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Agroecological innovations, social technologies and family farming. A review

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Abstract | This paper is a review of articles that address the relationship between Social Technology, Agroecological Innovations and Family Farming considering their convergence in food production. A search was carried out in the academic databases of Web of Science (WOS), Scopus (Elsevier), Agris, Google Scholar and CAPES journal database. By starting an analysis matrix that included the type of study, the conceptual framework, the methodology and the object of study, 16 articles were selected. In the study, a series of coincidences were identified about the type of study, the methodology, the object of study, and the concepts used. An approach that focuses on the role of agroecological innovations outside the specific experiences with a focus on understanding the own agroecological innovation system where the role of social technologies is fundamental as long as it is considered as elements that strengthen the agroecological transition processes and not as palliatives or as technologies with low intensity in knowledge.

Keywords: Agroecological transition, social innovations, Family farming, Food sovereignty.

Innovaciones agroecológicas, tecnologías sociales y agricultura familiar. Una revisión

Resumen | Este trabajo es una revisión sistemática de artículos que abordan la relación entre Tecnología Social, Innovaciones Agroecológicas y Agricultura Familiar considerando su convergencia en la producción de alimentos. Se realizó una búsqueda en las bases de datos académicas de Web of Science (WOS), Scopus (Elseiver), Agris, Google Scholar y la base de datos de revistas CAPES. A partir de una matriz de análisis que incluía el tipo de estudio, el marco conceptual, la metodología y el objeto de estudio, se seleccionaron 16 artículos. En el estudio se identificaron una serie de coincidencias sobre el tipo de estudio, la metodología, el objeto de estudio y los conceptos utilizados. Un enfoque que se centra en el papel de las innovaciones agroecológicas fuera de las experiencias específicas con un enfoque en la comprensión del propio sistema de innovación agroecológica donde el papel de las tecnologías sociales es fundamental siempre y cuando se considere como elementos que fortalecen los procesos de transición agroecológica y no como paliativos o como tecnologías de baja intensidad en el conocimiento.

Palabras clave: Transición Agroecologica, Soberania alimentaria, Agricultura Familiar, Soberanía alimentaria.

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1 Introduction

Agroecological Innovations (AIE) constitute a field of scientific studies and practices that seek to stop the degradation and exploitation of nature and society through collective social actions of a participatory nature in the search for the implementation of alternative agricultural systems to depredatory agribusiness seeking to enhance ecological biodiversity and sociocultural diversity (Toledo, 2002; Altieri y Nicholls, 2010; Levidow et al., 2021; Altieri y Nicholls, 2021).

The proposal of social technology (ST), on the other hand, meets such assumptions, contributing to the debate by inserting the role of technologies to reduce socioeconomic inequalities in a framework of social inclusion (Thomas et al., 2021; Fonseca y Serafim, 2009; De Brito Dias, 2011; Dagnino, 2009).

These occur within the framework of family farming (FA), which is recognized as the desired segment to materialize proposals for a more just and egalitarian future, given its potential characteristics of resisting monoculture and land concentration, interacting with local culture (Grisa, 2009; Schwab et al., 2020; Acevedo-Osorio, 2018), where food production (FP) is one of the fundamental axes, since its objective is to facilitate access to food for a large portion of the population, rescuing and protecting their eating habits within a framework of promoting food sovereignty.

As we have argued, social technology, agroecological innovations, family farming and food production are themes that converge not only in the space of practices but also in the conceptions that guide them. Particularly when we refer to accessibility, safety, health and food sovereignty for broad sectors of the population.

Considering this convergence we have identified as a gap the lack of studies that integrate the themes planted in the region. By means of a literature review, we will identify the approaches in recent literature that address Social Technology, Agroecological Innovations and Family Farming considering their convergence in food production.

In this context, the problem of this research is configured from the understanding of the characteristics of scientific studies and how they present agroecological innovations, social technology, family farming and food production. In order to answer this problem, the research aims to analyze the convergences between Agroecological Innovations, Social Technology and Family Farming discussed in the literature.

To achieve our objective we initially conducted a search of open access papers in the academic databases Web of Science (WOS), Scopus (Elsevier), Agris, Google Scholar and CAPES journal database using the following search term: Agroecological Innovations and Social Technology and Family Farming.

From the preliminary analysis and the research gap found it is possible to justify its realization from the following considerations, the first of them based on the theoretical contribution, which aims to contribute from the analysis of the concepts, theoretical framework objectives and main findings of the studies analyzed on a series of issues that, generally, are not considered as a research topic current literature.

Another element with which the study intends to contribute is in the design of public policies and rural extension actions aimed at generating sustainable rural development processes contributing elements to be incorporated. Finally, the application of the review method can provide a practical example of the application of the literature review methodology.

