

Social Network Analysis Uses and Contributions to Innovation Initiatives in Rural Areas: A Review

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Abstract: This paper identifies the main contributions of Social Network Analysis (SNA) use in the study of innovations in rural areas with an emphasis on agriculture and forestry. The bibliographic analysis was carried out on the Web of Knowledge (WoK) and Scopus platforms. Sixty-eight studies were found in which SNA was used as the main research tool in innovation processes in rural areas. The main fields of the SNA contribution were as follows: (i) social capital; (ii) social learning: information and knowledge flow for the adoption of innovations produced through existing social structures; (iii) the implementation and evaluation of innovations for local and territorial dynamization. The study contributes to summarizing the existing knowledge on SNA use in the study of innovations in rural areas and to informing future research. Understanding social networks is essential to strengthen and enhance the existing social capital and to promote social learning related to innovations in rural areas.

Keywords: SNA; innovation; networks; rural; agriculture; forestry

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1. Introduction

Despite the widespread consensus on innovation as a key factor for companies', regions' and nations' economic development and competitiveness [1,2], innovation studies have generally been undertaken in urban areas by linking innovations with high-tech and research and development (R&D) activities [3]. Not much attention has been paid to rural areas. However, this situation has been changing. Various innovations in rural areas related to social, productive, industrial and commercial aspects that favor the generation of new agreements for sustainable food systems have been identified, and intersectoral links for the development and modernization of the rural environment have been established. The contribution of rural innovations is now recognized as an important driver of sustainable rural development, and its input to address global challenges is being explored [4].

Some ongoing studies argue that rural areas require a different understanding of innovation and distinct innovation policies to address rural development by advocating an appropriate way to approach innovation in rural areas [5,6]. Some empirical studies have adopted a social network approach to analyze innovation initiatives in rural areas [7]. This relational perspective is more appropriate for the study of innovation in peripheral areas, like rural areas [8].

The origins of the social network approach lie in the work of Simmel (1909) [9], who claimed that sociology, rather than studying people and their features, should focus on analyzing social interactions and relationships. Following this, formalized concepts and measures were developed to better characterize a specific actor's position in the network, the relationships between different players and the network as a whole, and to investigate how they affect individual behavior and societal phenomena [10]. This combination of inputs from sociology and mathematics (graph theory) has led to the development of Social Network Analysis (SNA) to study social networks. Although SNA was developed decades ago, it has only been recently applied in fields beyond sociology and mathematics.



The rapid growth and diffusion of SNA is due to the development of better SNA tools, including powerful computer applications [11].

For all these reasons, it is relevant to determine the usefulness of SNA as a tool for analyzing innovation initiatives in rural areas by identifying the aspects that have been addressed in these initiatives, the results obtained and the most significant contributions of SNA use to the analysis of rural innovation systems. This study contributes to summarizing the existing knowledge on SNA use in the study of innovations in rural areas with an emphasis on agriculture and forestry. From this, it will be possible to conduct future research to contribute to the generation of knowledge to guide policies and programs that strengthen rural development.

This article is organized as follows: After this introduction, Section 2 describes the theoretical framework that leads to our research question. Section 3 covers the applied methodology. Section 4 presents the results, and Section 5 discusses them in more detail. Section 6 is a reflective summary of the main conclusions of the study.

2. Analytical Framework

2.1. Innovation and Networks

There are currently various definitions of innovation. One of the most widespread is that of the European Commission. It considers innovation to be "the renewal and enlargement of the range of products and services and the associated markets; the establishment of new methods of production, supply, and distribution; the introduction of changes in management, work organization, and the working conditions and the skills of the workforce" [12] (p. 23).

Although there are different opinions on what is involved in implementing an innovation process, it is generally related to three stages: invention, which refers to the development of a new idea; innovation, which is related to the commercialization of the invention; diffusion, which is the propagation of innovation in society [4].

The analysis of the innovation process has changed over time, from traditional concepts like the linear model of innovation or the Schumpeterian view, which considers that firms innovate in a sequential, ordered and isolated way, to theoretical concepts, which emphasize the interactive and systemic character of innovation. The systems approach, developed in the late 1980s, argues that innovation is a dynamic, evolutionary and nonlinear process that requires intense communication and collaboration between various actors both inside and outside firms [2].

An important element of an innovation system is the social networks within which innovation agents interact, or the sets of individuals or organizations in which each has connections of some kind to a number or all of the other set members [11].

The quality of social networks is related to social integration: its structure (e.g., size, density, heterogeneity and geographical distance); its composition (e.g., the proportion of relatives, friends, neighbors and formal ties); the quality of ties and the exchange of social support (e.g., duration, intimacy, importance of ties, frequency of contacts) [13]. A social network's form, function and boundaries are often determined by social and economic institutions. Here, they are conventionally defined as the rules, conventions, traditions, routines and norms of a given social or economic system [11].

A social network structure analysis poses important challenges, such as (i) defining and measuring links or relationships because individuals do not always accurately recall relevant social relationships; the possibility of not being able to contact or observe all the network nodes; much of the data come from limited link metrics, which often take a static and discrete view of something that is fundamentally dynamic and volatile; (ii) collecting data without biases and quirks because data are often obtained and categorized in different ways; nothing has been done to systematically assess the prevalence of characteristics in diverse social settings [14]

An innovation network is a set of connections between people with diverse social relationships in which information, knowledge and other social processes flow to facilitate

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the innovation process [15]. To the extent that innovation networks can accumulate a diversity of resources and capabilities from different types of actors that enhance the flow of different and new information and ideas into the networks, an innovation process is considered to be effective [16].

2.2. Social Networks and Social Learning

Social networks define or limit an individual's opportunities for social learning by defining or limiting membership or participation in a given innovation process, thereby limiting access to knowledge [11].

According to Reed et al. (2010), social learning may be defined as a change in understanding that goes beyond the individual to be situated in wider social units or communities of practice through social interactions between actors in social networks. However, there are three key problems with using the term: (i) as a concept, it is often confused with the necessary conditions or methods to facilitate social learning; (ii) confusion between the concept itself and its potential outcomes is frequent (a range of alternative processes may lead to the same outcomes without social learning taking place at all, or social learning may occur when any of these outcomes is lacking); (iii) little distinction is made between individual and social learning; learning occurs at the individual level (due to a change in people's understanding of the world and their relationship to it), but the learning process occurs through social interaction with others and existing facilitating mechanisms (e.g., information exchange through networks) [17]

To overcome these limitations, Reed et al. (2010) believe that social learning needs to (a) demonstrate that individual learning has occurred and there is a change in the understanding of the involved individuals; (b) go beyond the individual to be situated in wider social units; occur through social interactions and processes between people in a social network either through a direct interaction (e.g., conversation) or indirectly (through mass media, telephone, etc.) [17].

