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V1
Knowledge base of common features of co-innovation process to develop coupled innovations

Document Summary

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Abstract

13 multi-actor co-innovation case studies (CICS) across Europe and the Southern hemisphere are mobilised throughout the IntercropVALUES' project as Living Labs to innovate and co-design solutions with stakeholders of various value chains in order to develop intercropping agri-food value chains. This participatory approach remains challenging but innovative and leads a collective learning pathway. Our analysis aims to (i) identify strategies developed by 13 CICS (ii) determine the key factors enabling or hindering co-innovation processes for IC-based food value chains, and (iii) draw lessons to guide the design of such value chains.
The preliminary analysis reveals a **diversity of contexts and strategies among the 13 CICS**, ranging from exploratory field trials to integrated food-to-field approaches. Four main clusters emerged based on field experimentation, sorting issues and food processing ambitions. A mid-term evaluation highlighted **contrasting progress**, influenced by market, actor motivations, management capacity of such multi-actor network, history of collaboration between actors. CICS combining field and food dimensions and engaging diverse stakeholders show more coherent innovation dynamic.
Based on the learnings of the pilots managing the CICS, **six major insights for designing IC-based** VC were identified: (i) economic viability and market engagement are prerequisites for adoption (ii) field experimentation is essential but not sufficient alone (iii) co-design with farmer is needed for better adaptability in case of failure (iv) coupled innovation, VC coordination is necessary (v) knowledge sharing and advocacy also and (vi) documenting transformation processes is crucial for upscaling.

The study shows from the experience of multi-actor VC stakeholders that **developing IC-based food VC requires a multi-disciplinary innovation process** and highlights the **difficulties of conducting such participatory process**. Further work will cover the possible pathways to guide future "step-by-step" design of IC-based VC.

01

1. Introduction

Intercropping (IC) has long been recognized as a way to improve the sustainability of crop production (e.g. (Jensen *et al.*, 2020)). Despite its potential contribution to the EU agroecological transition, IC remains underdeveloped due to interconnected barriers across different stages of the value chains (VC) (Hauggaard-Nielsen *et al.*, 2021). Successful implementation relies on the ability of farmers and other stakeholders to innovate in coordination, shaping the feasibility of IC at the local level to their own situation (Magrini et al., 2018). To enhance IC use, innovation must be stimulated and coordinated not only at the farm level but also across the entire VC to generate mutual benefits. This requires multi-actor participatory approaches to address key challenges and drive innovation collaboratively (Meynard *et al.*, 2017).

The IntercropVALUES European project is structured around 13 multi-actor co-innovation case studies (CICS) to identify and overcome barriers to intercropping use for food. The CICS act as living labs (LL) where local actors (stakeholders) work together with researchers in a **participatory approach to co-innovate to develop intercropping value chains for food.** They are managed by pilots coordinating activities with stakeholders to design innovations at the VC level.

LL have emerged as participatory fruitful environments where actors collectively experiment, learn, and co-design solutions to complex problems. Each CICS follows its own step-by-step process, fuelled by activities and continuously adapting solutions fostered by learnings (Meynard *et al.*, 2023).

IC being a niche subject, there is a strong need to produce actionable knowledge to empower stakeholders to find adapted solutions to their system. Conducting multi-actor activities while producing actionable knowledge on such niche topics remains challenging. Moreover, given the complexity of developing IC-based food value chains, the numerous obstacles identified and little literature existing on this topic at the VC level, it is essential to **better understand the innovation processes possible and the key factors influencing IC successful implementation into VC**.

Our research aims to shed light on the different (i) **strategies deployed** by the CICS based on their specific contexts and more specifically to be able to (ii) shed light on the **determinant**

factors enabling or disablico-innovationng the development of co-innovation processes for IC for food and finally to (iii) **identify the possible ways** to design IC-based VC.

To address this, so far, we have conducted a first cross-case analysis of the CICS at the start of the project (2023) and second analysis at mid-term (2025). These analyses aim to compare different ways to develop IC VC in the context of Co-innovation case studies of a European project, in order to **identify patterns and provide valuable insights to support and guide co-innovation processes for IC development**.

02

2. Material and methods

2.1 Structure of the 13 Co-innovation case studies

2.1.1 Geographic situation

There are 11 CICS located in the North hemisphere and 2 in the South covering a diversity of contexts from Europe to Africa within the Workpackage (WP) 1 of the IntercropVALUES project (Figure 1).

Figure 1: Map of the 13 CICS locations. Source : Céline Chevalier.

2.1.2 Pilots and titles

The case studies cover a wide range of goals from developing local to national value chains. Each CICS is managed by one (or two) pilot(s) i.e., one person belonging to a structure which is one of the 27 partners of the IntercropVALUES project.

Table 1: CICS pilots and goals

CICS number	Country	Pilot	Goal
1	Denmark	Business Lolland-Falster	Develop new business opportunities along local food value chains – including **legumes**
2	Sweden	SLU	Increase market demand for locally produced **legumes**
3	Scotland	SAOS, SRUC	New and high value product development for **organic oilseed rape**
4	France, South-West	INRAE	Develop a diversity of **mixtures** for food innovations adapted to original low productivity contexts
5	Germany	UniKassel	New product development around wheat and pea **mixture**
6	Greece	AUTH	New sustainable products from **low input** systems for local markets
7	France, La Réunion	eRcane, Cirad	New proven crop **management strategies** using service plants between the sugarcane rows
8	Spain	INTIA	Collective **integrated protection management** strategies for agri-food industries for broccoli
9	Serbia	UNSFA	**Wheat pea products** with added value for a multi-functional farming
10	France, North-West	FNCUMA, INRAE	Local/regional values chains of **lentils** for public kitchens
11	Italy	RSR	Multiple **organic short value chains**
12	Mozambique	UEM, Cirad	"Global South" model building with the **transition from subsistence to commercial** family farming
13	Switzerland	FiBL	Experience benefits from **wheat fababean intercropping**

2.2 Collection of data

Data were collected from *self-reported monitoring files* updated by CICS pilots every six months (Figure 2). The dataset includes **descriptions of activities, participants, aims, pilot satisfaction of outcomes, results, key learnings, and impacts on action plan**.

