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Cultivating social innovation for agri-food sustainability transformations: a literature review

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Abstract

This scoping literature review focuses on the operation and orientation of social innovations (SI) in agri-food systems in order to understand their role in sustainability transformations. It aims to analyse and synthesise the types of cases studied, their characteristics, how they form relations, the societal problems they respond to and their contributions to transformation processes. The review is based on 86 empirical English articles published in Scopus and Web of Science between 2013 and 2023, covering 168 empirical SI cases. The data reveal limited geographical variation and a Eurocentric focus in the study of SI, but diverse spatial and operational foci of SI cases. We identify seven SI types: community food networks, food equity initiatives, capacity-building programs, agri-cooperatives, social agri-enterprises, agri-environmental initiatives, and tech-driven agri-services. These often localized solutions address different internal and external relations, aim to respond to a variety of societal needs and problems, and are rhetorically linked to transformations of various kinds. In addition to providing insights into key trends in the operation and orientation of SI, this analysis contributes to the discussion on the transformative potential of SI, including the ambivalent role of strong ties between SI and the state. Furthermore, this study identifies potential research avenues for the study of SI in agriculture and food. In particular, we call for reflexivity in researchers' normative assumptions, more rigorous reporting of relations and transformative contributions, and more systematic approaches to better integrate findings across SI cases as well as with adjacent concepts.

Keywords

transformative change, transition, social enterprise, rural development, alternative food networks, agri-food system

JEL Codes

O35, Q10

Authorship statement

All authors contributed equally to: Conceptualization, Data curation, Analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing. Visualization: CHD, JF, MCS. All authors share first authorship.

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1. Introduction

Understanding and fostering new or alternative ideas and practices and their (potential) transformative contribution, is imperative for promoting sustainability transformations in agri-food systems. In this context, there is an increasing scholarly focus on the emergence and role of so-called “niche initiatives” that develop and implement alternative visions and practices and may ultimately challenge and reconfigure existing unsustainable regimes. In addition to niches addressing ecological or economic issues, increasing attention has been paid to those focussing on social needs of various actors involved in the food system. This development can be linked to the term "transformative social innovation", which describes a relatively new but increasingly popular conceptual and empirical lens in transformation studies to study these phenomena and initiatives (Avelino et al. 2019; Pel et al. 2020; Wittmayer et al. 2020). This concept is deeply tied to sustainability transitions and empowerment theories, providing a tool to move beyond mere technological innovations to transformative ideas and practices in governance, lifestyles or work (Wieczorek 2018), highlighting the crucial role of social innovations (SI) as part of larger socio-technical transformation processes (De Geus et al. 2023; Pel et al. 2023a). Particularly in the areas of agri-food systems and rural development, SI has been identified as important for transformations (Neumeier 2012; Da Silva et al. 2024).

In agriculture and food, civil society or non-technological efforts that challenge the status quo are often subsumed under umbrella terms such as “alternative food networks" (Goodman et al. 2014) or "grassroots innovation" (Seyfang and Smith 2007). However, relying on these terms risks limiting transformative approaches to those that are inherently bottom-up or strictly oppositional to the current regime. A focus on transformative social innovation is more open and can encompass a greater diversity of new and alternative ideas and practices that appear necessary to advance transformation in complex agri-food systems (Zoll et al. 2024).

To date, SI in agri-food systems has mainly been understood through case study oriented empirical research and there is an apparent lack of integrated knowledge of these cases in academic literature. The few existing reviews on SI in agri-food systems focus on the contribution of SI to sustainable development goals (Da Silva et al. 2024) or as a means to prevent food waste (Al-Obadi et al. 2022; Zhao et al. 2023). With our review, we add to previous studies by taking an open approach that goes beyond addressing only selected problems, allowing us to identify the full range of transformative impacts presented in research so far. By focusing on studies employing a SI lens in their research approach, we aim to answer open questions about the operation, the (normative) orientation and transformative direction of SI in the agri-food sector (Wittmayer et al. 2024). Deepening this knowledge by broadening the scope of analysis is necessary to provide a clearer and more integrative picture of how SI can contribute to sustainability transformations, how its contributions can be supported, and what its limits are. Integrating empirical research on SI will lead to insights that transcend specific places or individuals (Zoll et al. 2024) while identifying patterns and trends, and addressing the need for a critical engagement with the academic literature and the often affirmative and hopeful picture of SI and civil society research (Dannemann et al. 2024) on delivering changes towards sustainability and human-well being.

Against this background, in this paper we aim to systematize and integrate empirical studies on SI in agri-food contexts through a scoping review (Munn et al. 2018). Based on the above-described shortcomings of the existing literature, we are interested in the following three research objectives, shaping specific research questions (see Table 1).

Table 1. Overview of research objectives, research questions and approaches

Objective	**Research questions**	**Approach**
Objective (1): Systematize and integrate SI operation in agri-food context	RQ1.1: What agri-food cases are studied from a social innovation lens and what are their key characteristics? RQ1.2: What internal and external relations are present in these SI cases?	To answer this question, we provide a comprehensive overview of which cases are studied from a SI lens, addressing the type of social innovations studied, their geographical spread as well as key characteristics of their operation. Additionally, we take a closer look into the internal and external relations that shape the social innovations' operative setting.
Objective (2): Systematize and integrate SI orientation in agri-food context	RQ2.1: What societal problems do SI aim to respond to? RQ2.2: How do SI in agri-food contribute to transformation processes?	To answer this question, we collect, integrate and analyze the problem descriptions in the academic literature that are connected with the need and relevance to focus on social innovations, the triggers that enabled their emergence and development as well as the transformative orientation that these cases are connected to, their contribution and potential obstacles.
Objective (3): Identify differences between different types of SIs with regards to the above described questions	RQ3: What patterns can we find in relation to the operation and orientation of different types of SI?	To answer this question, we provide a statistical analysis to map significant differences between different innovation types.

2. Theoretical foundations

The term and phenomenon of social innovation has been around since the 19th century (Godin 2015). However, it was only at the beginning of the 21st century that it became prominent on the agenda of social science researchers and policy makers (Schubert 2021). The concept has now become a buzzword taken up by many different academic communities and traditions (Ayob et al. 2016; Ziegler 2017).

While there is no consensus on the theoretical and methodological foundations of SI processes (Hernández Ascanio et al. 2023), some theoretical influences include social change, complexity,

entrepreneurship theories, and innovation studies, among others (Mulgan 2012). SI seems to be simultaneously understood as “process, solution, methodology, product, or as a strategy for social change” (Castro-Arroyave and Duque-Paz 2020, p. 2). This epistemological, theoretical, conceptual, and methodological diversity often leads to the affirmation of SI as being a domain still under construction (Domanski et al. 2020; Hernández Ascanio et al. 2023).
In this study, we follow the concept of transformative SI, generally framed as “changing social relations, involving new ways of doing, knowing, framing and organizing” (Pel et al. 2020, p. 1). From this perspective, SI often seeks to address actor, group, or place-specific challenges through new forms of collaboration or new ideas that alter existing structures and trajectories (Wirth et al. 2023). As such, change can occur at the macro (e.g. system or regime) or micro (e.g., individual, place) level (Avelino and Wittmayer 2019).

Transformative social innovation is an ongoing and gradual process that contributes to transformative change (Avelino et al. 2019). For SI to be transformative, it has to challenge, alter, or replace dominant formal or informal institutions that constrain existing practices, framings, and power relations. Transformative impact is achieved when it manages to diffuse innovative elements into the mainstream system while maintaining its radical innovative idea (Avelino and Wittmayer 2019). This can also present a contradiction, as SI can be prone to losing its transformative potential when it is mainstreamed (Wittmayer et al. 2020).

2.1 SI operation

Compared to technological innovations, SI crystallizes as social practices instead of technological artifacts, through self-directed processes of imitation, in ecosystems where different sectors interface and collaborate, and supported by intermediary infrastructures (Domanski et al. 2020). SI is distributed in networks of social and material relations that emerge from a specific socio-material context and occur through existing institutions (Pel et al. 2020). For example, non-profit SI is often donation-based and thus dependent on volunteer labor and unstable funding sources. More hybrid SI combine social and economic goals, and thus more frequently consist of collaborations between non-profit and for-profit organizations (Phillips et al. 2015). Overall, there is no single blueprint for the organizational and practical design of a SI, but the concept lives from its abundance of manifestations, which are adapted to the social needs, relations and context in which it is embedded.
Understanding transformative SI to enable changes in social relations requires a relational understanding when studying the dynamics in SI and how they operate. Crucial operational dynamics include internal and external relations that can lead to (dis)empowerment processes and connect to the transformative contribution of the SI. Internal relations take place within SI and concern micro-level processes such as individual behaviors as well as collective action and organizational forms of member empowerment. External relations encompass the formation of broader networks, relations to institutions seeking to challenge, alter or replace them while being shaped by them, as well as relations with the socio-material context that influence the transformative efforts of the SI (Pel et al. 2020). SI often operate locally but are connected in broader networks, sometimes even at the global level (Avelino et al. 2019).
Relations within SI consist of individual behaviors, but also micro-level collective action that empower their members. Studying internal processes is essential to understanding why SI

emerge in particular contexts (Pel et al. 2020). External relations can be crucial for the success of SI, providing sources of information about entrepreneurial opportunities, solutions to market and government failures, and an understanding of how to better meet existing social needs. However, the extent to which they influence SI performance is not clear (Hagedoorn et al. 2023). SI often criticize the current dominant features of social relations for being too competitive, market-oriented and fragmented. They therefore aim to replace them with communal and relational values characterized by trust, collaboration and empowerment (Wittmayer et al. 2019).

