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Climate Neutral Farms

D2.1 Conceptual and methodological framework for creative arena (living lab)

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D2.1 Conceptual and methodological framework for creative arena (living lab)

List of Abbreviations and Acronyms	
LL	Living Lab
I3S	Innovative Systemic Solution Space
GHG	Greenhouse gases

1 Executive summary

In order to determine the different systemic innovations that will be tested to reach climate neutral farms at the local level and within the different catchment area of a given I3S, it is important to propose a clear, concise and operational guideline. The idea is to use living-lab approach and participatory tools to define the solution space and some of the indicators that will be followed by the farmers. Different steps are necessary to obtain a shared solution and start farmers' empowerment towards the climate neutral farming concept. This deliverable presents the main steps to perform this creative arena, i.e. the approach to co-innovate. Furthermore, it presents an example of an already run creative arena in Ireland. This creative arena is in close link with different other tasks: T1.1, T1.2 and T1.4 for the different solutions at hand and the different themes discussed between the I3S managers; T3.1 and T3.2 due to the operational part of the process; T4.1 as it also provide useful items for the upscaling solutions on a given I3S. In a second step, the proposed solutions will be tested and simulated to analyse their impacts on the climate but also on the biodiversity and on the water footprint (T2.4).

2 Introduction

2.1. About the ClieNFarms Innovation Action

Supporting the Farm to Fork (F2F) strategy, contributing to the achievement of its objectives, the ClieNFarms project aims to demonstrate, evaluate and improve technical, organisational and financial solutions at the farm level that will contribute to the achievement of climate-neutrality of European agriculture by 2050. This will be done by a multi-actor approach, interactively integrating and improving existing solutions to achieve economically viable business models in farming systems by involving farmers, extension services, agri-food business, policymakers, finance and citizens. These solutions will be disseminated, and young farmers will be targeted through capacity building.

The central operational focus of ClieNFarms is the case-study structure that will allow a strong empowerment of farmers and supply chain accompanied by a smooth dissemination and replication of the tested innovations. Called I3S (Innovative Systemic Solutions Space) the demonstration structure is based on demonstration farms, lead commercial farms, outreach farms and replicate farms working all together with the supply chain in a living-lab like structure approach.

ClieNFarms also intends to pave the way for combined biogeochemical (reduction in GHG missions, increase C storage) and biogeophysical effects (increase in surface albedo, reduction in sensible heat flux and infrared radiation) in order to mitigate climate change more efficiently, without any negative impacts for food security or yield/product quality.

The project is vastly innovative as it aims to: (1) integrate different solutions to embrace mixed crop farming systems and animal production; (2) account for biogeophysical effects associated with changes in management practices in order to promote the synergies between the biogeochemical and biogeophysical effects; (3) move from farm level to (eco)system level either through farm networks or by involving supply chains in a multi-actor designed process; (4) validate integrative solutions and to develop the required financial incentives to engage farmers in the required transition.

2.2. Purpose of the document

This document gives the general lines to structure and run the creative arena in the different I3S. As each I3S will be different, a process of tailorization will be needed. This document describes both a) the conceptual framework of the challenges and solution space within which actors/stakeholders participate in co-creation of solutions and also b) the methodological framework that will define the methods and activities for knowledge brokering and sharing between I3S and stakeholders. This will be required for the effectiveness and aims of the network. The methods identified in this phase will be used to guide the interactions for the learning and brokering activities.

The main principles of the methods that will be identified are:

- Co-operation with stakeholders rather than studying them and a multi-actor approach
- Utilise various levels of interaction including guidance/policy briefs, videos and web-based communication.
- Involvement of regional levels as a lever to multiply impact

2.3. Structure of the document

The report is divided into three major sections.

In **section 1**, we describe the concepts of the living lab and participatory approaches.

In **section 2**, we describe step-by-step the modalities of the Creative Arena including a) the conceptual framework for defining the problem and the solution space, b) which stakeholders to involve, c) how to involve the stakeholders in co-creation and d) evaluation of the results and subsequent actions.

In **section 3** we describe an example of how the first Creative Arena (in Ireland) will function.

3 The living lab approach

This introduction to this section “*The living lab approach*” is mainly based on a translation of a section of a paper from Bergez, Siné and Mambrini-Doudet (2022).