Additionally, *individual CICS semi-structured reflexive interviews* were conducted twice a year by researchers involved in task 1.1. (from INRAE and RUC) to **reflect on the activities, identifying factors that facilitated or hindered success** (Figure 2).

Collective activities, such as workshops, webinars, annual meetings with training sessions, were also implemented (Figure 2) as the second mission of the WP1 team is also to support the CICS pilots with methods and tools to facilitate their living labs. Data on CICS progress and activities were also collected during these events.

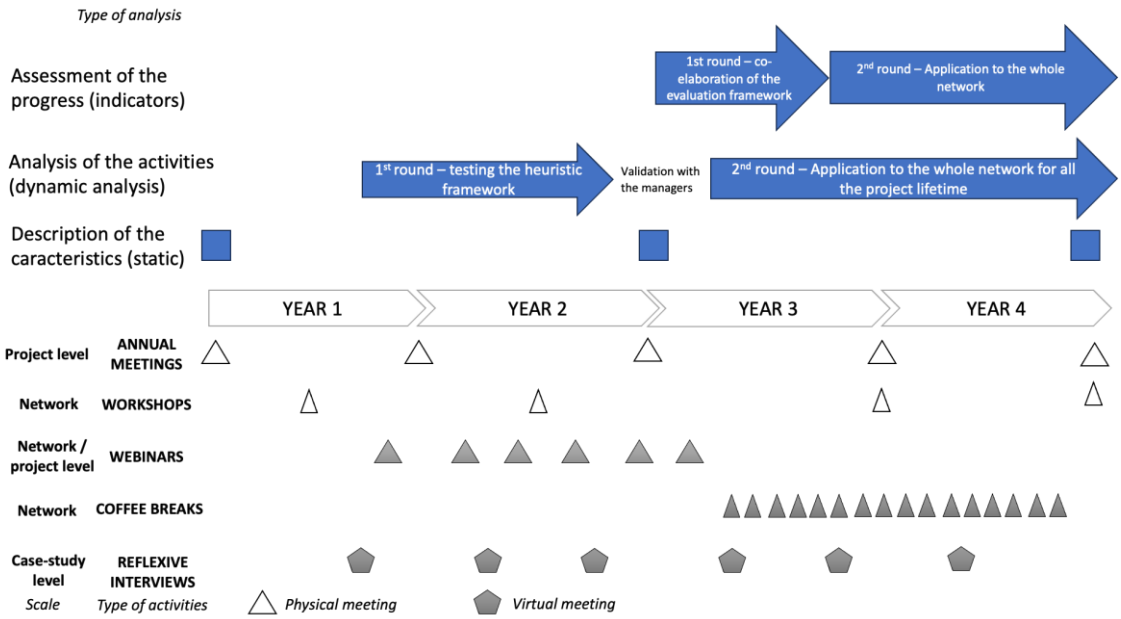

Figure 2: Overview of the method used for WP1 analysis and activities to support CICS

2.3 Data analysis protocol

Several types of analysis were performed during the project (Figure 2). Some of them correspond to static analysis (e.g., description of CICS characteristics at a precise moment) and others to dynamic ones (e.g., analysis of the activities performed by the stakeholders within the CICS).

2.3.1 Describing the initial states (2023)

The objective of the first analysis was to understand the starting point of each innovation network, their context, what they will be working on, how and with which resources. We characterised the initial state of each CICS, based on common variables: *type of IC studied, actors involved, history of collaboration and motivations, expertise on the subject, and knowledge production*. Our hypothesis was that these factors influence the pathways for developing IC-oriented VC.

2.3.2 Identification of different strategies to develop IC-based value chains

Based on the data collected during the first two reflexive interviews, we made a first analysis of the activities and goals leading to the identification of different strategies to develop IC-based

value-chains. More precisely, we combined information on IC perception by actors, type of field experiment, sorting issue encountered and type of food experiment.

2.3.3 *In itinere* evaluation of progress and achievements for the design of IC-based VC - 2025

The intermediary analysis assessed the status of each CICS two years after the start of the project. We developed an **evaluation framework to assess CICS contribution and achievements in regards to developing an IC-based VC**. We combined several indicators related to CICS results, means, impact and overall progress. The indicators were defined collectively with the CICS managers based on both the project's expectations (Table 2) and individual objectives of each CICS (Table 3). The framework considers dimensions such as *collaboration among stakeholders*, *knowledge management or governance issues*. The assessment was performed both by the WP1 coordinators but also by the CICS managers themselves during a collective workshop (30th of September 2025) gathering 10 out of the 13 CICS managers.

By cross-cutting the overall progress with the 4 clusters of situations previously identified, we ambitioned to find successful and more difficult situations according to the type of field experiment implemented, the sorting issues and ambitioned food processing experiments.

