CANALLS
AGROECOLOGICAL PRACTICES FOR SUSTAINABLE TRANSITION

D2.1. Methodology for co-creating optimal agroecological practice combinations- initial version

PROJECT ACRONYM: CANALLS
PROGRAMME: HORIZON Europe
Grant Agreement: No 101083653
TYPE OF ACTION: HORIZON-RIA
START DATE: 1 January 2023
DURATION: 48 months

Document Information

Issued by:	Diego Cerrudo
Issue date:	23/11/2023
Due date:	Dec 2023
Work package leader:	CIRAD
Dissemination level:	Public

Document History

Version	Date	Modifications made by
0.1	30/07/2023	First draft for review within CIRAD and by Mehreteab Tesfai (NIBIO) and Hycenth Tim Ndah (UHOH)
0.2	30/07/2023	First full version distributed by CIRAD for partners' feedback and quality review
0.3	11/12/2023	Version after incorporation of comments from quality review from IITA and ETHz
Final	31/12/2023	Final version was submitted to the European Commission

Authors

First Name	Last Name	Beneficiary
Diego	**Cerrudo**	**CIRAD**
Marc	**Corbeels**	**CIRAD**

In case you want any additional information, or you want to consult with the authors of this document, please send your inquiries to: diego.cerrudo@cirad.fr (Diego Cerrudo)

Quality Reviewers

First Name	Last Name	Beneficiary
Patrick	Mutuo	IITA
Isaac	Balume	ETHz

Disclaimer

Funded by the European Union under GA no. 101083653. Views and opinions expressed are however those of the authors only and do not necessarily reflect those of the European Union or REA. Neither the European Union nor the granting authority can be held responsible for them.

Executive Summary

Evidence shows that agroecology can increase agricultural productivity and build resilience to socio-ecological, economic, and climate shocks, delivering holistic solutions to complex food system challenges. However, we are missing well-tested and context-tailored agroecological practices (AEP). In CANALLS, we target equipping the agroecology living labs (ALLs) with practical tools to identify, implement, and optimize combinations of AEP that meet the opportunities and challenges of their context. This document describes the methodology for co-creating AEP combinations among ALLs' stakeholders, which is the deliverable 2.1 developed under Task 2.1. Agroecological transition involves simultaneous technological and institutional/organizational changes, accompanied by an increased capacity for problem-solving from farmers. Such a challenge calls for an innovation strategy that includes farmers and other actors in the agri-food system, and landscape policy improving relevance and legitimacy while maintaining the credibility of science. Moreover, the agroecological transition (AET) is an evolutionary process that can take several years to achieve a significant impact at scale. The AET is also a complex process occurring in different phases (conception, experimentation, implementation) which is dependent on the innovation system (IS). Therefore, the co-creation process not only must be efficacious, and efficient, but most importantly, it must be sustainable. Our focus is on the establishment of a co-creation process that can remain active once the CANALLS project is finished, which would allow deeper changes to happen. We intend to achieve that by adopting a participatory approach to the design of co-creation processes that adapt to the ALL particularities. The design of the co-creation framework and definition of exploration activities for the first year will be achieved in two workshops, online meetings, and stakeholder consultations within months 10 and 15 of the project. The activities are divided into four steps: 1) Get Ready: General alignments and coordination strategy of the co-creation process; 2) Shared vision: Agree on diagnosis and setting the scope for the co-creation; 3) Define the way: adaptation of the co-creation design to each of the ALL specificities and needs, co-creation design, AEP prototyping, and experimental design; 4) Action Plan: Planning of experimentation for the first year.

Table of Contents

List of Figures

List of Tables

Table 1: Terms and Definitions

Abbreviation	Definition
AEP	Agroecological Practice
AET	Agroecological Transition
AKIS	Agricultural Knowledge and Innovation System
ALL	Agroecological Living Lab
CP	Core Partners
DEED approach	Describe, Explain, Explore, Design approach
DST	Decision Support Tool
FFS	Field Farmer School
IPM	Integrated Pest Management
IS	Innovation System
ISFM	Integrated soil Fertility Management
NARES	National Research and Extension System
RST	Research Support Team
SH	Stakeholder
SROI	Social Return on Investment
VC	Value Chain
WP	Work Package
WS	Workshop

1. Conceptual bases

African food systems have great potential for enhancing food and nutritional security in and beyond Africa while driving inclusive and sustainable rural development (AGRA, 2018, Kerr et al. 2021, Horton et al. 2022, CDEAO, 2023). To tap into this potential, we must overcome the major economic, environmental, human, and policy challenges they face (SWAC/OECD, 2012). One alternative solution is agroecology, which offers an answer to this call (Holt-Giménez, 2002, Temple et al. 2018, Tittonell et al, 2022)). Evidence from practice in Africa shows that agroecology can increase agricultural productivity and build resilience to economic, socio-ecological, and climate shocks (AFSA, 2016), delivering holistic solutions to complex agri-food system challenges with people at their heart. However, we are missing well-tested optimal combinations of agroecological practices (AEP) tailored to the humid tropics of Central and Eastern Africa as well as evidence on their performance to inform decision-making for policy inputs. We need to speed up the agroecology transition by innovating and redesigning agroecosystems and food systems in a way that can meet the challenges of today and tomorrow. In response to this, one of the key tasks of the CANALLS project aims to equip the agroecology living labs (ALLs) with practical tools to identify, implement, and optimize combinations of AEP that meet the unique opportunities and challenges of their context. ***This document describes the proposed methodology for co-creating optimal agroecological practice combinations, which is the deliverable D.2.1 developed under task 2.1 activities.***

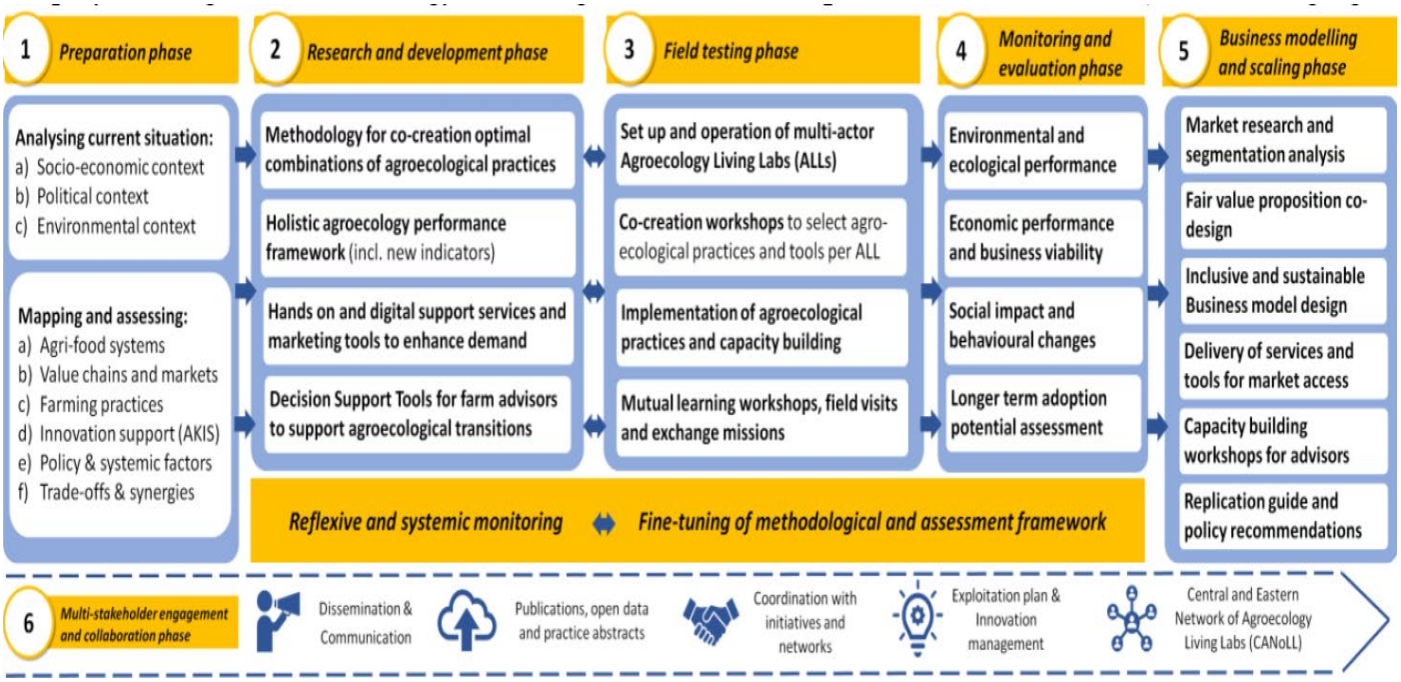


Figure 1: Description of core work packages of CANNALs

1.1. Co-creation: a key component of agroecological transition (AET)

Input-intensive technologies for agriculture production have been developed and transferred in a linear, top-down approach in different smallholder farmer contexts; however, systemic transformations require a change in knowledge production and innovation design and transference. An incremental and transformative[1] agroecological transition involves simultaneous technological and institutional changes, accompanied by an increased capacity for problem-solving from farmers and service providers to adapt the combination of practices to the local context (Posthumus, 2011, Temple et al, 2011, De Tourdonnet 2018). Such a challenge calls for an innovation strategy that includes farmers and other important multi-actors in the agri-food system, improving relevance and legitimacy while maintaining the credibility of science (Cash et al., 2003; Lacombe et al., 2018). It is becoming widely accepted that agricultural innovations

[1] *Transformative agroecology and combining science, practice, and social movements to create equitable and sustainable food systems. It's not just about sustainable practices, it's about integrating various approaches for fair and ecologically friendly outcomes. This involves anthropological methods to understand local knowledge and interdisciplinary science for comprehensive* research (Sachet et al., 2021).

respond better to local challenges when faced with farming systems and participatory approaches (Faure et al. 2010). Active involvement of end users in problem-solving and alternative development could increase the adoption of agroecological innovations (Reijntjes et al., 1992, Glover et al.2019) and maximize the impact of agricultural research (Leeuwis and Van der Ban, 2004; Aare et al., 2021)

Co-creation can be defined as the collaborative and/or cooperation development of new concepts, solutions, products, and/or services together with experts and/or stakeholders (http://www.open.edu/openlearncreate). It could allow for the blending of conventional methods with cutting-edge agroecological strategies. Moreover, it can help the stakeholders and other interested parties create their own systems, modify them to fit their needs and create their own compromises by utilizing both their own and scientific knowledge. Co-creation acknowledges the value of local knowledge, including that of farmers, rural communities, value chain actors, researchers, and other stakeholders. It involves them in the decision-making process and shares the leadership among them. Farmers' involvement is particularly important as it aims to increase their autonomy and self-determination over the process (Kindon et al., 2007a; Fals Borda, 2013) by defining the research problem, designing the research, and evaluating the anticipated results in collaboration with the researchers and other stakeholders.