2.3. Social Networks and Social Capital

There is no single definition of social capital because it depends on the author's perspective. The most widely accepted applicable notion of this concept is expressed in the links between people who know one another and the sharing of common interests [18]

Three different social capital categories have been identified: (a) bonding, which refers to trust and cooperation between network members with similar socio-demographic characteristics, with profound trust, dense multiple networks with strong ties, generally informal collaboration and long-term reciprocity; (b) bridging, which involves the links between separate networks for collaboration and coordination, characterized by larger, looser networks with weaker ties, less trust and the establishment of interactions across explicit, formal or institutionalized gradients of power or authority in society; (c) linking, which denotes the type of weak ties (Granovetter, 1985) [19] that allow the resources, ideas and information from formal institutions beyond the community to be used, and has links with open networks [20,21] by enabling access to new knowledge sources and promoting the adaptation of innovations

In agricultural innovations, it is widely argued that social capital allows access to not only resources that foster farm innovation, such as knowledge and funding, but also moral support [22]. Bonding facilitates cooperation and connection between farming community members by favoring exchanged informal knowledge and experience, and the sharing of physical resources. Bridging and linking social capitals allow more access to formal research-based knowledge, innovative experiences elsewhere and training and financial resources by opening up opportunities to diversify forms of production and business models [21]. However, social capital ties can also have disadvantages (called negative or dark social capital). They include the exclusion of outsiders, excessive demands on group members, restrictions to individual freedom and top-down leveling norms. According to Tregear and Cooper (2016), dense and rich social relations can provide a barrier to collective initiatives [22]. The acquisition of new knowledge from other types of social capital (linking) can also be inhibited and thereby diminish the social innovation capacity. Moreover, if linking social capital is concentrated in a few individuals, then they may act as "gatekeepers" of privileged information shared only by group members. Therefore, a balanced network with linking, bridging and bonding social capitals should be sought. Lambrecht et al. (2014) suggest integrating new actors and replacing actors to adapt the network to changing circumstances and needs [21].

3. Materials and Methods

In this literature review, two main methodological phases based on the proposal methodology of Snyder [23] were followed, as indicated below:

Phase 1. Designing the review. The purpose of the review was to investigate and synthesize evidence for the main and useful SNA contributions to analyze innovations in rural areas with an emphasis on agriculture and forestry. The research question of this review is as follows: what are the main contributions of SNA use in the study of innovations in rural areas? The inclusion criteria applied to identify the analyzed documents were as follows: (a) type of document: indexed article; (b) databases: Web of Knowledge (WoK) and Scopus platforms; (c) keywords: to search for articles on platforms, two words were used: "SNA" and "innovation", which were combined with a third word or lexeme: "rural", "agriculture", "agricultural", "forestry", "agri*", "agro*". All the publications that met the above three criteria were included without setting a time limit. Exclusion criteria: (a) repeated article: if the article was identified on both platforms, it was considered to be selected on only one platform and removed from the overall selected article count; (b) the subject matter of the article was not aligned with the study objective

Phase 2. Analysis. After applying the established criteria, the final selection included 68 articles (Table A1). In this phase, each article was analyzed after considering specific parameters, as follows: the article's year of publication; the journal in which it was published; its impact factor; its keywords; the abstract; the country where the study was conducted; the addressed thematic areas; the data-processing methodology; the findings on the main SNA contributions. Similar findings on the main SNA uses and contributions to rural innovation processes were collected, analyzed and linked. A meta-analysis [24] allowed us to complement the qualitative study of the main fields of SNA contribution.

4. Results

This section deals with aspects of the characterization of the study sample made up of 68 referenced articles. It identifies the three main SNA contribution fields by regarding innovation processes in the rural environment. Some limitations found in SNA use are also noted.

4.1. Characterization of the Study Sample

The aspects included in the characterization of the study sample were the articles' years of publication, the countries where they were conducted, the addressed thematic areas and the findings on the main SNA contributions

The considered reference articles were published between 2007 and 2020 (Figure 1). These articles were conducted in 1 of 38 countries or more (Figure 2). The United States and Italy were the most represented (8% each), followed by Mexico (7%), Ghana (6%) and Kenya (6%). Furthermore, 6% of the articles were conducted in regions from different continents. This geographical distribution could be related to the greater dissemination of SNA in Europe and North America, where the International Social Network for Social Network Analysis—INSNA (https://www.insna.org/, accessed on 30 March 2022)—created in 1977 in Delaware (USA), holds an annual meeting and other activities to promote and disseminate SNA-related research by publishing it in three professional journals: *Social Networks, Connections* and the electronic *Journal of Social Structure* [25]. Organizational initiatives like this have been replicated in other areas, but more belatedly. In the late

1990s, REDES (http://www.redes-sociales.net/, accessed on 5 February 2022), a Spanishlanguage INSNA affiliate, was created to organize meetings between Spanish-speaking researchers and to publish a social networking journal (http://revista-redes.rediris.es/, accessed on 5 June 2022).



Figure 1. Percentage distribution of the articles analyzed by year of publication.



Figure 2. Geographical scope of the study of the selected articles.

Fifteen areas were identified in the thematic areas addressed in the analyzed articles. The most frequent ones were agriculture (38%), industry (12%), livestock (10%), tourism (10%), local/regional development (6%) and economy (6%) (Figure 3).



Figure 3. Percentage distribution of the analyzed articles according to thematic areas.

Three main fields of SNA contribution were identified in the referenced studies. In particular, 12% of the studies contribute to the analysis of social capital, 43% to social learning (information and knowledge flow for the adoption of innovations), 32% to the analysis of implementing local and territorial innovations and 10% to the process of evaluating innovations. A lower percentage (3%) contribute to policy formulation but this was not considered to be the main study contribution (Figure 4).



Figure 4. Main SNA contributions in rural innovation processes.

4.2. Limitations of SNA and Its Combination with Other Approaches and Tools

Some of the challenges encountered when applying SNA are a lack of full data on the network, so egocentric data are relied on [26]. In other words, as actors' motives and degrees of understanding are not shown, qualitative information is collected in addition to the SNA [27]. Weaknesses in its ability to describe the effects on actors of the information they receive from the network are also indicated, and whether their behaviors changed and to what extent, why and how. Additionally, SNA implementation requires significant time and finance resources [28]

The use of other approaches or tools is seen to complement the information provided by the SNA and overcome limitations of information about the structure of social networks, which, as previously noted, come from limited measures of linkages that often take a static and discrete view of something that is inherently dynamic and volatile [14].

In the referenced studies, in methodological terms, SNA is used exclusively (48%) or in combination with other approaches (12%) and tools (40%). In particular, the approaches applied in combination with SNA are mainly as follows: Participatory Rural Appraisal (PRA), Participatory Impact Pathway Analysis (PIPA), triple-helix theory, among others. These approaches emphasize the analysis of the dynamics of stakeholder participation in the planning, managing and implementing of innovation processes to complement the findings on the social structures provided by the SNA.