Living Labs (LL) are open innovation devices operating on three principles: i) user involvement, ii) co-creation, iii) in real conditions (and with real communities). They are practice-oriented and knowledge-exchanging organizations, real-life environments or arenas where experiments are conducted, where new solutions are developed, and where innovation processes by and with users can be studied. LLs are known to produce three types of value: business, social and knowledge. Therefore the LL is very well fitted for the idea of local I3S creative arena.

LLs were initially developed to strengthen the role of the user in innovations related to the development of information and communication technologies. Then they found their place in other sectors of activity, such as e-health, sustainable cities, new ruralities. Each sector of activity, or even each local proposal, interprets in its own way the three main principles on which LL are based, and has specific characteristics.

The LL of agrosystems, which are the bases for LL dealing with farming systems, have common properties with the LL of sustainable cities and new ruralities: they are “situated”, shaped by the places or territories within which they come into action. They work for greater resilience of the systems within which they operate. They often arise from political will, combine public and private funding, and combine concerns around public, private and common goods.

Beyond that, they have real particularities in terms of: i) specific objectives, ii) activities, iii) types of participants and iv) with regard to the context in which they are established (McPhee *et al.*, 2021). In the European project ALL-Ready, which sets the framework for the future European network of living laboratories and research infrastructures for agroecological transition (www.all-ready-project.eu), Mambrini-Doudet *et al.* (2022) identified the particularities of LL capable of accelerating the agroecological transition (Table 1). This framework should make it possible to identify the conditions for a different innovation for reaching climate neutral farming.

Table 1: some specificities of the agroecosystem living labs and of the I3S

Specificities	Agroecosystem Living Labs	I3S creative arena
Objective	The general objective is to work for greater sustainability and resilience of the system within which LL operates. Innovation can be expressed in the form of new practices, activity management or processes	Reach climate neutral farms Use all possible levers to reach such objective: practices, new technologies, organisational, financial, policies...
Activities	The cyclic aspect of operations is very specific, innovation cycles are seasonal and can sometimes be very long. Linked to external and uncontrollable factors, the level of uncertainty in experiments and tests is high.	Cyclicity of the different farming production but also short and long term dynamic for the C sequestration. As for almost all agricultural productions uncontrollable events will impact the result: climate events but

	The need to bring local results to a larger scale, outside the strict perimeter of the living laboratory, is very high. The new practices resulting from an LL must be able to serve at least one production sector.	also policy changes and societal pressure The upscaling process of the I3S is fully in accordance with the need of bringing local results to a larger scale. Using the sourcing chain of the agrofood sector is a real plus.
Participants	The involvement of the public sector is particularly crucial. The involvement of researchers is particularly high. The role of users can be diverse and change over time. Due to the relatively high number and diversity of partners involved, in addition to providing scientific knowledge, the LL governance scheme is complex in order to maintain the commitment of the various key players in the territories and throughout the value chain. The researchers are also involved in the design of the operation of the LL.	The structure of the I3S follows the general scheme of the LL in agroecology: farmers are in the center with the Lead Commercial Farms and the Outreach Farms. Research and advisors are part of the system thanks to the Demonstration Farm. Banks are involved to allow for innovation in the financial aspect of the innovation. The agrifood chain is also involved due to its weight on the farmer's practices through the contractual elements. Local policy makers will also be invited as landscape and land-use aspects are important
Context	It is the agroecosystem that is considered. More inter- and trans-disciplinary research is called upon	A complete ID approach is used in the Innovative Systemic Solution Space in order to offer a large and complete multicriteria assessment

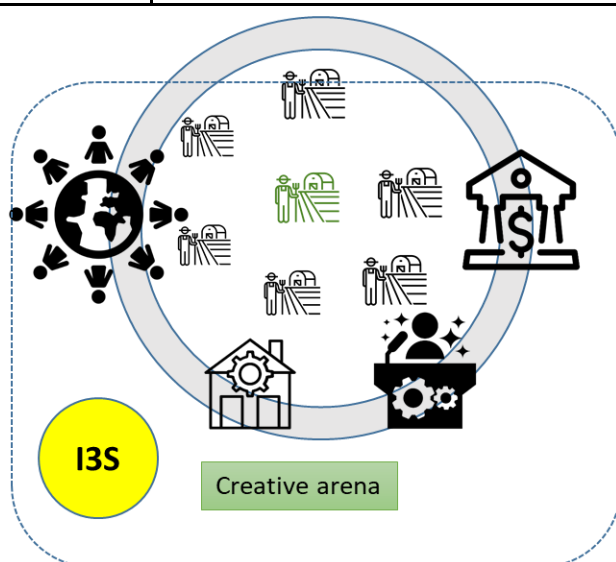


Figure 1: the I3S concept: around a demonstration farm (green) farmers and other elements of the agricultural ecosystem gather to find common innovations to reach climate neutral farms.