Co-creation is a central element of agroecology (Figure 1; FAO, 2018), and as a result, there has been a large increase in research efforts on the integration of agroecology and participatory methods. The participatory approaches are based on research cycles in which farmers and stakeholders are no longer research objects but become research actors (Kindon et al., 2007b); meanwhile, that has been identified as a key to accomplishing a transformative AET (Levidow et al., 2014; Méndez et al., 2017; Sachet et al., 2021). As a result of the research interest, there is good evidence of the benefits and challenges of alternative participatory approaches applied to AET. Considering those is key to the design and implementation of a successful framework for the co-creation of AEP within the ALLs.

Box 1. The main challenges of co-creation for AET and some considerations to overcome them are:

- Understanding the drivers and lock challenges for achieving an agroecological transition requires long-term research, co-learning, and trust among stakeholders. This is a process that demands a substantial investment of time and resources (Pound & Posthumus, 2016; Sachet et al., 2021). Maintaining the required level of commitment and support from stakeholders can be challenging. *⇒ Target innovations that are expected to have a short-term, visible impact on farmers (e.g., increase in income or food, or reduction of labor) to engage them (Pound and Posthumus, 2016; Périnelle et al., 2021). Only advance into the pipeline AEP that farmers are willing to test in their fields (Bellec et al., 2012). Moreover, in cases where other stakeholders, such as output market players, have an active role in the co-creation process, the benefits for them should also match their efforts. Finally, it's important to invest the time and resources to identify and target innovations that can be part of a change already underway (Vall et. al., 2019).*

- The plurality of the process of co-creation can raise a game of power among stakeholders; some of them may use the process for personal agendas and bring issues of power imbalances (i.e., who controls the process), all making a facilitation complex (Andrieu et al., 2019; Bacon & Mendez, 2005; Bellec et al., 2012; Méndez et al., 2017). *⇒ The selection of a capable facilitator is critical (Pound and Posthumus, 2016). While the needed capabilities of the facilitator will differ among contrasting ALLs, some general attributes are; good knowledge of context, interaction competence (effective communication and problem solving), visualization competence (external memory of topics developed), participation competence (bringing out the best in a group by cumulative learning) and dramaturgic competence (arranging an event alternating between suspense and thrill, group and plenary sessions, experience and cognition), commitment, and open-mindedness (Oepen, 2003; van Dijk et al., 2017). Facilitation can be supported by developing a smart coordination strategy for the co-creation process, with clear rules and an ethical framework. In-depth planning of the meetings and workshops is necessary to ensure that only relevant stakeholders are present and that clear and realistic agendas are prepared well in advance. Taking good notes and preparing clear and short workshop minutes is very important for transparency and avoiding conflict.*

- The sustainability of the co-creation process is key to achieving the long-term research objectives required for AET. Failing to create a process that can be maintained once external support service ends would limit the realization of the out-scaling potential of an AET (Dabire et al., 2017; Lacombe et al., 2018, Mathe et al.2023). *⇒ In the initial cycles of co-creation, the focus should be on developing a sustainable co-creation process that can lead to the long-term changes required for AET rather than focusing on the improvements in agroecology parameters or knowledge creation (Lacombe et al., 2018). Handover of the platform has to be clearly planned from the initial stages, considering capacity building within ALL actors for effective management and financing of the co-creation process once the project is over.*

- Participatory approaches may encounter institutional barriers within the academic and development organizations. Institutional changes to the current R&D structures are needed (e.g., an adaptation of the role of the extension worker; Pound and Posthumus, 2016; Méndez et al., 2017; (Falconnier et al., 2017). *⇒ Inclusion and approval from the local research and extension institutions from the initial design stages are critical to ensuring that co-created AEP combinations can be successfully implemented. At the very least, local research institutions must validate and approve the findings before engaging in innovations that may require changes in current research and extension platforms.*

- There is limited evidence of impacts at the scale of participatory approaches applied to systemic changes in agricultural systems (one exception example being AAPRESID[2]). In

[2] *There is a remarkable example of an impactful and self-sustaining innovation platform from which valuable lessons can be drawn. The Argentine No-Till Farmers Association (AAPRESID; derived from the Spanish "Asociación Argentina de Productores en Siembra Directa") is an NGO that brings together farmers, public research organizations, and the private sector to promote the development of sustainable agricultural systems. Founded in 1989 by a group of farmers who understood that they needed to join forces and share knowledge to achieve their vision of more sustainable*

general, there is little consideration for the effect of the implementation of participatory approaches when researchers no longer lead the project (Lacombe et al. 2018). *⇒ A robust monitoring system to evaluate the efficacy of the co-creation process at early stages, combined with a multistakeholder, participatory, and open-ended approach by the ALLs, would allow changes where needed (Pound and Posthumus, 2016; Andrieu et al., 2019; Falconier et al., 2017). For that, the flexibility and adaptability of the co-creation process are needed.*

- The values and intentions of the different stakeholders in the co-creation process may not necessarily appear in the outcome. The open-ended and user-centered approach of co-creation can lead to tensions between actual changes and researchers' agendas (Perinelle et al., 2021; Fox, 2004; Bacon and Mendez, 2005). *⇒ Ensure that the interests of key stakeholders (the ones that could push the co-creation process in the long run) are reflected in the objectives. Communication of expectations from different stakeholders and a clear and realistic assessment of resources needed and expected results are important to avoid mistrust, disappointments, and defaults.*

production systems (OECD, 2019)*. Initially, it was embraced by medium and small-scale farmers and technical assistance providers, with a focus on no-till systems. The association's influence rapidly expanded, amassing over 2,500 members and establishing 36 Regional Groups across Argentina and Brazil. It was a key driving force propelling the fast adoption of no-till practices in Argentina, continuously evolving to meet changing circumstances. An example of their work among its six programs is the "System of Chacras", designed to develop agricultural technologies tailored to a delimited area of production or a specific segment of farmers, with the overarching goal of disseminating these technologies across diverse regions and among all partners. The evolution of this platform underscores its origins, rooted in farmers' needs and adapting over time to cater to the demands of various stakeholders. For the farmers, it is a source of innovations to solve their challenges; for the private sector, it is a platform to design and create technologies that suit the needs of the farmers; and for researchers, it is a platform to potentiate their mandate of science applied to the sustainable development of the farming systems. Being self-funded by its members, AAPRESID has had a substantial positive impact on Argentina's production systems, aligned with the needs of its members (H. Gonzalez, personal communication, August 2023).*

1.2. Opportunities and challenges of co-creation within Living Labs

We can define an Agroecology Living Lab (ALL) as a collaborative and participatory approach to accelerate knowledge creation, innovation, and adoption of agroecology in agri-food systems. It is a real-world, field-based setting where various stakeholders, such as farmers, researchers, organizations and rural communities, service support, public actors, the private sector, and investors, work together to co-create solutions to the agricultural and food systems problems they face in their locality or region (Lamers et al. 2017). They do that while taking into account the specificities of farming systems and their environment and guided by agroecology principles. ***An ALL can bridge the gap between scientific research and practical implementation, supporting the co-creation of solutions that address complex challenges.*** The common elements of a Living Lab are (ENoLL, 2015): (1) Active user involvement; (2) Real-life setting; (3) Multi-stakeholder participation; (4) Multi-method approach; and (5) Co-creation.

Although the Living Labs' concept is relatively new in agricultural development, it has been applied in contrasting contexts, and key lessons have been shared. The REFOOTURE project was implemented in East Africa (Froebrich, et al., 2023 a,b,c), in Ouest Africa (Kouakou et al, 2017; Copaore Sawadogo et al 2023, Brouwers et al, 2023) and the AgriLinks Living Labs was implemented in Europe (https://www6.inrae.fr/agrilink/), both targeting a wide range of value chains and objectives. Important lessons and considerations from these projects can be applied to the CANALLS co-creation framework (Figure 2).

Table 2. Lessons to consider in the co-creation process. Experiences created in the Refooture and AgriLink Living Labs

Project	Location	Value chain/ targeted crops	Main Target	Key lessons for consideration in the co-creation process for CANALLS
Refooture	Ethiopia	Potato and maize	Use of compost to reduce mineral fertilizer	Transition requires long-term efforts, and to maintain the momentum of SH. Early dialogue is key for a common vision. Stakeholders need to experience tangible effects. Link innovation cases to existing initiatives
		Black pepper	Agroforestry and improved processing	
	Kenya	Potato and maize	Recycling biomass and waste. Using renewable energy sources. Water-saving, biodiversity restoration	
	Uganda	Aquaculture, vegetables	Recycling biomass and waste. Using renewable energy sources	
AgriLink Living Labs	Italy	Wheat	Developing local value chains	Living Labs are suitable for complex sustainability challenges and tailor-made innovation. Help forge new relationships by mutual appreciation, and knowledge exchange. They described four conditions for enabling a Living Lab to succeed[3]; balanced complexity, enabling setting, energy to move, and proficient facilitation
	Latvia	Horticultural products	Improve farmers' access to advice	
	Belgium	Maize	Supporting farmers' decision-making	
	Norway	Crop rotation	Innovative support services for crop rotation	
	Romania	Professionalize co-ops	Providing fiscal information to small farmers	
	Spain	IPM	Improving an early warning system	

[3] *Potters et al. (2022) described four conditions needed for a successful Living Lab: (1) The challenge is complex enough to justify the efforts of a LL but there is enough harmony among stakeholders to allow collaboration. (2) Enough resources and time for experimentation, and the flexibility of stakeholders to potential failures in the experimentation process and unexpected outcomes. (3) Requires high levels of dedication and resources from the actors. The energy to move is expressed in the capacity and willingness of stakeholders to engage. (4) The facilitator's role is crucial to the success of the ALLs, and care should be taken in selecting, preparing, and supporting him or her. To guide each phase of the co-creation process, the facilitator requires a thorough awareness of the context, the ability to combine leadership with curiosity and flexibility, and access to a variety of approaches and resources. Experience is vital, but social skills that foster positive relationships and a leadership-serving mindset appear to be the most important selection criterion. If the facilitator lacks facilitation expertise, practice, and training might help them build their abilities and methods. The E-course on Living Labs can be a good start.*

2. Co-creation framework for optimal AEP combinations

The AET is an evolutionary process that can take several years and several phases to achieve a significant impact at scale (Soule et al 2023). That depends on the agroecosystems and food system, the spillover effect in different phases of the process, landscape policy, and the complexity of the change that is needed. Identification and understanding of the drivers and obstacles to achieving an agroecological transition and co-creation of solutions require trust between researchers, farmers, and other key stakeholders (Sachet et al., 2021, Mathe et al 2023). It also depends on the locs and risks in relation to use the of news inputs (bio-inputs) or modification of power, reputation, and value repartition between different actors in rural communities or agricultural chains. Moreover, the goals of the ALLs will include multiple and complex changes (i.e., moving from full sun to shaded coffee) or a combination of complex technical, organizational, and policy changes (e.g., moving to an organic value chain). ***Therefore, the focus of WP2-task 2.1 ("Development of methodology for co-creating optimal agroecological practice combinations") will be to design, together with stakeholders, a co-creation process that is sustainable[4] and can survive CANALLS project.*** Sustainability of the co-creation process will allow deeper changes to happen at larger scales and align with the ultimate vision of an AET. We intend to achieve that by adopting a participatory approach to the design of the co-creation process that better fits each ALL needs, and following key considerations extracted from the literature:

Key considerations and actions 1: The co-creation process requires mid- to long-term efforts from different stakeholders in different forms and levels. It is important that the energy and commitment of the stakeholders are proportionally matched with the benefits they get, and that their expectations for results match reality. Moreover, co-created AEPs must respond to stakeholders' (with a focus on farmers) more urgent needs, have a direct, short-term, and tangible impact, have minimal penalties, and have an acceptable level of added complexity in their farming systems.

