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Participatory Research in Organic Farming: Insights from an Agroecology Living Lab in a Mediterranean Area

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Abstract

Agroecology living labs (ALLs) are progressively flourishing in Europe, materializing in newly conceived forms of participatory research open to a variety of actors. The living lab concept and its key implementing pillars are however not yet fully familiar to potential stakeholders, including those already experiencing co-research and co-innovation initiatives. An ALL in Southern Italy, operating at regional scale with organic farming operators, is testing different forms of actor engagement to enrich crop diversification arrangements, co-validate existing practices, experiment with innovative socio-technical approaches and explore their adaptability and scalability to the regional context and beyond. Results show significant potential for the ALL approach as long as the living lab can ensure motivation in participation, responsiveness to needs, flexibility of involvement and concreteness of outcomes. Moreover, as living labs are not necessarily self-propelling entities and may deal with stakeholder fatigue or with lack of expertise to address barriers to development, our experience shows that tailored initiatives have to be deployed in critical moments to either value existing opportunities or mitigate constraints. Success also depends on full deployment of genuine participatory approaches to ensure engagement of actors and to avoid trivializing the key methodological principles.

Keywords: agroecology, living lab, organic farming, participatory action research, crop diversification.

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1 Introduction

Participatory approaches, enabling a consensual identification of socio-technical solutions to existing or future problems, are often enacted in agrifood research and innovation (R&I) initiatives (Iocola et al., 2023). Once embedded in R&I funding programmes, there is a risk of them

turning into top-down technocratic approaches where participation is simply a mere simulation of engagement dynamics (Pimbert, 2017). In spite of this, efforts to achieve genuine participatory research activities that encompass both programme-led and bottom-up approaches to co-design alternative food systems, also addressing questions of equity and social justice, are recently intensifying (Rosset et al., 2019; Rosset and Martinez-Torres, 2012, Bezner Kerr et al., 2022; Pimbert, 2022).

In this context, participatory R&I processes in the agrifood domain have gained considerable recognition in the European Union (EU), so much so that their specific financial support arrangements have been conceptualised to operate under both research and innovation schemes (e.g., multi-actor research projects, innovation operational groups, living labs). Nevertheless, co-research and co-innovation initiatives still differ in terms of degree of actor engagement, their interaction with the different phases of the research as well as the variety of actors essentially involved in the process (Schneider and Buser, 2018). Farmer involvement may range from the request to host on-farm experiments, to compensation for income loss or extra work with small project budgets, to the establishment of a formally equal role in the initiative, sometimes disguised as investments to avoid double payments under the EU's Common Agricultural Policy regime.

The organic farming sector can be considered a frontrunner for experiential and participatory R&I in food and agriculture. It has built much of its knowledge reservoir on pioneers' experiments, direct observations and – gradually emerging – collaborative interactions between operators and a growing scientific community, in learning-by-doing and failing-forward conditions (Padel, 2001). Such approaches are still present in organic farming collaborative R&I and they are adopted by both researchers and actors with a greater awareness of obstacles, solutions and eagerness for smooth and functional cooperation (Canali et al., 2020).

Hence, after decades of experiential and empirical collaborative approaches in organic R&I (Delate et al., 2017; Koch, 2004; Leeuwis and Aarts, 2011), and after a dozen years of their institutionalization in the EU domain (Canali et al., 2020), there is a need to take the multi-actor approach in organic R&I a step further. Accordingly, the more recently implemented living lab framework for collective action is now broadening the set of options for participatory endeavours in agroecology and organic farming, as attested by its formal integration in research programmes (i.e., European R&I partnership on agroecology and its 2024 call for proposals; CORE ORGANIC, 2021).

Living labs (LLs) are considered as real-life environments and methodologies at the same time, including heterogeneous stakeholders and applying different models, methods, tools and business approaches (Hossain et al., 2019; Zavratnik et al., 2019). Originally, the concept mainly focused on technological innovation but gradually expanded to include broader social challenges (McPhee et al., 2021). In contrast with test bed setups, where users are involved as passive participants (Hossain et al., 2019), the LL method has been introduced to more generally stimulate and accelerate innovation through the direct participation of users in the design, implementation and validation of innovations (Leminen and Westerlund, 2019), as well as to address complex societal challenges and to steer sustainability transitions (Bouwma et al., 2022).The LL implementation can hence promote social engagement, having the potential of empowering marginalized actors, supporting social innovations, promoting collective action towards meaningful system changes (Bezner Kerr et al., 2022; Ciaccia et al., 2021). The potential of living labs in fostering capacity development and de-marginalisation in rural areas as well as in the food and farming domain is also being explored (Guzman et al, 2008; McPhee et al, 2021; Chapagain and Mikkelsen, 2023) and the concept is receiving increasing attention, undergoing a progressive theoretical and practical evolution. This transformation process towards user-centered sustainable food systems

fits with holistic attitudes that embrace a long-term vision, such as agroecology: the resulting "agroecology living labs" approach (Kiseleva, 2021; Barrios et al., 2020), thus encompasses a biophysical component (the agroecosystem as well as the trials, both in experimental and real-life conditions) and a social component (the actors engaged in the decisional process and in the validation of results) (Ciaccia et al., 2021).

In this paper, we draw reflections on the adoption of tailor-made participatory practices in setting up, facilitating, and consolidating the Agroecology living lab (ALL) approach, also adopting and adapting previous experiences from literature. In particular, we aim at capitalising the activities carried out in Southern Italy through the ERA-NET Core Organic-funded ALL-Organic research project revolving around temporal, spatial, genetic and practice-related crop diversification in organic farming. We report on the strategies implemented to dynamize the interactions with and among the involved actors and to promote their effective engagement in the process. Moreover, we present preliminary indications and evaluations on some of the biophysical agroecological arrangements carried out by the ALL participants. We finally articulate on how to energise an Agroecology living lab, countering emerging or underlying barriers, and discuss the participatory approach requisites resulting from the ALL dynamics, including in relation to the labels adopted to their framing vis-à-vis the participating actors.

2 Method

The opportunity to implement living lab approaches in a broader socio-technical context than previously experienced under different multi-actor and participatory frameworks has been seized through the ALL-Organic project (Agroecology Living Labs to promote robust and resilient Organic production systems), carried out in the Basilicata region (Southern Italy). The project, funded by the ERA-NET Core Organic programme and also activating ALLs in Estonia, Poland, Romania and Algeria, aims at testing crop diversification options in experimental and real farms as well as at examining LL dynamics in terms of functional socio-technical interactions with and among consumers, food processors, civil society organisations and local Authorities, further to (organic) farmers and advisors.