The tools used in conjunction with the SNA allowed us to complement the analysis of networks with the following: a statistical data analysis (15% of the articles, using SPSS, Stata, the logit model, the Heckman model and an econometric model); a content analysis (13% of the articles, using Atlas ti, MAXQDA, NVivo, among others); a geolocation analysis of networks (4% of the articles, using the Geographical Information System (GIS), Google Maps and Socio-Spatial Knowledge Network (SSKN)); other tools not mentioned in the previous categories (7% of the articles) (Figure 5). In line with this, Gillieatt et al. (2015) argue that the combination of SNA and qualitative data analysis, such as content analysis tools, can revise the network structure, process and functioning [29]. In addition, geolocation tools allow for the analysis of networks by incorporating spatial characteristics that help to understand innovation processes from a territorial perspective.



Figure 5. Uses of SNA alone or in combination with other approaches and tools.

5. Discussion

This section analyzes in depth the three main areas of SNA contribution in relation to innovation processes in rural areas.

5.1. Social Capital

In the reviewed articles, 12% use SNA to analyze actor networks and their relationship with social capital. This is particularly useful in the study of the socio-spatial aspects that underlie innovation processes.

One of the elements of social capital that has been frequently studied is trust. High levels of trust between actors have been found to enable the development of strategic networks in which actors share similar visions of the network and exchange information and knowledge. The high trustworthiness of the network's central organizations and the role played by the actors considered to be "intermediaries", and which connect the different network segments, are fundamental [30]. It also highlights the role of the central actors that maintains egalitarian relationships within the network by strengthening trust between actors [31]. In rural innovation networks, most central actors are public in nature and are seen as providers of information and resources [11,32]. These findings reveal the importance of not only the actors' positions within a network, but also their influence on the construction of trust and for bonding social capital.

As for the above-detailed capital types [20,21], the actors' heterogeneity, and the existence of both internal and external networks, can increase the three social capital types: bridging, by connecting with networks in other territories; bonding, by connecting with different local collectives; linking, by contacting supralocal institutions. Moreover, linking capital is significantly enhanced by the heterogeneity of the external networks that institutional actors have in other territories and favors the territorial expansion of innovation initiatives [31]. The different social capital types embedded in community-based social networks facilitate knowledge sharing among farmers, increase their access to information and connect them to various sources of support [33].

SNA is also used to analyze the socio-spatial phenomena that underlie the innovation process and are linked with social capital, such as migration and labor movement. Local migration has been found to foster the emergence of translocal networks that facilitate the exchange of ideas, knowledge and resources, contribute to bottom-up innovation and can strengthen the adaptive capacity of rural communities [34] and agro-ecosystems [35]. International migrants also emerge as important drivers of new products, processes and markets by introducing new ideas, expertise and external networks. Nonetheless, their contributions are more limited locally due to the socio-cultural aspects that systematically limit interactions [36]. It can be argued that migration processes tend to strengthen mainly bridging social capital, but this can be affected by socio-cultural factors, such as exclusion or limited interaction with outsiders. This is considered one of the disadvantages of social capital, or negative social capital [21]. Moreover, labor movement is an important factor that plays a role as an interregional conduit of tacit knowledge by expanding the social capital networks of smaller peripheral communities [37]. It also allows for the understanding of the affinity between industries and the relationship between sectors in the same regional system [38].

5.2. Social Learning: Information and Knowledge Flow for the Adoption of Innovations

SNA addresses various aspects related to the flow of information and knowledge for the adoption of innovations in rural areas, which facilitate the social learning process, but do not entirely cover it. However, its contributions are considered to go beyond the individual to cover broader social units, provide insight into the social interactions and processes between the actors within a social network [17] and, thus, understand the social structures that shape the social learning process.

Of the 68 referenced studies, 43% address the analysis of the flow of information and knowledge by considering the characteristics of the networks through which they flow, the actors' positions and roles, the means and channels of communication employed to access information and knowledge, and the speed of the diffusion of innovations.

The success of information exchange in producer networks is associated with the presence of organizational linkages [39], and the adoption of innovations positively correlates with the degree of connectivity with various organizations and actors [3]. Both these findings support the idea of learning as a social process, in which individuals often learn with others through social interaction [17,34].

However, it is not enough for networks to exist because they must have certain characteristics that are considered of quality and are related to their structure, composition, quality of links and exchange of social support [13]. In the reviewed articles, the producers with greater access to organizations are located in lower-density information networks with low levels of redundancy but efficient links [39], and with a high diversity of actors [40]. Sparse networks favor new knowledge acquisition but may hinder the exchange of existing knowledge [39]. Centralized networks foster innovation diffusion because information can be efficiently distributed among network members. However, a high centralization level might reduce access to diverse information sources and may thereby impede social learning [41].

The reviewed studies find, in formal structures, that innovation is predominantly diffused through formal vertical links (i.e., between hierarchical representatives), which

influence the network's organizational structure, affect its capacity for information diffusion and innovation processes [42] and lead to marked disparities in different members' innovation potentials [43]. However, this situation can be significantly controlled by key actors in leadership positions [43]. Informal structures are considered important in innovation processes, they last a long time and they appear to accumulate significant amounts of social capital, even in cases in which no actual economic transactions take place [44].

Related to the actors' positions in networks, the actors with central positions in them have a stronger influence on the flow of knowledge [45], and they use a variety of information channels, unlike peripheral actors [46]. Indeed, the asymmetry of communications is one of the factors that can weaken the interactions and links between the actors involved in sustainable innovation processes [47]. Therefore, the concentration of information on a few individuals (central actors) has to be avoided to prevent them from acting as gatekeepers of information that do not properly disseminate it [21].

SNA is also applied to analyze the roles of actors in the innovation process. Some studies highlight the influence of change agents of public services (extensionists, in particular) and consider them to be triggering actors in the diffusion and adoption processes of innovations among producers [48]. These actors influence the producer network structure due to their frequency of contact [49], and they have access to information, knowledge and production-related resources. Other studies highlight peer influence, which helps to overcome any constraints around the innovation process, such as risk aversion and low levels of education [50]. Producers also learn mainly from their peers and tend to consider one another to be their primary source of information [33,51,52], while government extension agents are the secondary source [33].

Another characteristic of social learning is that it occurs through social interactions and processes between actors in a social network either through a direct interaction (e.g., conversation) or other means (e.g., media, telephone, Web 2.0 applications) [17]. In rural areas, both types of interactions co-exist. In indirect interactions, the most widely used means of communication are information and communication technologies (ICT), mainly radio, followed by mobile phones and television. They allow information to reach many farmers [46]. In direct interactions, different positions of the influence of interpersonal communication on the adoption of innovations appear. Some authors consider that the network farmers who frequently communicate are more likely to attach more importance to the information received from formal agents (e.g., agricultural extensionists) than to that acquired from informal agents [53]. However, others attach more importance to the information from informal actors (for example, successful farmers who are considered reliable experts given their practical experience under similar conditions to other farmers) [52]. Therefore, it is considered necessary that information distribution occurs through formal and informal actors to substantially influence the diffusion of innovations [53].

Related to the speed of the diffusion of innovations, SNA enables the illustration of the reactivity or passivity of the actors' responses [54], and it finds that merely exposing innovation through weak heterophilic ties is sufficient to initiate the diffusion process. Moreover, interconnection bridges based on strong ties can lead to faster or slower diffusion, depending on the type of signals that circulate in the network [55].

