five other farmers. The results are shown in Figure 2.

Among the 19 farmers studied, we found only one cluster of farmers exhibiting multiple connections, forming a network that includes six of the interviewed farmers (A1, A5, A6, A10, A13, and A16), along with an additional 15 farmers mentioned by them. Within this network, farmers establish connections with each other through the initiatives previously described: the Solidarity Economy Law and Solidarity Economy Market, and the *Nutrire Trento Project* and CSA *Naturalmente*. Farmers A7, A9, and A12 did not have five farmers with whom they had more frequent contact. The methodology allowed for up to five nominees but these farmers indicated fewer names, and farmer A8 did not indicate any farmer.

Interactions among farmers were evaluated, specifically comparing two groups: the networked farmers (A1, A5, A6, A10, A13, and A16) and the remaining farmers (A2, A3, A4, A7, A8, A9, A11, A12, A14, A15,

5 In the region of Vassulgana (TN).

6 Provincial Law 13/2010, available at https://www.consiglio.provincia.tn.it/leggi-e-archivi/codice-provinciale/Pages/legge.aspx?uid=21678.

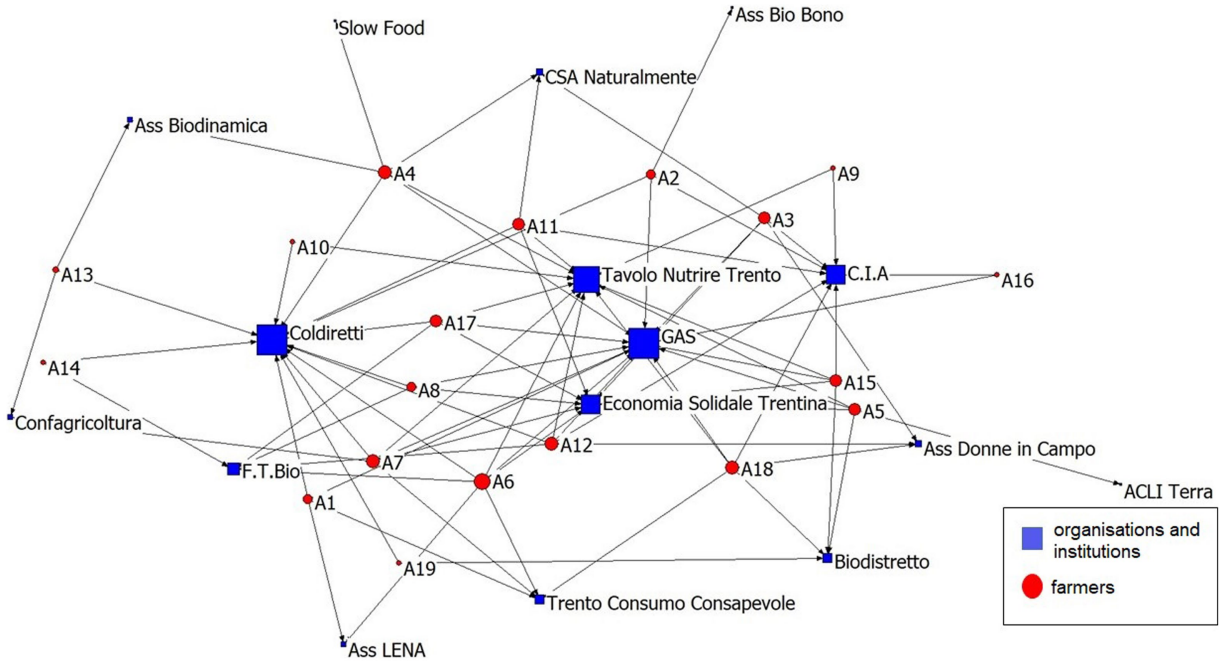

FIGURE 1
Interaction of farmers with organisations and institutions. Source: created by the authors.