Based on previous research initiatives revolving around a public lighthouse farm (Ciaccia et al., 2021; Nicholls and Altieri, 2018; see also DG AGRI, 2021), the Agroecology living lab was launched in the Basilicata region in 2021 calling on participation of regional organic farms as living lab '*primus inter pares*' (first among equals). The relaunched dynamic after the SARS-COVID 19 pandemic break offered renewed and broadened conditions for interaction among researchers, (organic) farmers and advisors around crop diversification experiences, through plenary, thematic and bilateral meetings. Participants were involved through personal ad hoc invitation, 'word-of-mouth' informal encouragement and social media launches, mostly targeting the organic farming community and related stakeholders. Plenary and thematic meetings also welcomed participation of non-agricultural actors, such as informed citizens, value chain operators and local institutions representatives.

As previously introduced, the ALL approach was meant to nurture and reflect upon two main and interconnected axes, which represent the main innovation goals: i) the socio-relational interactions within the LL, to explore the co-innovation potential in a broad territorial context and ii) the sustainability improvements of crop diversification experiences in their biophysical configurations (i.e., in a Long-Term field Experiment – LTE – and on-farm trials - OFTs). Altogether, they provide complementary indications on a landscape of agroecological patterns in the region and on the related knowledge, including knowledge gaps.

A methodological approach of participatory action research was used to collaborate with local communities and achieve a clear understanding of the role, resources and competencies of researchers and other actors during the ALL development trajectory (Ciaccia et al., 2021; Neef and Neubert, 2010; Van de Fliert and Braun, 2002). The ALL interactive activities were then managed according to a long-range, cyclical, self-correcting mechanism, following a simple four-step Action Research Spiral (plan, act, observe, reflect; Kemmis and McTaggart, 2000). A series of plenary and thematic gatherings, bilateral (in-person or online) meetings and farm visits aimed to design individual experimental pathways, to assess socio-technical progress, to discuss prerequisites of and actual participatory dynamics, to collect and analyse feedback on both socio-relational and biophysical aspects, to videorecord farmers' crop diversification experiences. The whole set of initiatives allowed the enforcement of actionable knowledge (Rossing et al., 2021), empowering stakeholders through action and iterative learning (Gamache et al. 2020), paving the way to the ALL advancement and providing room for manoeuvre to enlarge the initial core group of actors to a greater variety of stakeholders. This ultimately made the Agroecology living lab more dynamic and diverse in actors' composition and agroecological trajectories, thus also allowing to take into consideration the implications of ALL's work for the larger food system scale. Indications on actors' stakes, constraints, ambitions, networks, collaborative intentions and agroecological configurations were drawn through participatory observations (Audouin et al., 2019; Chonkova, 2014), qualitative interviews (Lavrakas, 2008) and problem tree analysis (DFID, 2002), whose emerging features are discussed in the results section.

Parallel to fostering and monitoring interactions within the ALL, a number of crop diversification initiatives were kickstarted, enriched or simply analysed in a reconfigured LTE and in real farm contexts, considering their temporal, spatial, genetic and practice-related dimensions. In a nutshell, crop diversification options ranged from implementing longer and more complex rotations, to introducing horizontal (e.g., strip cropping) or vertical (e.g., agroforestry) spatial combinations, to cultivating evolutionary populations (such as for durum wheat, common beans and tomatoes), to testing on-farm input production (e.g., compost, tea-compost and vermicompost).

3 Results

3.1 Agroecology living lab foundations and modus operandi

The ALL-Organic project funding allowed to reconvene in 2022 a pre-existing network of actors pooled together around the AGROFORSYLL (AGROFORestry System Living Lab) initiative promoted by CREA since early 2019 (Ciaccia et al., 2021) and discontinued due to the SARS-COVID 19 pandemic. AGROFORSYLL dynamized Basilicata's organic farmers around new cultivation arrangements whose explorative testing had to be carried out under more controlled conditions in an experimental station and whose contextualization and scalability to the macroregional farming area meant to be collectively discussed by an assorted group of farmers, advisors and researchers. In that occasion, the main routes for agroecological development emerging from the participatory exchanges (i.e., plenary meetings and a survey) where inspired by the need to diversify and integrate crops in newly designed configurations. This aimed at delivering greater farm resilience, taking into consideration climatic (long periods of drought; floods and prolonged water logging) and market drivers. Agreed options led to tests of: i. the integration of perennial crops (e.g., fruit crops) and/or agroecological infrastructures (e.g., hedgerows) with field and vegetable crops (agroforestry systems); ii. the implementation of practices able to contrast the effect of climate change in the area (e.g., intercropping, cover crop introduction, soil/hydraulic arrangements); and iii. the introduction of local and open pollinated varieties and landraces (Ciaccia et al., 2021).

Leveraging this existing network of actors and the initial trials and deliberations, new stakeholders were identified and attracted to the newly configured Agroecology living lab, thanks to the mediation of a cultural broker (a local organic farming expert). The cultural broker was tasked to facilitate the ALL dynamics and to highlight additional farmers' expertise as well as needs. A re-convened plenary meeting was then organised in April 2022 to recall the work done before the pandemic break and to present the opportunities arising from the new project. Thirty-nine people attended the first ALL plenary meeting: 21 farmers, 6 advisors, 8 researchers and 4 belonging to other constituencies (students, representatives of upstream companies). The meeting was convened in the research station that hosted the pre-pandemic initiative both to ensure continuity of intentions with the previous activities and to offer a neutral venue for participants. Discussions mostly revolved around the Agroecology living lab dynamics, the crop diversification options and the incumbent challenges for the organic sector. In this occasion, researchers mainly facilitated the dialogue to allow mutual familiarization among participants and the introduction of operational indications for crop diversification in the different pedoclimatic, agroecological and value chain situations in the Basilicata region. In this cognitive and socio-relational context, discussion about the biophysical LL component revolved around suitable and implementable crop diversification configurations in organic farming. Three main crop diversification typologies were considered of particular interest by the ALL participants: a) the agroforestry combinations, b) the adoption of evolutionary populations (organic heterogeneous materials, OHM, in the EU Organic Agriculture Regulation 848/2018 jargon), c) the on-farm agricultural input production (e.g., compost, tea-compost).

As the Agroecology living lab took its shape, greater space was given to contents and the crop diversification arrangements became centre stage. The first ALL reunion was followed up by bilateral meetings (Summer 2022 – Winter 2023) with a selection of actors, visiting their farms, analysing their crop diversification practices, exchanging about the farms' organizational layout and business intentions. These bilateral meetings were also organized to exchange about innovative ways of crop diversification to be tested and to identify new potential actors and related experiences. To this end, video-interviews were performed to highlight the farmers' 'unique selling point' in terms of innovation and savoir-faire and to give birth to a "library" of experiences, making sure that valuable and retrievable information is made available to the LL participants and to a larger audience. In this respect, video-interviews were edited and uploaded in a dedicated area of a scientific partner website to showcase a virtual "living library" allowing an easier identification of the available know-how (and of its holder) within the living lab. A total of 16 visits and 8 video-interviews were performed between July 2022 and June 2023 (table 1).