2.2 SI Orientation

Overarching orientations of SI are the satisfaction of social needs not met by existing solutions, the improvement of social inclusion and justice for previously excluded groups, and empowerment by providing access to resources and socio-political capability (Moulaert et al. 2005). SI aim to promote social impact and value. Therefore, profits generated from providing or trading goods and services are used to achieve social goals (Biggeri et al. 2017; Ozdemir and Gupta 2021). Understanding the orientation of SI is crucial because they contain narratives of change (Wittmayer et al. 2019). These narratives can identify and shape current problems, triggers and alternative pathways by reframing dominant norms and values that challenge the existing neoliberal system. This joint (normative) orientation contributes to identity formation and the creation of a sense of belonging, which can result in a guide for action to reach a desired future (Wittmayer et al. 2019). In addition, it can reveal insights into the type and scope of transformation to which SI want to contribute to and the obstacles they face in doing so. Drawing a line between transformative and incremental SI is not trivial and provides space for criticisms of the gap between transformative narratives and actual transformative impact (Pel et al. 2023b). Determining the latter can be challenging, because SI are often studied at an early stage of emergence, when their impact and scope are still uncertain.

Due to the multiplicity of existing definitions of SI, the concept is sometimes considered fuzzy (Van Der Have and Rubalcaba 2016), making it unclear what is (not) a SI. This risks diluting the analytical power of the concept and co-opting the term for innovations driven only by economic benefits (Solis-Navarrete et al. 2021). To avoid a neoliberal appropriation of SI, it is important to examine what motivates existing cases and whether they follow an agenda of empowerment and societal transformation (Pel et al. 2023b).

The elaborations on the operation and orientation of SI outlined above, and the key components that will lead to useful insights, provide the theoretical cornerstones that guide the methodological design as well as the findings of this review. Figure 1 provides a graphical representation of these cornerstones.

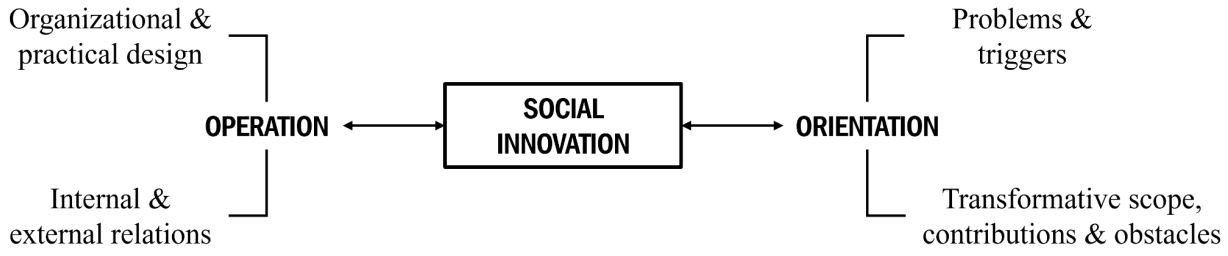

Figure 1. Overview of the theoretical cornerstones guiding this review

3. Methods

To systematize and synthesize empirical studies on SI in the agri-food context, we conducted a scoping literature review (Munn et al. 2018). We analyzed peer-reviewed empirical research articles, published in English, that focus specifically on SI in the agri-food context. We conducted this review in accordance with the general PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines (Page et al. 2021).

3.1 Selection of publications

To identify relevant empirical research publications, we searched Scopus and Web of Science using the following keyword combination "social innovation" OR "socially innovative" AND "agri*" OR "food". The keyword search was applied to titles, abstracts, and keywords and was conducted on January 3, 2024, to include all articles published up to 2023. Results from Scopus and Web of Science were merged, resulting in 355 articles. We selected relevant articles by screening abstracts based on the following inclusion criteria: articles had to be (1) written in English, (2) empirical research (excluding conference proceedings, literature reviews, opinion papers, etc.), (3) available as full-text, (4) have a clear focus on SI, and (5) have a clear focus on agri-food systems. To ensure inter-coder reliability, we conducted a test round of screening on a sample of 20 articles to ensure a common understanding of the inclusion criteria (particularly (4) and (5)). In a next step, the 355 articles were distributed among the five authors (coders) of this paper for screening and discussed our results in several meetings. For uncertain cases, we used full-text screening to decide on inclusion. The remaining uncertain cases were screened by a second coder and a consensus decision was reached. This process resulted in the selection of 86 articles for full-text in-depth review (Table S1). Figure 2 provides a graphical representation of the selection process.

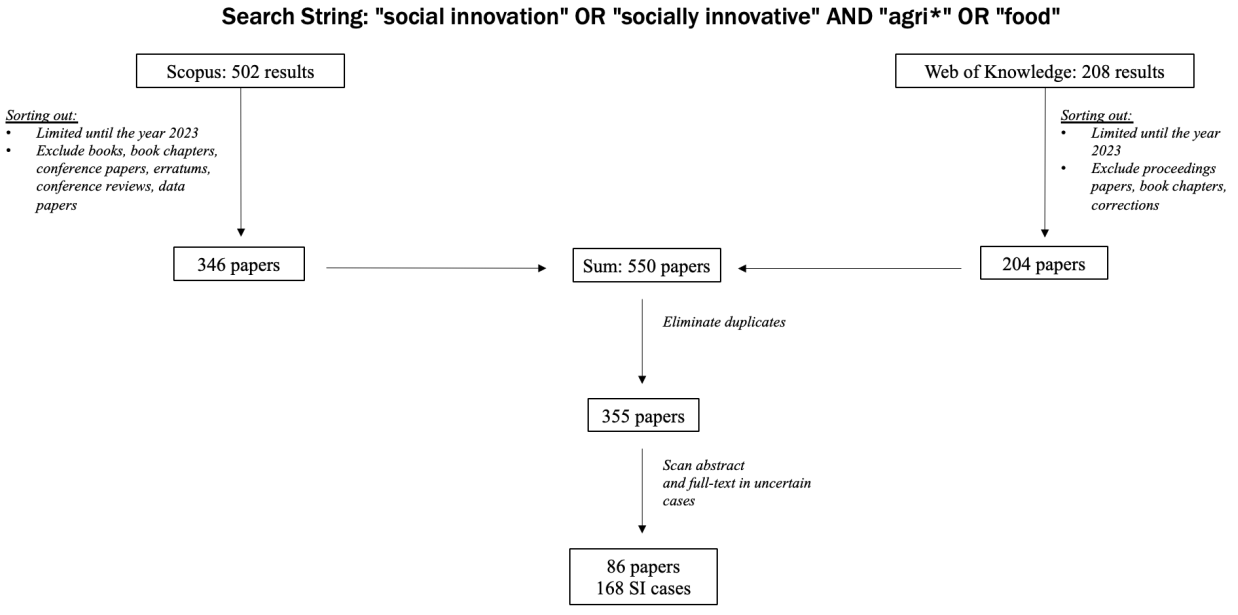

Figure 2. Sampling and selection procedure for full-text review

The resulting dataset includes publications published between 2013 and 2023, showing an increasing trend of publications on the topic with a peak in 2020 (Table S1). The journals in which they are published are quite heterogeneous, with the 86 articles in our dataset being published in 52 different journals. Overall, the journals have a focus on food, rural development and/or sustainability.

3.2 Coding the dataset

Following a deductive-inductive approach, we developed a coding guide that included 20 coding categories (Table S2), covering both bibliometric information and content-related information about the social innovation case(s) addressed in the publication. Since our main research interest is not in the academic papers themselves, but in the empirical cases addressed in these publications, we applied the coding scheme to each individual case identified. While many papers analyzed only one case of SI, others analyzed a bundle of cases. In cases where the different cases in a paper could not be distinguished from the description and information available, they were considered as one case. Thus, from the 86 selected articles, we collected information on 168 SI cases (Table S1).