2 Theoretical review

Critics of the Green Revolution model mockingly refer to it as an effort to "modernize" rural areas out of their own perceived "backwardness" (Caporal y Costabeber, 2004). In contrast, these critics have called for the support of traditional farming techniques that hold untapped potential. They advocate for a knowledge-driven, agroecological approach that employs resources available locally, and promotes sustainable agriculture both eco-

Tabla 1: Search conducted in the databases

Database	Search Terms	Result	Duplicates	Excluded	Final Result
Social Science CitationIndex (Web ofScience)	Agroecological Innovation and Social Technologyand Family Farming	14	2	11	1
Scopus (Elseiver)	Agroecological Innovation and Social Technologyand Family Farming	29	0	24	5
Agris	Agroecological Innovation and Social Technologyand Family Farming	13	2	13	0
Google Scholar	Agroecological Innovation and Social Technologyand Family Farming	16600	9	16591	7
CAPES	Agroecological Innovation and Social Technologyand Family Farming	31	4	6	3

Fuente: Author, 2021.

nomically and environmentally (Caporal y Costabeber, 2004: 79).

However, the dominant models of innovation, management, markets, and nature often have formidable obstacles that must be overcome to be successful in these endeavors.

In 1983, Altieri defined agroecology as "the scientific basis of alternative agriculture". Wezel and soldat (2009) demonstrated that by utilizing inputs based on internal knowledge, agroecosystems mimic ecological processes to cycle nutrients within and outside production units and conserve biodiversity. As Altieri pointed out in 2002, initially, these traditional practices were rooted in a social agricultural agenda designed to resist capitalist modernization, especially the techno-diffusionist model of the Green Revolution.

The role of resistance has been taken on by family farming, which is polysemic due to its varied theoretical definition, political definition, and public policy definition. Despite this, there are certain actions taken by family farming and its organizations that seek to transform the field, markets, and society (Altieri y Nicholls, 2008; Altieri y Toledo, 2011; Martínez-Torres y Rosset, 2014). In the 1990s, agroecology shifted from focusing on field and agro-ecosystem scales to a broader concentration on the entire food system, described as an international network of food production, distribution, and consumption (Wezel y Soldat, 2009).

Aiming to change this system, agroecology has been politically articulated as "the ecological management of natural resources through forms of collective social action that help to address social and environmental crises, thus countering neoliberalism and economic globalization" (Sevilla Guzmán 2006, 9). Without transformational strategies, agroecology will be relegated to marginal niches or different technologies to make agro-industrial systems greener (Levidow et al., 2021). It therefore does not arise in isolation, but in networks, assuming that regional configurations are inscribed on territories, not necessarily in terms of borders and responsibilities, but in technical, political, productive commonalities and relationships in areas such as ecology, ecology, etc., including innovative approaches to solving problems common to a wide range of sectors.

To strengthen family farming, the agroecological agenda seeks to increase their natural resource base, productivity and livelihoods. Basically, as Caporal and Costabeber (2004) point out, agroecology is the best way to organize production when ecosocial parameters take precedence over profit and commodity production.

In this regard, agroecological practices "restore local self-sufficiency, conserve and regenerate agrobiodiversity from natural resources, produce healthy food with low [external] inputs, and strengthen farmer organizations" (Altieri y Toledo, 2011). Rosset and Martinez-Torres point out that for family farmers and their movements, agroecology contributes to financial autonomy, environmental recovery and social cohesion. (**?**: 17). This perspective fosters linkages between farmer organizations, consumer-citizen groups, and social movements. Various programs have helped farming families increase their self-esteem, improve their agro-ecological practices and diversify their production (Grisa, 2009).

Since then, agroecological initiatives have also established short, direct-to-consumer food supply chains based on consumer purchases that support cooperative labor organizations and environmentally responsible practices. Small producers bypass traditional markets, avoiding the sterile competition they promulgate.

Agroecology practitioners have established knowledge sharing processes that link to sociotechnical concepts. This concept promotes collective skills, inclusion and socioeconomic justice, as well as the adaptation of manual skills in new ways instead of relying on technology (Dagnino, 2009; Fressoli y Dias, 2014; Instituto de Tecnologia Social, 2004). Through social technology, production methods can be developed, consolidated and cheaply accessed by producers, allowing them to replicate these methods in multiple locations.

In Latin America we can highlight two perspectives that have had great influence in terms of processes linking academia and social organizations, theory and practice. The first of these is the concept of Social Technology (ST) adopted by agroecology practitioners and support organizations. The second initiative, known as Technologies for Social Inclusion, came to fruition in 2009. This endeavor witnessed a group of researchers embarking on a transformative journey, incorporating an array of analytical elements and inquiries. They adopted novel approaches to actively involve non-academic stakeholders and took explicit political stances, aiming to effect positive interventions within the realms of inclusive and sustainable development dynamics (Thomas et al., 2021).

3 Methodology

The approach of this research will be eminently qualitative and exploratory in nature. The literature review used was intended to collect and critically analyze the studies or research papers identified by means of a classification process to identify, evaluate and interpret the work of researchers, scholars and professionals in a selected field of study.