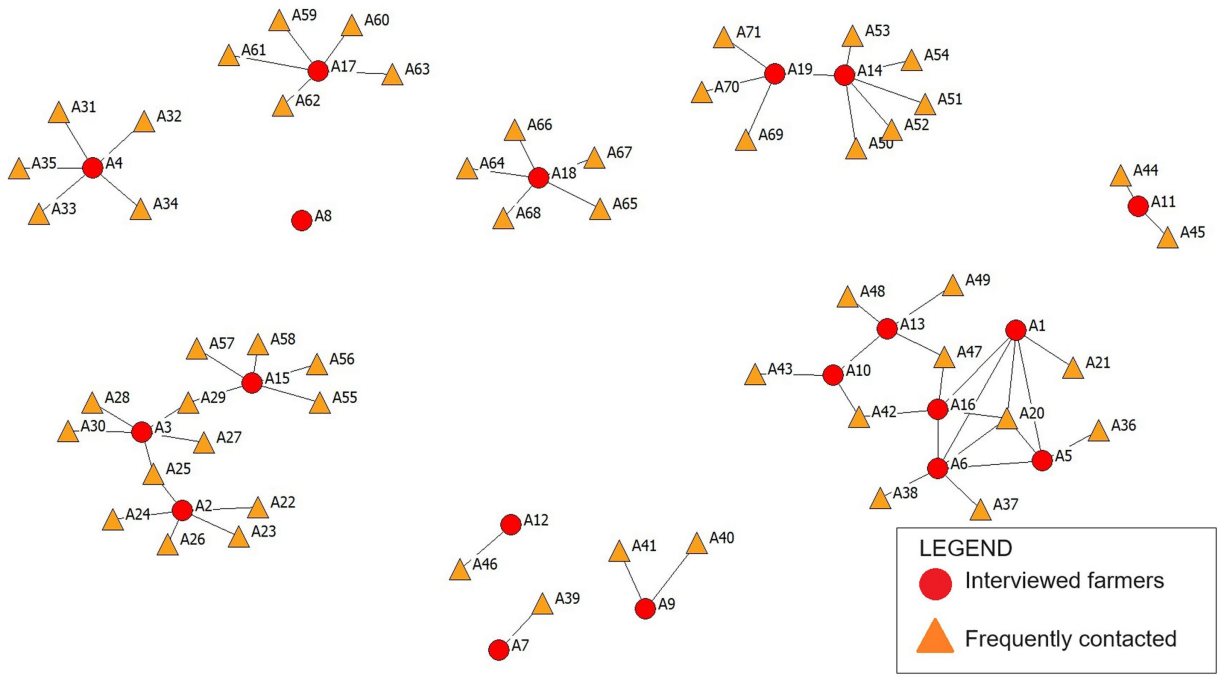

FIGURE 2
Interactions among farmers. Source: created by the authors.

A17, A18, and A19). By measuring the densities of the different interactions/relationships, expressed in Tables 2, 3 for the networked farmers and the remaining farmers, respectively, we were able to compare the intensity of these interactions. The type of these relationships was then further explored with objective questions about the presence or not of a certain type of interaction/relationship, namely, sharing of information about agroecological practices, friendship, collaborations for commercialisation, social participation/organisation (through co-management of resources, development of projects for the territory, and construction of public policies), and exchange of seeds and seedlings.

TABLE 2 Degree of interaction between CFN farmers by purpose (density measures).

	All	Sharing information on agroecology	Friendship	Marketing collaboration	Joint participation in an association or group	Participation and social arrangements	Seed exchanges
Density*	0.857	0.743	0.857	0.514	0.543	0.371	0.171
Total (N of ties)	30	26	30	18	19	13	6
Std Dev	0.403	0.375	0.396	0.328	0.335	0.284	0.194
Avg Degree	1.364	3.714	4.286	0.818	0.864	0.591	0.857

Source: created by the authors.
*The densities were calculated considering that the largest possible number of ties was: 35.

TABLE 3 Degree of interaction between farmers (outside CFN) by purpose (density measures).

	All	Sharing information on agroecology	Friendship	Marketing collaboration	Joint participation in an association or group	Participation and social arrangements	Seed exchanges
Density*	0.666	0.5	0.5	0.217	0.317	0.333	0.083
Total (N of ties)	40	30	30	13	19	20	5
Std Dev	0.52	0.220	0.220	0.149	0.179	0.185	0.093
Avg Degree	3.333	2.5	2.5	0.265	0.388	0.417	0.102

Source: created by the authors.
*The densities were calculated considering that the largest possible number of ties was: 60.

The density of each type of relationship was measured by calculating the total number of possible ties, considering that each farmer could nominate up to five farmers.