The I3S (Innovative Systemic Solution Space) structure fits very well with the description of this kind of engagement (Figure 1). We use the term I3S because: Systemic because it takes into account not only the farm but also the surrounding (eco)system (suppliers, advisors, research, agro-equipment, etc.). Solution space because different solutions will be proposed and tailored for each farm, depending on their pedoclimatic conditions, resources availabilities and constraints. Innovative, because the proposed solutions will induce emergence and adoption of efficient innovation including different new elements such as finance, banks, collaborative proposals

Basically, an I3S consists of different bricks that aim to test and spread tailored multi-actor, co-designed innovative solutions in order to reach climate-neutral farms along the supply chain and

along the local geographical extent. The first level of this structure is the Demonstration Farm (DF). Based on a specific production system, this DF allows testing innovative solutions (mainly equipment and

farming practices and a bit of economy) at a 5 to 6 TRL. Associated with Extension Services or Research Units, this DF is thoroughly piloted and the impacts on the biophysical system are measured to evaluate the potential improvement towards climate-neutral farming. The innovations tested on the DF come from the Knowledge Space Hub managed by task 1.4 in the project that gathers innovations from current or previous research and demonstration projects. The next level is the Lead Commercial Farm (LCF). These are commercial farms who are pioneers in innovation testing and are well connected to the DF. In the different R&D projects in Europe, they might be called “sign-post farms”, “pioneer farms” or “lighthouse farms”. In using such farms, prototypes tested and evaluated on DFs will be fully contextualised in an operational environment using these LCF. TRL of the different solutions will then jump a step forward from 7 to 8. Actual workload requirement, machinery, agronomic and organisational constraints will be integrated and monitored. These LCF will allow a real integration and application of solutions. The idea here is not to impose solutions but to set-up creative arenas (living-lab type structure): the farmers will choose the most suitable set of solutions for their farm to transition to climate neutrality. To help in this choice and to explore the possibilities, the creative arena will mix farmers, supply chain, banks, R&D in a participatory design structure. LCFs will be less intensely monitored than the DFs, but the social and economic dimensions will be recorded and analysed. The third brick is the surrounding commercial farms, called Outreach Farms (OF). LCF are part of a network of farmers (through their cooperative system, supply chain, advisory systems, friends and neighbours, etc.). Accordingly, I3S will mobilise a local multi-actor system of the value chains through a co-designed process. The supply chain is indeed very important to up-scale the different systemic solution systems tested by the LCF.

One can see that there is a large variety of actors to be involved in a co-design process. The following sections will describe how to mobilize the different kinds of persons in order to get a productive and fruitful participatory workshop.

4 The participatory approach

This introduction to this section “*The participatory approach*” is mainly based on a translation of a section of a guideline from Audouin *et al.* (2018) and on some elements from “D1.8 Protocol for the Multi Actor Approach”, AgriDemo-F2F European project (agridemo-h2020.eu) and from the Liaison project (liaison2020.eu).

4.1. Generalities

We use a participatory approach when, faced with a given situation, we choose to involve the stakeholders of the system under consideration in a process of improving the situation. From a pragmatic point of view, this involvement increases the legitimacy of a governance body. From a normative point of view, this involvement allows for a more democratic decision-making process, which, for the proposed improvements, will increase their:

- adaptability: by promoting local knowledge (empirical knowledge of the system studied: resources, actors; know-how; skills; capacity for innovation, etc.)
- adoptability: by getting closer to the real issues of the stakeholders and by engaging them at an early stage in the transition in order to facilitate the implementation of the proposed improvements.

This approach aims to reach a consensus regarding the ends and means of the project to be developed (Slocum *et al.*, 2006; Hazard and Audouin, 2016).

The term “participatory approach” is used to define very different processes in terms of ends and means. It refers in particular to different degrees of stakeholder participation in the process of reflection and decision-making. This degree of participation will determine the degree of mobilization of the empirical knowledge of local actors and their power in the process. In addition, the participation of key players and all stakeholders is essential to the process.