This activity was paralleled by the provision of information and expertise on key productive and policy aspects, which was also meant to nurture a sense of community and networking opportunities the ALL wanted to convey. As the National Strategic Plan for the EU Common Agricultural Policy (CAP) was about to be finalized (by the end of 2022) and implemented (as of 1st January 2023) a workshop was organized in November 2022 to respond to the participants' request for elucidation on the legislative and regulatory context. The workshop provided organic (and conventional) farmers with indications about the CAP technicalities and financial support opportunities, with peculiar respect to crop diversification and agroecological aspects. Two external policy experts and a senior advisor were invited to contribute.

Table 1. ALL initiatives and related contents

Topic	July '22	Sep. '22	Nov. '22	Feb. '23	June '23	Video-interviews
Production of agricultural inputs (e.g., vermicompost)	1	-	-	-	-	1
Agroforestry solutions (e.g., fruit with officinal plants and/or vegetables)	1	-	1	2	-	2
Use of Organic Heterogeneous Materials and mixture of varieties (e.g., durum wheat OHM and mixtures)	2	-	-	-	1	3
Diversification practices (e.g., reduced and/or alternative tillage)	-	1	2	1	-	1
Other (e.g., local varieties and landraces use)	1	3	-	1	-	1
Total	5	3	3	4	1	8

On the same day of the workshop, a subsequent new ALL plenary gathering offered the occasion to present the experimental station's crop diversification initiatives as well as to discuss the hypotheses to be implemented in the parallel on-farm trials. In a mixed, yet unbalanced, participation of 31 farmers (the far-greater constituency attending the meeting), 6 farm advisors, 2 agri-food processors, 3 non-project researchers, 3 students, the core of the discussion revolved around some technical aspects (such as tillage options or the preparation and use of tea-compost) and concrete perspectives for crop diversification approaches at both farm and market levels. The meeting also allowed the expression of interest by those farmers willing to trial unexperienced practices or organizational farm arrangements.

Interestingly, this set of interactions led to the definition of a gradient of farmers' involvement in the ALL activities, outlining different roles: the 'experimenters' of on-farm original solutions, the 'testers' of crop diversification options resulting from the ALL experimental initiatives, the 'discussants' of crop diversification innovations based on their own similar experiences and, finally, the broader set of 'participants' to meetings and events (figure 1). This latter role is more open-ended and plays the dual role of experience providers as well as beneficiaries of the stimuli generated by the others' more direct involvement in concrete crop diversification initiatives. The figures for each category are continuously evolving: at present, 4 experimenters, 5 testers, 15 discussants and ca. 100 participants compose the ALL actorial group.

Further to plenary and bilateral meetings, the ALL offered the occasion for a more in-depth discussion and learning on one of the crop diversification approaches, notably genetic diversification, through a dedicated on-farm encounter targeted to cultivation and reproduction of durum wheat Organic Heterogeneous Material (OHM). The event, attended by 20 farmers, 2 farmer advisors, 3 durum wheat processors and 3 non-project researchers, was organized in June 2023 with multiple objectives: i. provision of techno-scientific and regulatory information on OHM by two external senior geneticists who also guided the assessment of its yield potential and phytosanitary status; ii. field participatory assessments of durum wheat OHM performance, allowing participants'

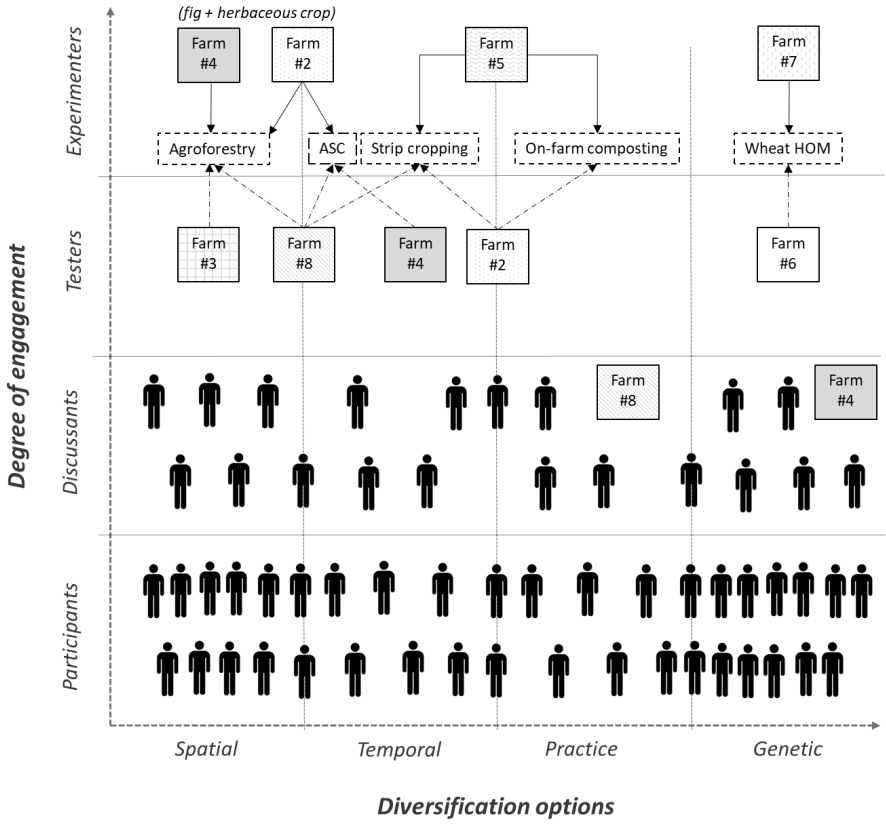

Figure 1. Gradient of farmers' involvement in the Agroecology living lab activities: i) 'experimenters' represent farmers testing the original diversification solutions and participating in the result acquisition; ii) 'testers' represent farmers testing crop diversification options resulting from the ALL-experimental initiatives; iii) 'discussants' debate the results; iv) 'participants' represent the broad group participating to meetings and events. ASC: agroecological service crops; OHM: organic heterogenous materials.

observations and comparisons with uniform varieties grown under organic conditions; iii. analysis and operationalisation of durum wheat OHM value chain perspectives, notably bread and pasta as final products; iv. setting up of a durum wheat OHM seed network in the region, based on the notification of the durum wheat OHM to the Ministry of Agriculture, Food Sovereignty and Forestry as the foundation of a seed material to be reproduced and cultivated by a network of regional farmers.