5.3. Implementation and Evaluation of Innovations

SNA has been widely applied to analyze the innovation initiatives that dynamize local economies related to specific sectors. However, it has also contributed to the study of wider territorial dynamics in which various productive sectors and actors from different levels of action converge. These findings fall in line with Dargan and Shucksmith (2008), who studied innovations in European rural areas. These authors found that they are related to the diversification of local economies; the intensification of local and global interactions; the strengthening of relationships between local actors toward new internal or local synergies [5].

Of the reviewed articles, 32% are related to the implementation of innovation initiatives and 10% to evaluation.

On the implementation of innovation initiatives at the sectoral level, networks have been found to be an efficient means of sharing resources by consolidating innovation initiatives by sector and acting in response to market demands [15]. Different networks appear to co-exist in the same productive sector. For example, in industry, agro-industrial companies form a complex social structure characterized by two types of networks: a dispersed network with low connectivity due to the commercial nature of relationships, and another underlying network of higher density enriched by kinship and friendship ties, which create cooperation and trust through tangible and intangible reciprocal exchanges [56].

Regarding territorial dynamics, SNA has contributed to the analysis of the organizational dynamics of the intersectoral networks that co-exist but have different levels and dimensions. Some examples are as follows: the local small-scale agro-industrial sector co-existing with a more formal large-scale sector [57]; entrepreneurial ecosystems with both rural and urban characteristics [58]; innovations promoted at the central level, but implemented at the regional and local levels [59]; cross-border cooperation networks that involve several countries and productive sectors [60].

SNA has also been used for the evaluation of different moments of the innovation process. It has made it possible to assess relationships between actors, to more deeply understand these actors' roles and importance during innovation processes [28,61] and to determine the effectiveness of advisory systems [26] and tools to reconfigure the social network structure [62].

6. Conclusions

The reviewed articles demonstrate that SNA is a useful tool that can be used alone or in combination with other approaches and tools to analyze social innovation initiatives in rural areas with a special emphasis on agriculture. SNA provides insight into not only the quality of the social structures on which social capital is built, but also the information and knowledge flows that favor social learning for the diffusion and adoption of innovations at both the local and territorial levels.

Key study aspects for strengthening social capital through social networks are identified as follows: the influence of the actors' positions for the development of trust; the composition of networks (heterogeneity vs. homogeneity) and its influence on the development of different social capital types and the expansion of innovations; the complex socio-spatial dynamics (migration, movement of labor) underlying the innovation process between different sectors and territories.

SNA is useful for understanding how information and knowledge are disseminated through social networks, but its scope is limited to determining whether social learning as such takes place. This is why it must be complemented with other research tools. However, knowing social structures helps to identify the key actors in this process, the roles they play, the most efficient ways and means of disseminating information and the diversity of the actors making up a network, among others.

SNA allows the analysis of the social networks in each productive sector and between the productive sectors that co-exist in the same territory, and the evaluation of different moments of the innovation process: at the beginning, to identify the key actors for the implementation of innovations; during the process, to analyze the configuration of social networks and to intervene if deemed appropriate; at the end, to evaluate the impact of innovation initiatives in the rural environment.

The analyzed articles demonstrate the importance of the role of change agents of public services (e.g., agricultural extensionists) as drivers of the innovation process and their capacity to influence the producer network structure (through the interactions they sustain with them, by accessing information and knowledge, via production-related resources), which could contribute to the creation of efficient agricultural innovation networks. Hence, change agents must be aware of both their particular influence on the innovation networks with which they interact and their structures to act in a way that can influence their efficiency. Likewise, government bodies should recognize the role of change agents and actively promote producer networks' efficiency through sectorial and local policies.

Given the importance of social networks for the innovation process in rural areas, their study and strengthening need to be considered in rural, agricultural and forestry development policies.

Based on the referenced articles, some gaps were found that could be addressed by future research: (a) Agricultural networks' structures have been extensively studied and an "efficient" network's characteristics have been established. However, in other sectors (i.e., forestry), the same degree of precision has not been found. Thus, further research is considered necessary; (b) The analysis of innovation networks shows the state of networks at a given time. Nevertheless, very few studies have addressed innovation networks over time. Hence, there is interest in investigating the characteristics of innovation networks that prove sustainable over time; (c) No studies have been identified that address the modeling of networks to increase their efficiency. This could be an interesting research field for strengthening innovation networks; (d) Despite SNA interactions at the network level and the actors' positions in the network, this analysis can be complemented with the study of individual factors and motivations for participating in innovation networks; (e) Very few studies have been found on innovation by applying SNA in Latin America and Africa. Therefore, it could be extended to other countries in these regions.

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

Appendix A

Table A1. Referenced articles.

No.	Author/Year	Title	Thematic Area	Area of Main Contributions	Approach to/Instruments of Data Analysis	Location
1	(Aboal et al., 2018)	Knowledge networks for innovation in the forestry sector: Multinational companies in Uruguay	Forestry	Social learning: information and knowledge flow	SNA	Uruguay
2	(Aerni et al., 2009)	Nostalgia <i>versus</i> Pragmatism? How attitudes and interests shape the term sustainable agriculture in Switzerland and New Zealand	Agriculture	Other (policies)	SNA + statistical analysis	Switzerland, New Zealand
3	(Aguilar-Becerra et al., 2019)	Path Dependence and Social Network Analysis on evolutionary dynamics of tourism in coastal rural communities	Tourism	Implementation of innovations	SNA + path dependence	Mexico
4	(Alimirzaei et al., 2019)	Executive Coherence in Iranian Pluralistic Agricultural Extension and Advisory System	Agriculture	Implementation of innovations	SNA + content analysis	Iran
5	(Almeida et al. <i>,</i> 2019)	Innovation diffusion in an agricultural health center: moving information to practice	Agriculture	Social learning: information and knowledge flow	SNA	United States

Table A1. Cont.