The methodological guidelines of this work are in dialogue with Kitchenham & Charters (2007) as from: establishing a review protocol that specifies the research question, establishing a strategy aimed at finding the largest literature available on the subject by establishing precise and explicit exclusion and inclusion criteria.

This research was developed in two stages. The first of them, from the review of the literature in order to obtain information needed to incorporate into the theoretical framework of the study, proving the existence of the variables studied in the theme of the study and the identification of possible gaps in knowledge. In a second moment, the studies found were analyzed, having as axis the research objectives.

The set of keywords was searched in the electronic databases Social Science Citation Index (Web of Science), Scopus (Elsevier), Agris (FAO) and Google Scholar between June 10 and July 10, 2021, using the "Portal Periódicos" CAPES (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior) platform.

Keywords related to the theme of the study in English were used as search terms in order to access the most relevant international studies with the following words in the three databases: Social Technology and Agroecological Innovation and Family Farm.

As inclusion criteria, it was considered that the document: be an article published in a peer-reviewed, open access journal, have been pub-

Tabla 2: Articles selected for analysis

Author/s	Title	Year	Name of the Journal
Sage, Colin	The transition movement and food sovereignty: from local resilience to global engagement in food system transformation	2014	Journal of Consumer Culture
Ortiz, Willington ; Vilsmaier, Ulli	The diffusion of sustainable family farming practices in Colombia: an emerging sociotechnical niche?	2018	Sustainability Science,
Blesh, Jennifer; Wolf, Steven	Transitions to agroecological farming systems in the Mississippi River Basin: toward an integrated socioecological analysis	2014	Agriculture and Human Values
Schiller, Katharina J.F; Klerkx, Laurens; Poortvliet, P. Marijn ; Godek, Wendy	Exploring barriers to the agroecological transition in Nicaragua: A Technological Innovation Systems Approach	2020	Agroecology and sustainable food systems
Pereira, Laura; Wynberg, Rachel; Reis, Yuna	Agroecology: The Future of Sustainable Farming?	2018	0
Gaitán-Cremaschi, Daniel; Klerkx, Laurens; Duncan, Jessica; Trienekens, Jacques H; Huenchuleo, Carlos; Dogliotti, Santiago; Contesse, María E; Rossing, Walter A. H	Characterizing diversity of food systems in view of sustainability transitions. A review	2019	Agronomy for Sustainable Development, Vol.39(1)
Hu, Zhanping	What Socio-Economic and Political Factors Lead to Global Pesticide Dependence? A Critical Review from a Social Science Perspective	2020	International Journal of Environmental Research and Public Health
Oscar José Rover, Bernardo Corrado de Gennaro and Luigi Roselli	Social innovation and sustainable rural development: The case of a Brazilian agroecology network.	2016	Sustainability, vol. 9, no. 1, p. 1-14.
GOULET, Frédéric.	Family farming and the emergence of an alternative sociotechnical imaginary in Argentina.	2020	Science, Technology and Society, v. 25, n. 1, p. 86-105, 2020.
ALTIERI, Miguel A.; TOLEDO, Victor Manuel.	The agroecological revolution in Latin America: rescuing nature, ensuring food sovereignty and empowering peasants.	2011	Journal of peasant studies, v. 38, n. 3, p. 587-612
ALTIERI, Miguel A.; FUNES-MONZOTE, Fernando R.; PETERSEN, Paulo.	Agroecologically efficient agricultural systems for smallholder farmers: contributions to food sovereignty.	2012	Agronomy for sustainable development, v. 32, n. 1, p. 1-13, 2012.
MARCHETTI, Livia et al. .	Beyond sustainability in food systems: perspectives from agroecology and social innovation	2020	Sustainability, v. 12, n. 18, p. 7524, 2020
LACOMBE, Camille; COUIX, Nathalie; HAZARD, Laurent.	Designing agroecological farming systems with farmers: A review.	2018	Agricultural systems, v. 165, p. 208-220, 2018
EL BILALI, Hamid.	Innovation-sustainability nexus in agriculture transition: case of agroecology.	2019	Open Agriculture, v. 4, n. 1, p. 1-16, 2019.
PIMBERT, Michel.	Agroecology as an alternative vision to conventional development and climate-smart agriculture.	2015	Development 58
JUÁREZ, Paula et al.	Transformative social innovation for food sovereignty: The disruptive alternative.	2018	The International Journal of Sociology of Agriculture and Food, v. 24, n. 3

Fuente: Author, 2021.

lished between the years 2010 and 2020, be focused on the American continent, within the agroecology topic and be written in English.

As exclusion criteria, through analysis of the abstract or full text, articles that were not linked to the objective or the theme proposed by the study and those that did not fit the inclusion conditions were excluded. As in most bases (WoS, Scopus, Agris, Periódicos da CAPES) the search results were relatively small, so it was possible to verify that the information contained in the articles published in them were related, in whole or in part, to the objective of our research question and identified gap.