In all meeting (plenary, thematic and bilateral) occasions, the researchers presented the ALL Organic 3-year project opportunity and its Agroecology living lab setting, stressing the prominence of co-creation and sharing of knowledge. Similarly, the adaptative nature and flexibility of intended crop diversification options were highlighted, aiming at a conciliation between existing farmers' organizational as well as productive choices with their possible re-orientations based on the ALL indications and on the performance evaluation provided by the involved scientists.

3.2 Biophysical component investigation

The ALL crop diversification experiences were planned to be carried out both in an experimental station and in a few farms. Farmers could choose from a variety of interventions (agroforestry, intercropping, longer and more complex rotations, introduction of agroecological service crops, strip cropping, adoption of cross composite populations or self-produced inputs). The individual crop diversification choices of the Agroecology living lab actors were foreseen to be assessed in their

performance either through 'ordinary' scientific means (such as evaluation of the diversification strategies in terms of productivity, weed management and soil fertility) or collective observations. Any of these potential experiments have been bilaterally discussed between the organic farmers and the research team to ensure both the consistency with the ALL-Organic project goals and the possibility to provide the necessary scientific expertise in support of their implementation and monitoring. These exchanges were sometimes followed up by more dedicated and detailed conversations to plan the specific crop diversification arrangements. They resulted in a matrix of interventions to outline the scale and location of the farm plots devoted to experiments as well as the specific technical aspects to investigate. Starting from the farmers interest in the different options, the on-farm trials were co-designed in an iterative way encompassing the farm visit, bilateral remote meetings and on-site discussions.

At the end of the process, 5 parallel trials were designed, whose implementation would be completed by Autumn 2024. As summarised in table 2, the co-designed solutions consisted in: i) a comparison between agroforestry system (fig and vegetables) *vs* pure vegetable and pure fig system (farm #2); ii) introduction of cover crop in citrus *vs* tilled citrus (farm #3); iii) intercropping of officinal plants in fig system *vs* pure fig (farm #4); iv) introduction of strip cropping and implementation of on-farm composting plant (farm #5); v) cultivation of durum wheat OHM (farm #7). Agreed protocols for self-monitoring the evolution of the trials and the compared systems (e.g., weed diversity and management, yield quantity and quality) as well as the setup of user-friendly indicators for the evaluation of results are accompanied by in-situ samplings carried out by the project researchers, to allow a more rigorous, yet still participatory, monitoring of the results.

Table 2. ALL biophysical component at the end of the 2022-'23 process

Diversification strategy	Farm ID#							
	1	2	3	4	5	6	7	8
Temporal								
Complex rotation	X				X			X
Agroecological service crops (ASC)	X	X	X	X				X
Spatial								
Intercropping	X		X	X	X			X
Agroforestry (fruit - vegetable crops)	X	X		X	X			X
Agroforestry (fruit - cereal crops)	X							
Hedgerows	X	X	X	X	X			X
Strip cropping	X							
Genetic								
Use of landraces/local varieties	X				X			X
Use of mixture of species	X		X	X				
Organic heterogeneous material	X		X	X	X	X	X	

Diversification strategy	Farm ID#							
	1	2	3	4	5	6	7	8
Practices								
Farm compost	X	X		X	X			X
Minimum/zero tillage	X	X	X	X	X			X

4 Discussion

4.1 The identified prerequisites for living lab realness

McPhee et al (2021) illustrated the characteristics of "agroecosystem living labs" defining aims, activities, participants, and contexts based primarily on observations from case studies in Canada and France. Among these defining characteristics, the place-based context emerged as particularly relevant, underlying the functional embeddedness of such experiences in the local food systems. Inspired by this study, the ALL-Organic project shows that the Agroecology living labs potential is amplified once a number of key requirements are fulfilled, possibly altogether (table 3): a. motivation of actors; b. responsiveness to operational and relational needs; c. urgency of challenges; d. legitimacy of the LL proponents; e. concreteness and realism of tested options; f. flexibility of involvement.

- **Motivation of actors**. Willingness to be involved in a collective endeavour is often taken for granted, however reluctance to engage in a third party-proposed venture whose reason is to foster territorial development and not leading to direct and more immediate results is common. This does not only apply to research in agriculture, but also in the health (Bakken et al., 2009) and education (Kuswandoro, 2023) domains, including when policy-setting is at stake. The Basilicata ALL witnessed a widespread actors' interest, particularly among organic farmers, who felt the opportunity to engage in an operational network of like-minded people and saw the occasion of identifying solutions to pressing needs. Overall, more than 100 participants attended the plenary and thematic meetings, most of whom were organic farmers willing to concretely explore and analyse crop diversification options: this indicates a quite relevant attachment to the ALL, compared to similar initiatives carried out in other territories and contexts, including those promoted by the authors of the present paper (Delate et al., 2017; Canali et al., 2020).

- **Responsiveness to operational and relational needs**. Significant participation to ALL events and propositions likely occurred for two concurrent reasons: on one hand, market and climatic vagaries are determining increasing uncertainties in managing organic farms so that more resilient conditions are searched for, valuing applicable crop diversification options for their potential to stabilize farm yields and to provide flexibility in relation to market demand and price fluctuation; on the other hand, opportunities to liaise with peers and/or scientific knowledge holders (whether researchers or advisors) are seen as an effective way to expand or consolidate social networks (Yu et al., 2019), if not even to get rid of social and cognitive isolation.

- **Urgency of challenges**. Worries in terms of economic and environmental farm performance are triggering some entrepreneurial audacity meant to explore innovative business

options, further amplified by the acceleration and severity of climatic extreme events and by the market and economic destabilization resulting from the war in Ukraine.

- **Legitimacy of the LL proponents**. Previous interactions and collaborative research initiatives promoted in the region (e.g., through the AGROFORSYLL project) enabled trust building between researchers and actors; moreover, the integration of a cultural broker to the coordination team granted a relational and scientific credibility to the newly fashioned ALL. These friendly conditions ensure mutual confidence among the key participants and pave the way to a hopefully enduring collaboration, whose main challenge is the ALL perennialization once the funded project is over. At the same time, this pre-condition should be functional to a locally adapted governance of LLs leading to actors' empowerment based on specific arrangements and roles (Toffolini et al., 2021).

- **Concreteness and realism of tested options**. A reality check is necessary to assess the biophysical experiments' worth for the farmers. While it is - at present - premature to evaluate the crop diversification options' performance, this will be carefully analysed through participatory approaches to achieve a co-validation of results using both practitioners' and researchers' lenses. This latter effort will be mainly carried out by the 'experimenters', jointly with the research team, leaving the doors open to any additional ALL participants willing to observe and have a say about the on-farm crop diversification experiments, particularly those who play the 'discussant' role in the ALL.