- → To ensure that the objectives and outcomes of the co-creation process match farmers' and other key stakeholders' needs, these will be included in the early stages of the design of the co-creation process. Moreover, a strategy will be designed for each ALL to effectively bring the voices of farmers to the meetings and workshops.
- → To ensure that farmers' diversity is captured and represented in the ALL a farmers' typology analysis will be performed in case it's not already available.
- → The design of the co-creation process and research objectives will not be pre-determined by researchers but discussed and agreed upon among stakeholders.

[4] *The success of a co-creation process is assessed in terms of **Efficacy:** The co-creation process achieves its goals; the anticipated outputs take place as planned and take the appropriate form. **Efficiency:** The number of resources (including time, energy, and enthusiasm) is? in relation to the outputs of the co-creation process. **Sustainability:** While the co-creation process' effectiveness and efficiency are necessary for sustainability, they are insufficient. To guarantee that the co-creation process is perpetuated once the CANALLS project is over, the early cycles of co-creation must build local financing sources, capacities and ownership.*

→ The focus will be to identify, and if possible, target AEP that are part of a change already underway.

Key considerations and actions 2: The capacity of the facilitator and the support he or she receives are key factors determining the results of the co-creation process.

→ A plan of capacity building for the facilitators will be done for the ALLs according to their needs
→ A toolbox of supporting tools for the facilitator according to ALL needs will be developed
→

Basic rules of facilitation

- Be clear about the expected result of each workshop, then choose the appropriate methods and tools for the workshops.
- Make agreements with participants for every event, every sequence, and every step.
- Successful facilitation begins with good preparation for the workshop (e.g., tools, materials, venue, food, and drinks, assigning roles and responsibilities to facilitation support activities, etc)
- Limit yourself to what is feasible.
- Monitor the energy and engagement of the group and react to it with flexibility on the activities and managing the mining of breaks.

Source: (Herrera et al., 2013)

Key considerations and actions 3: Based on experiences from other participatory research projects, the risk of the co-creation process stagnating once CANALLS project is over is high.

→ The handover of the platform governance and management will be planned from the initial design
→ Develop capacities, ownership, and governance structures within the farmers, local research and extension organizations, and other local stakeholders to continue the co-creation process. This includes training, tools, and follow-up support.
→ NARES involvement from the initial design stages for approval, validation, and ownership
→ Identify among the local stakeholders those who are most likely to assume leadership after CANALLS, and engage them in that role at rather early stages of platform design.
→ Alternative sources of finance after a 3-year project will be explored from early stages of ALLs activities. These could be farmers' associations, input suppliers, output markets, national research institutions, NGOs, and other research institutions.

Key considerations and actions 4: The co-creation process is a new approach in the ALLs, and changes to the initial design will probably be needed. Moreover, objective changes are also expected after each experimentation cycle or even before a cycle is finished.

→ Monitoring and evaluation of the co-creation process will be performed for continual improvement and adaptation.

The co-creation process will be designed in agreement among stakeholders within each ALL (participatory design of the co-creation process) through a series of meetings and workshops described in four steps (Figure 2). The focus will be to ensure alignment with the considerations

listed above. This description of steps to design the co-creation process, however, may slightly differ among ALLs, according to the starting point of the projects and engagement among stakeholders which CANALLS build on. The steps described below would apply to an ALL with low engagement among stakeholders and still a not fully consented definition of co-creation objectives (described in Tables 3 and 4 and Figure 2).

1. **Get ready:** General alignments among core partners, setting a coordination strategy for the co-creation process. Mapping resources available for co-creation of AEP.
2. **Share vision:** Align on the diagnosis of the focus value chain, the key challenge to target, and general concepts of agroecology. Definition of the co-creation objectives.
3. **Define the way:** The co-creation framework is defined based on the co-creation objectives and the resources available. Prototyping of agroecological practices or solutions. Design of the experimental phase and assigning roles and responsibilities for the partners and stakeholders in the experimentation phase.
4. **Action plan:** Planning of experimentation for the first year. Plan the monitoring and evaluation of the co-creation process.

CIRAD will conduct step 1 based on reports from WP1 complemented with further analysis if required (e.g., farmers' typology), and stakeholder consultations. In a stakeholder meeting the coordination structure and general alignments will be agreed (Task 2.2). Based on the results from step 1, the following steps will be adapted to the specifics of each. For example, ALLs with strong linkage and trust among stakeholders and clear objectives could simplify steps 2 and 3.

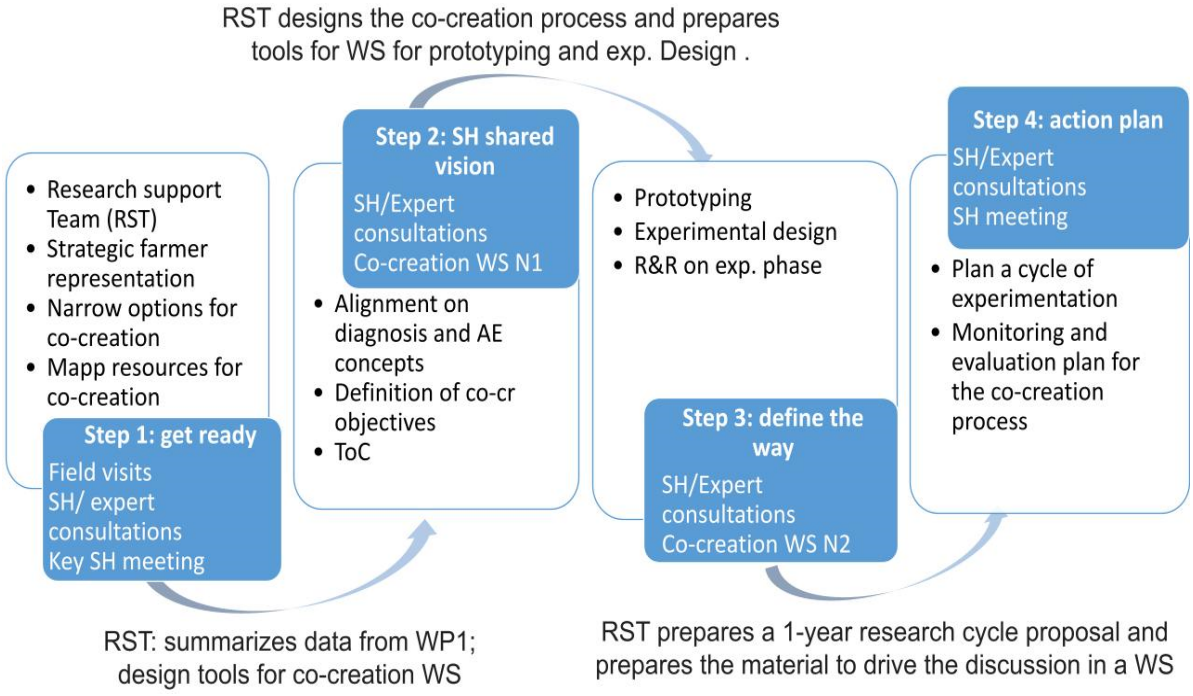


Figure 2. CANALLS AEP Co-creation Conceptual Framework. RST research support team

Table 3: Steps for adaptation of a co-creation process to the ALL needs. Workshop (WS), Research support team (RST), Core Partners (CP), Stakeholders (SH)

Steps	Milestone	Arena	Lead
1. Get ready	1.1. Smart governance and management structure of the co-creation process. Coordinator/ Facilitator/ Research Support Team (RST) *(within T3.1, T3.2)*	Meetings of CP, Inception WS	NBIO, CIRAD
	1.2 The R&D partners align on the general challenges to target with co-creations within CP *(within T3.2)*	Field visits, CP meetings, and consultations	CIRAD
	1.3 Define a system for strong representation of farmers in the co-creation, where their voice is heard, and feedback goes in both directions	SH consultation, Farmers' meeting, Inception WS	Coordinator, CIRAD, NBIO
	1.4 Resources available for the experimentation are mapped and described. Including human and financial resources, infrastructure, and equipment.	SH consultation, field visits **& WS1**	RST, CIRAD
2. Share vision	2.1. Co-creation tools designed. Report, PPT, and other tools to guide the consensual diagnosis and scope of the co-creation process. Collect relevant figures used to feed into simple impact models.	SH consultation	RST, CIRAD
	2.2. SHs agree on the key challenges to target and co-creation objectives.	**WS1**	Coordinator, CIRAD
3. Define the way	*3.0. Cognitive mapping and synchronization, if needed*	*Interviews/ FG*	*RST, CIRAD*
	3.1. RST designs a long-term co-creation process (e.g., DEED cycle adapted to the ALL), and drafts a report and PPT for the key SHs	SH consultation	CIRAD
	3.2. The approach for the cycles of co-creation is discussed and defined during a workshop with SHs.	**WS2**	Coordinator, CIRAD
	3.3. Review of the challenges to be targeted and refining objectives of co-creation. Theory of change for the co-creation objectives.		
	3.4. AEPs are prototyped		
	3.5. Key aspects of the exp. design for the first year/cycle discussed and agreed upon. Roles and responsibilities for stakeholders in the experimental phase are assigned.		
4. Action Plan	4.1. RST prepares a 1-year research cycle proposal. It includes the experimental approach, measurements, data analysis and reporting, tools, and equipment to be used, and clear calendars, roles, and responsibilities (*within T4.1/2/3/4*)	SH consultation	RST, CIRAD
	4.2. The co-creation activities for the next year are agreed upon, with defined objectives, strategy, roles, responsibilities, rules, and calendar of activities.	Meeting with ALL's SH	Coordinator, RST, CIRAD
	4.3. Monitoring and evaluation for the co-creation process are designed (*within WP4*)	SH consultation	RST, CIRAD