This analysis allowed us to investigate elements of citizenship in farmer networks, identifying their character as a collective organization for collaboration and as a social and political organization in the territory, as well as understanding how information circulates within these networks.

Among the networked group of farmers (A1, A5, A6, A10, A13, and A16), a high degree of friendship (85%) was found, along with a significant level of joint participation in collectives and organisations (50%) and a substantial flow of information sharing about agroecology (74%). The elements of citizenship found in these networks include the participation of these organised farmers in collaborative networks of production and consumption where they directly connect with consumers. This facilitates the participation of both farmers and consumers in the agrifood system and enables local control over food production and distribution.

Despite the experiences associated with *Nutrire Trento* and the Solidarity Economy Market, a large network of farmers was not found, and neither *Nutrire Trento* nor the Solidarity Economy Market were identified as an agroecological movement due to the low density (37%) of participation and political action among those involved in these two endeavors. Therefore, we will consider the network of farmers (A1, A5, A6, A10, A13, and A16) who participate in the *Nutrire Trento* and the Solidarity Economy Market as part of a Civic Food Network (CFN), one that is still in its early stages and can be described as embryonic.

The level of political participation among farmers outside of this CFN (33%) was quite similar to that of CFN farmers (37%). However, it can be observed that there is a collaboration for marketing (51%) and more sharing of information about agroecology among CFN farmers. On the other hand, the collaboration for the exchange of seeds and seedlings remains low in both groups (17% within CFN and 8% outside of it).

3.4. Agroecological performance of farmers within the CFN

In this section, we aimed to assess the farmers who are connected to what we referred to as an embryonic Civic Food Network (A1, A5, A6, A10, A13, and A16) and compare them with the other farmers (A2, A3, A4, A7, A8, A9, A11, A12, A14, A15, A17, A18, and A19).

For agrobiodiversity on the farms, the data obtained indicate that there is no difference in the number of species produced for commercial purposes (Table 4) between the two groups of farmers. However, there is a small difference in the diversity of breeds and cultivars among the farmers within the CFN (56 cultivars/breeds) and those outside of it (61 cultivars/breeds).

Regarding biodiversity linked to the percentage of native vegetation, which includes native forests, native forests in recovery, and native pastures, a higher number was observed for farmers within the CFN (41%) compared to the other farmers (28%).

It has been observed that both groups of farmers have a reduced number of traditional cultivars and breeds compared to the total number of cultivars and breeds.

Proportionally, farmers within the CFN place a higher value on production for self-produced food. Among them, 85% (6 out of 7 farmers) consider this production essential, while among the non-CFN farmers, 67% (8 out of 12) view it as essential. Similarly, proportionally,

TABLE 4 Biodiversity in the farms.

	CFN FARMERS				FARMERS OUTSIDE OF THE CFN.			
	AGROBIODIVERSITY			Natural ecosystems (%)	AGROBIODIVERSITY			Natural ecosystems (%)
	Species	Cultivars/ breeds	Traditional cultivars/ breeds		Species	Cultivars/ breeds	Traditional cultivars/ breeds	
Average	30	56	10	41	29	61	14	28
Minimum	4	9	1	0	3	3	0	0
1st quartile	27	34	1	12	22	40	1	2
Median	33	43	8	40	30.5	66	5	13
3rd quartile	41	73	11	69	40.2	88	18	59
Maximum	44	151	36	81	50	110	80	90
Std. Dev	12.1	42.4	11.3	24.2	13.7	32.3	21.4	31.5

Source: created by the authors.