No.	Author/Year	Title	Thematic Area	Area of Main Contributions	Approach to/Instruments of Data Analysis	Location
6	(Andrieu et al., 2019)	Co-designing Climate-Smart Farming Systems with Local Stakeholders: A Methodological Framework for Achieving Large-Scale Change	Agriculture	Implementation of innovations	SNA + others	Colombia, Honduras
7	(Balfour and Alter, 2016)	Mapping community innovation: Using social network analysis to map the interactional field, identify facilitators, and foster community development	Development	Social learning: information and knowledge flow	SNA + statistical analysis (SPSS)	United States
8	(Birkenberg and Birner, 2018)	The world's first carbon-neutral coffee: Lessons on certification and innovation from a pioneer case in Costa Rica	Agriculture	Implementation of innovations	SNA	Costa Rica
9	(Borsotto et al., 2019)	An exploratory study on the construction of networks in social farming	Agriculture	Social learning: information and knowledge flow	SNA + statistical analysis	Italy
10	(Bourne et al., 2017)	A network perspective filling a gap in assessment of agricultural advisory system performance	Agriculture	Evaluation	SNA	Tanzania, Kenya, Rwanda
11	(Brønd, 2018)	Territory and trade networks in the small-scale oil-palm industry in rural Ghana	Industry	Implementation of innovations	SNA	Ghana
12	(Cammarano et al., 2017)	R&D Collaboration Strategies for Innovation: An Empirical Study Through Social Network Analysis	Industry	Implementation of innovations	SNA + others	Multiple countries
13	(Carson and Carson, 2018)	International lifestyle immigrants and their contributions to rural tourism innovation: Experiences from Sweden's far north	Tourism	Social capital	SNA + content analysis	Sweden
14	(Carson et al., 2014)	Understanding local innovation systems in peripheral tourism destinations	Tourism	Implementation of innovations	SNA + others	Australia
15	(Cho and Park, 2012)	Government organizations' innovative use of the Internet: The case of the Twitter activity of South Korea's Ministry for Food, Agriculture, Forestry and Fisheries	ICT	Social learning: information and knowledge flow	SNA	S. Korea
16	(Cowell et al., 2018)	It takes all kinds: understanding diverse entrepreneurial ecosystems	Economy	Implementation of innovations	SNA	United States
17	(Crowley et al., 2018)	Community of Practice: A flexible construct for understanding SME networking roles in the Irish artisan cheese sector	Industry	Social learning: information and knowledge flow	SNA + content analysis (NVivo)	Ireland
18	(Cox et al., 2018)	ICTs for conservation agriculture: influence of actor positioning in knowledge networks in Laikipia and Machakos counties, Kenya	ICT	Social learning: information and knowledge flow	SNA + statistical analysis (SPSS)	Kenya
19	(de Souza et al., 2015)	Collaborative networks as a measure of the Innovation Systems in second-generation ethanol	Energy	Implementation of innovations	SNA + VantagePoint	Multiple countries
20	(Díaz et al., 2018)	Drought vulnerability assessment of cattle producers in the Sierras del Este-Uruguay: nteractions between actors and agents	Livestock	Implementation of innovations	SNA + GIS	Uruguay
21	(Díaz-José et al., 2016)	Innovation Diffusion in Conservation Agriculture: A Network Approach	Agriculture	Social learning: information and knowledge flow	SNA	Mexico

Table A1. Cont.

No.	Author/Year	Title	Thematic Area	Area of Main Contributions	Approach to/Instruments of Data Analysis	Location
22	(Fitjar and Timmermans, 2016)	Regional skill relatedness: towards a new measure of regional related diversification	Industry	Social capital	SNA	Norway
23	(Fuller et al., 2007)	Use of social network analysis to describe service links for farmers' mental health	Health	Social learning: information and knowledge flow	SNA	Australia
24	(Gava et al., 2017)	Knowledge networks and their role in shaping the relations within the Agricultural Knowledge and Innovation System in the agro-energy sector. The case of biogas in Tuscany (Italy)	Energy	Social learning: information and knowledge flow	SNA	Italy
25	(Giurca and Metz, 2018)	A social network analysis of Germany's wood-based bioeconomy: Social capital and shared beliefs	Economy	Social capital	SNA	Germany
26	(Sánchez et al., 2013)	Role of change agents in innovation adoption by smallholder sheep farmers	Livestock	Social learning: information and knowledge flow	SNA + statistical analysis (SPSS)	Mexico
27	(Govoeyi et al., 2020)	Social network analysis of practice adoption facing outbreaks of African Swine Fever	Livestock	Social learning: information and knowledge flow	SNA	Benin
28	(Herraiz Lizán et al., 2019)	Relational analysis in socially innovative initiatives. The case study of Alianza Mar Blava (Ibiza-Formentera)	Development	Social capital	SNA	Spain
29	(Isaac et al., 2014)	Migrant farmers as information brokers: agro-ecosystem management in the transition zone of Ghana	Agriculture	Social capital	SNA + statistical analysis	Ghana
30	(Isaac, 2012)	Agricultural information exchange and organizational ties: The effect of network topology on managing agrodiversity	Agriculture	Social learning: information and knowledge flow	SNA	Ghana
31	(Karampela et al., 2019)	Agritourism networks: empirical evidence from two case studies in Greece	Tourism	Social learning: information and knowledge flow	SNA	Greece
32	(Kofler et al., 2018)	The special characteristics of tourism innovation networks: The case of the Regional Innovation System in South Tyrol	Tourism	Implementation of innovations	SNA + others	Italy
33	(Kratzer and Ammering, 2019)	Rural innovations in biosphere reserves—A social network approach	Development	Implementation of innovations	SNA	Austria, Switzerland
34	(Labarthe, 2009)	Extension services and multifunctional agriculture. Lessons learnt from the French and Dutch contexts and approaches	Agriculture	Evaluation	SNA + Institutional Economic Analysis (IEA)	France, Netherlands
35	(Lamb et al., 2016)	A social networks approach for strengthening participation in technology innovation: lessons learnt from the Mount Elgon region of Kenya and Uganda	Agriculture	Social learning: information and knowledge flow	SNA	Kenya Uganda
36	(Leenders et al., 2007)	Innovation team networks: The centrality of innovativeness and efficiency	Human resources	Social learning: information and knowledge flow	SNA	Multiple countries
37	(Levy and Lubell, 2018)	Innovation, cooperation, and the structure of three regional sustainable agriculture networks in California	Agriculture	Implementation of innovations	SNA	United States

Table A1. Cont.

No.	Author/Year	Title	Thematic Area	Area of Main Contributions	Approach to/Instruments of Data Analysis	Location
38	(Li et al., 2011)	Relationships and evolving networks of rural manufacturing clusters: A case study in Yucheng County, Henan Province of China	Industry	Implementation of innovations	SNA	China
39	(Li et al., 2018)	Evolution Characteristics of Government-Industry-University- Research Cooperative Innovation Network for China's Agriculture and Influencing Factors: Illustrated according to Agricultural Patent Case	Agriculture	Implementation of innovations	SNA + triple-helix theory	China
40	(Lombardi et al., 2020)	Network impact of social innovation initiatives in marginalised rural communities	Agriculture	Evaluation	SNA + Social Innovation in Marginalized Rural Areas (SIMRA)	Italy
41	(Lopolito et al., 2011)	Innovation niches and socio-technical transition: A case study of bio-refinery production	Industry	Evaluation	SNA	Italy
42	(Magala et al., 2019)	Actor social networks as knowledge sharing mechanisms in multi-stakeholder processes: a case of coffee innovation platforms of Uganda	Agriculture	Social learning: information and knowledge flow	SNA + content analysis (Atlas ti)	Uganda
43	(Makkonen et al., 2018)	A social network analysis of cooperation in forest, mining and tourism industries in the Finnish-Russian cross-border region: connectivity, hubs and robustness	Development	Implementation of innovations	SNA	Finland, Russia
44	(Manzo et al., 2018)	Complex Contagions and the Diffusion of Innovations: Evidence from a Small-N Study	Pottery	Social learning: information and knowledge flow	SNA + computational models	India, Kenya
45	(Martinus, 2018)	Labor Networks Connecting Peripheral Economies to the National Innovation System	Economy	Social capital	SNA + econometric modeling	Australia
46	(Morone and Lopolito, 2011)	Socio-technical transition pathways and social networks: A toolkit for empirical innovation studies	Industry	Evaluation	SNA	Italy
47	(Nasitumbi et al., 2018)	Actor diversity and interactions in the development of banana hybrid varieties in Uganda: implications for technology uptake	Agriculture	Implementation of innovations	SNA + content analysis (NVivo)	Uganda
48	(Payumo et al., 2019)	Metrics-based profiling of university research engagement with Africa: research management, gender and internationalization perspective	Research	Social learning: information and knowledge flow	SNA + other (Scopus database)	Multiple countries
49	(Putra and Pedersen, 2018)	Biogas Technology Diffusion Among Farmers Through Rural Communication Network: A case from Indonesia	Energy	Social learning: information and knowledge flow	SNA	Indonesia
50	(Quiedeville et al., 2017)	Ex-post evaluation of the impacts of the science-based research and innovation program: a new method applied in the case of farmers' transition to organic production in the Camargue	Agriculture	Evaluation	SNA + Participatory Impact Pathway Analysis (PIPA) + others	France
51	(Quiédeville et al., 2018)	Using social network analysis to evaluate the impacts of the research: on the transition to organic farming in the Camargue	Agriculture	Evaluation	SNA	France