In the case of the Google academic database, it was used from the need to complement results on the research since the results were reduced in the bases used the inclusion and exclusion criteria previously determined. This reduced characteristic allowed him to check the basic information of the content of each article in its title, abstract.

Considering that the number of articles in the databases was relatively low for the selection, the introduction, theoretical framework and conclusion were also read in order to check if they were related to the objective of our research. In the base belonging to the International System for Agricultural Science and Technology (Agris-FAO) the selected articles were duplicated in other bases. Thus, our research was consolidated in 16 selected articles as shown in Table 1.

After the exclusions step, 16 articles remained to be analyzed in this study and are presented in Table 2.

From the analysis of the sixteen selected articles it was structured an analysis matrix contemplating the type of study; conceptual framework; methodology; object of study. This matrix served to organize and systematize the content in general of the articles selected for our study guiding our research as shown in Figure 1.

4 Analysis and discussion of the data

In this section we will begin the analysis of the information contained in the articles, starting with the key words contained in them since they configured a fundamental part for the selection. The same was performed on the online platform https://www.wordclouds.com/ with the final result as shown in Figure 2.

As can be seen, the key words that stand out in the tool are Latin-America, Sustainability-transitions, food sovereignty, agroecology, agricultural innovation systems, family-farming. This is an indicator of the themes that are most prevalent in the papers.

The use of these keywords is not only an indicator of the most frequently used themes but also of possible research gaps. The word cloud clearly shows the region where the experiences and cases analyzed are located (LA), the technology to be used (agroecology), the process to be developed (sustainable transitions), the expected result (innovative agroecological systems), the actor that can develop this process (family farming) and the expected end result (food sovereignty).

4.1 About the type of study

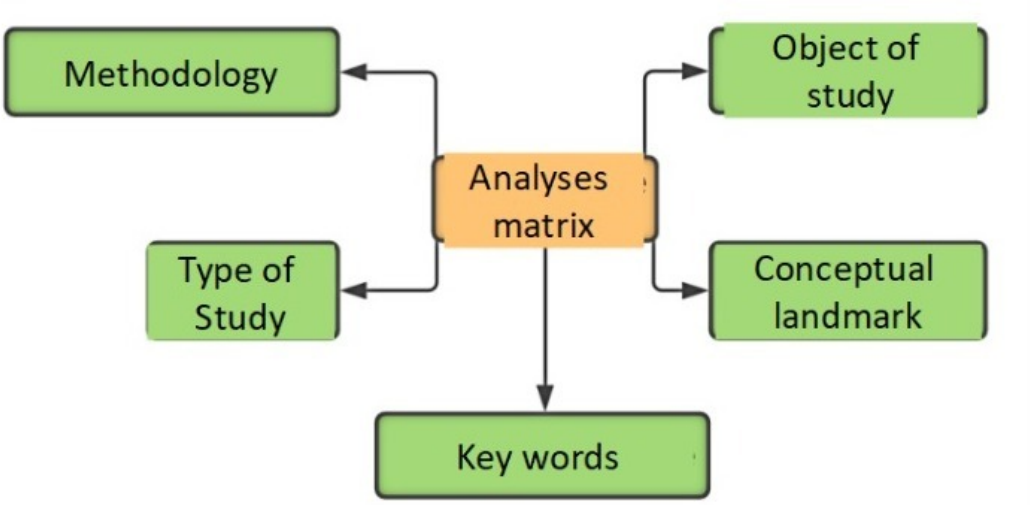
Considering the sixteen studies analyzed the type of study that prevails and the case study with 10 studies that use it, 4 literature review studies, one conceptual analysis and desk research.

This is an indicator of how the articles draw heavily on practical experiences to make their points and apply the conceptual categories in their theoretical analysis

4.2 About the methodology used

As can be seen in Table 5. Of the sixteen studies selected, the use of qualitative methodologies prevails and the use of quantitative methods is not found in them. The systematic literature review is used by four of them, the theoretical-conceptual analysis by two of them, the rest uses in-depth interviews, comparative case analysis, secondary data analysis, in-depth interviews and participant observation. It highlights the use of the Case-based Mutual Learning Session (cbMLS) and the 3-D

Figure 1: Matrix of the analysis used



Fuente: Author, 2021.