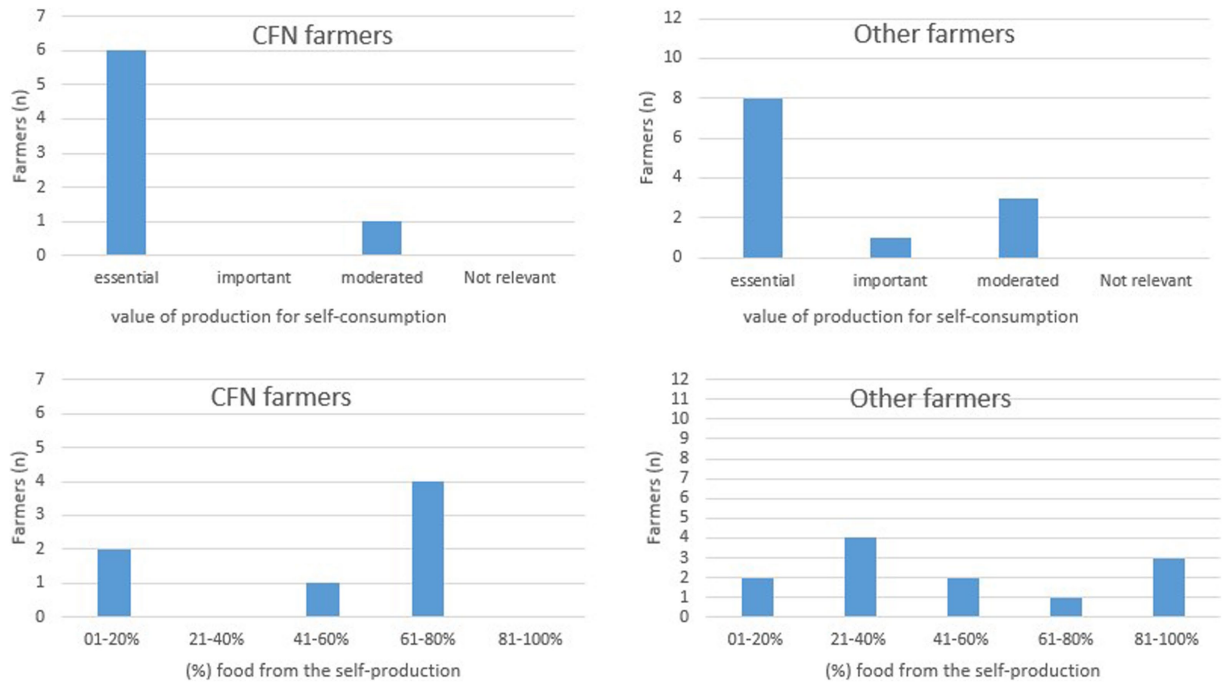

FIGURE 3
Production for self-produced food in the farms. Source: created by the authors.

TABLE 5 Input source in the farms.

Fertilisings' sources produced on the farm (%)			Breeds and seedlings produced on the farm or obtained through exchanges (%)		
	CFN FARMERS	OUTSIDE CFN		CFN FARMERS	OUTSIDE CFN
Average	35,9	45,6	Average	30	33
Minimum	0	0	Minimum	10	0
1st quartile	1	0	1st quartile (Q1)	15	1
Median	15	35	Median	25	19
3rd quartile	95	95	3rd quartile	50	65
Maximum	100	100	Maximum	60	100
Std. Dev	40,1	44,3	Std. Dev	17,1	33,6

Source: created by the authors.

a higher percentage of CFN farmers produce over 60% (4 out of 7 farmers) of the food in their diet within their own farming units, compared to the other farmers, where the percentage is 33% (4 out of 12) (Figure 3).

Regarding resource efficiency, farmers outside the network exhibited a slightly higher average of self-produced fertilizers (45%) compared to CFN farmers (36%). Conversely, for seeds, the disparity was minimal; CFN farmers recorded 30% from self-production or exchange, while non-CFN farmers registered 33% (Table 5).

Although we observed a slight improvement in some agroecological indicators, such as the percentage of natural ecosystems and resource efficiency within the farms and production for self-produced food, there is not a significant difference in terms of agrobiodiversity, specifically in the number of species produced, between the different groups of farmers studied.

3.5. The influence of short food supply chains on agroecology

Based on the data obtained, it was evident that all the farmers interviewed, both within and outside the CFN, exhibited positive indicators of agroecology. A common characteristic among these farmers is their involvement in short food supply chains. Notably, these farmers engaged in short food supply chains demonstrate a higher level of production diversification compared to the general agricultural landscape of the Trentino territory.

The official data from the Province of Trento (ISPAT, 2014) shows that approximately 81% of the agricultural area in the territory is dedicated to apple and grape crops, including organic production. In contrast, farmers involved in short food supply chains reported an average of 29 different species in their production. This observation is particularly significant, considering that these farmers operate within a region predominantly characterised by monoculture and long supply chains.

According to farmers in our research, supply chain channels interfere with their productive choices as to cultivated products, as well as the choice to diversify or specialise their production more. When asked which channels influence their choices and how, interviewees highlighted that cooperatives are channels that stimulate specialisation (Figure 4). From the words of the key stakeholders and farmers, it is understood that cooperatives are safe markets for specific products and that they, albeit limited, guarantee financial stability for families, though they also limit productive choices.