- **Flexibility of involvement**. The gradient of ALL participants engagement is aimed at providing flexible and friendly conditions to accommodate different operational, cognitive and schedule availabilities of ALL participants (Hong Huang and Thomas, 2021). Offering room for greater or lesser involvement enables an expanded network of actors to occur and generates a larger reservoir of relevant knowledge to nurture the ALL collective. The project's living library is exemplificatory in this respect: representing a variety of existing crop diversification approaches, the video-interviews complement, enrich and inspire the practices introduced through the project experiments, overall providing a diversified set of organic farming agroecological modalities. Moreover, the living library sets the conditions to uphold the links of the ALL network once the project and its trials are over, possibly ensuring a legacy.

Table 3. Enabling requirements for an Agroecology living lab in the Basilicata context

Requirements	Local contextualisation	Agroecology living lab evidence
Motivation	The Basilicata's agri-food sector plays a major role in the regional economy (the highest share in Italy), due to the significant weight of employment in agriculture and a wide range of products, representing a key lever in sustaining remote rural areas (Viccaro et al., 2018)	Plenary meetings favoured an intense debate on the role of non-scientific actors in local development, enabling the emergence of the need for greater actors' involvement in R&I initiatives and policy design
Responsiveness	Organic farmers, particularly smallholders, are open to exchange opinions and solutions in participatory activities aimed at: (i) meeting the growing demand for local products, ensuring fair remuneration (Silva et al., 2019) and (ii) sharing own experiences and knowledge (Ciaccia et al., 2021)	Several farmers highlighted the need to achieve more complex, yet performing cropping systems, also relying on diversification options, to be less vulnerable to market and climate fluctuations. The absence of well-developed and functioning local associationism for organic farmers, resulting in sense of isolation, is mitigated by the ALL relational and networking opportunities
Urgency of challenges	In the last two decades, the area has been affected by the increased recurrence of flooding events, favoured by natural factors (soil characteristics), severity of climate change and human activity (Bentivenga et al., 2020). Moreover, the region was impacted by inputs price spikes resulting from the Russia-Ukraine conflict (Amicarelli et al., 2023)	The adoption of OHM raised great interest, leading to a dedicated activation of one ALL research strategy, with the identification of an 'experimenter' farm and 6 'testers', and the organisation of a dedicated training meeting. Development of an on-farm composting plant in one 'experimenter' farm to showcase practices and results, resulting in other farmers as followers
Legitimacy of LL proponents	The CREA experimental station in the Metaponto plain area has a long history of collaboration and interaction with local producers and processors (Ciaccia et al., 2020; Ciaccia et al., 2021). Availability of cultural brokers to enable connections among groups having different socio-economic backgrounds (Jezewski and Sotnik, 2001)	Previous field research experiences had led to the creation of a network of actors, mainly from the Ionian coast of Basilicata. The identification of a cultural broker (an agronomist familiar with the regional organic farming community) made it possible to reach out new actors, facilitating the integration of newcomers to the original network

Concreteness and realism	The LTE acts as a territorial hub for innovation, in which (i) research demands derive directly from stakeholders, (ii) research issues are addressed and tested in-situ, and (iii) results are discussed within the same stakeholder platform. The connection with territorially-based farms maximizes the impact of the activities at local/regional scale (Ciaccia et al., 2020)	Local experiences as well as farmers' knowledge and needs were collected and discussed to design the new LTE activities in order to showcase implementable solutions. The process led to experiments that reflect emerging needs and innovation trajectories of the territory (e.g., the choice of fig in agroforestry system; the creation of a local OHM seed system; etc...) and are of relatively easy replicability
Flexibility of involvement	Participatory approaches are seldom applied in the region or in the farming sector. As a consequence, flexibility and adaptability are often essential to achieve effective participation (Pain and Francis, 2003)	The ALL experience led to the definition of different roles of the actors (Figure 1). These roles are intended to be temporary, with the possibility of switching from one role to another depending on the topic and interest of the individual actors and their time availability

4.2 B-ALL, F-ALL, C-ALL, W-ALL: an alternative to standard SWOT analyses

Learning from what described above and pursuing more actionable knowledge (Rossing et al., 2021), the ALL-Organic experience led to convert a standard SWOT analysis into an operational set of enabling or avoidable conditions and related actions. Strengths, Weaknesses, Opportunities and Threats, highlighting internal and external factors that affect organisations or strategies (Bull et al., 2016), are here reconsidered to report and reflect upon initiatives undertaken by the ALL collective to address those factors. Playing with words, B-ALL, F-ALL, C-ALL and W-ALL (echoing BALL, FALL, CALL, WALL with the Agroecology Living Lab – ALL – at their core) refer to facilitating or constraining conditions for which actions allowed to lever opportunities (B-ALL and C-ALL) or to mitigate limitations (F-ALL and W-ALL).

LLs are hardly self-propelling entities (Toffolini et al., 2021): commitment, constancy in participation and tangibility of outcomes require shared motivations, a valuable trigger (being it policy incentives, concrete and accessible innovations or funded initiatives) and a functional interactive mechanic. The ALL-Organic activities showed that merely kicking off a living lab would not provide any sufficient conditions to ensure continuity of encounters and interventions, unless a core group of people/institutions fuels participation, dedicated human and financial resources are made available and intervention trajectories respond to actual needs and result manageable by actors. To get the Agroecology living lab rolling a few (pre)conditions were essential: energies from the inside, networking actors, triggering interest in actionable contents, provision of operational and cognitive resources to develop and strengthen capacity, showcasing examples of contextualizable innovations, pursuit of complementarity among actors, and value chain opportunities development. Moreover, in the ALL-Organic case, the LL vicariously played the role of dissolved local/regional organic farmers' associations as aggregation agent. These above-mentioned enablers represent the B-ALL (Table 4.i), entirely in the hands of the ALL promoters and actors.

Table 4. Examples of B-ALL, F-ALL, C-ALL, W-ALL

i. Getting the BALL rolling (starting and connecting)	**ii. Avoiding a FALL (actor disaffection)**
- Networking actors - Triggering interest in actionable contents - Provision of resources to develop capacity -Showcasing examples of contextualizable innovations	- Cultural broker mediation - Bilateral meetings and ad hoc interventions - Tailoring interventions to capacities and availabilities - Reconciliation of concepts with practice - Living Library strategy
iii. Making a CALL (for missing expertise)	**iv. Getting over the WALL (addressing barriers)**
- Identification and recruitment of external experts - Sharing of objectives and approaches	- Sharing of national/EU initiatives - Lobbying and advocacy

B-ALL is counterbalanced by F-ALL (Table 4.ii). Loss of actors' interest, lack of relevance, decontextualization of ideas vis-à-vis market dynamics, actors' socio-technical impediments, inadequate or asymmetric relationships may easily result in participants disaffection and withdrawal.