Table 4: Timeline of steps for adaptation of a co-creation process to the specific context and needs of the ALL. Workshop (WS), Research support team (RST), Stakeholders (SH)

Steps	Milestone	Arena	M10	M11	M12	M13	M14	M15
1. Get ready	1.1. Smart governance and management structure	Meetings of CP	x					
	1.2 The R&D partners align on the general challenges to target	Field visits, CP meetings, and consultations	x	x	x			
	1.3 Define a system for strong representation of farmers	SH consultation, Farmers' meeting	x	x				
	1.4 Resources available for the experimentation are mapped	SH consultation, field visits **& WS1**	x	x	x	x		
2. Share vision	2.1. Co-creation tools designed.	SH consultation	x	x	x			
	2.2. SHs agree on the key challenges to target and co-creation objectives.	**WS1**				x	x	
3. Define the way	*3.0. Cognitive mapping and synchronization, if needed*	*Interviews/ FG*				*x*	*x*	
	3.1. RST designs the co-creation process	SH consultation				x	x	
	3.2. The co-creation process is defined	**WS2**					x	x
	3.3. Theory of change for the co-creation objectives.							
	3.4. AEP is prototyped							
	3.5. Exp. design for the first year/cycle agreed. Roles and responsibilities for stakeholders in the experimental phase							
4. Action Plan	4.1. RST prepares a 1-year research cycle proposal.	SH consultation					x	x
	4.2. The co-creation activities for the next year are agreed upon	Meeting with ALL's SH						x
	4.3. Monitoring and evaluation for the co-creation process	SH consultation						x

2.1. Step 1. Get Ready: General alignments and coordination strategy of the co-creation process

Before the process for co-creation can be designed and the co-creation cycle becomes functional, the coordination strategy has to be established. This is part of the work package three[5]. When setting up a functional co-creation process, in addition to the general considerations on the establishment of an ALL, and specifically to the co-creation process there are four important aspects to consider:

1. **Smart governance and management of the co-creation process.** ***(milestone 1.1)***. In a series of meetings and field visits, a governance structure for the co-creation process must be designed with clear roles and responsibilities of selected participants. Ideally, governance should be from the start from organizations that will remain in the area and part of the agroecological transition once CANALLS is over. Training and tools required for good governance of the co-creation process should also be defined after the elections of the members. A facilitator for the co-creation process will be named for the ALL (probably will be the ALL coordinator), and a training and support plan will be designed according to the needs. This could be a training session for all facilitators on Living lab coordination, facilitation monitoring, and evaluation and on the use of different tools required for co-creation activities. In our proposal of designing and implementing a co-creation process, critical steps would be taken by a selected group of researchers who will have specific roles to support the process. Ideally, they should belong to organizations that will remain in the area and be part of the agroecological transition once CANALLS are over. The selection of this group (2-3 researchers) should also be done by the core research organizations of CANALLS with National Agricultural Research and Extension Systems (NARES).

2. **Alignment on the co-creation's overall direction to make sure that R&D partners' efforts and interests are balanced.** There is a need for researchers to align on the basic concepts and criteria to evaluate the relevance of the challenges that could be targeted with the co-creation activities. Moreover, if researchers can narrow and agree on prioritize the challenges to target before the co-creation workshops start, the discussions within the workshop could be simplified. Farmers and other stakeholders will still have the opportunity to bring new challenges (see Annex I for the description of the first co-creation workshop). In a 3-step process, the ideas from researchers will be collected, compared based on key indicators, and narrowed to 1-3 to be fed into the co-creation process (see in annex II the description and tool used for this exercise) ***(milestone 1.2).*** The indicators used to compare the challenges include

    a. **Alignment with current projects**. How much do the challenge and the expected co-creation activities align with the current projects CANALLS is building on. Alignment in terms of objectives, equipment, research platforms, knowledge

[5] *Task 3.2 (Establishment of agroecology living labs and multi-actor community building) and Task 3.1 (Planning, operation, monitoring, and capacity building for agroecology living labs)*

created, etc. This score is defined based on literature review and consultation with local project staff.

b. **The expected transition into agroecology after 10 years**. The challenges to target should lead to an agroecological transition of production and/or food systems, which is the central objective of CANALLS. We adapted an existing tool to estimate what the transition to agroecology might look like in 10 years' time (i.e., the Agroecology Criteria Tool; Agroecology Info Pool 2019). The tool is based on the 10 elements of agroecology. For each element, we assessed the current level, ranging from 0 to 100 (maximum level achieved). Then, depending on the challenge to be met and the expected results, we estimated what would be the change would be for each element. Integrating the scores for each element results in the expected overall evolution towards a more agroecological system.

c. **The expected economic impact for farmers in 5 year as a result of co-creation activities**. This is the expected increase in profit for the targeted farmers, coming from plots with focus crops. The profit is the difference between total revenue and total costs of production. It represents the impact for an average farmer in the action area, including both adopters and non-adopters. This is an important consideration because a small benefit for most of the farmers can be more impactful than a large impact on a small group of adopters. The increase in profit that is expected for a farmer, if the co-creation is successful and he/she adopts the technology is then factored by the chance of success in the co-creation process (what is the chance that the co-creation objectives are achieved) and the % of land with the focus crop in the ALL, where the innovation is adopted. So, the resulting value is the expected profit increase, on average for plots with the focus crop. The values for profit calculations, chance of success in the co-creation objectives and the expected adoption were obtained from literature review, expert consultation and based on the expertise of scientists from CIRAD populating the tables.

   *Economic Impact for farmers (%) = profit increase for adopter or AEP is co-creation in successful (%) * chance of success in co-creation * adoption of the co-created practices*

d. **Behavior change from the farmer or other stakeholder.** A score that aims to capture how much change in farmers' behavior is needed to adopt the co-created innovation. For example, replacing an input for one that is used in the same way, but has a lower cost would mean a very low behavior change. Meanwhile shifting from full-sum cocoa to agroforestry requires a large behavior change from the farmer. This parameter is related to the expected adoption of the co-created AEP, but because of its relevance, we made it a parameter on its own. The values for were obtained from literature review, expert consultation and based on the expertise of scientists from CIRAD populating the tables.

e. **Experimentation feasibility.** While the expected results from co-creation could have a significant potential impact on farmers and be an important driver for agroecological transition, the experimentation required may be beyond CANALLS' capacity and timeframe. This score attempts to determine to what extent it is

possible, within the framework of the CANALLS project, for the ALL to carry out the experimentation required for the targeted challenge. The values for were obtained from expert consultation and based on the expertise of scientists from CIRAD populating the tables.

3. **Strong farmer representation in the workshops** ***(milestone 1.3)***. Main decisions on the objectives and approaches for co-creation will be made in workshops where farmers will be voiced by representatives (e.g., cooperative leadership, farmers group leaders, etc). There is evidence that the active participation and leadership of farmers in the process is critical for a successful co-creation process and as such its key to ensure that representatives are accurately reflecting farmer's views (Tucker et al., 2014). Moreover, in the case of relevant diversity among farmers in the targeted region (e.g., ethnical, activity type, or other typology that can lead to misrepresentation if only one group is participating) a diagnosis of farming system diversity is crucial before trying to find representant of this diversity of farmers. For a good voicing of farmers in workshops and meetings, we propose that previous to the first workshop (WS1), the facilitator/coordinator of the ALL should design together with the farmers' organization a system where the flow of information from farmers to the workshop, through the farmer's representatives, is effective. This could be for example, a guideline and tools for the farmer's representatives to discuss the key items of the agenda before the workshop and a guideline to provide feedback to farmers after the workshop (see figure below).

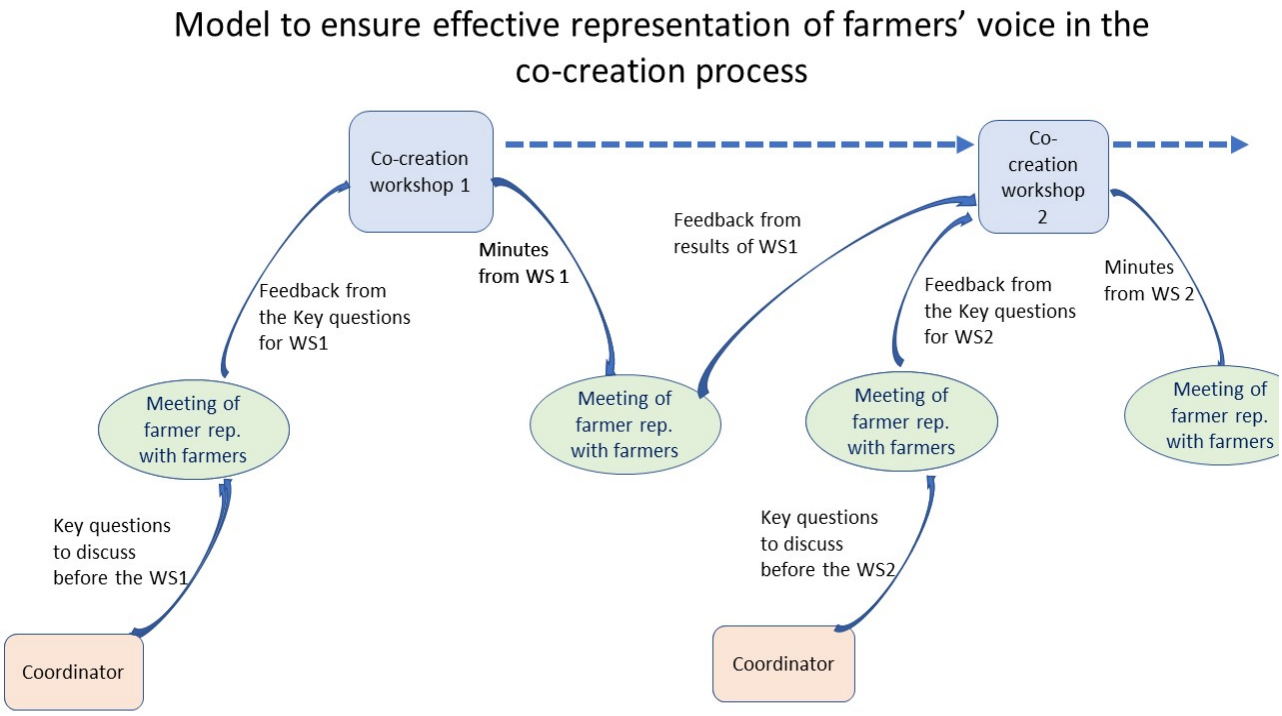


Figure 3. Proposed communication approach to ensure that the voice of farmers is brought to the workshops and that they then get feedback from the discussion and conclusions that happened on it.