Table 2: Assessment template to be filled in by the CICS pilots, based on project's requirements and expectations indicators. Sept 2025

Indicator	**Guidelines**		**To fill in**		
	Questions to help you	Arguments / Proof	Level of satisfaction	Proof	What can I do to improve satisfaction?
Unique specificity of your CICS	*What unique feature makes this CICS interesting for analyzing how to develop value chains for IC ?*		/		
Intercropping as a primary object of study for the network in place	*What is the main foundation of your CICS?* *Is studying IC a goal or part of a whole (organic, pesticide-free…)?*	*Specify your main focus and give examples of activities implemented were IC was a central topic and activities where it was not.*	Satisfying More or less Not satisfactory		
Overall progress	*Assess your overall progress made to reach your CICS' goals.* *From one QI to the next, were there major changes?*	*Indicate which changes.*	Satisfying More or less Not satisfactory		
Integrating the whole value chain dimension	*Are you looking beyond the field?* *Are you working with the whole value chain members?*	*Give concrete examples of activities implemented in this sense.*	Satisfying More or less Not satisfactory		
Installing a coordination between the practitioners	*Are you thinking and designing trials concomitantly for field and food?*	*Give concrete examples of articulation between the group and value chain members*	Satisfying More or less Not satisfactory		
Transferring knowledge between different parties (Hostain 2019)	*Are you producing and capitalising new knowledge useful for others?* *Are you disseminating beyond your CICS?*	*Give an example of a production, deliverable, result, learning or data that you produced and disseminated.*	Satisfying More or less Not satisfactory		
Inspiring others	*Have you inspired other CICS or projects?* *What experience sharing have you had?*	*Give an example of how you have contributed to the dynamics of the CICS' community, how you've inspired others, show what others were able to gain from your CICS*	Satisfying More or less Not satisfactory		

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Integration in the project's ecosystem	*Are you mobilising other CICS, WP or expertise from the IntercropVALUES' project and using this for the dynamic of your CICS?*	*Give examples for links with other project's activities and mention how this has contributed to make progress in your CICS.*	Satisfying More or less Not satisfactory		
Interaction with other CICS and making connections	*Beyond WP's collective sessions, have you discussed or initiated communication and activities with other CICS*	*Show which close interactions you've had with other CICS*	Satisfying More or less Not satisfactory		
Impact and continuity	*Are you looking to develop a value chain or to show a proof of concept that it can be done?* *After the project, will the actors continue without you?*	*Explain how the actors see the continuity after the project.*	Satisfying More or less Not satisfactory		
Looking beyond the project to work on the subject of IC	*Have you integrated other projects and not stayed limited to IntercropVALUES?*	*Name the projects that you know relevant for the subject of intercropping. Show how they are linked and used for the dynamic of your CICS.*	Satisfying More or less Not satisfactory		

Table 3: Assessment template to be filled in by the CICS pilots based on their own CICS ambitions and goals in regards to developing an IC-based VC. Sept 2025.

Indicator	**Guidelines**	
	Description of your own indicator based on your CICS ambitions and goals	Why is it important to have a look at this in regards to developing an Intercrop-based value chain?

2.3.4 Explanatory and determinant factors of success

The final analysis aimed at identifying explanatory and determinants factors to lead a successful co-innovation design process for developing an IC-based VC.
To do so, we first analysed individually each CICS situation, and then cross-analysed the individual conclusions to highlight common inherent and external factors to the CICS influencing successes or difficulties.

2.3.5 Highlighting the lessons learnt for designing intercrop-based value chains

During the 3rd workshop organised by WP1 (30th September 2025 – Edinburgh), the CICS pilots were asked to present one lesson, learning or result for designing IC-based VC they considered useful or important to share with the collective. From this, the lessons were categorised into themes highlighting essential steps and activities to implement for designing such VC.

3. Results

3.1 The initial states of the Co-innovation case studies: what was the starting point of the 13 CICS?

3.1.1 A diversity of initial situations

Across the 13 CICS, there is a variety of situations in terms of: *IC studied, value chains, motivations, network of stakeholders, history of collaboration within the network, knowledge production strategy*.

In the type of **IC studied**, two approaches to IC have been identified. CICS with:

i. An **exploratory approach** based on **testing several crop combinations** in parallel (wheat–peas; lentil–camelina; barley–pea, etc.)
ii. A targeted and **focused approach** based on the implementation of a **single specific crop combination** (wheat-pea) or several IC around a **single chosen crop** of 'interest' (lentil)

In addition to these approaches, some crops were combined with **non-harvested service plants**, such as broccoli mixed with vetch. Other CICSs chose to combine **two plants harvested for human consumption**. Still others combine **two harvested plants**, one for **human** consumption and the other for **animal feed** (Figure 1). The commonality is that there is **at least one crop for human consumption in the IC studied**.

Figure 1: Photos of some IC studied by the CICS. (Left) Broccoli and vetch service plant IC by CICS 8 (credits : INTIA). (Middle) 2 harvested crops for food with wheat and fababean by CICS 13 (credits: FiBL). (Right) 2 harvested plants for food (wheat) and feed (pea) by CICS 5 and 6 (credits: AUTH).

The diversity of CICS situations also extends to the **nature of the pilots** managing the CICS (Figure 2). Based on the institution type or the profession of the pilot(s), 5 groups of CICS were defined:

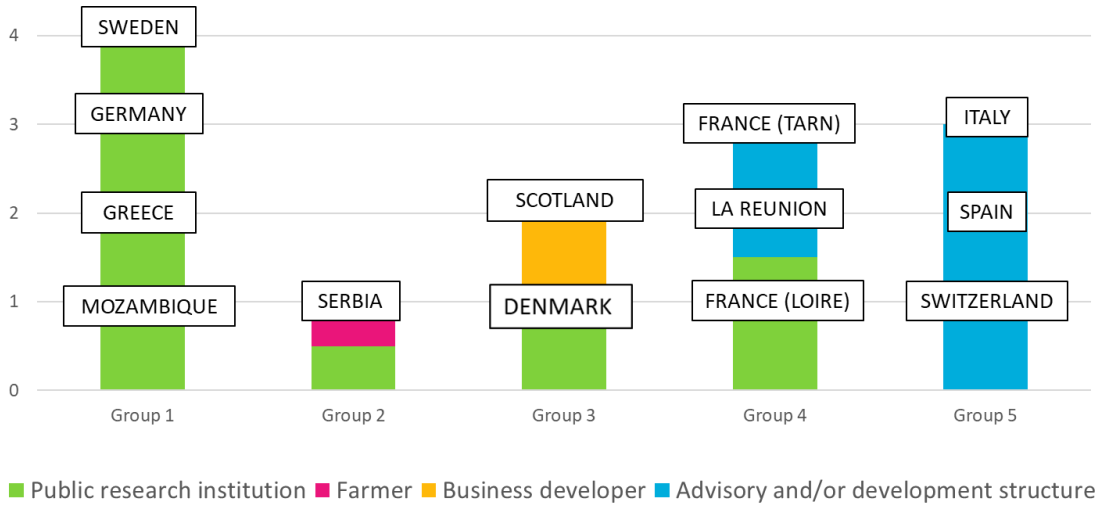

Figure 2 : Nature of the pilots leading the CICS. 2023.

- **Group 1** is composed of four CICS that have pilot(s) only from public research institution.
- **Group 2** includes the only CICS (CICS#9, Serbia) in which a farmer also takes up a role of a pilot.
- **Group 3** regroups the two CICS that are involving business developer structure (private sector) in the management.
- **Group 4** gathers the CICS in which the management is shared between research institutions and advisory and/or development structures.
- **Group 5** corresponds to the three CICS that do not involve public research institution in the management team and are managed only by research and development or advisory structures.

All CICS have at least either a research organisation, an advisory service or development structure as pilots.

3.1.2 Commonalities in the ambitioned approaches

When examining each CICS, we also observed similarities in the initial motivations and strategies as well as the actors to be involved, including:

A diversity of stakeholders was to be involved in the different CICS allowing them to experiment on the field as well as the food level.

3.2 Emerging strategies to support IC based value-chain

3.2.1 CICS viewing IC as a mean or as an end leading to different strategies around field experiment

The activities pursued by the CICS were influenced by how they perceived IC use. While some CICS perceived IC as a mean to reach more sustainable system, mentioning that "IC is part of the story" (CICS 3), "part of a whole (agronomic approach, zero-residue, cultivation technique…)" (CICS 8), it is seen as a tool or a way for some growers to grow organic or reducing input use. Others perceived IC as an end in itself, focusing on producing and valorising mixtures (Figure 3).

Identifying this distinction was quite important in the perspective to analyse innovation dynamics as this may have an impact on how and why CICS implement certain types of activities and how the innovation process unfolds.

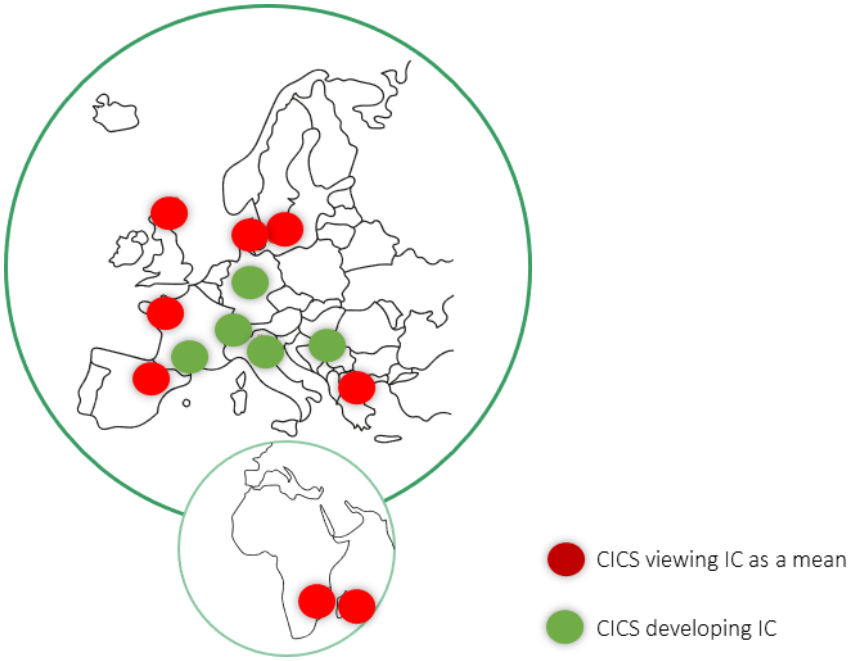

Figure 3: Map of the CICS identified according to how they perceive IC use

For instance, the first analysis shows that those focusing on IC as a mean, seem to conduct on-station or on-farm experiments (OFE) without necessarily engaging in food processing and marketing around IC. *(CICS 3, CICS 6)*

Others operate at various levels. CICS with a food-to-field strategy seek to overcome food and field barriers, for instance by progressing towards growing successful mixtures for artisanal product making within a territory. *(CICS 4, 5, 9, 13)*

Therefore, based on how they perceive IC and its use, not all CICS have implemented the same type of experiments and therefore are not confronted to the same challenges. Three clusters have been identified (Figure 4):

i. CICS where experiments are carried out at **on-station, under controlled conditions**. *For instance, CICS 12 Mozambique, implementing trials under contrasted level of water and nutrient inputs.*

ii. CICS where experiments are carried out by **researchers on-farm**. *For instance, in Greece where a wheat-pea intercrop is being tried in 3 different locations on farmer's plots and France (Tarn) co-designing IC with farmers, advisors and researchers for on-farm trials.*

iii. CICS where experiments are carried out by **farmers on-farm**, which are not used to collect scientific quantitative data but more qualitative and for creating a shared space for farmers to exchange on IC.