Tabla 3: Type of study

Title	Type of study
The transition movement and food sovereignty: from local resilience to global engagement in food system transformation	Case Study
The diffusion of sustainable family farming practices in Colombia: an emerging sociotechnical niche?	Case Study
Transitions to agroecological farming systems in the Mississippi River Basin: toward an integrated socioecological analysis	Case Study
Exploring barriers to the agroecological transition in Nicaragua: A Technological Innovation Systems Approach	Case Study
Agroecology: The Future of Sustainable Farming?	Case Study
Characterizing diversity of food systems in view of sustainability transitions. A review	Literature review
What Socio-Economic and Political Factors Lead to Global Pesticide Dependence? A Critical Review from a Social Science Perspective	Literature review
Social innovation and sustainable rural development: The case of a Brazilian agroecology network.	Case Study
Family farming and the emergence of an alternative sociotechnical imaginary in Argentina.	Case Study
The agroecological revolution in Latin America: rescuing nature, ensuring food sovereignty and empowering peasants.	Case Study
Agroecologically efficient agricultural systems for smallholder farmers: contributions to food sovereignty.	Case Study
Beyond sustainability in food systems: perspectives from agroecology and social innovation	Desk Research
Designing agroecological farming systems with farmers: A review.	Literature review
Innovation-sustainability nexus in agriculture transition: case of agroecology.	Literature review
Agroecology as an alternative vision to conventional development and climate-smart agriculture.	Theoretical/ conceptual analysis
Transformative social innovation for food sovereignty: The disruptive alternative.	Case Study

Fuente: Author, 2021.

Tabla 4: Methodology used

Title	Methodology used
The transition movement and food sovereignty:from local resilience to global engagement in food systemtransformation	Theoretical and conceptual analysis
The diffusion of sustainable family farmingpractices in Colombia: an emerging sociotechnical niche?	Transformative methodology. Quantitativecontent analysis. Case-based Mutual Learning Session (cbMLS)
Transitions to agroecological farming systemsin the Mississippi River Basin: toward an integratedsocioecological analysis	Qualitative. In-depth interviews. Comparativeanalysis of cases.
Exploring barriers to the agroecologicaltransition in Nicaragua: A Technological Innovation SystemsApproach	Qualitative, In-depth interviews, literaturereview, field study.
Agroecology: The Future of Sustainable Farming?	Literature review
Characterizing diversity of food systems inview of sustainability transitions. A review	Literature review
What Socio-Economic and Political Factors Leadto Global Pesticide Dependence? A Critical Review from a SocialScience Perspective	Literature review
Social innovation and sustainable ruraldevelopment: The case of a Brazilian agroecology network.	Quali. In-depth interviews. And documentanalysis
Family farming and the emergence of analternative sociotechnical imaginary in Argentina.	Qualitative analysis of experiences
The agroecological revolution in Latin America:rescuing nature, ensuring food sovereignty and empoweringpeasants.	Quali- Analysis of socio-ecologicalcharacteristics and their economic, social and cognitivecomponents
Agroecologically efficient agricultural systemsfor smallholder farmers: contributions to food sovereignty.	Qualitative. Documentary analysis, the studydescribes and discusses these perspectives, their trajectories andimplications of action research.
Beyond sustainability in food systems:perspectives from agroecology and social innovation	Qualitative secondary data analysis
Designing agroecological farming systems withfarmers: A review.	Literature review
Innovation-sustainability nexus in agriculturetransition: case of agroecology.	Quali. Using the STEPS centre's 3-D (Direction,Distribution and Diversity) method.
Agroecology as an alternative vision toconventional development and climate-smart agriculture.	Conceptual-Theoretical Analysis
Transformative social innovation for foodsovereignty: The disruptive alternative.	In-depth interviews Secondary data analysis Participant Observation

Fuente: Author, 2021.

Tabla 5: Object of study of the selected articles

Title	Object of Study
The transition movement and food sovereignty:from local resilience to global engagement in food systemtransformation	Transition movements working to establish analternative and diverse sustainable local eco-economy for thedevelopment of new production and consumption networks.
The diffusion of sustainable family farmingpractices in Colombia: an emerging sociotechnical niche?	initiatives that have promoted innovations insustainable family farming in Colombia
Transitions to agroecological farming systemsin the Mississippi River Basin: toward an integratedsocioecological analysis	Grain producers and rotational grazers in Iowatransitioned to agroecological management practices.
Exploring barriers to the agroecologicaltransition in Nicaragua: A Technological Innovation SystemsApproach	The development of agroecology as a publicpolicy in Nicaragua
Agroecology: The Future of Sustainable Farming?	By comparing examples of agriculturaldevelopment strategies in emerging economies, we illustrate how aradical change in these countries could open alternative pathwaysfor other developing countries.
Characterizing diversity of food systems inview of sustainability transitions. A review	plant food systems focusing on the production,distribution and consumption of vegetables with low or nopesticides in Chile
What Socio-Economic and Political Factors Leadto Global Pesticide Dependence? A Critical Review from a SocialScience Perspective	Global dependence on pesticides
Social innovation and sustainable ruraldevelopment: The case of a Brazilian agroecology network.	Ecovida Agroecological Network of SouthernBrazil
Family farming and the emergence of analternative sociotechnical imaginary in Argentina.	Institutional actors involved in the promotionof family farming as an alternative to the development of theagricultural sector with the implementation of alternativepractices and the organization of science and technology.
The agroecological revolution in Latin America:rescuing nature, ensuring food sovereignty and empoweringpeasants. , 2011	The trajectory of agroecological movements inBrazil, the Andean region, Mexico, Central America and Cuba andtheir potential to promote broad-based and sustainable agrarianand social change is briefly presented and examined.
Agroecologically efficient agricultural systemsfor smallholder farmers: contributions to food sovereignty.	Perspectives that contemplate traditionalfamily farming and the promotion of diversified agriculturalsystems as a social and economic base to promote socio-ecologicalconversion by participating in Participatory Guarantee Systems(PGS) and the development of a new agenda for food sovereignty.
Beyond sustainability in food systems:perspectives from agroecology and social innovation	Participatory Guarantee Systems (PGS) and thedevelopment of a new agenda for food sovereignty.
Designing agroecological farming systems withfarmers: A review.	Articles on the design of innovative farmingsystems in which farmers and other stakeholders were involved
Innovation-sustainability nexus in agriculturetransition: case of agroecology.	This review article aims to shed light on theinnovation/sustainability nexus in the agroecological transition.
Agroecology as an alternative vision toconventional development and climate-smart agriculture.	Agroecology and Climate Smart Agriculture (CSA)
Transformative social innovation for foodsovereignty: The disruptive alternative.	La Vía Campesina (the International Peasant Movement)