Cooperatives are important and consolidated channels that have guaranteed markets for family farmers, but cooperatives tend to favour the monoculture mode of production and decrease the autonomy of farmers when it comes to products marketed to the cooperative. This loss of autonomy can be minimised as they diversify the supply chain channels, agrobiodiversity, and economic activities in the production units.

Short food supply chains stand out as important channels to maintain or stimulate productive diversification. In this sense, the channels that most stimulate agrobiodiversity are farmers markets and sales on the farm, along with, more recently, collective farmers' organisations not mediated by cooperatives.

Overall, farmers responded that their participation in short food supply chains positively influences their practices, mainly by making them seek greater resource efficiency through the greater use of natural fertilisers produced on the farm. Additionally, they seek waste reduction, reuse, recycling, and diversification of production (Figure 5). To promote the efficiency of the production systems and maintain biodiversity, all the farmers studied have used agroecological practices – many of them traditional, such as conservation of soil, crop management, green manures, field biological pest control, and composting (Figure 6).

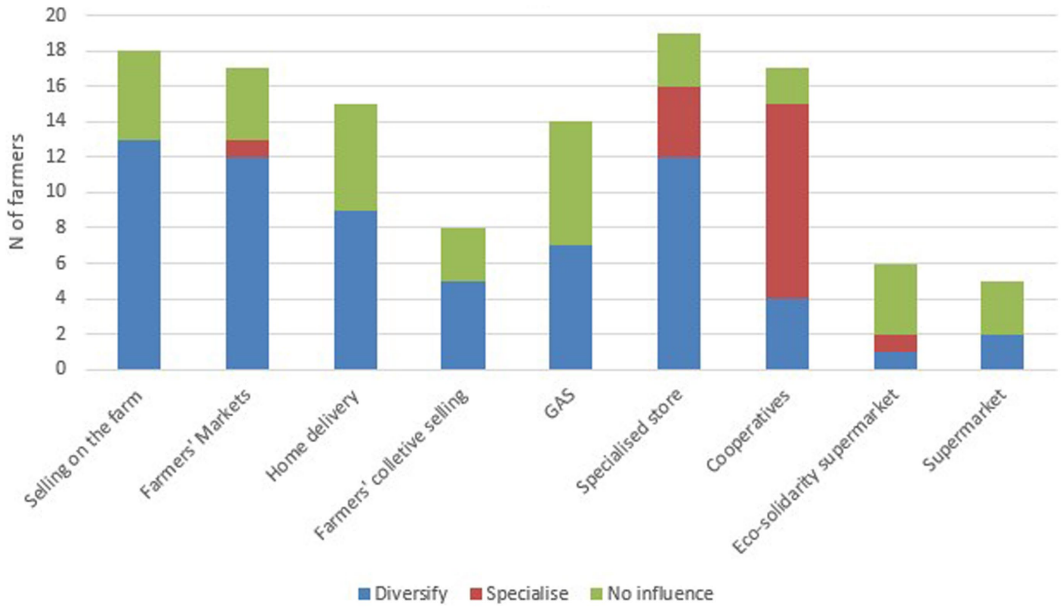

FIGURE 4
Farmers' perception of the influence of supply chain channels on agrobiodiversity. Source: created by the authors.