4. **Mapping resources available for the experimentation phase** ***(milestone 1.4)***. To do this, the RST team will use deliverables from WP1, follow-up calls and meetings, and discussions during the WS1. The resources to be mapped and described include
    a. Researchers, the private sector, and farmers' commitment to the experimentation phase. It also involves understanding the time availability and the capacities and skills of the participants for the experimentation phase. For example, the area of expertise of researchers involved in the co-creation, past and current experience of actors in different participatory research approaches (e.g. farmer field schools, on-farm trials, tricot, etc).
    b. Financial sources for experimentation activities.
    c. Inputs for experimentation activities; e.g., from the private sector of research organizations.
    d. Equipment; e.g., for trial set up, follow up, and measuring.
    e. Facilities; e.g., research stations, experimentation land within cooperatives, or farmers' land.

2.2. Step 2. Shared vision: Agree on diagnosis and setting the scope for the co-creation

The alignment on the diagnosis and setting the objectives of the co-creation efforts is one of the most critical steps toward a successful ALL. Given the diverse range of interests and goals held by multiple stakeholders, it is crucial to strategically select the challenges to address and set co-creation objectives that harmonize the interests of partners and stakeholders while remaining feasible. To achieve this, a series of activities take place both before (milestone 1.2) and during the first co-creation workshop.

The RST will support the facilitator on the first workshop with tools to guide the discussions to identify priority topics where the interests of key stakeholders overlap ***(milestone 2.1)***. The tools include a guide on activities for the co-creation workshop adapted to the needs of each ALL (see annex I).

The RST and CIRAD will also collect relevant figures that can be used to do simple impact and business models during the workshop discussions. The figures to collect will depend on the crop and value chain targeted, for example for coffee production systems would include:

- General
  - % of farmers growing coffee in the ALL area of influence
  - Average agricultural land for farmers
  - % of the total agricultural land of coffee growers where they grow coffee
- Inputs
  - Average use of chemical fertilizer (kg/ha or kg/tree for each type of fertilizer)
  - Price payed by farmers for each fertilizer
  - Organic fertilizers use (kg/ha or kg/tree for each type of fertilizer)
  - Market price of fertilizer
- Labour
  - Cost per hectare per labor activity
  - Person-day per labour payed by farmers
- Production
  - Most common variety used
  - Time from seeding to transplant
  - Time of the year for seeding and for transplanting
  - Time from transplant to first commercial harvest
  - Most common production systems (e.g., full sun, intercrop with banana and beans, etc.)
  - Current average yields (expresses in cherry, and dry, and per surface area and per tree
  - Potential achievable yields for the area (using good agricultural practices and to achieve maximum return of investment)
  - Estimated yield gap attributed to different factors
  - Average tree density
  - Total cost of production per hectare
- Processing
  - Processing done be farmers

    - Processing done by coops
    - Processing done by exporter
- Market
    - Current price payed to farmers for production
    - Current price payed to cooperatives after tax
    - Current price payed to exported after tax
    - Average cost of transport from farm to coop (e.g. USD/ kg per km)
    - Price ratio across the value chain expressed in USD/kg. For example, for coffee green coffee at 11% moisture:
        - To farmer at gate
        - To farmer at coop
        - To coop at gate
        - To coop at exporter
        - To exporter at harbour
- Taxes/ subsidies:
    - Inputs taxes
    - Input subsidies
    - Sales tax
- Losses:
    - On-farm at harvest.
    - On-farm farm processing.
    - From farm to market.
    - On cooperatives or intermediaries.
- Conversion Factors
    - Cherry to dry after fermentation and draying
    - Dry after fermentation to parchment coffee
    - Parchment coffee to green coffee
    - Cherry harvested in the farms to green coffee bagged to export

First workshop objectives

- Analyze and diagnose the current state of the focus crop and value chain
- Create a structural analysis of the causes and effects of the key challenges faced by stakeholders
- Explore the alternative objectives for the co-creation activities within the ALL

Expected workshop outputs ***(milestone 2.2)***

- Stakeholders define the challenge(s) to target with the co-creation efforts
- Stakeholders define the objectives for co-creation
- A calendar of co-creation activities is defined for the next 6 months

2.3. Step 3. Define the way: adaptation of the co-creation process, AEP prototyping, and experimental design

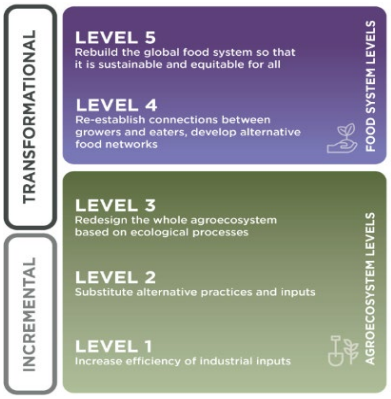
The main considerations to identify and design an experimental approach that adapts to the context and needs of the ALL are 1) Seasonality of the focus crop/s, 2) Relevance of the co-creation of AEP within the needs and objectives of the ALL, 3) Vision for the lifespan of the co-creation process, 4) Co-creation objectives and research questions, 5) Resources for available for experimentation, and 6) Level of stakeholder engagement and collaboration previous to CANALLS. See in Table 5, alternative experimentation approaches that could fit different hypothetical contexts.

Seasonality of the focus crop/s. This is related to the agroforestry transition phase. The research methodology would be probably different when targeting perennial crops (coffee and cocoa) in agroforestry as compared to seasonal crops (maize, rice, cassava) in forest-degraded areas. Perennial crops (especially when researching long-term impact technologies) will have to rely more on trials already established (e.g., the “CocoaSoils” project in Cameroun; CocoaSoils 2019), observational research based on systems and technologies currently used by farmers (e.g., innovation-tracking), crop modeling, and or the adaptation of knowledge and innovations already used in similar contexts (e.g., the “ShadeTreeAdvice” tool; Van der Wolf et al., 2016). On the other hand, for seasonal crops, and especially when targeting short-term-impact technologies, the research can be based on a continuous cycle of seasonal trials with a more classic research pipeline approach where technologies are explored and tested on a seasonal basis using on-farm trials (e.g., the tricot approach for varieties of a crop or alternative pest control products; (van Etten et al., 2020) on on-station trials (e.g., if available within the NARES) or on combination of both.

Relevance of the co-creation of AEP within the needs and objectives of the ALL. This parameter tries to address the energy that the ALL will have for the process of co-creation of AEP. Is the challenge the ALLs’ stakeholders decide to focus on related to agronomy? The agronomic challenge has an agroecology approach to be targeted? In some cases, the challenge faced by stakeholders is not related to agronomic aspects at all, and the resources of the ALL will go in other directions. For example, the challenge that the ALL decides to target is to connect the large amount of nutrients accumulated and wasted by cattle farmers with the nutrient-depleted soils of crop production farmers in the same region. The restriction, however, is a lack of collaboration among both types of farmers due to political or ethnic issues rather than a lack of knowledge of the potential win-win of connecting both production systems. Although demo plots and trials could

be needed to support the development of monetization of manure, the focus of the ALL may be on how to build the relationship among both farmers' groups.

Research questions. This is related to the level of food system change targeted. The lower levels are more agronomic challenges, farmer-centered and plot-specific, targeting agronomic research questions such as soil fertility and pest management. On the other hand, higher levels are more market-entered related to crop quality and production practices that can open new and higher-value markets, such as biodiversity, carbon credits, and organic certification. While the first would rely more on classic research methods such as on-farm trials to evaluate ISFM and IPM approaches, the second may be more based on field observations, crop modeling, and satellite tools to improve production systems and to develop tools required by the market.



Resources for experimentation

The resources were already mapped in step 1 (milestone 1.4). The main aspects of the resources that will influence the design of the co-creation framework for each ALL include

- The energy of the ALL for the co-creation of AEP.
- Availability and capacities of coordinator, facilitator, and implementers of the research pipeline.
- Research platforms and approaches that are already in place to be used (see Table 5).
- Resources for the co-creation process, including financial resources, equipment, facilities, and inputs.
- Level of stakeholder engagement and collaboration previous to CANALLS.

Table 5. Description of alternative experimentation approaches available for co-creation

Exp. approaches / platforms	Lead	Energy	Pros	Cons	Research questions it adapts to
Farmer Field School	Farmers and the support org.	Large support is required; finance, time, and skills	+ Farmer-centered. - Adoption barriers. + Sustainable as farmers build capacity as researchers. Social benefits; farmers' cohesion	High cost with limited extrapolation. Different mindset and skills from extension agents Scalability is limited. Limits input from scientists and other SH	Simple technologies, about behavioral change; e.g., compost technique, mulching Organizational aspects; e.g., the creation of protocols to increase quality
On-farm trials/ tricot within cooperatives	Can be led by farmers' orgs.	Large but can be split among actors; tricot more on the farmers, and on-farm balanced among farmers and researchers	+Scalability. + Potential to reveal risks and constraints faced by farmers + Cost effective than FFS Easier to balance farmer <> market <> science objectives. Working with co-ops. reduces coordination efforts.	Need well-organized co-ops. Co-ops may share interests with researchers May not be as inclusive Difficulties in trial design, because of many confounding factors Challenges related to data quality and oversight of field activities. Difficult for long-term trials.	Agronomic questions that bring no risk Evaluate interactions with the environment and need farmers' feedback. If well-functioning coops could target more complex issues with the involvement of several stakeholders,
On-station trials	Researchers	Relatively low	Can evaluate complex questions Better in academic research. -Cost +data quality +control of the innovations with risk; not released varieties, toxic pesticides.	Limited info. on adoption barriers Limited info. in interaction with the environment Results may not be representative of farmers' context.	Technologies with low interaction with the environment; some pesticides Not released inputs Inputs that could have negative impacts on farmers. Pre-selection of prototypes Long-term trials
Modeling	Researchers	Low capacity and data for calibration are already there	Can be cost-effective. Can test long-term and climate change scenarios. Unlimited alternative prototypes and interactions with env. Management practices are difficult to perform on trials; shade management	Needs a high level of expertise. Need good local data for cal/ validation. Outputs can be far from reality. Can be difficult to communicate with farmers and other stakeholders Limited to questions within the boundaries of model development	Ex-ante's evaluation of econ. and env. feasibility and impacts. Evaluation of innovations with long-term impact Pre-selection of prototypes Climate change scenarios, e.g., agroforestry benefits x altitude interaction.