The in-depth coding was performed by the five authors (coders). To ensure inter-coder reliability, the coding guide, coding instructions and examples were developed together. Additionally, this guide was discussed and improved by all coders after a test round on a sample of 15 articles. Other uncertainties that arose during the coding process were discussed among all coders to ensure a continuous common understanding of the coding guidelines.

The content codes focused on gathering information about the operation and orientation of each SI case. For the operation, we focused on the type of innovation and its main product and/or service (both coded inductively), as well as other characteristics such as its geographical location and spatial level and context, its focus in the value chain and economic operation, and its lifetime and size. These codes were coded deductively according to predefined categories and give insights into their organizational and practical design. In addition, we paid special attention to the internal and external relational context of the SI cases. In terms of orientation, we looked specifically at the problems that the SI cases were intended to address, as well as specific triggers for their development (i.e., problem orientation), and how the case studies are connected to transformation processes, as well as potential contributions or obstacles of the SI to these processes (i.e., transformative orientation). Data for all of these codes were collected inductively.

3.3 Analyzing the codes

The analysis combines quantitative and qualitative approaches. The deductive codes were first explored through descriptive statistics (presented in section 4.1). The inductive codes provided the basis for an iterative and collective process of qualitative analysis, focusing on grouping the codes into condensed result categories that help systematize and characterize the dataset (Table S2). In this way, we created an empirically driven overview of the types of SI in the agri-food

sector (see section 4.2), their main internal and external relational approaches (see section 4.3), the problem orientation (see section 4.4), as well as the transformative orientation (see section 4.5) of the SI. Finally, to understand the context, problem orientation, transformation orientation and relational approaches associated with the different types of SI (as outlined in 4.2), we conducted chi-squared contingency table tests and Fisher's exact test (see Table S3 for more details), using the False Discovery Rate (FDR) correction to adjust for multiple testing. The following sections report findings based on significant results at p-value <0.05. We used R v.4.4.2 (R Core Team 2024) and RStudio v.2024.9.1.394 (RStudio Team 2024) for all statistical analyses.

4. Results

4.1 Geographic, scalar, spatial and economic characterisation of social innovations in agri-food

The analysis of geographical distribution highlights that the cases are predominantly set in Europe (69% of the total), in particular in Italy, Germany and the Netherlands. A small proportion of the cases are located in Asia and South America. North America and Africa are barely represented. The vast majority of cases focused on the local or regional level (79%), with only about one-third of the cases focusing on the national level. The analysis of their spatial context shows a slight dominance of SI focusing on rural areas (51%), although SI in urban areas (36%) were also well represented in the dataset compared to those focusing on the urban-rural fringe (13%). Figure 3 presents a graphical representation of the overall findings on the geographic, scalar, and spatial distribution of the SI cases.

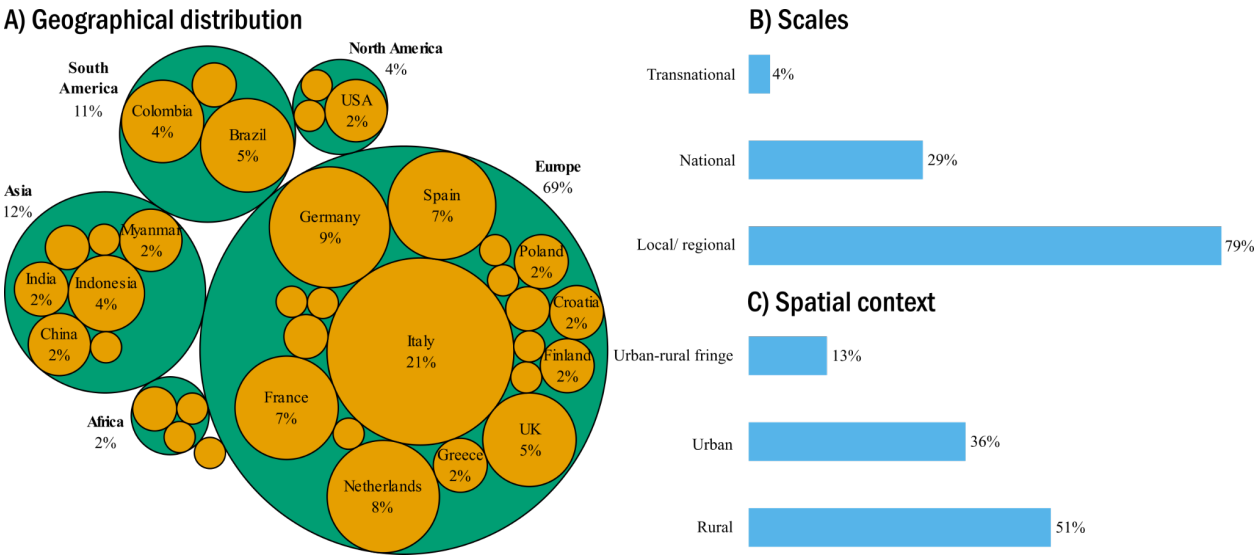

Figure 3. Characterisation of social innovation cases according to geographical, scalar and spatial distribution. Percentages indicate distribution among the full dataset of 168 cases. Several hits per study are possible for scales and spatial context.

A key characteristic of SI is the focus of their activities within the agri-food value chain (note: multiple foci are possible). Here, we find that the vast majority of the cases focus on agricultural

production (70% of all cases), followed by the distribution (43%) and consumption (35%) of food. In economic terms, we find that many SI are set up to make an economic profit (55%), while a smaller part is understood as non-profit innovations (26%). More detailed information on these findings is presented in Figure 4.

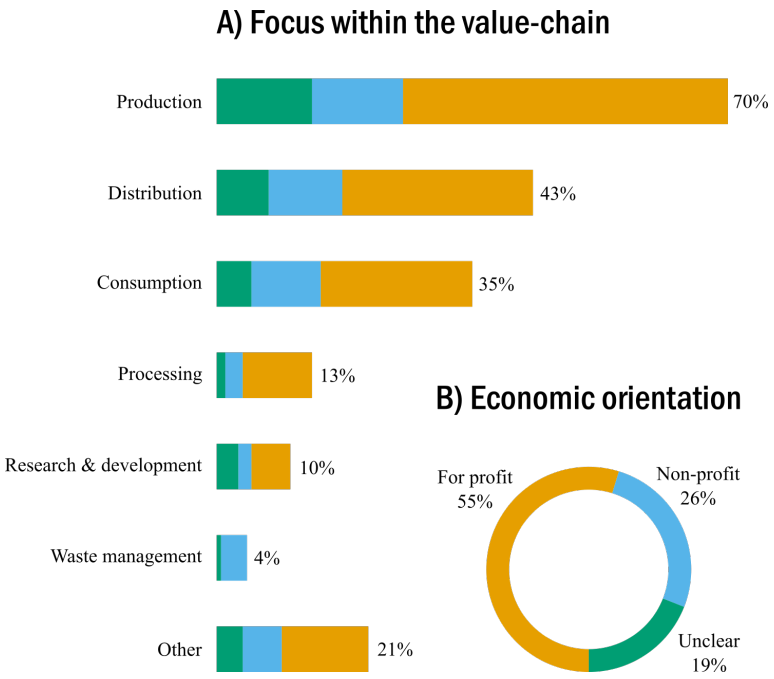

Figure 4. Characterisation of social innovations according to their focus within the value-chain and their economic orientation. Percentages indicate distribution among the full dataset of 168 cases. Several hits per study are possible for foci within the value-chain.

4.2 Types of social innovations in agri-food

We identified seven distinct clusters of cases which we understand as specific types of SI in the agri-food context (see Table 2 for a detailed description and examples per type).

The first type focuses on *community food networks*, reflecting grassroots efforts to strengthen local food systems through active community engagement in food production and distribution. These initiatives predominate in Europe (94%) and in urban areas (69%). Type two includes *food equity initiatives,* which target food assistance and social inclusion. They support marginalized groups and promote social inclusion in the context of agriculture and nutrition. This type is also predominantly studied in Europe (85%) and to a lesser extent in North America (12%). Compared to other types of SI, *food equity initiatives* are particularly associated with a non-profit orientation (48%).The third type is formed by *capacity-building programs*, which focus on improving the knowledge and skills of a wide range of actors. Such programs are significantly connected with cases in Africa (13%). The type *agri-cooperatives* concentrates on improving market access and resource sharing through collaborative and network approaches. It is particularly oriented towards profit (77%), research and development (41%), and processing (36%). The fifth type comprises *social agri-enterprises* that combine economic and social goals and aim to integrate a social

impact mission with agricultural business. These enterprises are strongly represented in South America (56%) and are mostly profit-oriented (81%). Type six includes *agri-environmental initiatives* that focus specifically on responsible and biodiversity-friendly agricultural practices in rural areas (87%). Finally, the type *tech-driven agri-services*, focuses on digital solutions and services to increase agricultural efficiency and economic opportunities. This type of SI is strongly connected to studies in Asia (55%), a for-profit orientation (82%), and acting at national level (91%).