3.2.2 Strategy around sorting and food processing

One of the main challenges for IC for human food, is sorting. To answer downstream stakeholders' standards, farmers are today obliged to sort and separate entirely their IC harvests.

However, this is more or less specific to certain situations and the level of difficulty for this challenge varies according to the type of IC. We have identified 3 clusters within the CICS based on the issues related to sorting (Figure 5):

i. **CICS that have grain sorting problems** because they work with a *combination of two or more food species that are harvested simultaneously* (wheat-peas, wheat-chickpeas, buckwheat-millet in CICS 4 France, Tarn).

ii. **CICS that do not have sorting issues** because they work with *two or more food species using **different harvesting methods*** (by hand, with the sugarcane-cowpea combination in La Réunion CICS 7).

iii. **CICS that do not present sorting problems** because they work on combinations of *food crops and **service crops not harvested*** (broccoli-vetch CICS 8 Spain). Therefore, for instance in CICS 8 (Spain), "as the processor doesn't have any inconvenience from the IC, trials have been focused on field management" and not on the impact of food processing.

Consequently, not all the CICS have the same issues and not all work to tackle the same ones.

Sorting is very much correlated to the ambitioned valorisation and outlet. Different strategies can be identified based on the sorting and food processing ambitions within the CICS.

4 clusters have been identified based on food processing issues (Figure 6):

- **Cluster 1**: **CICS without food processing** – CICS working with *two or more food species using different harvesting methods or with food crops and service crops not harvested, therefore* ***not having sorting issues****.*

These CICS happen to implement either *on-farm experiments*, working directly on farmer's systems and *also implementing on-station research experiment* complementary to the on-farm experiment*.*

- **Cluster 2**: CICS concerned only with sorting and **separating 100% the grain mixture** – *CICS working with public kitchen, growing using IC to help produce legumes.*

This is the case for CICS 10 Loire, France, implementing only *on-farm experimentations* focusing on lentils meanwhile attempting to solve sorting issues to answer public kitchen's quality standards.

- **Cluster 3**: CICS with an interest in better understanding the **impact of IC on the composition of sorted grains or grain blends**.

Either for *marketing purposes* (CICS 3 Scotland), *consumer awareness* (CICS 11 Italy) or because working with *food processors* which may have an impact on the food process (CICS 4 France, CICS 5 Germany, CICS 6 Greece, CICS 9 Serbia)

- **Cluster 4**: CICS that conduct *food experiments* with species mixtures.

Either with the ambition to adapt recipes to the impact of residues of legumes in the flour or to develop a new product based on mixed cereal-legume flour with higher proportion of legumes than after a simple sorting step. These 5 CICS are all *working with food processors on flour-based products.*

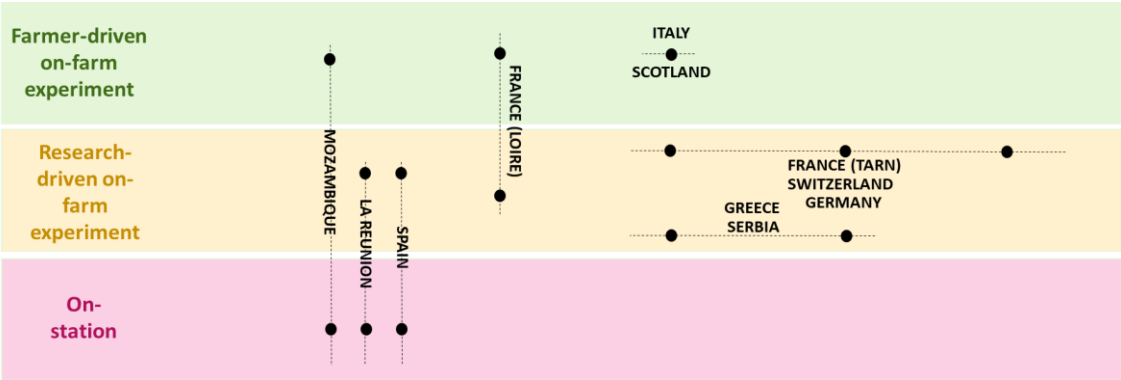

Figure 4: 3 clusters of CICS based on the type of field experiment implemented. 2025.

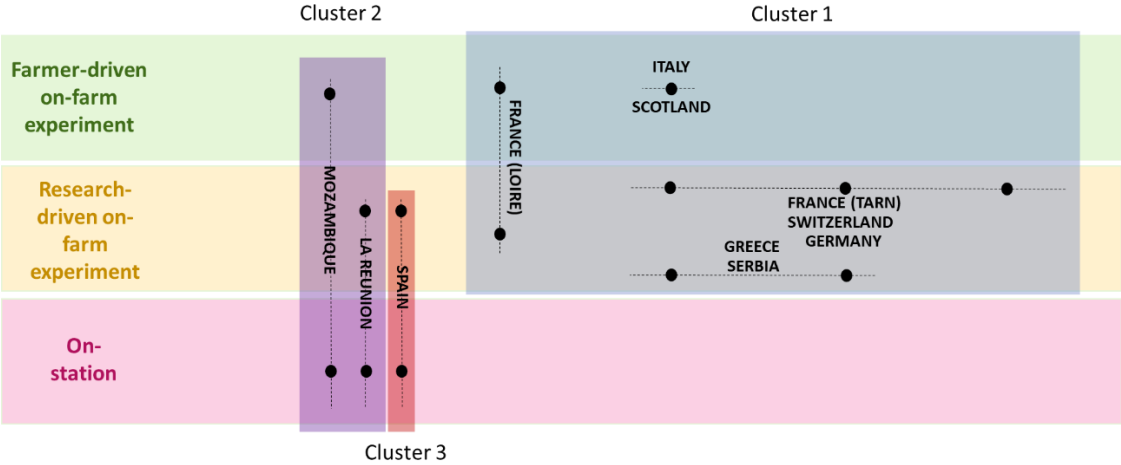

Figure 5 : 3 clusters of CICS based on the type of field experiment and sorting issues. 2025. Blue: sorting issue / Purple : no sorting issue – harvest seperately / Red : no sorting issue – 1 crop harvested