No.	Author/Year	Title	Thematic Area	Area of Main Contributions	Approach to/Instruments of Data Analysis	Location
52	(Reed and Hickey, 2016)	Contrasting innovation networks in smallholder agricultural producer cooperatives: Insights from the Niayes Region of Senegal	Agriculture	Social learning: information and knowledge flow	SNA	Senegal
53	(Reidolf, 2016)	Knowledge networks and the nature of knowledge relationships of innovative rural SMEs	Economy	Social learning: information and knowledge flow	SNA + content analysis	Estonia
54	(Rendón-Rendón et al., 2019)	The social fabric of cheese agro-industry: cooperation and competition aspects	Industry	Implementation of innovations	SNA	Mexico
55	(Rockenbauch et al., 2019)	Do translocal networks matter for agricultural innovation? A case study on advice sharing in small-scale farming communities in Northeast Thailand	Agriculture	Social capital	SNA + statistical analysis (Stata)	Thailand
56	(Romeiro and Costa, 2010)	The potential of management networks in the innovation and competitiveness of rural tourism: a case study on the Valle del Jerte (Spain)	Tourism	Implementation of innovations	SNA + others (Likert scaling method)	Spain
57	(Saint Ville et al., 2016)	Exploring the role of social capital in influencing knowledge flows and innovation in smallholder farming communities in the Caribbean	Agriculture	Social capital	SNA + Socio-Spatial Knowledge Network (SSKN)	Saint Lucia
58	(Saint Ville et al., 2017)	How do stakeholder interactions influence national food security policy in the Caribbean? The case of Saint Lucia	Policies	Other (policies)	SNA + content analysis (MAXQDA)	Saint Lucia
59	(Sánchez Herrera and Dimitri, 2019)	The role of clustering in the adoption of organic dairy: a longitudinal networks analysis between 2002 and 2015	Livestock	Implementation of innovations	SNA + Google maps	United States
60	(Skaalsveen et al., 2020)	The role of farmers' social networks in the implementation of no-till farming practices	Agriculture	Social learning: information and knowledge flow	SNA + content analysis (NVivo)	England
61	(Spielman et al., 2011)	Rural innovation systems and networks: findings from a study of Ethiopian smallholders	Agriculture	Social learning: information and knowledge flow	SNA + Participatory Rural Appraisal (PRA)	Ethiopia
62	(Sreeram and Gupta, 2018)	An innovation system perspective of two dairy value chains in Kerala	Livestock	Implementation of innovations	SNA	India
63	(Unay et al., 2015)	Adoption of agri-environmental measures by organic farmers: the role of interpersonal communication	Agriculture	Social learning: information and knowledge flow	SNA + logit model	Germany
64	(Villarroel- Molina et al., 2019)	Use of social networks to explore smallholder's adoption of technologies in dual-purpose farms	Livestock	Social learning: information and knowledge flow	SNA	Mexico
65	(Vishnu et al., 2019)	Diversity, complexity and structure of social networks: Study of a smallholder dairy project	Livestock	Social learning: information and knowledge flow	SNA + Participatory Rural Appraisal (PRA)	India
66	(Weyori et al., 2018)	Agricultural innovation systems and farm technology adoption: findings from a study of the Ghanaian plantain sector	Agriculture	Social learning: information and knowledge flow	SNA + Heckman model	Ghana

Table A1. Cont.

No.	Author/Year	Title	Thematic Area	Area of Main Contributions	Approach to/Instruments of Data Analysis	Location
67	(Woodland and Mazur, 2019)	Examining capacity for "cross-pollination" in a rural school district: A social network analysis case study	Education	Implementation of innovations	SNA	United States
68	(Zheng and Liu, 2018)	Identification of focal actors in the translation of the rural tourism actor-network: a case in China	Tourism	Implementation of innovations	SNA	China