Table 2: Types of social innovations identified

Type of social innovation (SI)	**Includes**
Community food networks (n=48; 27% of all cases)	community-oriented food production and distribution initiatives; typically community-led, self-organized initiatives ranging from community gardens and single farm networks linking producers with consumers, to territorial networks that connect multiple producers with a broad base of consumers.
Food equity initiatives (n=33; 20%)	food assistance and social inclusion initiatives; services and programs empowering women in agricultural communities or marginalized individuals, such as people with disabilities or mental health challenges as well as disadvantaged youth or people in need of food aid. A subset also includes urban food policies geared towards fostering equity in urban food systems.
Capacity-building programs (n=23; 14%)	initiatives for food education and agricultural skills; training for sustainable farming, incentivizing youth to engage in agriculture as well as awareness raising for food waste or teaching cooking skills and food literacy.
Agri-cooperatives (n=22; 13%)	Cooperatives and farmer networks; initiatives varying significantly in size and reach, ranging from small, local cooperatives to larger, nationally operating networks focusing on regional branding and joint marketing. Most cooperatives in this type are economically driven and highly organized, often concentrating on a specific sector, region, or type of agricultural practice.
Social agri-enterprises (n=16; 10%)	social enterprises connecting economic and social goals; agritourism initiatives that incorporate educational programs and efforts to preserve traditional agricultural practices and varieties.
Agri-environmental initiatives (n=15; 9%)	environmental and sustainable agriculture initiatives; initiatives prioritizing the preservation of farmland, sustainable forestry and fishery management, wildfire prevention, pesticide-free farming, and overall biodiversity conservation.

Tech-driven agri-services (n=11; 7%)	digital and service innovations promoting agriculture; digital platforms that support farmer communication and product promotion, e-commerce services for farm products, peer-to-peer lending systems, remote gardening apps for consumers, and booking platforms for agritourism.

4.3 Internal and external relations of social innovations in agri-food

In this section, we focus on findings regarding the relational context as a key element in the operational design of the SI in our dataset. More specifically, we focus on how the cases sought to develop empowering collectives (i.e. internal relations), and how and with whom the initiatives sought to form, or contribute to broader networks or other actors (i.e. external relations). Table 3 provides a detailed overview of the variety of internal and external relationships found in the literature analyzed, and Figure 5 provides insights into which relationships are most associated with specific SI types (as presented in the previous section).

Regarding the internal relational context, the findings highlight five main approaches to creating and enhancing relations within SI initiatives: *Emphasizing benefits from the initiatives; learning and knowledge-sharing; sharing values, visions, or goals; internal governance aspects;* and *empowerment*. Other aspects touched upon include the *expansion of participation and co-creation, the involvement of diverse actors,* and *enhancing quality of connections*. Several aspects of the internal relational context are different among SI types. Agri-cooperatives were significantly connected to *emphasising benefits* (64%), *empowerment* (27%) and *learning and knowledge exchange* (32%). *Learning* was also significantly connected to the SI types capacity-building programs (30%) and agri-environmental initiatives (33%).

Regarding the external relational context, the five main approaches to create and strengthen relations between the SI and external actors include: *Establishing relations with the state; emphasizing results, benefits, or sense of impact from the initiative; obtaining external funding; communication strategies & promotion;* and *enhancing quality of connections*. Other aspects include the *production, exchange, or transfer of knowledge; co-creation and transformation of legal frameworks; government support including funding; advocacy; knowledge-based partnerships; opening new markets;* and *product or service innovation/differentiation*. *Establishing relations with the state* is particularly connected to food equity initiatives (42%). Government support (including funding) is most common in agri-cooperatives (23%). Finally, *emphasising results, benefits, or sense of impact* is particularly present in agri-environmental initiatives (33%).

Table 3: Types of internal and external relations identified

Category	**Includes**
Internal relations	

Emphasizing benefits from SI (n=69; 41% of all cases)	sharing material and ideational resources, positive impacts on the wider territory and community, improvement of quality of life and economic conditions, psychological benefits for participants, shifts in values or attitudes, increased resilience.
Learning & knowledge exchange (n=28; 17%)	internal knowledge co-production, knowledge sharing, collective learning, aiding cognitive proximity and capacity building.
Shared values, visions, or goals (n=24; 14%)	creation of meanings and development of a clear vision. Shared narratives, purpose, responsibilities, motivation, principles, or risks. Mobilization under a shared vision.
Internal governance (n=20; 12%)	coordination between actors, organizational structures, decision-making and management practices, agency, and funding.
Empowerment (n=20; 12%)	economic empowerment through self-funding, improvement of economic conditions, increased independence for food producers. Among others.
Expansion of participation and co-creation (n=18; 11%)	stakeholder involvement both internally and with the local community, participatory approaches, co-design and experimentation to develop solutions.
Involvement of diverse actors (n=12; 7%)	multi-actor and cross-sector collaborations within networks, bringing together different interests and competences in the initiative.
Enhancing quality of connections (n=9; 5%)	strengthening relations within networks, processes aided by strong connections, closeness, good or improved collaboration, well connected members, creating synergies.
External relations	
Establishing relations with the state (n=36; 21%)	co-creation of legal frameworks, participation in legislative change and implementation of laws, government support including funding, collaboration with local authorities.
Emphasizing results, benefits, or sense of impact from initiative (n=26; 15%)	positive impacts on the wider territory, community, and ecosystem. Overcoming political obstacles. Improvement of quality of life and economic conditions.
Obtaining external funding (n=17; 10%)	the need for external funds. Funding through national and international grants, institutional actors, or community donations. Capacity to acquire funding and obstacles faced.
Communication strategies & promotion (n=17; 10%)	communicating the model being implemented, implementing educational programmes, increasing public awareness, appearing in mass media, receiving awards.
Enhancing quality of connections (n=14; 8%)	structured, strong, stable, or trusting relations, constant or enhanced contact, embeddedness in territory or other movements, strong commitments, donors as partners.

Production, exchange, or transfer of knowledge (n=12; 7%)	connecting with external knowledge, involving actors like universities or research institutes, disseminating knowledge, public awareness.
Co-creation and transformation of legal frameworks (n=11; 7%)	involvement in drafting legal frameworks, demanding favorable legal frameworks, policy innovation, engagement with local governance, supportive legal frameworks at local and national level.
Government support including funding (n=9; 5%)	support from local governments or regional development plans, financial support, reduction of transaction costs.
Advocacy (n=9; 5%)	protesting, direct action (e.g. towards food companies or supermarkets), representing the model at political events, confronting elected officials.
Knowledge-based partnerships (n=5; 3%)	establishing collaborative spaces with universities and other actors in the education sector, intensifying existing relations, research and development partnerships.
Opening new markets (n=4; 2%)	pursuing external markets, increased capacity to access distant markets, enabling access to markets via infrastructure.
Product or service innovation/differentiation (n=4; 2%)	resignifying existing offerings (eg. farms as learning spaces), tailoring offerings to involve new actors, implementation of new development strategies, incorporating consumer health or environmental concerns in product/service design, incorporating stories to existing products, pursuing product uniqueness or collectability.

In both internal and external relational contexts, the process of forming relationships is mentioned extensively. This process is referred to in a variety of ways: linking, collaborating, networking, building social bonds, building community, or building partnerships. Specific descriptions of the quality of connections appear only marginally in both internal (5%) and external (8%) relational contexts.