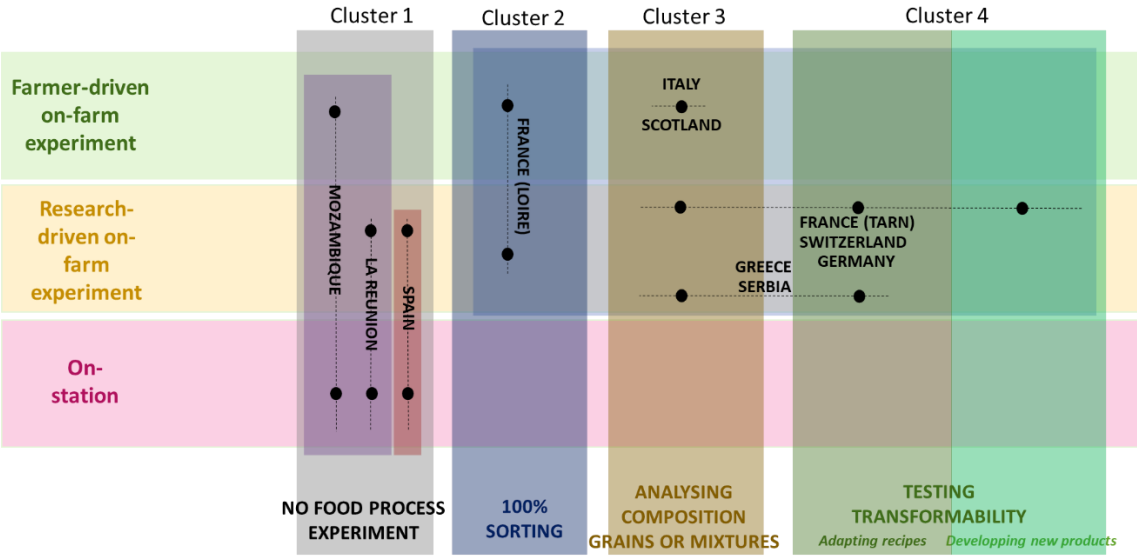

Figure 6 : 4 clusters of CICS based on the type of field experiment, sorting issues and ambitionned food processing experiment. 2025.

3.2.3 Other strategies

Different levers have been identified throughout the scientific literature and with the work of WP6 from the IntercropVALUES' project.

It has been collectively shared that not only activities at the field level is necessary for levering value chain barriers but also for instance:

- Raising awareness among the different VC stakeholders (CICS 11 Italy with consumers and regulation bodies).
- Necessity to show provide some proof of concepts (CICS 9 Serbia, CICS 13 Switzerland, CICS 5 Germany, CICS 4 France Tarn) to convince stakeholders.

2 CICS (1 Denmark, 2 Sweden) have not been identified in such cluster, as they encounter difficulties progressing, putting them on-stand by. Indeed, when confronted to action, certain CICS have encountered successes but also difficulties.

3.3 *In itinere* overall evaluation

The intermediary analysis (two years after the start of the project) based on a common set of criteria shows that the CICS' progress differs strongly from one another (Table 4).

All CICS have performed well in **transferring knowledge** to different stakeholders through either farm field day, advisory extension services, food processors meetings, policy makers, conferences, university courses. And **inspiring others**, either other CICS or projects.

Looking at the **overall progress indicator** from Table 4, which gives us some insight on the CICS' pilot perception of how they have progressed since the start of the project, we can see that the overview is mitigated and mostly more or less satisfying. Indeed, pilots have encountered several obstacles, either sometimes because of inherent factor from IC (e.g., Not providing satisfying results on field – CICS 6) or sometimes inherent to the management of the CICS (e.g., Encountering difficulty in working with certain actors – CICS 1).

Moreover, some CICS don't fully fulfil the project's requirements due to discrepancy from the project's expectations (CICS working on food processing – **integrating the whole value chain dimension and stakeholders**) and the CICS' needs based on practitioners and value chains (e.g., CICS 7 focusing on intercrop with service plants without relevance to focus on the impact on food processing).

On the other hand, some CICS integrate the whole value chain dimension, working with research, farmers and food processors and thinking concomitantly of developing IC value chain to lever agronomy and food issues. For instance, CICS 13 testing varieties designed for food applications.

This variability in the results encourages to look further into explanatory factors that can justify these dynamics, successes and failures.

Table 4 : CICS overall assessment (made by the CICS pilots and WP1 coordinators), based on the project's requirement and expectation indicators. September 2025.
Green: satisfaction regarding the indicator / Yellow: more or less satisfactory / Orange: not satisfactory

CICS number	8	5	11	4	10	7	3	6	12	13
CICS country	SPAIN	GERMANY	ITALY	TARN	LOIRE	LA REUNION	SCOTLAND	GREECE	MOZAMBIQUE	SWITZERLAND
Intercropping as a primary object of study for the network in place										
Overall progress for the objective to design IC-based VC / lever IC barriers										
Integrating the whole value chain dimension for the design of IC-based VC										
Installing a coordination between the practitioners										
Transferring knowledge between different parties (Hostain 2019)										
Inspiring others										
Integration in the project's ecosystem and impact on the CICS dynamic										
Interaction with other CICS and making connections										
Impact and continuity of the ICVC										
Looking beyond the project to work on the subject of IC										

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3.4 Explanatory and determinant factors of success and failures

The following elements are still under elaboration. This section presents first data of the cross-analysis but need to be consolidated.