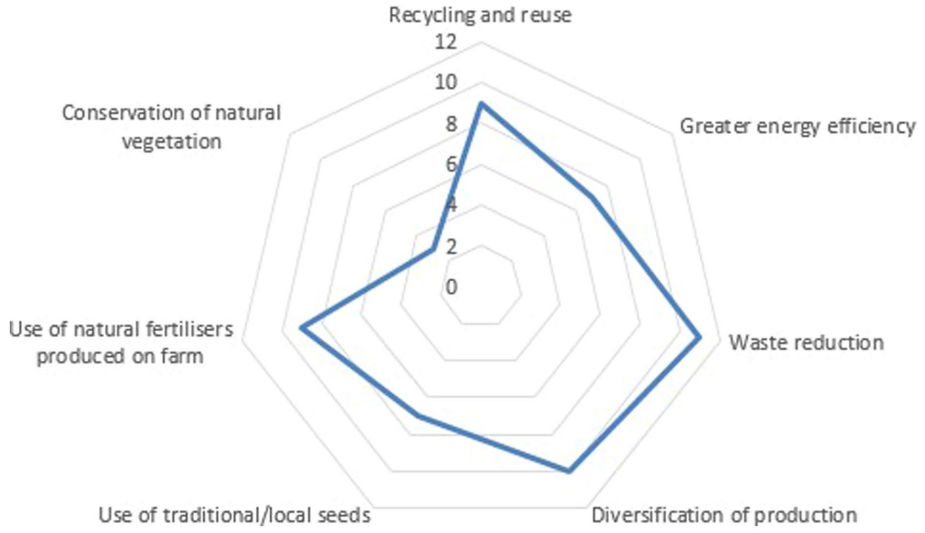

FIGURE 5
The influence of short food supply chains on the farmers' practices. Source: created by the authors.

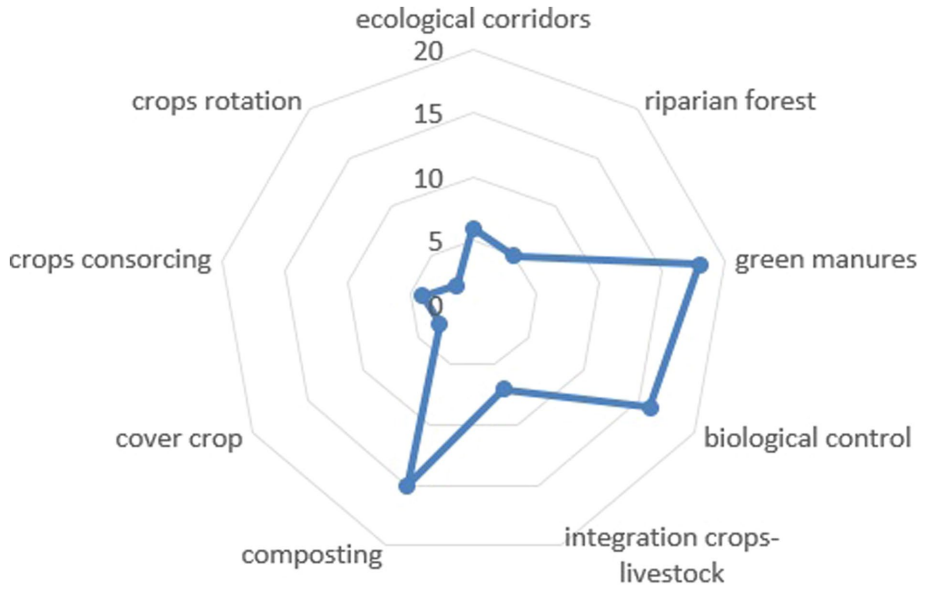

FIGURE 6
Agroecological practices in the farms. Source: created by the authors.

4. Discussion - citizenship and promotion of agroecology In food networks

Networks can act both to encourage and foster certain practices and innovations, as well as to restrict them. Shove et al. (2012) highlight that practices are influenced by social structures in which they transit, change, and reproduce, called social orders and systems. Seemingly neutral networks are actually biassed by patterns of inequality, perpetuated through mastering and marginalising specific practices (*Ibid.*).

In the province of Trento, there are networks linked to the hegemonic agrifood system that hinder the development of farmer networks for short food supply chains and agroecology. However, some farmers in the Province of Trento are also embedded in connections beyond those structures of domination that monopolise technology and food supply.

Various authors (Souza et al., 2021; Carrieri et al., 2023; Pugas et al., 2023) identified, in Brazil, initiatives to approximate consumption in which farmers and their organisations play a major role in structuring these experiences. These emerging networks have been contributing to the redesign of production-consumption

relations through the connected action between consumers-citizens and producers-citizens (Renting et al., 2012).

The context of low confidence and doubts regarding contemporary highly processed food has stimulated the creation of groups of consumers of organic foods in urban areas. They seek, through short food supply chains, to ensure knowledge of food trajectory (Brandenburg, 2002; Kneafsey et al., 2013). Renting et al. (2012) highlight the large number of food network initiatives and experiences that are emerging with the drive and conduct of citizen-consumers. For Brunori et al. (2012), a crucial point for understanding the CFN is the role of consumers and how they have been placed in this context. This stems from the fact that in the traditional view, consumption is understood as an individual act, belonging to the private sphere and guided by individual interests, thus following that the act of consuming will always strengthen the capitalist system (Brunori et al., 2012).