In the case that the direction of the co-creation process is expected to involve changes with a high degree of complexity, multiple interdependencies among factors in the system, or require significant behavior change from farmers, further cognitive mapping and analysis may be needed ***(milestone 3.0)***. Identification of values and language shared among researchers, farmers, and other actors can be realized and exploited in the prototyping process, and in the design of strategies for scaling the AEP. Understanding these perspectives helps identify areas of alignment and divergence, enabling more contextually relevant and collaborative solutions. This analysis can be coordinated by the RST, and be performed before they draft the proposal of the research activities for the coming year. There are different approaches to performing this analysis, and the best will depend on the goals and the characteristics of the system under study, the available data, the available resources, and the expertise of the stakeholders. The method includes focus groups, interviews, surveys, and cognitive mapping techniques.

At this point, CIRAD (with support from the ALL collaboration and the RST) will have all the information required to adapt the co-creation framework to the needs of each ALL ***(milestone 3.1)***. For this, there will be a need for collaboration from the stakeholders, where follow-up calls and meetings may be needed. These activities may be a time-consuming and resource-intensive step; however, they should be seen as a cost-effective way and as a sustainable process ***(milestone 3.2)***. The proposal of the co-creation process for each ALL will include the following components:

- The diagnosis for the focus value chain and food system (if available, including the farmers' typology analysis)
- The challenge to target and the objectives of co-creation, with a description of the rationale and process used to define them.
- Results from the cognitive synchronization analysis (if applicable)
- Resources available for experimentation. This includes human resources (researchers, private sector, and farmers' commitment for the experimentation phase) and availability of financial resources, inputs (e.g., from private sector and research organizations), equipment (e.g., for trial set up, follow up, and measuring), and facilities (e.g., research stations, experimentation land within cooperatives, or farmers' land).
- The co-creation approach selected e.g., DEED cycle (Giller et al., 2008).
- General description of the experimental approaches to be used for the experimental steps in the co-creation process (e.g., on-farm trials within farmers in cooperatives, modeling, station trials, FFS approach to developing new crop management practices, etc.)
- Roles and responsibilities of stakeholders in the co-creation process, commitments for at least the first cycle of experimentation, and clarity on the source of funding for their activities.
- Clear governance structure for the co-creation platform and defined roles and responsibilities for the coordinator, facilitator, and RST.
- Timeline of commitment and expected duration of the co-creation process. This includes the estimated duration of each co-creation cycle (e.g., DEED cycle), the number of cycles

to be performed, and the expected lifespan of the platform. In case the lifespan is expected to be longer than the duration of the CANALLS project, an exit plan will be included.

- Financial sustainability strategy to maintain the co-creation process in the mid and long term. Identifying funding sources after CANALLS project duration is essential to ensuring the platform's long-term sustainability. This should be a key activity of the ALL coordinator and could for example involve partnerships with funding agencies, private sector actors, and government bodies.

Once the co-creation process has been agreed upon (to be done as the initial activity of co-creation workshop #2), in the same workshop, stakeholders will propose a theory of change for the co-creation objectives ***(milestone 3.3)***, and prototype alternative AEP to be evaluated ***(milestone 3.4)***. Moreover, in the same workshop, participants will and discuss and agree on aspects of experimental design execution planning roles and responsibilities for stakeholders in the first experimental phase ***(milestone 3.5)***.

2.4. Step 4 - Action Plan: Planning of experimentation for the first year

At this point, there should be a clear co-creation framework, roles, and responsibilities assigned, clarity on the resources available for the experimental phase, and specific objectives and prototypes to evaluate. With this information, CIRAD and the RST (with support from the coordinator) will draft a detailed 1-year/1-cycle experimentation plan ***(milestone 4.1).*** The proposal would include:

- An introduction and justification of the research, with objectives. Including business and impact models (if applicable)
- An adoption barriers analysis for the prototypes under evaluation. These may lead to specific trials and/or specific measurements
- Material and methods to be used for the experimentation
- Approximate financial cost of the year/cycle of experimentation. This is key to evaluating the efficiency of the platform and to planning strategies for its financial sustainability
- Roles and responsibilities of participants in the experimental phase
- Calendar of activities

The proposal is reviewed by stakeholders and discussed in virtual meetings. Consensus is reached with a focus on the agreement among those who have active roles in the experimentation process. ***(milestone 4.2)***

Monitoring and evaluation of the co-creation process is key to ensuring that objectives are being met by the platform ***(milestone 4.3).*** Parameters to monitor the efficacy, efficiency, and sustainability of the platform will be drawn from the theory of change constructed as part of Step 3, milestone 3.3 (Douthwaite and Hoffecker, 2017; Thornton et al., 2017).

For example:

- Input: Resources used for co-creation, such as funding for workshops and meetings, collaborative experimentation, and human resources used by different stakeholders.
- Outputs are the tailored AEP co-created, the decision support tools designed to address challenges like crop nutrient and pest management, and the training of farmers
- Outcomes are the farmers' adoption of AEP and decision support tools, an increase in knowledge and skills of farmers, and an increase in stakeholder cohesion. Also, outcomes expected from researchers may include an improvement in the participative approach, codesign process, etc.
- The impact of the co-creation efforts derived from the adoption, use, and scaling of AEPs. It can be measured in terms of an increase in yield, quality, income, and profit increase for farmers and other key stakeholders, and agroecological transition.

The metrics to evaluate, under the same example, would be:

For Efficacy: in the initial cycles, outputs can be evaluated. As co-creation cycles advance, outcomes and even some impact parameters can be included in the efficacy analysis.

- AEP co-created. Number of AEP prototyped, evaluated, and identified as with potential for adoption
- Number of farmers and other stakeholders that received training.
- Number of decision support tools designed.
- Adoption of developed AEP. Assessment of the interest of experimental farmers in adopting the changes tried. Andrieu, (2021), *"considered as adoption at the moment a farmer decides to increase the initial experimental area or to invest his/her own resources to continue implementing the practice"*.
- Capacity building. Assessment of changes in the knowledge of stakeholders involved in the innovation platform that resulted from the training. The changes in knowledge should be measured at the beginning and at the end of the process (Marinus et al., 2021).
- Impact parameters, such as profit for farmers and other stakeholders, environmental impact indicators, such as soil carbon or carbon stock on agroforestry, AET with TAPE approach.

For Efficiency: The efficiency can also be evaluated at different scales:

- Cost to perform each trial. This is a metric that can be compared with other similar research projects.
- The cost per AEP co-created and decision support tool designed
- Cost per farmer trained
- Efficiency of training to increase knowledge among stakeholders (knowledge increase/ cost of training)
- Total cost of operationalizing the ALL relative to total impact (e.g., impact = profit increase per average farmer affected * total number of farmers affected)
- Social return of investment for the co-creation process (e.g., the impact of the co-creation/ cost of the co-creation process; Arrillaga-Andreessen and Hoyt, 2003; SROI 2012)

For Sustainability:

- % of the cost of the co-creation process that comes from stakeholders other than CANALLS' funds (i.e., financial sustainability of the co-creation process)
- Analysis of how benefits match the input of stakeholders
- Commitment and energy of participants at the end of each cycle (e.g., surveys during and at the end of the cycle)

3. Strategy for a successful co-creation process and exit plan

An exit strategy will be included in the co-creation design. Aspects to consider for a successful exit strategy include:

- Continual engagement of key stakeholders
    - User center design
    - Measure impact
    - Celebrate successes
    - Transparency
    - Clear data privacy and security
- Capacity building for coordination and facilitation
    - Facilitator
    - Key stakeholder representatives
    - Local researchers and extension agents
- Documentation and knowledge transfer
    - Tools and guidelines used during the CANALLS project
    - Key documents such as MoU, concept notes, reports, databases.
    - Training material
    - Minutes from meetings and workshops
- Financing
    - Members
    - External
- Mechanism for continual improvement of the co-creation process
    - Monitoring evaluation and learning
    - Feedback Mechanisms

4. References

Alföldi, T., & Wielinga, E. (2022). The Spiral of Initiative/Innovations-Tools for analyzing networks (i2connect 2/4).

Angbo-Kouakou E., Temple L., Mathé S., Assemien A., (2017). Plateformes d'innovation comme dispositif d'orientation des trajectoires technologiques des filières agricoles. Cas de la filière banane plantain en Côte d'Ivoire. Technologie innovation. Vol 17 -2.

Brouwers, J., Sanogo, D., Fayama, T., Dabire, D., Bastide, B., Seghieri, J., ... & Van den Berg, J. (2023). First experiences to ground agroforestry Innovation Platforms into their local institutional context. BASE.

Aare, A. K., Lund, S., & Hauggaard-Nielsen, H. (2021). Exploring transitions towards sustainable farming practices through participatory research – The case of Danish farmers' use of species mixtures. *Agricultural Systems*, *189*. https://doi.org/10.1016/j.agsy.2021.103053

AFSA. (2016). *Agroecology: The Bold Future of Farming in Africa*. www.afsafrica.org

AGRA. (2018). *Africa Agriculture Status Report: Catalyzing Government Capacity to Drive Agricultural Transformation*. *6*.

Agricultural Policies in Argentina. (2019). OECD. https://doi.org/10.1787/9789264311695-en

Agroecology Info Pool 2019. https://www.agroecology-pool.org/methodology/

Andrieu, N., Howland, F., Acosta-Alba, I., Le Coq, J. F., Osorio-Garcia, A. M., Martinez-Baron, D., Gamba-Trimiño, C., Loboguerrero, A. M., & Chia, E. (2019). Co-designing Climate-Smart Farming Systems With Local Stakeholders: A Methodological Framework for Achieving Large-Scale Change. *Frontiers in Sustainable Food Systems*, *3*. https://doi.org/10.3389/fsufs.2019.00037

Bacon, C. M., & Mendez, E. V. (2005). *Participatory action research and support for community development and conservation: Examples from shade coffee landscapes in Nicaragua and El Salvador Building climate change resilience with coffee smallholder producers by extending organic practices to staple crops View project*. https://www.researchgate.net/publication/262804526

Bellec, F. Le, Rajaud, A., Harry, O. L., Bockstaller, C., & Malezieux, E. (2012). Evidence for farmers' active involvement in co-designing citrus cropping systems using an improved participatory method. *Agronomy for Sustainable Development*, *32*(3), 703–714. https://doi.org/10.1007/s13593-011-0070-9

Casagrande, M., Lefèvre, V., Capitaine, M., & Peigné, J. (2015). *5 th International Symposium for Farming Systems Design Participative design of conservation agriculture cropping systems in organic agriculture*. www.tilman.net

Cash, D. W., Clark, W. C., Alcock, F., Dickson, N. M., Eckley, N., Guston, D. H., Jä Ger ¶, J., & Mitchell, R. B. (2003). *Knowledge systems for sustainable development*. https://www.pnas.org

CDEAO, 2023. La news lettre agro-ecologie, 8p, Fevrier

CocoaSoils, 2019. https://cocoasoils.org/

Dabire, D., Andrieu, N., Djamen, P., Coulibaly, K., Posthumus, H., Diallo, A. M., Karambiri, M., Douzet, J. M., & Triomphe, B. (2017). OPERATIONALIZING AN INNOVATION PLATFORM APPROACH for COMMUNITY-BASED PARTICIPATORY RESEARCH on CONSERVATION AGRICULTURE in BURKINA FASO. *Experimental Agriculture*, *53*(3), 460–479. https://doi.org/10.1017/S0014479716000636

Descheemaeker, K., Ronner, E., Ollenburger, M., Franke, A. C., Klapwijk, C. J., Falconnier, G. N., Wichern, J., & Giller, K. E. (2019). WHICH OPTIONS FIT BEST? OPERATIONALIZING the SOCIO-ECOLOGICAL NICHE CONCEPT. *Experimental Agriculture*, *55*(S1), 169–190. https://doi.org/10.1017/S001447971600048X

De Tourdonnet, S., & Brives, H. (2018). Innovation agro-écologique: comment mobiliser des processus écologiques dans les agrosystèmes?. Innovation et développement agricole dans les systèmes agricoles et agroalimentaires, Quæ Éditions, 71-80.