These risks were mitigated through a series of interventions and conditions. The role of a cultural broker with relevant knowledge of technical and social dynamics within the regional organic sector was important for the identification of tacit needs and to solicitate timely ALL proponents' interventions. Enough care was paid to bilaterally discuss the framework of individual roles and possibilities, offering a gradient of possible involvement and customising interventions as much as possible. Tailoring initiatives to emerging needs and operational capacity of both the actors group and the individual farms showed the possibility to reconcile collective and personal objectives (even if this may be time and energy demanding). The ALL's crop diversification framework was articulated into a set of possible actionable strategies to better suit the technical and marketing orientations of farms, whose *menu à la carte* was negotiated and operationalised within the ALL accommodating as much as possible actors' interests and possibilities. To avoid any science-centric dynamic, local and experiential know-how was valued and made recognisable through a set of video-interviews ultimately resulting in a living library of crop diversification options (and their performers), complementing the newly proposed ALL experiments. Further to enrich the overall ALL portfolio of experiences, providing individuals with roles, protagonism and visibility proved to enable allegiance to the common endeavour.

Despite the wealth of practices and capabilities within the Agroecology living lab collective, the ALL cannot be self-reliant on any possible relevant matters. Important areas for action on policy- or regulatory-related issues may require external advice or orientation. The same applies for some scientific or technical aspects. The ALL-Organic team made twice use of expertise recruited outside its realm and in both occasions (the EU Common Agricultural Policy – CAP - framework for subsidies; the cultivation and registration of Organic Heterogeneous Material) a large attendance showed a significant hunger for information, also far beyond the ALL participation boundaries. These public initiatives addressed emerging interests within the farming community that could not be fully responded within the available ALL expertise, requiring external experts: C-ALL results in a strategy of capacity development of the entire ALL collective, with the LL itself playing a crucial role of knowledge broker (Table 4.iii). This means that the Agroecology living lab territorial boundaries can be porous to integrate 'foreign' resource persons/organisations

where and when relevant to provide with expertise unavailable within its realm. Moreover, once informed about the ALL intentions and *modus operandi*, the external experts showed interest in its dynamics remaining somehow attached to the collective.

Finally, an Agroecology living lab acts in a context where a number of lock-ins hinder faster and more transformative development of the primary sector, as the policy and regulatory as well as market environments are not necessarily favourable to agroecological approaches. A more in-depth analysis of the socio-political barriers allows a greater understanding of constraints further to facilitate the identification of their mitigation potential. The ALL-Organic initiative operated in this respect promoting a greater awareness of ALL actors, including bringing in information and experiences in relation to national or European (agroecological) initiatives. This served to avoid a passive stand vis-à-vis barriers and to encourage a more collective call to action. W-ALL should not thus be a paralysing experience and it may be also countered through a dialogue with some of its institutional bricks: ALL Organic activated a dialogue with the regional and national Administrations to explore room for manoeuvre on identified areas of intervention, triggering interventions (e.g. advocating the printing of a training manual on evolutionary populations by the Regional Agriculture Development Agency) or paving the way to the durum wheat OHM registration, emulating similar EU and national initiatives (Table 4.iv).

4.3 Managerial and policy implications

The Agroecology living labs, to be intended as arenas for participatory processes among a varied set of actors, may result in a pool of suitable and available informative and cognitive sources to cope with the unpredictability of climate patterns and market dynamics. This socialising condition may enable greater adaptation to the vagaries that impact farming and would more largely mitigate the sense of isolation and minuteness in the face of challenges or fears of enormous magnitude (Angelini et al., 2016). In this respect, ALLs represent but one way of interaction and mutual enrichment between people living in rural – and somehow marginal – areas or conditions. Yet, they stimulate solidarity, goal convergence, sharing of instruments and incremental collective knowledge that may represent an added value vis-à-vis more individualised research and innovation endeavours. While all these aspects were only recently embraced by the ALL-Organic project, they do not represent the ambition of the present manuscript. They may anyhow receive further dedicated research, benefitting from social scientists' specialised attention, and possibly leading to policy reformulation in agricultural knowledge and innovation systems (AKIS), which is currently receiving relevant EU funding and whose efficiency and effectivity is sometimes questioned (EU SCAR AKIS, 2019).

5 Conclusions

Frequent calls for food systems transformation are increasingly echoed in many different, and sometime conflicting, environments: FAO (2021), transnational corporations (Bayer, 2020) and social movements (Declaration of the International Forum for Agroecology, 2015) plea for a rapid transformation of the food and farming systems to achieve a greater sustainability, more responsiveness to the climate crisis, food security and social justice. Drivers and end-points of the possible routes for food systems transformation, however, remain disputed (Colombo, 2023). This quest for transformative enterprises is not limited to farming and rural areas and it is echoed in urban contexts (Cuomo et al. 2020) or industrial activities (Scheel, 2016), to achieve circular economy and zero residues.

Promoting territoriality and agency, empowering the local community through the reinforcement of available competences, contrasting the ecosystems degradation, improving farming legitimacy through a greater agroecological performance may be ingredients for a more genuine and socially-sensitive transformation of primary production. Despite doubts about the LL capacity to really deliver solutions to societal challenges (Paskaleva and Cooper, 2021), this agenda may find a functional ally in the Agroecology living labs. Having a common framework for action and reflection as well as converging goals based on a debated consensus, LLs may operationalize territorially-embedded initiatives. Such plans might improve the technical approaches of a few and inspire a greater community to adapt the relevant techniques to their peculiar contexts, thus offering a scalability potential. Indeed, the launch of the European Partnership 'Accelerating Farming Systems Transition: Agroecology Living Labs and Research Infrastructures' (Partnership on agroecology - European Commission (europa.eu)), programmatically linking agroecology and living labs, shows the legislator's intention to strengthen research policies in this twofold direction.

The relevance of the ALL Organic's outcomes assessment shows a number of limitations. The time scale of the intervention, which also includes AGROFORSYLL previous activities, remains limited in order to more thoroughly assess the ALL impact on the region's organic sector and the sustainability of its network. The territorial focus, limited to the Southern Italy Basilicata region, hinders any generalization of our socio-technical considerations, not least in relation to the replicability of the crop diversification approaches. Speculations may thus lack of robustness and the presented experiences are not necessarily applicable in other contexts. However, our findings show that the quality and relevance of both participatory mechanisms and outcomes represent the quintessence of a living lab success, whose indicators have to be agreed upon by those involved. What the ALL-Organic initiative has demonstrated is that regardless of the "shell" that houses the participatory effort – whether it is a living lab or another venue – it is the participatory process itself that matters. In the ALL-Organic initiative the living lab "shell" seemed negligible for the participants. The ALL actors were informed about the LL framework the project worked with, but this did not lead to any particular excitement or aversion. Conversely, as many of the ALL actors were accustomed to partaking in knowledge co-creation initiatives, the greatest interest lay in the essence and results of the participatory dynamic.