We observed, in the Trentino territory, a great centrality of the consumers' organisations. However, there are no large collective mobilisations of farmers: the existing entities of farmers are configured as union representations. Despite the clear centrality of the GAS, those interactions between consumers and farmers do not necessarily reflect in consumers' support of the family farm movement. Additionally, farmers described that they often observe a lack of knowledge by consumers about the dynamics of production and of family farming.

The dynamics of the Italian GAS show that the organisation of consumers for purchase, working actively and unpaid in the organisation of collective purchases, guarantees an important and consolidated short food supply chain for agroecological/organic agriculture, expressed in a large number of GAS distributed throughout the territory. The centrality of the GAS in the territory indicates changes, even if at the regional level, in the mechanisms of food governance with the protagonism of collective consumer organisations. The most consolidated contribution of the Civic Food Network in the territory for the promotion of agroecology is the support of the SFSCs, which have been important for maintaining agroecological and family farms.

The GAS do not promote the collectivisation of farmers and are managed by consumers, which means greater participation, autonomy, and self-organisation of consumers, but this participation does not include farmers.

The civil organisations that develop from farmer collectives are in their initial stage, as expressed in the two recently created associations L.E.N.A and CSA *Naturalmente*, which seem to point to new paths based on the collective action of rural actors. Some of these experiences emerge as collaborative organisations for marketing and can also strengthen other interactions, such as the exchange of information on agroecology.

Initiatives such as the Solidarity Economy Market and the *Nutrire Trento Project* are actions aimed at promoting new relationships, as well as a short food supply chain. In the *Nutrire Trento* case, we have the promoting space for the collective discussion for community-based solutions in the territory.

The *Nutrire Trento* is approaching a process of democratic participation that can be appropriated by the actors of the territory. Therefore, in the same way, it enables the consumer to cease being a mere consumer, and the farmer to become more than a producer of food and more an agent of civil and political participation and of transformation of the food system. In the same direction, Santini et al. (2020) identified that spaces for interaction can foster a process of community empowerment and social innovation by stimulating dialogue among involved stakeholders. However, the effective participation of farmers in the meetings (*tavolo*) of *Nutrire Trento* is still low, and the collectivisation of farmers encounters difficulties in the territory.

CSA *Naturalmente* highlights the network action with the appropriation of discussion spaces by civil society, in which farmers appropriated the *Nutrire Trento Project* and from it established relationships amongst farmers, consumers, and the entities involved, generating new organisational arrangements and providing innovative practices. Despite showing potential, the initiative is small and the participants report organisational difficulties, as well as difficulties linked to territorial structures and other organisations that hinder alternative networks and production diversification.

Thus, this initiative showcases the appropriation of institutionalised spaces and markets in order to build new relationships. In this case, the new organisation arose from the need to confront a crisis and establish relationships that were not dependent on the institutionalised space.

Networks between farmers have great potential for the sharing of information on agroecological production practices, are strongly present in the interaction between farmers in the network, and can be used as a potential for strengthening Civic Food Networks in the territory. Despite the existence of food networking initiatives and the existence of farms with agroecological production, in the Province of Trento, a strong agroecological movement was not identified between farmers and their initiatives.

The network of farmers identified forms a small, embryonic Civic Food Network (CFN). Table 6 provides a synthesis of the elements of

TABLE 6 Characteristics of the found CFN.

Variables	Characteristic of CFN
Citizenship	The found CFN is linked to collective mobilisation and self-organisation of rural actors, which have been strengthened through institutional spaces and support entities such as the public university. They have been operating through short food supply chains, providing more autonomy for farmers and consumers, as well as local control over food production and distribution. These networks are recent, involve a few farmers, and do not have strong political action in the territory. Therefore, we consider them as an embryonic CFN.
Agroecology indicators (biodiversity, resource efficiency, production for self-produced food)	The embryonic CFN presented a higher degree of natural biodiversity and production for self-produced food, which may be stimulated by the action of networks and the increased circulation of information about agroecology. However, the most significant promoter of agroecology is the short food supply chains, which are a central element of CFNs.

Source: created by the authors.

citizenship and agroecology found in the studied network and their contributions.