Dogliotti, S., García, M. C., Peluffo, S., Dieste, J. P., Pedemonte, A. J., Bacigalupe, G. F., Scarlato, M., Alliaume, F., Alvarez, J., Chiappe, M., & Rossing, W. A. H. (2014). Co-innovation of family farm systems: A systems approach to sustainable agriculture. *Agricultural Systems*, *126*, 76–86. https://doi.org/10.1016/j.agsy.2013.02.009

Falconnier, G. N., Descheemaeker, K., Van Mourik, T. A., Adam, M., Sogoba, B., & Giller, K. E. (2017). Co-learning cycles to support the design of innovative farm systems in southern Mali. *European Journal of Agronomy*, *89*, 61–74. https://doi.org/10.1016/j.eja.2017.06.008

Faure, G., Blundo-Canto, G., Devaux-Spatarakis, A., Le Guerroué, J. L., Mathé, S., Temple, L., ... & Hainzelin, E. (2020). A participatory method to assess the contribution of agricultural research to societal changes in developing countries. Research Evaluation, 29(2), 158-170.

Faure G., Gasselin P. (ed.), Triomphe B.(ed.), Temple L. (ed.), Hocdé H (ed.). 2010. Innover avec les acteurs du monde rural : la recherche-action en partenariat. Versailles : Ed. Quae, 221.

Giller, K. E., Leeuwis, C., Andersson, J. A., Andriesse, W., Brouwer, A., Frost, P., Hebinck, P., Heitkönig, I., Van Ittersum, M. K. and Koning, N. (2008). Competing claims on natural resources:What role for science. Ecology and Society 13:34.

Giller, K. E., Tittonell, P., Rufino, M. C., van Wijk, M. T., Zingore, S., Mapfumo, P., Adjei-Nsiah, S., Herrero, M., Chikowo, R., Corbeels, M., Rowe, E. C., Baijukya, F., Mwijage, A., Smith, J., Yeboah, E., van der Burg, W. J., Sanogo, O. M., Misiko, M., de Ridder, N., … Vanlauwe, B. (2011). Communicating complexity: Integrated assessment of trade-offs concerning soil fertility management within African farming systems to support innovation and development. *Agricultural Systems*, *104*(2), 191–203. https://doi.org/10.1016/j.agsy.2010.07.002

Glover, D., Sumberg, J., Ton, G., Andersson, J., & Badstue, L. (2019). Rethinking technological change in smallholder agriculture. Outlook on Agriculture, 48(3), 169-180.

Greve, H. R. (2007). Exploration and exploitation in product innovation. *Industrial and Corporate Change*, *16*(5), 945–975. https://doi.org/10.1093/icc/dtm013

Guzmán, G. I., López, D., Román, L., & Alonso, A. M. (2013). Participatory action research in agroecology: Building local organic food networks in Spain. *Agroecology and Sustainable Food Systems*, *37*(1), 127–146. https://doi.org/10.1080/10440046.2012.718997

Holt-Giménez, E. (2002). Measuring farmers' agroecological resistance after Hurricane Mitch in Nicaragua: a case study in participatory, sustainable land management impact monitoring. *Agriculture, Ecosystems & Environment*, *93*(1–3), 87–105. https://doi.org/10.1016/S0167-8809(02)00006-3

Horton, D., Devaux, A., Bernet, T., Mayanja, S., Ordinola, M., & Thiele, G. (2022). Inclusive innovation in agricultural value chains: lessons from use of a systems approach in diverse settings. Innovation and Development, 1-23.

Kerr, R. B., Madsen, S., Stüber, M., Liebert, J., Enloe, S., Borghino, N., ... & Wezel, A. (2021). Can agroecology improve food security and nutrition? A review. Global Food Security, 29, 100540.

Lacombe, C., Couix, N., & Hazard, L. (2018). Designing agroecological farming systems with farmers: A review. In *Agricultural Systems* (Vol. 165, pp. 208–220). Elsevier Ltd. https://doi.org/10.1016/j.agsy.2018.06.014

Lamers, D., Schut, M., Klerkx, L., & Van Asten, P. (2017). Compositional dynamics of multilevel innovation platforms in agricultural research for development. *Science and Public Policy*, *44*(6), 739-752.

Levidow, L., Pimbert, M., & Vanloqueren, G. (2014). Agroecological Research: Conforming—or Transforming the Dominant Agro-Food Regime? *Agroecology and Sustainable Food Systems*, *38*(10), 1127–1155. https://doi.org/10.1080/21683565.2014.951459

Marinus, W., Descheemaeker, K. K. E., van de Ven, G. W. J., Waswa, W., Mukalama, J., Vanlauwe, B., & Giller, K. E. (2021). "That is my farm" – An integrated co-learning approach for whole-farm sustainable intensification in smallholder farming. *Agricultural Systems*, *188*. https://doi.org/10.1016/j.agsy.2020.103041

Mathé S., Fongang Fouepe HG., Sonfack M., Temple L., Ndjana JA, Brice Talla Sadeu M. New Challenges for Innovation Support Services to Improve Cocoa Quality and Sustainability in CameroonRevue Science, Technologie, Développement, Vol 3 N°1.

Méndez, V. E., Caswell, M., Gliessman, S. R., & Cohen, R. (2017). Integrating agroecology and participatory action research (PAR): Lessons from Central America. *Sustainability (Switzerland)*, *9*(5). https://doi.org/10.3390/su9050705

Périnelle, A., Meynard, J. M., & Scopel, E. (2021). Combining on-farm innovation tracking and participatory prototyping trials to develop legume-based cropping systems in West Africa. *Agricultural Systems*, *187*. https://doi.org/10.1016/j.agsy.2020.102978

Posthumus, H. (2011). *Enhancing adoption of conservation agriculture practices through co-innovation platforms in sub-Saharan Africa*.

Pound, B., & Posthumus, H. (2016). *The merits and limitations of innovation platforms for promoting Conservation Agriculture in sub-Saharan Africa*.

Reijntjes, Coen., Haverkort, Bertus., & Waters-Bayer, Ann. (1992). *Farming for the future : an introduction to low-external-input and sustainable agriculture*. Macmillan.

Rigal, C., Wagner, S., Nguyen, M. P., Jassogne, L., & Vaast, P. (2022). ShadeTreeAdvice methodology: Guiding tree-species selection using local knowledge. *People and Nature*, *4*(5), 1233–1248. https://doi.org/10.1002/pan3.10374

Ronner, E. (2018). *From targeting to tailoring: Baskets of options for legume cultivation among African smallholders STEP-UP (Sustainable Transition to Entrepreneurial Production in Agriculture through Upgrading) View project*. https://www.researchgate.net/publication/324694844

Sachet, E., Mertz, O., Le Coq, J.-F., Cruz-Garcia, G. S., Francesconi, W., Bonin, M., & Quintero, M. (2021). Agroecological Transitions: A Systematic Review of Research Approaches and Prospects for Participatory Action Methods. *Frontiers in Sustainable Food Systems*, *5*. https://doi.org/10.3389/fsufs.2021.709401

Soulé Adam, N., Temple L., Mathé S., Kwa M., 2023. Functional Dynamics to Strengthen an Agroecological Technological Innovation Process in a Developing Country. The Case of Plantain Multiplication Technology by Plants from Stem Fragments in Cameroon, Journal of Innovation Economics & Management, vol. , no. 0,

SWAC/OECD. (2012). *FOOD SYSTEM TRANSFORMATIONS Implications for people and policies IN THE SAHEL AND WEST AFRICA Club SAHEL AND WEST AFRICA Secretariat*.

Temple L., Compaore Sawadogo EMF., (2018). Innovation Processes in Agro-Ecological Transitions in the Developing Countries, Collection ISTE, Série Innovation in Engineering and Technology 190 p - ISBN : 9781786302724 - http://iste.co.uk/book.php?id=1333

Temple L., Kwa M, Tetang J, Bikoï A, (2011). Organizational determinant of technological innovation in food agriculture and impacts on sustainable development. Agronomy for sustainable development, 31 (4): 745-755.

Temple L., Talla SMB, Kamga R., Awah MLA., Mathé S. 2023. Ecosystem of actors and sectoral governance strategies for agricultural innovation in Cameroon. 26th European Seminar on Extension & Education Sustainability transitions of agriculture and the transformation of education and advisory services: convergence or divergence?

Thornton, P. K., Schuetz, T., Förch, W., Cramer, L., Abreu, D., Vermeulen, S., & Campbell, B. M. (2017). Responding to global change: A theory of change approach to making agricultural research for development outcome-based. *Agricultural Systems*, *152*, 145–153. https://doi.org/10.1016/j.agsy.2017.01.005

Tittonell, P., El Mujtar, V., Felix, G., Kebede, Y., Laborda, L., Soto, R. L., & De Vente, J. (2022). Regenerative agriculture—agroecology without politics?. Frontiers in Sustainable Food Systems, 6..doi: 10.3389/fsufs.2020.584605

Tucker, J., Cullen, B., Amsalu, A., & Ludi, E. (2014). *R4D Series 11 Research for Development Series Innovation Platforms to Enhance Participation in Rainwater Management: Lessons from The Nile Basin Development Challenge with a Particular Focus on Political Economy and Equity Issues Partner of*.