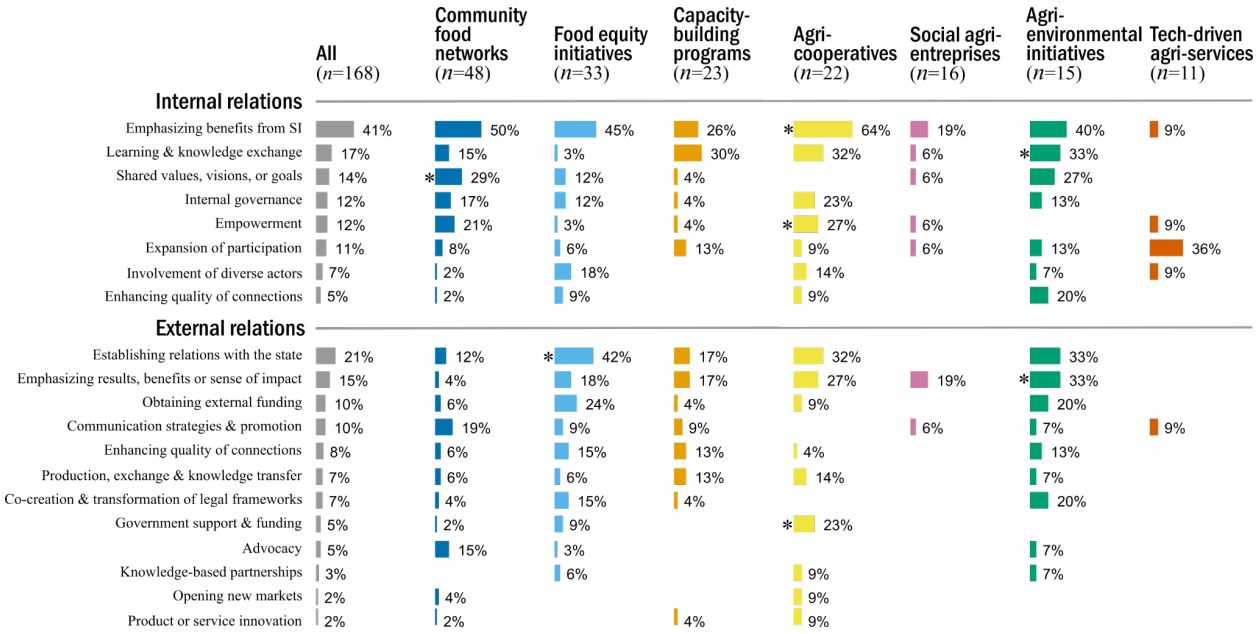

*Figure 5. Shares of internal and external relations in all cases and for the seven assigned SI types. Percentages show the share of cases in the full dataset or each SI type, which were assigned specific relations. Shares do not add up to 100% as more than one category could be assigned to each case. * highlight the highest percentage across SI types, in case of significant differences across SI type at p-value <0.05 (see Table S3 for further details on contingency table tests).*

4.4 Problem-orientation of social innovations in agri-food

The dataset provides a rich overview of different problem framings related to the need for and use of SI in the agri-food context, comprising its problem-orientation. Overall, five problem classifications were most present in the dataset, while another five categories were less present (see Table 4 for the full overview). The most frequently mentioned issue is *socio-economic exclusion & marginalization*. This includes issues beyond the agri-food system itself, such as poverty, unemployment and depopulation. Here SI is presented as a means to address these major societal challenges. In most other cases, the problematization remains closer to challenges directly related to food and agriculture, presenting SI as a means to improve the agri-food system itself. In this latter category, we distinguish between *food production challenges*, which include issues such as low agricultural productivity, the effects of climate change and food waste; *lack of access*, which refers to limited availability and access either to safe, fresh and quality food or to land or the agri-food market; and *disconnection*, which can take many forms and shapes, which are often interrelated. For example, some of the cases refer to the disconnection between people and places (i.e. the deterritorialization of food production), the disconnection between people in the food system (i.e. between producers and consumers, mistrust in certification systems) as well as the disconnection between people and food itself due to industrialisation processes and unsustainable consumption patterns. The final dominant problem category revolved around *environmental degradation*. While most of the problem descriptions in this category remain rather

general, others point to specific problems of overexploitation (e.g. overfishing), loss of biodiversity or increased fragility of ecosystems.

We identified significant differences in problems among SI types (Figure 6). Social agri-enterprises significantly addressed *socio-economic exclusion* (62%), *environmental degradatio*n (73%), *poor health* (44%) and *political failure* (50%). Tech-driven agri-services specifically dealt with *food production challenges* (73%). Agri-environmental initiatives address *environmental degradation* (52%). Community food networks dealt specifically and almost uniquely with *disconnection* (50%).

Table 4: Types of problems identified

Type of problem	**Includes**
Socio-economic exclusion & marginalization (n=56; 33% of all cases)	marginalization of vulnerable groups and communities, depopulation issues in rural areas, poverty and unemployment issues as well as the lack of education.
Food production challenges (n=53; 32%)	low agricultural productivity, the limited income of farmers, limited generational renewal and cropland abandonment as well as food production vulnerabilities through climate change or through limited variability, challenges of digitalization and pest control in food production as well as the issues around food waste.
Disconnection (n=37; 22%)	disconnection between human-place (i.e. the deterritorialization of food production), the disconnection between humans in the food system (i.e. between producers and consumers, mistrust in certification schemes) as well as the disconnection between human and the food itself due to industrialization processes and unsustainable consumption patterns.
Environmental degradation (n=36; 21%)	problems of overuse, the loss of biodiversity and the fragility of certain ecosystems
Lack of access (n=36; 21%)	lack of access to food (e.g. food poverty & insecurity or the uneven access to safe, fresh and quality foods), to land (for new farmers, for citizens) as well as to markets (local or rather distant).
Power imbalances (n=17; 10%)	uneven decision and economic power between food system actors, e.g. the market power of retailers, the domination of agribusinesses for example in seed monopolies as well as the speculative practices done with agricultural land.
General unsustainability of the food system (n=15; 9%)	general unsustainability (social, environmental or economic) of the global food system. Sometimes these general statements are connected with the downsides of the capitalist system and globalization but are not further specified.
Poor health (n=13; 8%)	unsustainable and unhealthy diets and malnutrition.
Political failure (n=11; 7%)	problems of corruption and institutional voids to the failure of development projects and distrust in political leadership.
Impact challenges (n=3; 2%)	very specific for an already developed social innovation, such as the problem of scaling and spreading or as well as the lack of opportunities to innovate.

In addition to the problems, we also analyzed whether specific triggers were mentioned that enabled the emergence or development of the SI. Although less than a third of the cases referred to such a specific trigger, we find interesting indications of which events or situations can provide a window of opportunity for SI in the agri-food sector. The triggers identified are *growing demand and awareness*, *institutional changes, responses to environmental or agricultural practices and conflicts, the COVID-19 pandemic, socio-economic crises, increased availability of resources, and the emergence of new networks*. Table 5 provides additional context for these triggers from the perspective of SI types. Community food networks were significantly connected to the trigger *Growing demand and awareness* (25%), compared to other SI types (Figure 6). Other triggers were not significantly different.

Table 5: Types of triggers identified

Type of trigger	**Includes**
Growing demand and awareness (n=17; 10% of all cases)	food scandals, discontent & distrust with conventional food system.
Institutional changes (n=15; 9%)	very concrete, e.g. the election of a new mayor or also more general e.g. changes in environmental law.
Environmental issues (n=12; 7%)	Response to conventional agricultural practices and conflicts.
COVID-19 (n=11; 7%)	response to the impact of the pandemic on food distribution and the increased popularity and awareness for direct marketing channels.
Socio-economic crises (n=8; 5%)	Response to socio-economic conditions following a crisis, e.g. the 2008 economic crisis in Europe.
Increased availability of resources (n=6; 4%)	novel legal instruments, public-private partnerships, online platforms, policy initiatives, subsidies or small seed grants, etc.
Emergence of new networks (n=7; 4%)	Creation of interested groups, new associations which opened up space and opportunity for SI.

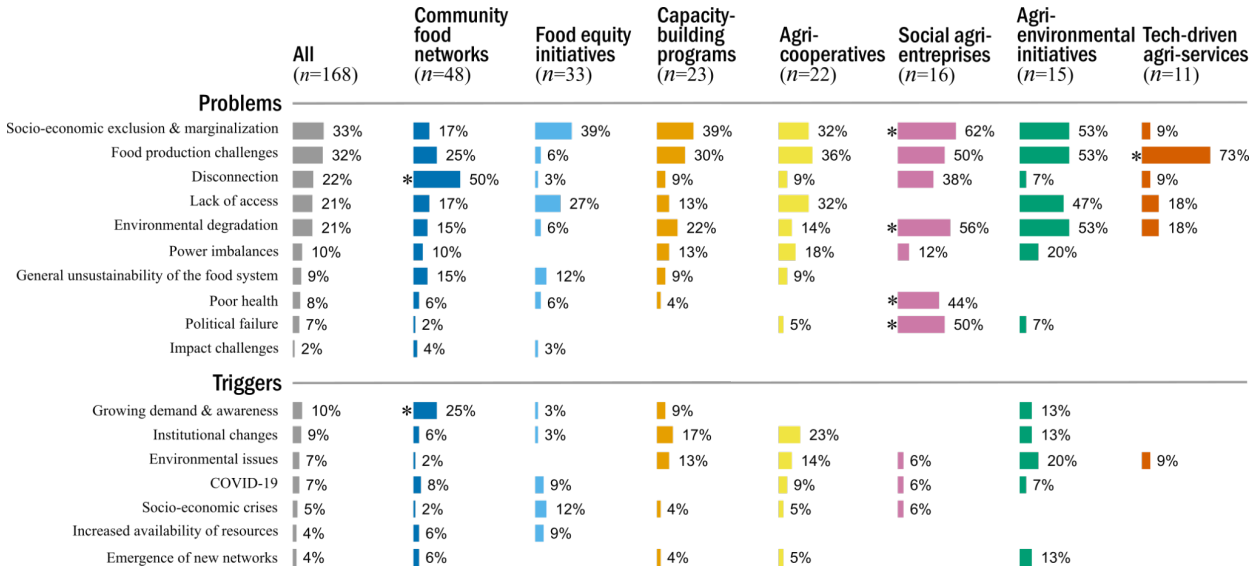

Figure 6. Shares of problems and triggers in all cases and for the seven assigned SI types. (Same methodological remarks as for Figure 5. See Table S3 for further details on contingency table tests.)