All of these factors will determine the adaptability and adoptability of the fruits of the approach. In a participatory process, the degree of participation chosen defines the weight of:

- the expertise of the stakeholders in the process,
- the power granted to each stakeholder.

The degree chosen will directly impact the quality of the productions in terms of adaptability and adoptability of the proposed improvements as well as the probability that they will actually be implemented.

The degree of participation, the complexity of the process and the investment in terms of time or human resources are proportional.

Concertation differs from consultation by the early involvement of stakeholders in the project design process. On the other hand, decision-making is not up to the stakeholders as in the case of co-decision.

Concertation implies the realization of a collective work of co-construction. The resulting action or decision must be the result of a consensus (Berthomé, 2013).

Due to the real impact that ClieNFarms expects on the different I3S territories, a full and deep concertation is required.

4.2. Quality of the participatory process

Criteria of quality

- ✓ Transparency and Relevance
- ✓ Representativeness of participants
- ✓ Effective and equitable participation
- ✓ Added value of the production in terms of originality and cooperation

The quality of the participatory process can be judged by the inclusion of participants in the process. It is a question of meeting a criterion of representativeness in relation to the theme of the approach:

- Are the stakeholders of the considered system present?
- Are they present in number?
- Do they represent a maximum of opinion on the theme?

But also to meet a criterion of relevance by seeking to increase the effects of the process through timely participation:

- Are the key actors of the project present?

We will thus ensure the presence of certain actors with a specific role for the theme of the approach (example: funders, public authorities,

experts, media, etc.) by using the Interest/Influence diagram approach (see section 5.5)

The process must meet the criterion of fairness, i.e. establish a relationship of equivalence with all participants. Process fairness is embodied in the concepts of transparency, participant empowerment and neutrality. Participants must be able to formulate requests that will have an effective impact on the evolution of the process. The process must be objectively evaluated by a third party and/or by the participants themselves (Vergne, 2013).

However, it is not enough to bring together the "good" actors of the territory and to be fair to guarantee the quality of the productions. The participatory approach, compared to the usual interactions in the form of a plenary meeting, takes the participants out of their comfort zone. Certain criteria must be respected in order to justify the real added value of the participatory approach:

- democratic: the participation of all those present in the deliberation is effective with a search for equity more than equality,
- instrumental: the productions are original thanks to the mobilization of collective intelligence,
- social: the participants developed their social network at the end of the workshop in order to lay the foundations for cooperation for the implementation of the proposed actions (Programme Alimentaire Mondial, 2001; Diot-Labuset, 2015; Dionnet *et al.*, 2017).

4.3. Workshop toolbox

The ambitious objectives of effective participation, originality of productions and cooperation between participants require an investment in resources. Facilitation tools make it possible to equip the process to meet these objectives.

The quality of the deliberation depends on:

- the constitution of a common knowledge base based on the information provided by the participants
- the course of a debate: presentation of the respective arguments of the parties involved
- the development of a dialogue between the participants: exchange on the arguments and explanation of the points of view (Vergne, 2013).

These 3 points require the establishment of a climate of trust stimulated and framed by adequate facilitation. This mission can be supported by the use of different participatory tools, avoiding direct confrontations. The tasks of the facilitator being multiple, these tools allow him to achieve his different objectives more easily and in a structured way: balance the exchanges, frame, limit oversights or mark the exercise)

For the participant, participatory tools have other advantages:

- move from a passive attitude of learning, common in classic information/consultation formats, to an active attitude of creation/co-construction,
- extract yourself from classic representations and open up new perspectives, which facilitates the exploration of innovative options,
- understand and apprehend complex systems more easily, which releases the ability to concentrate required for creative activities.

Finally, participatory tools make it possible to establish a certain equity between participants. Indeed, each participant has his own logic, his character and his privileged mode of expression. The tools are then intended to superimpose the modes of representation (written, diagram, drawings, maps, etc.) and expression (written/oral, plenary/group/anonymous) to stimulate all the participants.

5 The creative arena step-by-step

The following steps are general steps that need to be tailored depending on the specificities of the I3S (production system, country, climatic zone, surrounding production/financial ecosystem...). Depending on the I3S situation (production system, surrounding actors' ecosystem, expected stakeholders involvement...) not all these step are included and a different order may be required.