Fuente: Author, 2021.

Figure 2: Keyword Cloud

Fuente: Author, 2021.

method (Direction, Distribution and Diversity) of the STEPS center.

4.3 About the object of the selected studies

The main focus of the selected studies is on the study of experiences that implement, in the framework of agroecology, rural development initiatives through sustainable innovations in the framework of transition processes.

We have studies that have as axis at the global level (Altieri y Toledo, 2011; Altieri et al., 2012; Sage, 2014; Pimbert, 2015; Lacombe et al., 2018;El Bilali, 2019; Hu, 2020; Marchetti et al., 2020; Pimbert, 2015) which consider the role of peasant movements; the implementation of public policies that promote the participation of social actors and organizations, and; practices such as Participatory Guarantee Systems (SPG) the agroecological production in the framework of the design of innovative production systems considering the nexus innovation sustainable development in the agroecological transition process.

Considering the studies whose object is in regional or local areas (Juárez et al., 2018; Blesh y Wolf, 2014; Rover, 2016; Ortiz et al., 2018; Gaitán-Cremaschi, 2019; Goulet, 2020; Schiller, 2020), the articles are mainly located in Latin America and the Caribbean (Brazil, Cuba, Argentina, Chile, Colombia, Mexico and Nicaragua) and only one of them is located in North America (United States).

4.4 About the concepts used

Considering the conceptual frameworks used by the articles, it is possible to indicate that they have a series of conceptual elements in common, which indicates that they share a paradigm in the sense that a consensual model adopted by the community of researchers and extensionists for the explanation and resolution of problems.

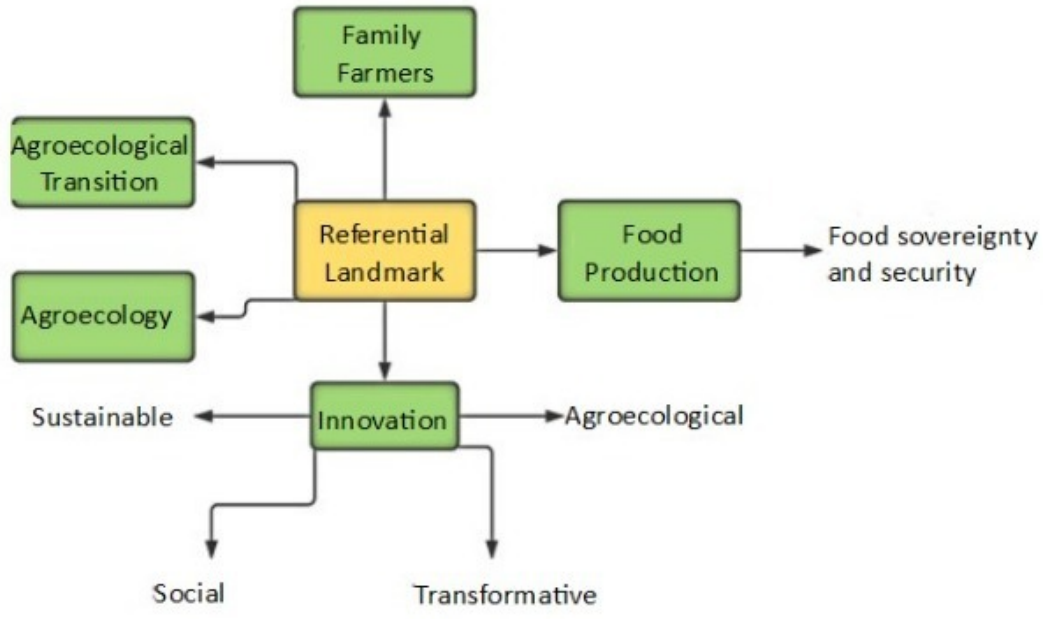
Next we will briefly expose the most representative conceptual elements and the authors who use them, for this we will put a definition that we consider most representative, obviously there may be small variations between them, given the multidisciplinary nature of the studies analyzed, being the definition an exemplifying element of the concept about a conceptual element in common and not a standard or rule followed by all articles, it works better as an ideal type.