3.4.1 Confrontation to real-life market

The uncertainties and hazards sometimes slowed down the CICS or forced them to rethink their focus and objectives especially regarding market issues.

During the project, some CICS changed their IC targeted approach to adopt an exploratory approach. For example, our CICS10 in the Pays de Loire region switched from a crop combination centred around lentils to several other combinations (barley-peas) due to market conditions, which were not favourable for lentils alone.

CICS 5's ambition is to "look for proof of concept". In this case, the VC already existed and therefore the bakers will continue to bake farmers' and millers' flour however, integration of IC will depend on economy of scale.

3.4.2 Confronted to actors' motivations, interests and needs

Within participatory multi-actor networks, the difficulty also resides in being constrained to actor's motivations, interests and needs. It is very much actor-dependant and driven.

In France, CICS10 aimed to work on sorting issues, based on the experience of a collective sorting line that would be installed on a farm to enable a group of farmers to sell lentils to collective catering establishments. Unfortunately, after careful consideration and in-depth examination of the proposed system, the purchase of the planned sorter did not go ahead. The reasons for this decision were mainly related to the workload that this would entail for the farm, which would have to switch from being a farm to a sorting facility.

In Italy, CICS11 is focusing its efforts on the field, raising consumer awareness and lobbying local authorities in line with farmers' priority needs that were identified during a collective workshop. Therefore, their initial aim at understanding the impact on composition of grains or mixtures is not a priority obstacle to lever compared to others.

CICS7 in La Réunion switched from a combination of sugar cane and a service crop to a combination of sugar cane and a crop harvested for consumption, voème (cowpea), as requested by farmers.

CICS 8 Spain, there was no interest of agro-industry to look into the impact of IC on quality and no interest to look into specific branding or labelling for IC – therefore no implementation of food or market experiment.

Integrating the whole VC dimension not only depends on the pilot's actions but also on the actor's dynamic: "not all actors contributed equally to the CICS effort. Sometimes very frustrating!" (CICS 5)

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3.4.3 Change of leadership

In Denmark and Sweden, CICS1 and 2, underwent a change of leadership, which delayed the implementation of activities aimed at achieving their objectives.

3.4.4 Weather-dependent

Finally, in Greece, CICS 6 was expecting sufficient quantity of mixed grain crops to be produced after a year of fieldwork to proceed to look into food aspects.

3.4.5 Management of the CICS

In addition to those hazardous explanatory factors, we have also identified numerous factors connected to the management of the CICS itself.

For instance, the clarity of vision for the targeted VC has to be identified. A clear and well-defined vision of the intended VC and existing barriers facilitates progress. Some CICS pilots have limited visibility on barriers and how to address them. Whereas in others, a strong understanding of the food-scale ambition enables more transverse and coherent actions and smoother progress. We've seen that CICS that have implemented a collective workshop with stakeholders to collectively identify barriers and solutions to test have been able to move forward in testing solutions and implementation experiments. Those who have lacked this cohesive network exercise (CICS 1, 2) have failed to progress, unless their CICS had a history of collaboration (CICS 3).

The history of collaboration between stakeholders in the CICS and between actors and the pilot testifies as an enabler and influence in the success. CICS with no prior experience with VC actors typically began by forming farmer networks and concentrating on farm-level knowledge. These activities are identified as time-consuming and can hinder the implementation of other activities. Meanwhile, those with pre-existing actor networks have initiated activities both at farm and food levels or engaged in broader knowledge dissemination. CICS with a history of collaboration have shown to move forward more rapidly and serenely.

However, some CICS with no prior stakeholder collaboration were also able to move forward due to the **pilot's capacity to mobilise a diversity of actors, resources and skills**. Effective stakeholder engagement is crucial in participatory research-action. For some CICS, efforts focus on field experiments and dissemination activities, such as open days, but lack strong actor mobilisation to act. In contrast, some CICS organise one-on-one meetings or collective workshops to actively engage key actors.

The fourth factor is the ability to conduct diverse activities across the VC. CICS integrating both field and food activities tend to progress well (CICS 4, 5, 13). This requires both strategic alignment and pilot ability to manage multi-faceted activities sometimes out of his or her key

expertise on relatively unexplored subjects. Example CICS 6 has not integrated the whole value chain dimension and only explored IC through field experimentation. This can be explained due to the pilot's expertise focusing on agronomy and not being used to exploring food processes for instance.

3.5 Lessons learned so far for designing intercrop-based value chains

6 key insights for the effective design of IC-based VC have been identified throughout the learnings of the CICS pilots (Figure 7).

A fundamental consideration is the **economic dimension of intercropping systems**. The establishment of viable markets and profitable supply chains is a prerequisite for stakeholder engagement. **Without clear economic incentives, the adoption of intercropping practices remains limited**. Consequently, there is a need to combine ecosystem services and an economic balance for developing IC-based VC.

Field experimentation has proven to be an essential component for developing and validating intercropping systems. These trials serve two primary purposes: (i) generating new technical and agronomic knowledge, and (ii) providing tangible evidence to convince farmers of the feasibility and benefits of intercropping. However, such trials are uncertain, being influenced by climatic conditions and sometimes the choice of the species combined, and thus may not always deliver conclusive results.

As a result, some CICS have found it useful to **co-design individually the intercrops** with farmers, as the need and adaptable solutions will be strongly dependent on the farm and the system in place. Furthermore, it is also important to **engage other actors from the supply chain** to share the risks taken during the innovation process and not only rely on field trials and results. IC has shown benefits beyond the field and it seems crucial to convince food industries and other influential stakeholders (policy makers, consumers…) to participate in levering obstacles.