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6 References

Amicarelli, V., Lombardi, M., Varese, E., and Bux, C. (2023). Material flow and economic cost analysis of the Italian artisan bread production before and during the Russia-Ukraine conflict. *Environmental Impact Assessment Review, 101*, 107101.

Angelini L., Carrino S., Khaled O.A., Riva-Mossman S. and Mugellini E. (2016) Senior Living Lab: An Ecological Approach to Foster Social Innovation in an Ageing Society. *Future Internet,8*(4), 50; https://doi.org/10.3390/fi8040050

Audouin, E., Bergez, J. E., and Therond, O. (2019). Participatory methodology for designing an agroecological transition at local level. *Agroecological Transitions: From Theory to Practice in Local Participatory Design*, 177-206.

Bakken S., Lantigua R. A., Busacca L.V., and Bigger J.T. (2009) Barriers, Enablers, and Incentives for Research Participation: A Report from the Ambulatory Care Research Network (ACRN). *The Journal of the American Board of Family Medicine, 22* (4) 436-445; https://doi.org/10.3122/jabfm.2009.04.090017

Barrios, E., Gemmill-Herren, B., Bicksler, A., Siliprandi, E., Brathwaite, R., Moller, S., Batello, C., and Tittonell, P. (2020). The 10 Elements of Agroecology: Enabling transitions towards sustainable agriculture and food systems through visual narratives. *Ecosystem and People*, *16*, 230–247

Bayer (October 13 2020) Bayer helping transform the food system through innovation in agriculture. https://www.bayer.com/media/en-us/bayer-helping-transform-the-food-system-through-innovation-in-agriculture/ Accessed on August 30 2023

Bentivenga, M., Giano, S.I., and Piccarreta, M. (2020). Recent Increase of Flood Frequency in the Ionian Belt of Basilicata Region, Southern Italy: Human or Climatic Changes? *Water*, *12*, 2062.

Bezner Kerr, R., Liebert, J., Kansanga, M., and Kpienbaareh, D. (2022). Human and social values in agroecology: A review. *Elementa: Science of the Anthropocene*, *10(1)*, 00090.

Bouwma, I., Wigboldus, S., Potters, J., Selnes, T., van Rooij, S., and Westerink, J. (2022). Sustainability Transitions and the Contribution of Living Labs: A Framework to Assess Collective Capabilities and Contextual Performance. *Sustainability*, 14(23), 15628.

Bull, J. W., Jobstvogt, N., Böhnke-Henrichs, A., Mascarenhas, A., Sitas, N., Baulcomb, C., ... & Koss, R. (2016). Strengths, Weaknesses, Opportunities and Threats: A SWOT analysis of the ecosystem services framework. *Ecosystem services, 17*, 99-111. https://doi.org/10.1016/j.ecoser.2015.11.012

Canali S., Antichi D., Cristiano S., Diacono M., Ferrante V., Migliorini P., Riva F., Trinchera A., Zanoli R. and Colombo L. (2020) Levers and Obstacles of Effective Research and Innovation for Organic Food and Farming in Italy. *Agronomy, 10*(8), 1181; https://doi.org/10.3390/agronomy10081181

Ciaccia, C., Ceccarelli, D., Antichi, D., Canali, S. (2020) Long-term experiments on agroecology and organic farming: The Italian long-term experiment network. In *Long-Term Farming Systems Research*; Elsevier: Amsterdam, The Netherlands; pp. 183–196. https://doi.org/10.1016/B978-0-12-818186-7.00011-4

Ciaccia, C., Testani, E., Fiore, A., Iocola, I., Di Pierro, M., Mele, G., Ferlito, F. Cutuli, M., Montemurro, F., Farina, R., Ceccarelli, D., Persiani, A., Canali, S., & Diacono, M. (2021). Organic Agroforestry Long-Term Field Experiment Designing Trough Actors' Knowledge towards Food System Sustainability. *Sustainability, 13*(10), 5532. https://doi.org/10.3390/su13105532

Chapagain M. R. and Mikkelsen B. E. (2023) Is a Living Lab Also a Learning Lab? Exploring Co-Creational Power of Young People in a Local Community Food Context. *Youth, 3*(2), 753-776; https://doi.org/10.3390/youth3020049

Chonkova, B. (2014) CrowdWise. In D3.2 Public Engagement Methods and Tools; Report of "Engage 2020, Tools and instruments for a better societal engagement in Horizon 2020"; pp. 49–51. Available online: https://engage2020.eu/media/D3-2-Public-Engagement-Methods-and-Tools-3.pdf (accessed on 29 March 2024).

Colombo L. (2023) Il podere delle parole. *Re| Cibo, 2*(1) https://doi.org/10.13135/3034-834X/9498

CORE ORGANIC (2021) CORE Organic Cofund Third Call 2021. 'Organic farming systems for improved mixed plant and animal production'.ERA-Net Cofund on Coordination of European Transnational Research in Organic Food and Farming Systems

Cuomo F., Ravazzi S., Savini F. and Bertolini L. (2020) Transformative Urban Living Labs: Towards a Circular Economy in Amsterdam and Turin. *Sustainability* 2020, 12(18), 7651; https://doi.org/10.3390/su12187651

Declaration of the International Forum for Agroecology, Nyéléni, Mali (2015) Development 58, 163–168. https://doi.org/10.1057/s41301-016-0014-4

Delate, K., Canali, S., Turnbull, R., Tan, R., and Colombo, L. (2017). Participatory organic research in the USA and Italy: Across a continuum of farmer–researcher partnerships. *Renewable Agriculture and Food Systems, 32*(4), 331-348.

DFID (2002). Tools for Development: A handbook for those engaged in development activity. Department for International Development (DFID). London, UK

DG AGRI (2021) Exploring potential synergies between Horizon Europe and the CAP on living labs and lighthouses applied to agriculture. European Commission; AGRI.DDG1.B.2/

European Commission, draft proposal for European partnership for accelerating farming systems transition: agro-ecology living labs and research infrastructures, 2022. Available online at https://research-and-innovation.ec.europa.eu/research-area/agriculture-forestry-and-rural-areas/ecological-approaches-and-organic-farming/partnership-agroecology_en Accessed on September 01 2023

EU SCAR AKIS (2019), Preparing for Future AKIS in Europe. Brussels, European Commission.

FAO (2021) Strategic framework 2022-31. Food and Agriculture Organization of the United Nations Rome, October 2021

Gamache, G., Anglade, J., Feche, R., Barataud, F., Mignolet, C., and Coquil, X. (2020). Can living labs offer a pathway to support local agri-food sustainability transitions? *Environmental Innovation and Societal Transitions, 37*, 93-107.