References

- 1. Van Lancker, J.; Mondelaers, K.; Wauters, E.; Van Huylenbroeck, G. The Organizational Innovation System: A Systemic Framework for Radical Innovation at the Organizational Level. *Technovation* **2015**, *52–53*, 40–50. [CrossRef]
- Tödtling, F.; Trippl, M. One Size Fits All?: Towards a Differentiated Regional Innovation Policy Approach. *Res. Policy* 2005, 34, 1203–1219. [CrossRef]
- Putra, A.R.S.; Pedersen, S.M. Biogas Technology Diffusion Among Farmers Through Rural Communication Network: A Case from Indonesia. J. Rural. Community Dev. 2018, 13, 107–118.
- Kratzer, A.; Ammering, U. Rural Innovations in Biosphere Reserves—A Social Network Approach. J. Rural Stud. 2019, 71, 144–155. [CrossRef]
- 5. Dargan, L.; Shucksmith, M. LEADER and Innovation. Sociol. Rural. 2008, 48, 274–291. [CrossRef]
- 6. Martens, K.; Wolff, A.; Hanisch, M. Understanding Social Innovation Processes in Rural Areas: Empirical Evidence from Social Enterprises in Germany. *Soc. Enterp. J.* **2020**, *17*, 220–239. [CrossRef]
- Onitsuka, K. How Social Media Can Foster Social Innovation in Disadvantaged Rural Communities. Sustainability 2019, 11, 2697. [CrossRef]
- 8. Eder, J. Innovation in the Periphery: A Critical Survey and Research Agenda. Int. Reg. Sci. Rev. 2019, 42, 119–146. [CrossRef]
- 9. Simmel, G. The Problem of Sociology. Am. J. Sociol. 1909, 15, 289-320. [CrossRef]
- Dufays, F.; Huybrechts, B. Connecting the Dots for Social Value: A Review on Social Networks and Social Entrepreneurship Connecting the Dots for Social Value: A Review on Social Networks and Social Entrepreneurship. J. Soc. Entrep. 2014, 5, 214–237. [CrossRef]
- 11. Spielman, D.J.; Davis, K.; Negash, M.; Ayele, G. Rural Innovation Systems and Networks: Findings from a Study of Ethiopian Smallholders. *Agric. Hum. Values* **2011**, *28*, 195–212. [CrossRef]
- 12. European Commission. Innovation Management and the Knowledge-Driven Economy; European Commission: Brussels, Belgium, 2004.
- 13. Hlebec, V.; Filipovic Hrast, M.; Kogovsek, T. Social Networks in Slovenia. Eur. Soc. 2010, 12, 697–717. [CrossRef]
- 14. Jackson, M.O. Social and Economic Networks; Princeton University Press: Princeton, NJ, USA, 2010.
- 15. Romeiro, P.; Costa, C. The Potential of Management Networks in the Innovation and Competitiveness of Rural Tourism: A Case Study on the Valle Del Jerte (Spain). *Curr. Issues Tour.* **2010**, *13*, 75–91. [CrossRef]
- Jacobsen, E.; Beers, P.J.; Fischer, A.R.H. Inventions for Future Sustainable Development in Agriculture. In *The TransForum Model: Transforming Agro Innovation Toward Sustainable Development*; Van Latesteijn, H., Andeweg, K., Eds.; Springer: Dordrecht, The Netherlands, 2010; pp. 1–162. [CrossRef]
- 17. Reed, M.S.; Evely, A.C.; Cundill, G.; Fazey, I.; Glass, J.; Laing, A.; Newig, J.; Parrish, B.; Prell, C.; Raymond, C.; et al. What Is Social Learning? *Ecol. Soc.* 2010, *15*, r1. [CrossRef]
- 18. Rivera, M.; Knickel, K.; María Díaz-Puente, J.; Afonso, A. The Role of Social Capital in Agricultural and Rural Development:Lessons Learnt from Case Studies in Seven Countries. *Sociol. Rural.* **2019**, *59*, 66–91. [CrossRef]
- 19. Granovetter, M.S. The Strength of Weak Ties. Am. J. Sociol. 1973, 78, 1360–1380. [CrossRef]
- 20. Klerkx, L.; Proctor, A. Beyond Fragmentation and Disconnect: Networks for Knowledge Exchange in the English Land Management Advisory System. *Land Use Policy* **2013**, *30*, 13–24. [CrossRef]
- 21. Cofré-Bravo, G.; Klerkx, L.; Engler, A. Combinations of Bonding, Bridging, and Linking Social Capital for Farm Innovation: How Farmers Configure Different Support Networks. *J. Rural Stud.* **2019**, *69*, 53–64. [CrossRef]
- 22. Tregear, A.; Cooper, S. Embeddedness, Social Capital and Learning in Rural Areas: The Case of Producer Cooperatives. *J. Rural Stud.* **2016**, *44*, 101–110. [CrossRef]
- 23. Snyder, H. Literature Review as a Research Methodology: An Overview and Guidelines. J. Bus. Res. 2019, 104, 333–339. [CrossRef]
- Liberati, A.; Altman, D.G.; Tetzlaff, J.; Mulrow, C.; Ioannidis, J.P.A.; Clarke, M.; Devereaux, P.J.; Kleijnen, J.; Moher, D. The PRISMA Statement for Reporting Systematic Reviews and Meta-Analyses of Studies That Evaluate Health Care Interventions: Explanation and Elaboration. *Ann. Intern. Med.* 2009, 151, W65–W94. [CrossRef] [PubMed]
- 25. Freeman, L.C. The Development of Social Network Analysis: A Study in the Sociology of Science; Empirical Press: New York, NY, USA, 2004.