The design of IC-based VC thus requires the integration to **combine field and food approaches** considering the constraints and needs of each actor.

Some CICS initiatives have put forward the importance of **disseminating and transferring knowledge as well as advocating** for the practice whilst trying to innovate.

Finally, to develop IC-based VC, it is essential to **demonstrate and capitalise changes** at the VC level. Therefore, there is a need to support capitalisation of the transformation, the innovation process, in order to scale up. CICS from this project contribute directly to this effort by providing real-world examples to illustrate different ways possible to make those changes and work on the development of IC.

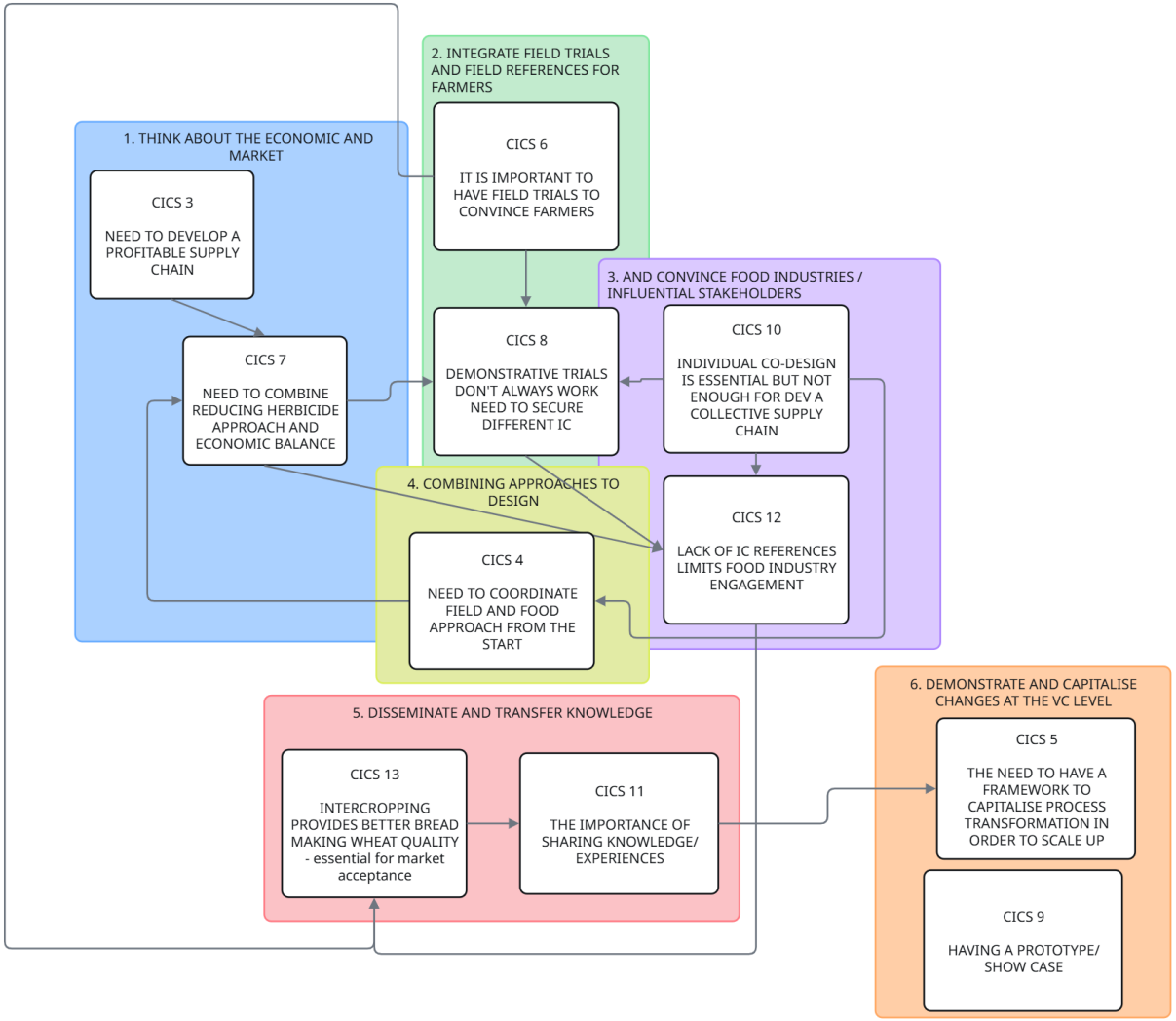

Figure 7: mind-map of the 6 insights for designing intercrop-based value chains. Sept 2025.

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4. Conclusion and perspectives

This study highlights how multi-actor networks, working to develop IC agri-food VC, are shaped by a combination of factors: vision of IC, strategy clarity, actor mobilisation, management skills and history of collaboration. It is complementary to Salembier *et al.* (2023) findings on multi-actor experimental networks management and functions which highlighted different ways to manage such networks. Here we explored the facilitating factors enabling innovation processes coordinated in multi-actor networks.

The WP1 team drew two key lessons from this analysis. The success of such co-innovation case studies depends heavily on:

- ➔ The actors, farmers, project pilots,
- ➔ The real-life markets,
- ➔ The learnings, and available resources.
- ➔ the innovation project governance.

More specifically applied **to the case of intercropping, it also depends heavily on the nature of the intercropped crops and the targeted value chain**.

In the next phase of the project, the team will analyse the various activities implemented by the CICS (experiments, design workshops, etc.), their results, and key factors in order to draw lessons from the project and **suggest different approaches for designing a value chain around IC** expanding the "step-by-step" cropping system design framework (Meynard *et al.*, 2023) to integrate a VC dimension.

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INTERCROP VALUES

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