Guzman J.G., Schaffers H., Bilicki V., Merz C. and Valenzuela M. (2008) Living labs fostering open innovation and rural development: Methodology and results; *IEEE International Technology Management Conference (ICE)*, Lisbon, Portugal, pp. 1-8

Huang, J. H., & Thomas, E. (2021). A Review of Living Lab Research and Methods for User Involvement. *Technology innovation management review, 11*(9/10), 88-107.

Hossain, M., Leminen, S., and Westerlund, M. (2019). A systematic review of living lab literature. *Journal of cleaner production, 213*, 976-988.

Iocola, I., Ciaccia, C., Colombo, L., Grard, B., Maurino, S., Wezel, A., and Canali, S. (2023). Agroecology research in Europe funded by European and transnational programmes: current status and perspectives. *Open Research Europe, 2*(139), 139.

Jezewski, M.A., and Sotnik, P. (2001). *The Rehabilitation Service Provider as Culture Broker: Providing Culturally Competent Services to Foreign Born Persons*. Center for International Rehabilitation Research Information and Exchange: Buffalo, NY, USA.

Kemmis, S., and McTaggart, R. (2000). Participatory Action Research: Communicative Action and the Public Sphere. In The Sage Handbook of Qualitative Research; Denzin, N.K., Lincoln, Y.S., Eds.; Sage Publications Ltd.: Thousand Oaks, CA, USA, pp. 559–603.

Kiseleva, M. (2021). Agroecology living labs: defining characteristics and key components of their successful orchestration. In Digital Living Lab Days Conference (p. 102).

Koch C. (2004) Innovation networking between stability and political dynamics, *Technovation, 24*, 729-739

Kuswandoro, W. E. (2023). From Reluctance to Acceptation: Participation of Poor-People in Policy Implementation Using Discursive Institutionalism. *Jurnal Transformative, 9*(1), 1-21.

Lavrakas, P. J. (2008). *Encyclopedia of survey research methods*. P.J. Lavrakas Ed. Sage publications, Inc. Thousand Oaks, CA, USA.

Leeuwis C., and Aarts N. (2011). Rethinking Communication in Innovation Processes: Creating Space for Change in Complex Systems. T*he Journal of Agricultural Education and Extension 17*, 21 - 36

Leminen S. and Westerlund M. (2019) Living labs: From scattered initiatives to a global movement; *Creativity and Innovation Management*. https://doi.org/10.1111/caim.12310

McPhee, C., Bancerz, M., Mambrini-Doudet, M., Chrétien, F., Huyghe, C., and Gracia-Garza, J. (2021). The defining characteristics of agroecosystem living labs. *Sustainability*, *13(4)*, 1718.

Neef, A., and Neubert, D. (2010). Stakeholder participation in agricultural research projects: A conceptual framework for reflection and decision-making. *Agriculture and Human Values, 28*, 179–194.

Nicholls, C. I., and Altieri, M. A. (2018). Pathways for the amplification of agroecology. *Agroecology and Sustainable Food Systems, 42*(10), 1170-1193.

Padel, S. (2001). Conversion to organic farming: a typical example of the diffusion of an innovation?. *Sociologia ruralis, 41*(1), 40-61.

Pain, R., & Francis, P. (2003). Reflections on participatory research. *Area*, *35(1)*, 46-54.

Paskaleva K. and Cooper I. (2021) Are living labs effective? Exploring the evidence. *Technovation. 106*, https://doi.org/10.1016/j.technovation.2021.102311

Pimbert, M. (2022). Transforming food and agriculture: Competing visions and major controversies. *Mondes en developpement, 199-200*, 361-384.

Pimbert, M. (2017). Democratizing knowledge and ways of knowing for food sovereignty, agroecology, and biocultural diversity. In M. Pimbert (Ed.) *Food Sovereignty, Agroecology and Biocultural Diversity*. Taylor & Francis.

Rosset, P., Val, V., Barbosa, L. P., and McCune, N. (2019). Agroecology and La Via Campesina II. Peasant agroecology schools and the formation of a sociohistorical and political subject. *Agroecology and Sustainable Food Systems, 43*(7-8), 895-914.

Rosset, P.M., and Martínez-Torres, M.E. (2012). Rural social movements and agroecology: context, theory, and process. *Ecology and society, 17*(3), 12 pp.

Rossing, W. A., Albicette M.M., Aguerre V., Leoni C., Ruggia A., and Dogliotti S. (2021) Crafting Actionable Knowledge on Ecological Intensification: Lessons from Co-Innovation Approaches in Uruguay and Europe. *Agricultural Systems 190*,103103. https://doi.org/10.1016/j.agsy.2021.

Scheel C. (2016) Beyond sustainability. Transforming industrial zero-valued residues into increasing economic returns. *Journal of Cleaner Production*, *131*, 376-386. https://doi.org/10.1016/j.jclepro.2016.05.018

Schneider, F., and Buser, T. (2018). Promising degrees of stakeholder interaction in research for sustainable development. *Sustainability Science*, *13*, 129-142.

Silva, E., Hendrickson, J., Mitchell, P., and Bietila, E. (2019). From the field: A participatory approach to assess labor inputs on organic diversified vegetable farms in the Upper Midwestern USA. *Renewable Agriculture and Food Systems*, *34*, 1–6

Toffolini Q., Capitaine M., Hannachi M., and Cerf M. (2021) Implementing agricultural living labs that renew actors' roles within existing innovation systems: A case study in France. *Journal of Rural Studies*, *88*, 157-168; https://doi.org/10.1016/j.jrurstud.2021.10.015

Van de Fliert, E., and Braun, A.R. (2002). Conceptualizing integrative, farmer participatory research for sustainable agriculture: From opportunities to impact. *Agriculture and Human Values, 19*, 25–38. [CrossRef]

Viccaro, M., Rocchi, B., Cozzi, M., & Romano, S. (2018). SAM multipliers and subsystems: structural analysis of the Basilicata's agri-food sector. *Bio-based and Applied Economics*, *7*(1), 19-38.

Yu W., Chavez R., Jacobs M., Wong C. Y., and Yuan C. (2019) Environmental scanning, supply chain integration, responsiveness, and operational performance: An integrative framework from an organizational information processing theory perspective. *International Journal of Operations & Production Management, 39*(5), 787-814. ISSN: 0144-3577

Zavratnik, V., Superina, A., and Stojmenova Duh, E. (2019). Living Labs for Rural Areas: Contextualization of Living Lab Frameworks, Concepts and Practices. *Sustainability*, *11*, 3797. DOI https://doi.org/10.3390/su11143797.

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