4.5 Transformative orientation of social innovations in agri-food

In this section, we focus on the transformative orientation of the cases and the contributions and obstacles associated with the cases within a broader social transformation process. In almost a third of the cases, no specific link was made between the SI case and transformation. The findings presented below therefore only apply to part of the dataset.

SI in the agri-food context are associated with different types of transformation. The most common is a focus on *sustainable change* and *food system transformation*, often in combination. In addition, links are made between SI and rural development, broader socio-political changes such as social order, and in a few cases also socio-spatial or socio-technical transformations. Statistical tests across SI types show that social agri-enterprises (62%) are particularly associated with sustainability-oriented transformations, while the community food networks (52%) are linked to food system transformations (Figure 7). We find that SI, even in their transformative orientation, can be linked to a variety of transformation processes, possibly even simultaneously.

The list of potential contributions by SI to transformation processes is long and varied. The most prominent contribution is in *knowledge and capacity building*, for example by creating spaces for learning new skills. This contribution is linked to two other prominently mentioned contributions: the *creation of new social relations* and *networks between actors* in different places, and the *strengthening of empowerment, inclusion and trust*, for example in relation to gender mainstreaming and the empowerment of marginalized actors. The contribution of SI to *creating economic opportunities* and *changing consumption patterns or agricultural practices* is also mentioned. Many of the cases are also linked to the potential to scale up or out of their niche and

contribute to system transformation and changes in power relations. More information on these contributions, as well as others less frequently mentioned in the dataset, can be found in Table 6.

In comparing transformative contributions according to SI types (Figure 7), we found that social agri-enterprises predominantly focus on *social relations* (44%), *gains in environmental sustainability* (38%), *knowledge and capacity building* (50%) and *changes in agricultural practices* (38%). Many agri-environmental initiatives create *economic opportunities* (40%). Community food networks focus on *changes in practices* (40%), while *entrepreneurship and innovation* are most common in agri-cooperatives (27%).

Table 6: Types of contributions identified

Type of contribution	**Includes**
Knowledge and capacity building (n=41; 24% of all cases)	potential and contribution for/to knowledge and capacity building, related to learning, transfer, training opportunities, knowledge exchange, spillover, capacity building, education, attitudes, capacity for engagement.
Social relations and networks (n=35; 21%)	new social ties and networks, e.g., linking different actors, rural-urban, network building, public-private partnerships, place-based & territorial relations.
Empowerment, inclusion & trust (n=33; 20%)	empowerment of vulnerable groups, safe spaces, gender empowerment, inclusion, justice, trust
Economic opportunities (n=30; 18%)	contributions to (regional and individual) economic development, increased yields, economic capital building.
Change in behavior (n=28; 17%)	general change in practices and behavior, often among consumers such as reduced food waste, sustainable practices, changed consumption.
Mainstreaming & scaling of niches (n=24; 14%)	SI are considered to have the potential for being mainstreamed, scaled out of current niche, i.e., replication, scaling up & out.
Power and governance change (n=22; 13%)	change in governance schemes and modes, policy change, changes in power relations.
Change in agricultural practices (n=21; 12%)	changes in how agriculture is practiced related to organic farming, land protection, changes in products (differentiation, fair trade, etc.), marketing, pilot carbon farms.
Other social benefits (n=17; 10%)	shared social responsibility, social farming and local community benefits, quality of life.
Environmental sustainability gains (n=12; 7%)	gains related to biodiversity, nature conservation, climate change mitigation, ecological stewardship.
Entrepreneurship & innovation (n=11; 7%)	entrepreneurship & innovation (also in periphery).
Discursive change (n=7; 4%)	change of frames, narratives.

Institutional work (n=7; 4%)	advocacy work or institutional work aimed at the change of institutions.
Cultural change (n=6; 4%)	change in values, norms, human-nature relations.
Conservation of culture (n=5; 3%)	recovery/conservation of culture, traditions, and practices.
Alternative economies (n=4; 2%)	contributions and spaces for local economies, alternative capitals, capitalist emancipation.
Experimenting & prefiguration (n=3; 2%)	experimenting & prefiguration of change in experimental spaces, inspiration, prefiguration.

SI initiatives encounter various obstacles to contributing to transformative processes (see Table 7). Many cases face *formal dependency* as an obstacle, related to issues such as lack of formal support from policy makers at different levels, or related to legal barriers and access to land or public services. In many cases, *isolation* is a barrier, which limits the impact on other actors and networks. There are also cases of *conflict and contestation* between different actors or with existing institutions and regimes. *Power and agency* are seen as barriers, e.g. related to asymmetric power relations, as well as documented *lack of capacity and knowledge*, e.g. related to training and administrative or formal skills. Some also report *issues related to economic aspects* such as funding or labour costs, while others discuss the *conventionalization of SI* and reduced transformative capacity as obstacles. Finally, in some cases, *issues related to participation and recruitment of volunteers* can be an obstacle to the contribution of SI to transformation. In comparing obstacles across SI types, we found that community food networks faced the most *isolation* (i.e., difficulties related to scaling and stabilization) (35%), while food equity initiatives strongly faced *formal dependency* (45%) (Figure 7).

Table 7: Types of obstacles identified

Type of obstacle	**Includes**
Dependency (formal) (n=37; 22% of all cases)	dependency on formal institutions, lack of formal support and formality related to policy at different levels, bureaucracy, infrastructural support, access to land, public services, legal barriers, lack of formality.
Isolation, scale & size (n=36; 21%)	difficulties related to the stabilization of niche practice, scaling difficult, size, small, narrow, limited effect on other networks and actors.
Conflict & contestation (n=13; 8%)	conflict and contestation with existing institutions, other initiatives, regime, members, perspectives, misunderstandings, local elites, farmer resistance, overlapping interventions.
Lack of power & agency (n=9; 5%)	issues related to power and agency concerning asymmetric power relations, autonomy (retail etc.), lack of power for structural change, competition for resources.

Economic issues (n=8; 5%)	economic issues due to high costs, labor costs, debt levels, continuous financial support necessary, funding, shareholder interest.
Lack of capacities and knowledge (n=7; 4%)	issues related to capacities & knowledge such as training, lack of administrative and formal skills.
Conventionalization (n=6; 4%)	conventionalization and reduced transformative capacity because of partnering with public agencies, promoting business as usual, pragmatic approach to change inside capitalist grammar.
Participation (n=5; 3%)	issues related to participation and recruiting of volunteers such as commitment, communication, group homogeneity.