Utter, A, et al. 2021. Co-creation of knowledge in agroecology. Elem Sci Anth, 9: 1. DOI: https://doi.org/10.1525/ elementa.2021.00026

Vall, E., Blanchard, M., Coulibaly, K., Ouédraogo, S., Dabire, D., Douzet, J.M, Kouakou, P.K., Andrieu, N., Havard, M., Chia, E., Bougouma-Yameogo, V., Koutou, M., Karambiri, M., Delma, J.B., Sib, O. (2019). Co-design of innovative mixed crop-livestock farming systems in the cotton zone of Burkina Faso. In E. P.-M. S. P. P. R. B. R. M.-C. T. F.-X. Côte (Ed.), *The agroecological transition of agricultural systems in the Global South, Agricultures et défis du monde collection* (pp. 17–35). Éditions Quæ.

van Der Wolf, J., Jassogne, I., Gram, G., & Vaast, P. (2019). Turning local knowledge on agroforestry into an online decision-support tool for tree selection in smallholders' farms. Experimental Agriculture, 55(S1), 50-66. doi:10.1017/S001447971600017X

van Dijk, L., Buller, H., MacAllister, L., & Main, D. (2017). Facilitating practice-led co-innovation for the improvement in animal welfare. *Outlook on Agriculture*, *46*(2), 131–137. https://doi.org/10.1177/0030727017707408

van Etten J, & Abidin, E. , A. D. , B. E. , C. E. , L. M.-L. , L.-N. I. , M. B. , M. R. , O.-C. B. , Q. C. , de S. K. T. B. , T. H. A. , U. J. , & V.-S. J. (2020). *The tricot citizen science approach applied to on-farm variety evaluation: methodological progress and perspectives*. https://doi.org/10.4160/23096586RTBWP20212

Fals Borda, O. (2013). Action research in the convergence of disciplines. Int. J. Action Res. 9, 155–167. doi: 10.1688/1861-9916_IJAR_2013_02_Fals-Borda

Kindon, S., Pain, R., and Kesby, M. (eds.). (2007a). "Introduction: connecting people, participation and place," in Participatory Action Research Approaches and Methods. Connecting People, Participation and Place (London; New York, NY: Routledge Taylor and Francis Group). pp. 1–6.

Kindon, S., Pain, R., and Kesby, M. (2007b). "Participatory action research: origins, approaches and methods," in Participatory Action Research Approaches and Methods. Connecting People, Participation and Place, eds S. Kindon, R. Pain, and M. Kesby (London; New York, NY: Routledge Taylor & Francis Group), p. 9–18

The SROI Network, A Guide to Social Return on Investment, 2012, https://socialvalueuk.org/resource/a-guide-to-social-returnon-investment-2012/

Annexes

Annex I - Description and guide of the first co-creation workshop

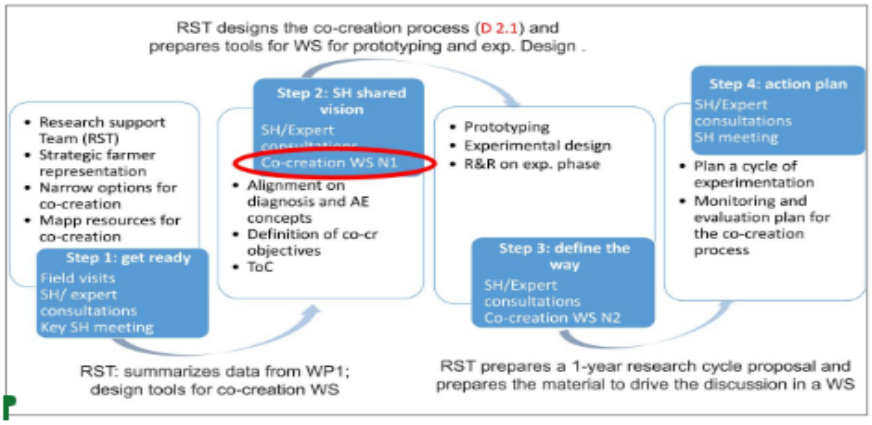
Each ALL coordinator and co-creation facilitator will be supported with an ALL specific guide and power point presentation to guide the workshop. The guide consists of a detailed description of the activities that should take on the co-creation workshops and a checklist of issues to consider on the preparation and facilitation.

Here is a link to the guide for the co-creation for Ntui AA, here is a link to the PPT and here is a link to a schematic representation of how the workshop would unfold. The support for co-creation workshops is adapted to each AL needs.

Co-Creation Workshop 1

NTUI

This workshop is within the second step of the process to define the co-creation framework and plan the co-creation activities for the first cycle in the ALL (see scheme below and see here the activities within Task 2.1 and here the approach for the adaptation of the co-creation framework to each ALL conditions). The workshop will happen soon after the ALL inceptition meeting which is part of task 3.2 led by NIBIO (see here the workshop calendars for all WPs).



The definition of the objectives of the co-creation is one of the most critical steps toward a successful ALL. A wrong direction would lead to a fast drop in partners' commitment and a complete failure of the ALL. Given the diverse range of interests and goals held by multiple stakeholders, it is crucial to spend the required resources and time to strategically select the challenges that address and harmonize the partners' interests, while remaining feasible. To achieve this, a series of activities will take place before and during this co-creation workshop.

Before the workshop, the R&D (Research and Development) partners engaged in an exercise to identify and align the most relevant challenges to target with the co-creation efforts, from their perspective. These identified challenges are integrated into this workshop's agenda, where they will be scrutinized and compared against other ideas gathered from farmers and other stakeholders. The pre-alignment among R&D partners significantly streamlines the challenge of reaching a consensus on the challenges to prioritize within the workshop, while ensuring that the the most critical challenges are included in the analysis and clear for the researchers.

Workshop Objectives


CANALLS
AGROECOLOGICAL PRACTICES
FOR SUSTAINABLE TRANSITION
Premier atelier de
fo-création
Ntui
Funded by the European Union under GA no. 101083653. Views and opinions expressed are however those of the authors only and do not necessarily reflect those of the European Union or REA. Neither the European Union nor the granting authority can be held responsible for them.
Funded by
the European Union


Program
Program of today
Day 1
9:00-9:20- Welcome
9:20-10:00- Objectives, expectations and key concepts
10:00-10:50- What are the challenges?
10:50- 11:05 Coffee/tea break
11:05-12:35 Prioritization of challenges
12:30- 13:30 Lunch break
13:30- 15:00 Main 3 challenges analysis in groups
15:00- 15:15 Coffee/tea break
15:15- 16:00 Plenary discussion and consensus and definition of challenge trees
Expectations (clustered in si...
WS objectives and expected outcomes
Participants understand and align on basic concepts of agroecology and living labs
Participants define the challenge(s) to target with the co-creation efforts
Participants define the general objectives of the co-creation activities
Resources for co-creation are mapped
A calendar of co-creation activities is defined for the next 6 months
Facilitator to present the WS objectives, expected outcomes and the agenda
Align on main concepts
What does it mean? Why is important? Examples?
Agroecology
Agroecological Practice
Agroecological Living lab
Co-creation
Identifyir
Participants
Challenge A
Challenge A
Challenge D
Participa
challenges
Expert challe

Annex II - Exercise and tool used for researchers to aling on the challenge to target and co-creation objectives

We worked on an exercise to get researchers to align themselves on 1-3 challenges that (from our point of view) are more appropriate to target in each ALL (find here the link to the folder for the tools for each ALL). This tool will be used by the researchers to prioritize and align themselves with the challenges to be targeted, from their point of view. This step is necessary to simplify the co-creation workshop process and to balance power between researchers and other stakeholders. The selected challenges will be introduced in the first co-creation workshop, where they will be evaluated and compared with other challenges identified by other stakeholders. The exercise consists of 3 steps:

1. Gathering ideas from researchers. this is their opportunity to share their ideas and interests, as well as those of their institution. the key challenges to be targeted will be collected from 4 sources: individual ideas from key partners, ideas collected during CIRAD field visits, results from the Nairobi workshop and data collected in WP1.
2. The challenge comparison parameters are selected (CIRAD), and the table is filled in with the scores for each parameter. The scores will be completed by CIRAD, with the support and validation of the research specialist designated for each challenge.
3. Reduce the list of challenges to be targeted in the co-creation process to 1 to 3. The table will be sent to the selected representatives of each main partner one week before a meeting at which the selection of options will be made. This selection will take place during an online meeting during which the table will be described, the scores validated (relative comparison of each parameter between the options) and each colleague will rank the options in order of relevance.

A	E	F	G	H	I	J	K	L	P	Q	R	S	V	W
Défi à relever	**Source de l'idée**				**Alignement sur CoocaSoils** 0= not at all, 100= fully	**Transition prévue de l'agroécologie par rapport à l'état actuel après 10 ans**			**Chance de succès dans la co-création** 1= très faible ; 100= très élevée	**Taux d'adoption attendu** 5= très faible ; 30= très élevé	**Impact économique attendu pour les agriculteurs dans 5 ans, suite à la co-création**		**Changement de comportement requis de la part de l'agriculteur** (0=aucun ; 100=très élevé)	**Experimentation feasibility** (0=very difficult; 100= very simple)
	Individual f. Visits	WS Nairobi	WP1 surveys			**Score la TA intégral et MESURABLE** (changement mesurable en % de la TA une fois à l'échelle ; dans 10 ans)	**Intégrale, score TA** (changement en % de la TA une fois à l'échelle ; dans 10 ans)	**Score la TA** (% de variation de la TA pour un adoptant d'PAE réussi ; en 10 ans)			**Augmentation moyenne des bénéfices de tous les agriculteurs de la zone d'influence ALL** (% d'augmentation des bénéfices	**Augmentation possible des bénéfices par agriculteur** (% d'augmentation des bénéfices en un an)		
Insets et Maladies; Dommages aux cultures et coûts de la lutte contre	x	x	x	40	0,12	0,21%	2,99%	35	20	0,21	6	65	60
Carences nutritionnelles des cultures	x	x	x	70	0,08	0,17%	3,15%	35	15	1,58	60	50	70
Mauvaise gestion de l'ombre	x	x		30	0,27	0,47%	3,16%	60	25	3,60	48	50	50
Variétés anciennes	x		x	20	0,31	0,47%	2,90%	65	25	1,83	22,50	20	70
Le faible prix du marché entraîne une restriction de l'adoption de l'EAP à forte intensité de main-d'œuvre.	x			5	0,14	0,23%	4,52%	25	20	0,53	21	80	30
La mauvaise gestion financière entraîne des restrictions à l'adoption de la PAE	x			20	0,08	0,16%	5,41%	30	10	0,32	21	80	30
Perte de qualité après la récolte	x			10	0,13	0,23%	5,03%	30	15	1,42	63	70	50
Le coût élevé de la main-d'œuvre limite l'adoption de pratiques agroécologiques	x			20	0,18	0,28%	2,65%	35	30	2,68	51	70	60