- 26. Bourne, M.; Gassner, A.; Makui, P.; Muller, A.; Muriuki, J. A Network Perspective Filling a Gap in Assessment of Agricultural Advisory System Performance. *J. Rural Stud.* **2017**, *50*, 30–44. [CrossRef]
- Reidolf, M. Knowledge Networks and the Nature of Knowledge Relationships of Innovative Rural SMEs. *Eur. J. Innov. Manag.* 2016, 19, 317–336. [CrossRef]
- 28. Quiédeville, S.; Barjolle, D.; Stolze, M. Using Social Network Analysis to Evaluate the Impacts of the Research: On the Transition to Organic Farming in the Camargue. *Cah. Agric.* **2018**, *27*, 15012. [CrossRef]
- 29. Gillieatt, S.; Fernandes, C.; Fielding, A.; Hendrick, A.; Matthews, R.; Matthews, S. Social Network Analysis and Social Work Inquiry. *Aust. Soc. Work* 2015, *68*, 338–351. [CrossRef]
- Giurca, A.; Metz, T. A Social Network Analysis of Germany's Wood-Based Bioeconomy: Social Capital and Shared Beliefs. Environ. Innov. Soc. Transit. 2018, 26, 1–14. [CrossRef]
- 31. Herraiz Lizán, C.; Vercher Savall, N.; Esparcia Pérez, J. Análisis Relacional En Iniciativas Socialmente Innovadoras. El Caso de Estudio de Alianza Mar Blava (Ibiza-Formentera). *Cuad. Geográficos* **2019**, *58*, 83–102. [CrossRef]
- 32. Guerrero-Ocampo, S.B.; Díaz-Puente, J.M.; Nuñez Espinoza, J.F. Multi-Actor Partnerships for Agricultural Interactive Innovation: Findings from 17 Case Studies in Europe. *Land* **2022**, *11*, 1847. [CrossRef]
- 33. Saint Ville, A.S.; Hickey, G.M.; Locher, U.; Phillip, L.E. Exploring the Role of Social Capital in Influencing Knowledge Flows and Innovation in Smallholder Farming Communities in the Caribbean. *Food Secur.* **2016**, *8*, 535–549. [CrossRef]
- 34. Rockenbauch, T.; Sakdapolrak, P.; Sterly, H. Do Translocal Networks Matter for Agricultural Innovation? A Case Study on Advice Sharing in Small-Scale Farming Communities in Northeast Thailand. *Agric. Hum. Values* **2019**, *36*, 685–702. [CrossRef]
- 35. Isaac, M.E.; Anglaaere, L.C.N.; Akoto, D.S.; Dawoe, E. Migrant Farmers as Information Brokers: Agroecosystem Management in the Transition Zone of Ghana. *Ecol. Soc.* **2014**, *19*, 56. [CrossRef]
- 36. Carson, D.A.; Carson, D.B. International Lifestyle Immigrants and Their Contributions to Rural Tourism Innovation: Experiences from Sweden's Far North. *J. Rural Stud.* **2018**, *64*, 230–240. [CrossRef]
- Martinus, K. Labor Networks Connecting Peripheral Economies to the National Innovation System. Ann. Am. Assoc. Geogr. 2018, 108, 845–863. [CrossRef]
- Fitjar, R.D.; Timmermans, B. Regional Skill Relatedness: Towards a New Measure of Regional Related Diversification. *Eur. Plan.* Stud. 2016, 25, 516–538. [CrossRef]
- Isaac, M.E. Agricultural Information Exchange and Organizational Ties: The Effect of Network Topology on Managing Agrodiversity. *Agric. Syst.* 2012, 109, 9–15. [CrossRef]
- 40. Sanya, L.N.; Sseguya, H.; Kyazze, F.B.; Baguma, Y.; Kibwika, P. Actor Diversity and Interactions in the Development of Banana Hybrid Varieties in Uganda: Implications for Technology Uptake. *J. Agric. Educ. Ext.* **2018**, *24*, 153–167. [CrossRef]
- Bodin, Ö.; Crona, B.I. The Role of Social Networks in Natural Resource Governance: What Relational Patterns Make a Difference? Glob. Environ. Chang. 2009, 19, 366–374. [CrossRef]
- 42. Woodland, R.H.; Mazur, R. Examining Capacity for "Cross-Pollination" in a Rural School District: A Social Network Analysis Case Study. *Educ. Manag. Adm. Leadersh.* 2019, 47, 815–836. [CrossRef]
- 43. Reed, G.; Hickey, G.M. Contrasting Innovation Networks in Smallholder Agricultural Producer Cooperatives: Insights from the Niayes Region of Senegal. *J. Co-Oper. Organ. Manag.* **2016**, *4*, 97–107. [CrossRef]
- Karampela, S.; Kavroudakis, D.; Kizos, T. Agritourism Networks: Empirical Evidence from Two Case Studies in Greece. Curr. Issues Tour. 2019, 22, 1460–1479. [CrossRef]
- 45. Crowley, C.; McAdam, M.; Cunningham, J.A.; Hilliard, R. Community of Practtice, a Flexible Construct for Understanding SME Networking Roles in the Irish Artisan Cheese Sector. *J. Rural Stud.* **2018**, *24*, 68–84. [CrossRef]
- Cox, J.; Sseguya, H.; Kyazze, F.; Mkomwa, S.; Okello, D. ICTs for Conservation Agriculture: Influence of Actor Positioning in Knowledge Networks in Laikipia and Machakos Counties, Kenya. *Rural Ext. Innov. Syst. J.* 2018, 14, 24–33. [CrossRef]
- 47. Weyori, A.E.; Amare, M.; Garming, H.; Waibel, H. Agricultural Innovation Systems and Farm Technology Adoption: Findings from a Study of the Ghanaian Plantain Sector. *J. Agric. Educ. Ext.* **2018**, *24*, 65–87. [CrossRef]
- 48. Vishnu, S.; Gupta, J.; Padmaja, S.S. Diversity, Complexity, and Structure of Social Networks: Study of a Smallholder Dairy Project. *Outlook Agric.* **2019**, 49, 245–255. [CrossRef]
- 49. Sánchez, J.; Rendón, R.; Cervantes, F.; Quito, T. Role of Change Agents in Innovation Adoption by Smallholder Sheep Farmers. *Rev. Mex. Cienc. Pecu.* **2013**, *4*, 305–318.
- Oriana, V.M.; Cecilio, B.C.; Antón Rafael, G.M.; Jaime, R. Use of Social Networks to Explore Smallholder's Adoption of Technologies in Dual Purpose Farms. ESIC Mark. Econ. Bus. J. 2019, 50, 233–257. [CrossRef]
- Díaz-José, J.; Rendón-Medel, R.; Govaerts, B.; Aguilar-Ávila, J.; Muñoz-Rodriguez, M. Innovation Diffusion in Conservation Agriculture: A Network Approach. Eur. J. Dev. Res. 2016, 28, 314–329. [CrossRef]
- 52. Skaalsveen, K.; Ingram, J.; Urquhart, J. The Role of Farmers' Social Networks in the Implementation of No-till Farming Practices. *Agric. Syst.* **2020**, *181*, 102824. [CrossRef]
- Gailhard, İ.U.; Bavorová, M.; Pirscher, F. Adoption of Agri-Environmental Measures by Organic Farmers: The Role of Interpersonal Communication. J. Agric. Educ. Ext. 2015, 21, 127–148. [CrossRef]
- Govoeyi, B.; Agbokounou, A.M.; Camara, Y.; Ahounou, S.G.; Dotche, I.O.; Kiki, P.S.; Abdou Karim, I.Y.; Delabouglise, A.; Antoine-Moussiaux, N. Social Network Analysis of Practice Adoption Facing Outbreaks of African Swine Fever. *Prev. Vet. Med.* 2020, 179, 105008. [CrossRef]

- 55. Manzo, G.; Gabbriellini, S.; Roux, V.; M'Mbogori, F.N. Complex Contagions and the Diffusion of Innovations: Evidence from a Small-N Study. *J. Archaeol. Method Theory* **2018**, *25*, 1109–1154. [CrossRef]
- Rendón-Rendón, M.C.; Espinoza, J.F.N.; Soriano-Robles, R.; Ortiz, V.E.E.; Pérez, L.M.C.; Jiménez-Jiménez, R.A. The Social Fabric of Cheese Agroindustry: Cooperation and Competition Aspects. *Sustainability* 2019, 11, 2921. [CrossRef]
- 57. Brønd, F. Territory and Trade Networks in the Small-Scale Oil-Palm Industry in Rural Ghana. *Appl. Geogr.* **2018**, *100*, 90–100. [CrossRef]
- 58. Cowell, M.; Lyon-Hill, S.; Tate, S. It Takes All Kinds: Understanding Diverse Entrepreneurial Ecosystems. J. Enterprising Communities 2018, 12, 178–198. [CrossRef]
- Carson, D.A.; Carson, D.B.; Hodge, H. Understanding Local Innovation Systems in Peripheral Tourism Destinations. *Tour. Geogr.* 2014, 16, 457–473. [CrossRef]
- Makkonen, T.; Hokkanen, T.J.; Morozova, T.; Suharev, M. A Social Network Analysis of Cooperation in Forest, Mining and Tourism Industries in the Finnish–Russian Cross-Border Region: Connectivity, Hubs and Robustness. *Eurasian Geogr. Econ.* 2018, 59, 685–707. [CrossRef]
- 61. Quiedeville, S.; Barjolle, D.; Mouret, J.-C.; Stolze, M. Ex-Post Evaluation of the Impacts of the Science-Based Research and Innovation Program: A New Method Applied in the Case of Farmers' Transition to Organic Production in the Camargue. *J. Innov. Econ. Manag.* **2017**, *22*, 145–170. [CrossRef]
- 62. Lombardi, M.; Lopolito, A.; Andriano, A.M.; Prosperi, M.; Stasi, A.; Iannuzzi, E. Network Impact of Social Innovation Initiatives in Marginalised Rural Communities. *Soc. Netw.* **2020**, *63*, 11–20. [CrossRef]

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