The presence of some improved agroecological indicators among the interconnected farmers in the Civic Food Network may be linked to the existence of farmer networks and organisations, as well as the increased flow of sharing information about agroecology within these networks.

In the propagation of innovations and the search for collective solutions, interaction in social networks emerges as an important element. Horizontal information sharing favours the maintenance of traditional knowledge and ways of farming, meanwhile providing alternatives to systems that monopolise technology and knowledge (Sabourin, 2001; Agne and Vaquil, 2011; H.L.P.E, 2019).

Another characteristic of CFNs is collaboration for commercialisation, which is explained by the fact that some farmers have felt the need to collectivise to strengthen their autonomy and enlarge their access to markets, in a context where conventional markets in the territory give farmers less autonomy and participation. The collective farmer groups and associations present in these networks are mainly related to collective marketing initiatives and have propitiated other forms of participation in the territory.

Despite this small difference in agroecological indicators, it is important to highlight that all farmers presented positive indicators, especially regarding agrobiodiversity. In this regard, it is important to highlight two important points: (1) the CFNs found are embryonic and recent, indicating that they are still in the early stages of development; and (2) the sample studied was limited to farmers engaged in short food supply chains, and there are studies that suggest that short food supply chains promote agroecology, particularly in terms of promoting agrobiodiversity.

Rover et al. (2020) investigated the impact of retail strategies on the diversification of organic production establishments and analysed them from the perspective of the conventionalisation of organic farming. The authors concluded that the production needs to meet markets' demands, which may bring about a loss of biodiversity. As a counterpoint, they identified that the proximity between producers and consumers, by means of direct sales and spatial proximity, was fundamental in order to foster biodiversity in the studied farms.

The diversified production favours the production for the families' own consumption. Pozzebon et al. (2018) identified that the participation of agroecological farmers in short food supply chains (street markets) in the West of Santa Catarina, Brazil, is an important income generation strategy and allows the concretisation of self-produced food that promotes families' food security.

There is also a tendency for SFSCs to sell organic (especially in the Southern European region) or even biodynamic produce (Darolt et al., 2013; Kneafsey et al., 2013; Niederle, 2013). The ecological indicators demonstrate that the interviewed farmers, both within and outside what we refer to as a CFN, differ from the logic of the hegemonic food system. They sustain biodiverse production, some degree of autonomous input production, agroecological practices, and production for self-produced food. Therefore, we conclude that an important factor promoting agroecology is the adoption of short food supply chains.

5. Conclusion

The Civic Food Networks in the Trentino territory are embryonic because there is difficulty in the collective organisation of farmers. This challenge is related to the territorial structures that favour long commercialisation chains, monoculture, and individualisation of farmers, imposing restrictions on innovative and sustainable processes.

However, there are initiatives aimed at contributing to the promotion of short food supply chains, the establishment of spaces for debate, and the participative construction of innovations for a more sustainable local food system. The projects identified have more participants from public administration and the university than from the producers themselves.

The Civic Food Networks in the Trentino territory promote agroecology, though primarily through short food supply chains, which directly benefit agrobiodiversity and sustainable practices.

Civic Food Networks have the potential to facilitate greater participation of consumers and producers in the food system, allowing for local control over the production, distribution, and marketing of food through short food supply chains. They can also support production units with agroecological practices, creating alternatives to the dominant systems in the territory. However, this process faces challenges in mobilising rural and urban actors and in strengthening both Civic Food Networks and agroecology.

This work contributes to the academic debate by aiding in the understanding of how farmers have integrated into Civic Food Networks, as well as how these networks contribute to agroecology. Finally, this work points to the possibility of using social network analysis methodology to study Civic Food Networks.

5.1. Limitations

This research, due to its lack of knowledge regarding potential Civic Food Networks in the territory, focused the investigation on farmers involved in short food supply chains. Therefore, all the farmers studied are engaged in short food supply chains. As a result, the comparison between farmers participating or not participating in CFNs may not yield significant differences in agroecological indicators, as short food supply chains themselves have been shown to promote agroecology.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving humans were approved by Ethics Committee on Research of the University of Santa Catarina. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

MC conducted the research in all its stages: research design, data collection, results analysis, and manuscript writing. FF and OR are both supervisors of the doctoral research that led to this paper. They were involved in all the research design, discussion of the results, and writing of the paper. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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