Considering the first concept, among the articles selected from the databases is the one by Altieri and Toledo (Altieri y Toledo, 2011: 588) that brings the concept of agroecological transition:

Agroecological initiatives aim to transform industrial agriculture, in part, by transitioning existing food systems from fossil fuel-based production, primarily for agroexport crops and biofuels, toward an alternative agricultural paradigm that encourages local/national food production by small family farmers based on innovation and local resources and solar energy.

This concept is shared by the rest of two selected items (El Bilali, 2019; Ortiz et al., 2018; Schiller, 2020; Gaitán-Cremaschi, 2019; Hu, 2020; Blesh y Wolf, 2014; Pimbert, 2015; Sage, 2014) that also share the analytical-conceptual element, although there may be certain differences between them, in general the concept is very broad and implies a series of elements such as access by peasants to land, seeds, water, credit and local markets. For this, the existence of State actors is necessary for the creation and implementation of public policies

Figure 3: Referential framework of the articles



Fuente: Author, 2021.

that facilitate access to financial incentives, access to markets and agroecological technologies.

On the concepts of Food Sovereignty and Food Security the first of them and defined as "(...) the right of people to produce, distribute and consume healthy food within and near their territory in an ecologically sustainable way." (Altieri y Toledo, 2011: 589) and on the concept of Food Security, Marcheti et. al (2020: 11) signal that:

> (...) a food production system is sustainable if it ensures food security for all people, reducing the causes of malnutrition and preserving environmental quality(...) . valuing farming systems determined by local producers and users (...) as an alternative for producing healthy, diverse, nutritious, innocuous, abundant and affordable food produced sustainably and promoting the conservation of natural resources.

These concepts are shared and used by the rest of authors (Juárez et al., 2018;Goulet, 2020; Altieri et al., 2012; Gaitán-Cremaschi, 2019; Rover, 2016) focusing on one or the other, but both are interconnected and are not used in isolation. The concept of food security is conceived within the framework of sustainable rural development processes.

Another of the concepts that constitute one of the fundamental conceptual axes of all articles is Agroecology, which is defined by Altieri (2011: 588-559) as:

> (...) Agroecology is a science and a set of practices. As a science, agroecology is the «application of ecological science to the study, design and management of sustainable agroecosystems» (Altieri, 2002) (...) Agroecology is highly knowledge intensive and is based on techniques that are not provided top-down but developed on the basis of farmers' knowledge and experimentation (...) promotes community-oriented approaches that address the livelihood needs of its members, emphasizing self-sufficiency, thus the usual presence of community grain banks.

Authors argue that agroecology can generate new productive systems or alternative agricultural systems (Juárez et al., 2018;Blesh y Wolf, 2014; Sage, 2014; Rover, 2016). It is seen to combine innovation and sustainability in agriculture, thus promoting a transition to agri-food sustainability that encompasses all dimensions of sustainability (El Bilali, 2019; Goulet, 2020; Schiller, 2020). Agroecology further grants peasantry control over territory (Ortiz et al., 2018) and facilitates product-

ive diversity and food supply, thus contributing to food security and sovereignty processes (Gaitán-Cremaschi, 2019). Additionally, it can reverse the prevalence of industrial agriculture and enable a more sustainable and equitable system (Hu, 2020). Moreover, it can function as a restorative element (Lacombe et al., 2018) and is a key element in transition processes (Pimbert, 2015).

Social, agroecological, transformative or sustainable innovation and taken by several authors (Juárez et al., 2018; Altieri y Toledo, 2011; El Bilali, 2019; Ortiz et al., 2018;Goulet, 2020; Schiller, 2020; Gaitán-Cremaschi, 2019; Pimbert, 2015; Sage, 2014; Rover, 2016) and considered as a key element given that it has the ability to transform the agri-food systems where it is applied by means of sustainable development (Juárez et al., 2018; Ortiz et al., 2018;Pimbert, 2015; Sage, 2014; Rover, 2016; Marchetti et al., 2020; El Bilali, 2019; Ortiz et al., 2018; Marchetti et al., 2020) with a focus on territory, inclusion, access to knowledge and increased income by family farmers and their communities.

Food production is considered fundamental to ensure food sovereignty, combat hunger, secure land use and ownership (Juárez et al., 2018; Altieri y Toledo, 2011; El Bilali, 2019; Ortiz et al., 2018;Altieri et al., 2012; Hu, 2020; Blesh y Wolf, 2014; Pimbert, 2015; Marchetti et al., 2020) in that it promotes practices that are productive and ecological.