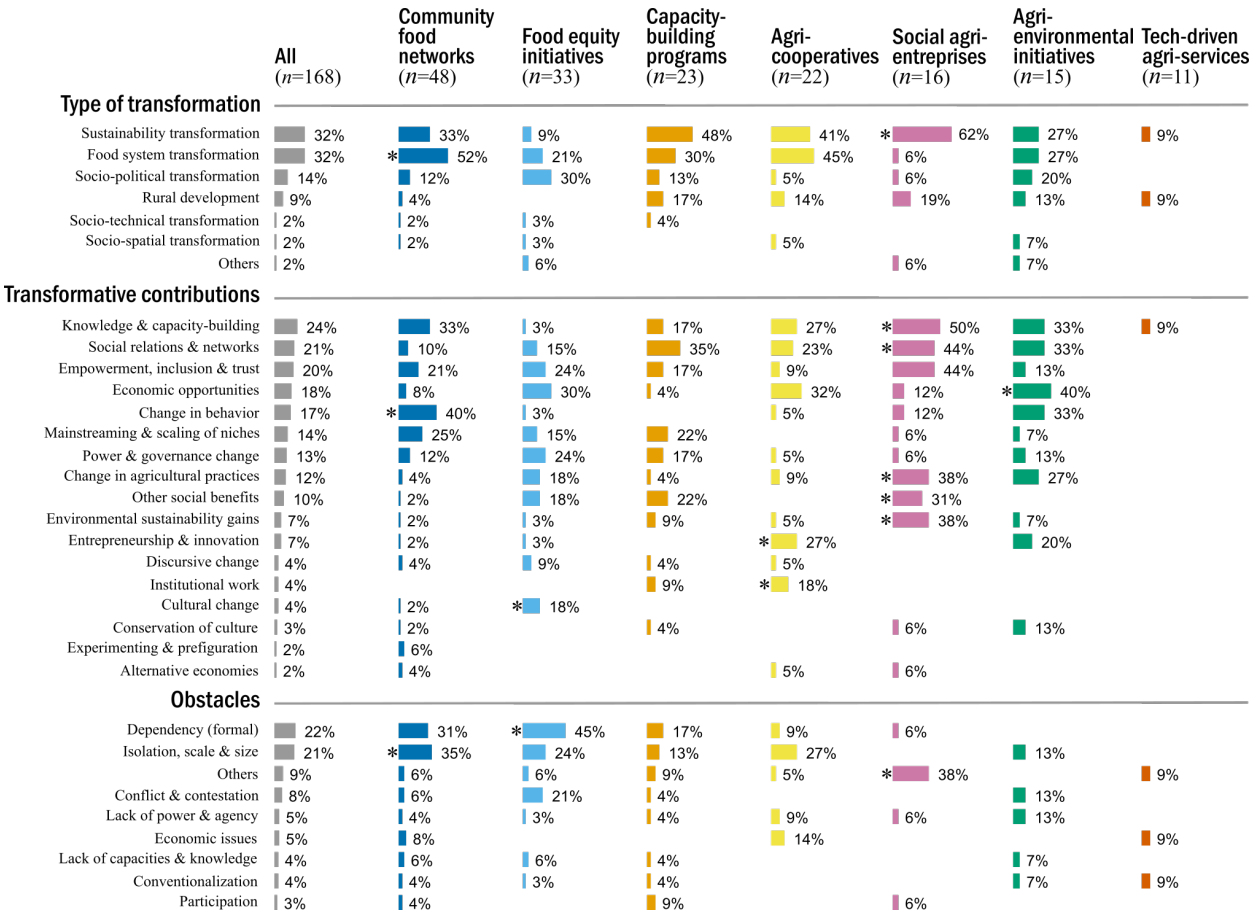

Figure 7. Shares of type of transformation, transformative contributions and obstacles in all cases and for the seven assigned SI types. (Same methodological remarks as for Figure 5. See Table S3 for further details on contingency table tests.)

5. Discussion

The findings of this paper provide valuable insights at two levels. First, it allows for an integration of case-level findings, highlighting interesting and relevant characteristics and operational

practices of SI initiatives in the agri-food sector, as well as their transformative orientation (see 5.1). Second, the data and our findings also represent the current state of SI in agri-food research, contributing to the lively discussion on the transformative potential of SI (see 5.2) as well as highlighting certain biases, blind spots and unanswered questions that remain to be answered (see 5.3).

5.1 Main insights on the operation and orientation of social innovations in agri-food

The results of this study highlight the wide diversity of approaches that are analyzed and understood as “social innovations” (SI). While other scholars have identified clusters of research communities studying SI (Van Der Have and Rubalcaba 2016), but have refrained from categorizing SI in general due to its broad applicability to different social and environmental problems (Eichler and Schwarz 2019), we have been able to structure SI for the agri-food context, based on their organizational and practical design and their thematic focus. In all the types identified (see section 4.2), the SI concept is characterized by initiatives that integrate social issues and relationships with the economic and/or environmental spheres of the agri-food sector. Moreover, the types show that SI is not "only" concerned with the provision of agriculture and food, but is always linked to a service for the wider society, both within and beyond the agri-food context. This confirms that SI is used as a broader concept than alternative food networks or grassroots (Zoll et al. 2024).

Within this variation, the dataset and its analysis point to interesting and potentially surprising characteristics (presence or absence) of the cases that may indicate some trends in SI operation. First, the Eurocentric focus of the data set is immediately apparent. While this is not directly surprising as most SI research clusters are located in Europe and the US (Rajasekhar 2020; Janik et al. 2021), the dominance of Italy - which accounts for more than a fifth of the total dataset - may represent a novel insight, suggesting that in this country SI dominates the theoretical perspective from which certain phenomena (CSAs, urban gardens, etc.) are studied. Second, the results confirm the regional character of SI cases and their strong link to rural areas and rural development (Neumeier 2017; Castro-Arce and Vanclay 2020). Third, the dominance of a for-profit orientation of SI in the data is noteworthy. While the "social" element often carries the connotation that there is no economic objective driving these initiatives, practice shows otherwise. This finding suggests that for-profit operations are not inconsistent with social and environmental goals, and SIs challenge this long-held assumption. Mission-driven initiatives are increasingly adopting for-profit strategies to raise funds to ensure the sustainability of their causes. Likewise, for-profits are adopting mission-driven characteristics, ultimately leading to a growing number of hybrid organizations (Komatsu Cipriani et al. 2020). Fourth, the findings on internal and external relations go beyond the argument that these are key to SI (Phillips et al. 2019; Pel et al. 2020), but provide deeper and more integrated insights into which internal and external relations play a critical role in the work of initiatives and what practices build and sustain these relations. The findings are consistent with the SI literature, in which micro-level processes at the individual and initiative levels enable members to work on issues that matter to them and provide them with a sense of autonomy, relatedness, and competence (Pel et al. 2020).

In addition to SI operation, the results of this study also provide insights into SI orientation. In line with the diversity of cases, there is also a diversity of problems for which SI is perceived as a potential solution. Overall, the problem orientation is clearly linked to a social or socio-economic issue or need. Even when the problem description focuses on environmental degradation, it is linked to the negative social consequences of this situation. Also with regard to the transformative orientation, the results show a wide variety of possible transformation processes to which SI is linked, encompassing social, economic, political and environmental dimensions. However, a focus on food system transformation and broader system change, often in combination, dominates. This shows that the "agri-food" element of the SI initiative is often both the goal and the means in the desired change process. The fact that SI addresses and improves multiple social problems, challenges, or issues is a common finding, indicating that different societal problems are intertwined and that the ways to address them are also interrelated (Eichler and Schwarz 2019). In addition, the limited number and variety of triggers identified in the SIs studied is noteworthy. This suggests that SI do not necessarily rely on a contextual shift or a specific window of opportunity to emerge and develop. Instead, they result from a long-term, socially embedded process. In contrast, other scholars often highlight sudden shocks or abrupt crises as key drivers of social change (Biggs et al. 2010; Howaldt et al. 2015; Jaeger-Erben et al. 2015). This, in turn, underscores the crucial role of relations, particularly in facilitating spaces and institutional environments that create the necessary conditions for SI to develop.

Looking more closely at the links between operation and orientation, this study highlights that the problem and transformation descriptions are often rather broad and general, while the initiatives are mainly focused on place-based and local activities. This finding strengthens the argument that there is no one type of SI for one problem or one transformation process, but that context matters and helps to explain the wide variety and diversity of SI operations and orientations. We illustrate this with an in-depth discussion of three of the SI types, each representing a different constellation of SI operation and orientation.

The first type is the most common SI type in the literature to date, *community food networks*, and the most represented in Europe. The focus of this type of SI is on promoting food system transformation by creating self-organized initiatives and networks, connecting producers and consumers, and promoting shared visions and goals to foster behavior change, especially in urban areas. Contributing to broader transformation relies on regional network approaches, consumer and producer participation, and behavior change in urban areas. *Community food networks*, which rely heavily on personal connections and shared values, are limited in their ability to scale. As this also limits their solutions to food system problems to a small scale, replication of initiatives may be promising to spread this type of SI (Kump and Fikar 2021). However, there is a lack of research on the long-term economic viability of such food supply models (Egli et al. 2023). The second type are *social agri-enterprises*, which are most common in South America. They include for-profit social and environmental entrepreneurs and agritourism initiatives that aim to address a wide range of social, economic and environmental issues through knowledge and capacity building, social networks, changing agricultural practices and ensuring environmental benefits. In the literature reviewed, *social agri-enterprises* emerge as a more holistic approach to promoting broader sustainability transformations by addressing complex and interconnected

problems, including through for-profit enterprises. While mission adherence can positively influence purchase intentions for *social agri-enterprise* products (Ip et al. 2024), these enterprises often lack dedicated policy support, highlighting the importance of collaborative relationships to create synergies (Lorenz et al. 2024). The final type of SI discussed in detail here are the *tech-driven agri-services*, which are most prevalent in cases from Asia. They include for-profit digital and service innovations, such as e-commerce services, producer apps, and peer-to-peer lending systems, developed at the national level and mostly targeted at food production challenges. Compared to other types of SI, *tech-driven agri-services* hardly address any kind of relational context or broader societal transformations, which may limit their transformative reach. Yet, it is worth noting that *tech-driven services* are scaling up at a large scale rather than at a local scale, which may lead to greater transformative potential. Even though some scholars argue that virtual solutions help sustainability-oriented niche providers reach a wider range of users (Alfnes et al. 2024), they should be understood as complementary and not a substitute for real-life connections, as they cannot replicate the same experiences offered in material spaces (Bos and Owen 2016).