Finally, despite the fact that the articles used in this study mention various actors in sustainable rural development processes (mainly the state and its various social institutions, social support organizations such as foundations or national and international NGOs), they all agree that to achieve a sustainable rural development process that includes the development of agroecological innovations, family farmers and their organizations play a key role. At this point, studies highlight a number of characteristics of family farmers, such as their capacity to resist agribusiness and the lack of public policies (Juárez et al., 2018; Sage, 2014), their role as a catalyst for social and technological innovation processes (Juárez et al., 2018; Altieri y Toledo, 2011;Blesh y Wolf, 2014), in caring for the environment through the multiple use of natural resources fostering, creating and preserving biological diversity (Altieri y Toledo, 2011; Ortiz et al., 2018; Hu, 2020; Lacombe et al., 2018) and as a guarantor of food security and sovereignty from its practices (Altieri et al., 2012; Marchetti et al., 2020; El Bilali, 2019; Rover, 2016; Goulet, 2020).

The concepts discussed so far are closely interconnected in the field of sustainable agriculture and food systems. Together, they form analytical chains that are essential for understanding the construction of sustainable, equitable and resilient food systems that support the well-being of farmers, communities and the environment, while ensuring food security and food sovereignty.

Family farming is a fundamental model in which small family-owned and managed farms play an important role in global food production. The agroecological transition implies a paradigm shift towards sustainable and environmentally friendly agricultural practices, based on principles of ecological diversity, recycling and synergy. Agroecology, as a scientific discipline, provides the knowledge base needed to underpin this transition by studying the intricate interactions between organisms and their environment within agricultural systems.

Food production, in the context of family farming and agroecology, emphasizes the adoption of sustainable approaches that minimize negative environmental impacts while meeting the demands of an adequate food supply. In addition, food sovereignty and food security are interconnected concepts that emphasize the rights and access of communities to healthy and culturally appropriate food. They defend local food systems, empower farmers and protect against external dependencies.

Finally, innovation plays a key role in driving the agroecological transition and addressing food production challenges. It involves the development and application of novel techniques, technologies and practices that promote sustainable farming methods, improve productivity, reduce waste and strengthen resilience to climate change.

5 Final considerations

This literature review has allowed us to recognize a relatively good number of studies that incorporate agroecology, social technologies and family farming as analytical and conceptual components of innovative agricultural systems. However, an approach that integrates the three mentioned components into a conceptual analytical system to be incorporated in the understanding of agroecological transitions.

We proposed an analysis matrix that allows to characterize and analyze in each of the sixteen articles by the type of study; conceptual framework; methodology; object of study.

The availability of the studies used, only those that were openly accessible were considered because they are more widely available. Additionally, the authors took into account elements such as accessibility, impact, transparency, and accountability that this type of paper provides for scientists with limited funding.

Regarding the type of study used, they are based on the analysis of both cases and experiences, which indicates the need to support the theoretical and political position of agroecology with practical experiences that show how agroecology works in real life, but there is a lack of experiences that show what did not work to improve learning.

In as much as the methodologies employed are concerned, these are mostly qualitative and utilize a wide and rich variety of techniques, notwithstanding the fact that studies that utilize both primary and secondary quantitative data in their analyses would be of vital relevance.

Considering the objects of study contemplated by the articles, they focus mainly on collective experiences that are located in Latin America and the Caribbean. It is noteworthy how the prevalence of theoretical productions of the region are relevant and important for understanding the processes of agro-ecological transition. It is noteworthy that the work analyzes an experience in the United States, since it is one of the countries that have one of the largest food production based on pesticides and the intensive use of pesticides. In the North there are also resistances and persistence of family farming.

As for the referential framework of the articles, they have elements in common, such as the use of concepts like agroecology, agroecological transition, family farmers, food production and innovation. The concepts are essential for the development of a more sustainable, equitable, and resilient food system. This system would support the well-being of farmers, communities, and the environment. While previous research has focused on the role of agroecological innovations in specific experiences, it is imperative to generate new research that broadens the scope to encompass the role of agroecological innovations in a more general sense. This necessitates a greater emphasis on comprehending the agroecological innovation system itself, wherein the role of social technologies assumes fundamental importance. Such technologies should be recognized as elements that bolster the agroecological transition process, rather than being regarded as mere palliatives or technologies with low knowledge intensity.

Considering the biases and limitations of this study, it is crucial to incorporate vital themes. Climate change, diversity, and heterogeneity of individuals within the realm of family farming (including indigenous communities, Afro-descendant communities, generational aspects), as well as gender and power differences within this structure, in future research.

These themes have a significant impact on the dynamics of agroecology and food systems, and it is important not to overlook them. By exploring these critical dimensions, the authors of this study understand that it is possible to enhance the understanding of the multifaceted nature of agroecological innovation. This, in turn, paves the way for a better comprehension of the processes involved in sustainable rural development.

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