5.2 Transformative potential of SI

The transformative potential of SI is a key discussion in the literature (e.g., Wittmayer et al. 2019; Pel et al. 2020; Zoll et al. 2024), as well as in policy and practice. It is a challenging task to pinpoint exactly how transformative potential is expressed and how it can be measured or analyzed, given the emergent nature of SI and the different systems and/or boundaries (e.g., Pel and Stirling 2024) through which transformations are considered and which drive empirical research questions. However, given the integrative picture of this review, we present insights that can enrich the ongoing discussions, also beyond the agri-food context.

In our analysis, we find that most external relations focus on securing the initiative (e.g., financially) and increasing the impact of their activities. In this regard, SIs focus primarily on relationships with the state and on creating public-private partnerships through advocacy practices, confronting elected officials, and negotiating regulatory frameworks. At the same time, the documented barriers to achieving greater impact are external to SI and can be overcome by targeted policy interventions aimed at creating a supportive environment for the development of SI. This points to the crucial role of multi-level policy making in providing conditions such as land, exchange platforms, financing, etc. and in shielding SI. We also see the importance of strong relationships with government organizations, as several SI cases documented this as a key focus. However, this finding can also be nuanced, as 'dependency' - including on the state - is also perceived as a major obstacle to transformation. This suggests that SI requires institutional support from stable actors to enable community-based, participatory forms of innovation (Pel et al. 2020). We note that it also documents the somewhat ambivalent role of state-SI relations, the different quality they can have (e.g. dependency vs. support), and the challenges of formalizing - often informal - social arrangements that can be associated with a loss of autonomy and the original values of an SI initiative (Wittmayer et al. 2020; Zoll 2024).

Surprisingly, collaboration with other like-minded actors and initiatives in broader networks (as suggested by Pel et al. 2020 for broader impact) does not appear as prominent in the data, suggesting that this element may be a major blind spot in SI operations to increase their

transformative potential beyond their own initiative (Zoll et al. 2018). In addition, only a few cases mention scaling or mainstreaming as a key strategy to enable change. This is somewhat at odds with strategies for SI to achieve social change through outscaling and replication (e.g., Westley et al. 2014; Moore et al. 2015), but confirms the often-discussed contextual relevance of SI and the place-specific effects of SI. At the same time, it raises the question of what other strategies of amplification SI can employ to enhance its transformative potential (see Lam et al. 2020; Dabard et al. 2024). In addition, we note that replication and outscaling is an academic view of processes of social change that are often considered across different SIs. These dynamics can be difficult to report on or anticipate for SIs because they transcend their operational scale.

Finally, our review documents that the production, exchange and transfer of knowledge is a key relational approach of SI. These practices are also represented in the transformative contributions that initiatives can make, as the lack of knowledge and capacity is seen as a barrier. This may point to a key resource that drives SI and that social actors need to mobilize. While this calls for reflection on how SI can be used in regions with less knowledgeable actors and structures, such as those provided by higher education institutions, our research documents many SI cases from rural and peripheral regions (as does other research, e.g., Neumeier 2017; Castro-Arce and Vanclay 2020), some of which are often considered to lack knowledge for technological innovation.

5.3 Reflection on the state-of-the-art of SI in agri-food scholarship and future directions

Based on the findings and experiences of this review, we will highlight and reflect on certain characteristics of SI scholarship and discuss possible ways forward. Overall, there is a lack of critical engagement with SI at both the conceptual and empirical levels.

First, the resulting Eurocentric focus of our review is in line with the concentration of conceptual research in Europe (e.g., Moulaert et al. 2005; Avelino and Wittmayer 2019; Pel et al. 2020; Wittmayer et al. 2020). Although there are some exceptions, it is imperative for future integrative efforts to explore if and why other concepts are used in other geographical contexts to describe similar phenomena and improve learning. Even within the Eurocentric academic culture, it is often unclear why the SI concept is used to pursue an analysis rather than one of the other widely used options such as AFNs or grassroots innovations. Making this choice more transparent and argumentative will help to better understand which and how cases should be compared and integrated. Based on the literature reviewed, we also found that the SI concept and related conceptual foci such as its relations (cf. Pel et al. 2020) are characterized by fuzziness and ambiguity in their use in empirical research. This becomes a challenge when attempting to integrate and systematize findings beyond descriptive statistics. Furthermore, although conceptual work on SI is developing and gaining prominence in the field, using the SI lens does not require addressing certain characteristics of initiatives. Consistent with this ambiguity is the unexplored relationship between 'social innovation' and 'transformative social innovation'. While this is the result of recent conceptual developments, we suggest that future research take a stronger position here and justify the chosen concept. This will allow for more fine-grained and

systematic accounts of assessing the impact and transformative aspects of SI in the context of agriculture and food.

Second, SI are often framed as inherently good, fueling high expectations of transformative impact (Dabard et al. 2024; Dannemann et al. 2024). While research has begun to highlight the downsides of SI (e.g., Coad et al. 2021; Fougère and Meriläinen 2021; Pel et al. 2023a), the case studies in our review rarely report downsides, unanticipated or negative consequences. In addition, the literature reviewed shows that the documentation of problem orientation is much more prominent than the engagement with transformative contributions, as if these were assumed rather than empirically situated. While this may to some extent be due to the emergent nature of SI, this normative underpinning of research risks implicitly mobilizing a biased picture of SI and reinforcing conceptual and empirical blind spots in certain areas of research. We call for a critical engagement with normative assumptions and increased reflexivity among researchers in order to explore the real potential of SI for much-needed transformative processes of various kinds.

Building on these reflections, we also highlight a number of relevant directions for future research on the topic. First and foremost, the analysis points to relevant empirical research avenues that need to be explored, such as how empowerment is understood and practiced within SI, an examination of the challenges SI face in engaging and building broader networks, and how this affects their success in addressing the issue at hand. In addition, there is a need to explore how SI could strengthen its transformative impact at different scales and to develop methodological toolkits to better understand and identify transformative SI. Furthermore, while the analysis pointed to the diversity of internal and external relations associated with different types of SI, little could be said based on the data about the quantity and quality of these relations and how they changed over time. Also, the distinction between internal and external relations has often not been made in the literature. Making this distinction more explicit may contribute to a deeper integrative understanding of the operational design of initiatives. Based on our analysis, we also suggest that future research should more thoroughly explore different types of SI and their precise operational and orientational patterns. Our review is a first step in unraveling these somewhat contradictory findings and systematizing research on SI in the context of agriculture and food. While these research avenues emerge from our review of the agri-food context, they also have great potential to provide insights for other sectors analyzed through an SI lens, such as energy or mobility, to explore cross-cutting empirical challenges of SI, and to systematize conceptual and empirical work.

6. Limitations and concluding outlook

This review presents, to our knowledge, the first in-depth integrative perspective on SI in the agri-food sector, without limiting it to a specific part of the value chain. Through our analysis, we have been able to systematize, integrate, and deepen the knowledge on the operation and direction of SI. Of course, like any academic endeavor, this review has a number of methodological limitations. We acknowledge that our review focuses only on peer-reviewed research published in English, thereby excluding other valuable insights from gray literature or research published in other languages. The conceptual focus on SI, operationalised through our search string, deliberately excluded other approaches, such as grassroots innovation, in order to explore the

potential and specificities of this particular area of research. Future research could further complement our findings by comparing them with other concepts, particularly also because the same empirical phenomenon might be considered through different conceptual perspectives. Note also that our results should be read as trends, as some cases did not provide consistent information about some of our codes, especially regarding their problem and transformation orientation. With our findings, but also with our experiences in working with the diverse scholarship adopting an SI lens to address empirical questions, we have also contributed to the lively discussion on the transformative potential of SI and future directions of SI scholarship. Overall, this study provides solid insights and practical suggestions to further cultivate social innovation in and for sustainability transformations in agri-food contexts and beyond.

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