General steps in the development and implementation of participatory methods are the following (Slocum *et al.*, 2006):

1. Recruit a team for the project
2. Define the ambition and objectives of the strategy
3. Determine the scope and direction of a public participation process
4. Understand the legislative, jurisdictional and social context of the issue and the decisions to be made
5. Define who to involve and why
6. Understand the timing and process of decisions
7. Design the plan (choosing one or more methods)
8. Raise funding
9. Set adequate timelines and other resources needed to make the process work
10. Recruit participants
11. Promote the event
12. Implement the plan
13. Evaluate process and results
14. Produce and disseminate the final report

In the following we will give some key elements of each of these steps.

5.1. Recruit a team for the project

At the beginning of the collaborative process, responsibilities, project boundaries and goals should be clearly defined with an established group that forms the active core of the multi-actor process. Starting small has numerous advantages: quicker and easier communication, faster action, and a higher probability of a generative dialogue towards a concept for the multi-actor partnership. Logistics are also simpler and it is also cheaper than starting with large multi-stakeholder workshops which are more difficult to facilitate and manage. Once the good collaboration is established in this smaller group, further outreach can begin. This core group is formed by project members (WP leaders), a subset of I3S managers and by other actors who are particularly motivated to achieve the goals. These should include representatives of a) Primary actors: Farmers/primary producers, food processors, farm advisory services, farm organisations. b) Secondary actors: Financial services, policymakers, media (agri-food magazines, etc), NGO's (environmental organisations, consumer organisations), retailers. The formation of a core group is helpful for streamlining future processes and decisions. It is important to note that the core group consists of actors who are important for the co-design, as well as actors who can contribute significantly to the achievement of the goal. It is also important that actors in the core group do not act as private individuals, but as representatives of a relevant sector (e.g. ministry, company, NGO, etc.). In order to ensure core group functionality, the roles and responsibilities should be clearly defined and distributed within the core group in line with the expertise of individual members.

5.2. Define the ambition and objectives of the strategy

The traditional development of mitigation strategies shortcomings in that a) environmental aspects are emphasised without regard to economic and/or social aspects and b) mitigation research focussed on addressing important gaps in scientific knowledge, but miss on utilization and implementation. Scientists from a range of disciplines have acknowledged the importance of undertaking interdisciplinary and transdisciplinary research, especially when natural and social scientists are attempting to gain a shared understanding of a problem and its solutions (Bodin *et al.*, 2019). In particular, there is an increased need for including stakeholders in the assessment process in order to build acceptance of the results and to support their implementation (Lyytimäki and Rosenström, 2008; Binder, Feola and J.K, 2010) The introduction of the concept of solution space in relation to GHG mitigation has recently been used in order to achieve multiple objectives, including the reduction of emissions whilst maintaining farm income in Africa (Groot *et al.* 2012). Here, the emission intensity impacts were analysed in relation to *both* socio-economic indicators such as profitability and labour requirements, as well as environmental indicators such as land-use diversity, nutrient losses and soil organic matter accumulation. Furthermore, the 'sustainability choice space' (SCS) (Potschin, 2013) has attempted to identify policy outcomes were acceptable to stakeholders across a set of predetermined criteria, seeking to identify options for sustainable development, or the "room for manoeuvre" in designing policy making.

5.3. Determine the scope and direction of a 'public' participation process

5.3.1. The Framework

The assessment and abatement cycle should follow a similar structure to the Driving Forces–Pressures–State–Impacts–Responses (DPSIR) framework. This DPSIR framework has been extensively used for analysing a range of anthropogenic environmental issues environmental problems emanating (Elliott, 2002, Karageorgis *et al.*, 2006, Borja *et al.*, 2006, Bell, 2012, Gari *et al.* 2015) and recently agriculture and de-forestation (Kyere-Boateng *et al.* 2021). The framework integrates environmental, social and

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economic information and facilitates socio-economic development with environmental sustainability (Elliot 2002). It also helps to identify what policy direction to follow that enhances the sustainable utilization and appropriate management of water resources.

Using this model, stakeholders should a) consider the underlying socio-economic drivers (D) of emissions (eg. demand for meat and dairy, population growth), the resultant pressure, (P) (land-use change, animal population growth), the resultant 'status' (S) or change in GHG emissions and ultimate impact (I) of those emissions in terms of an increase in global warming (as well as associated impacts such as eutrophication and/or biodiversity impacts). Combining the information on D, P, S and I will thus yield a response (R). These responses should, in turn, yield decreases in one or more of D, P, S with an ultimate reduction in I (see Figure 2).

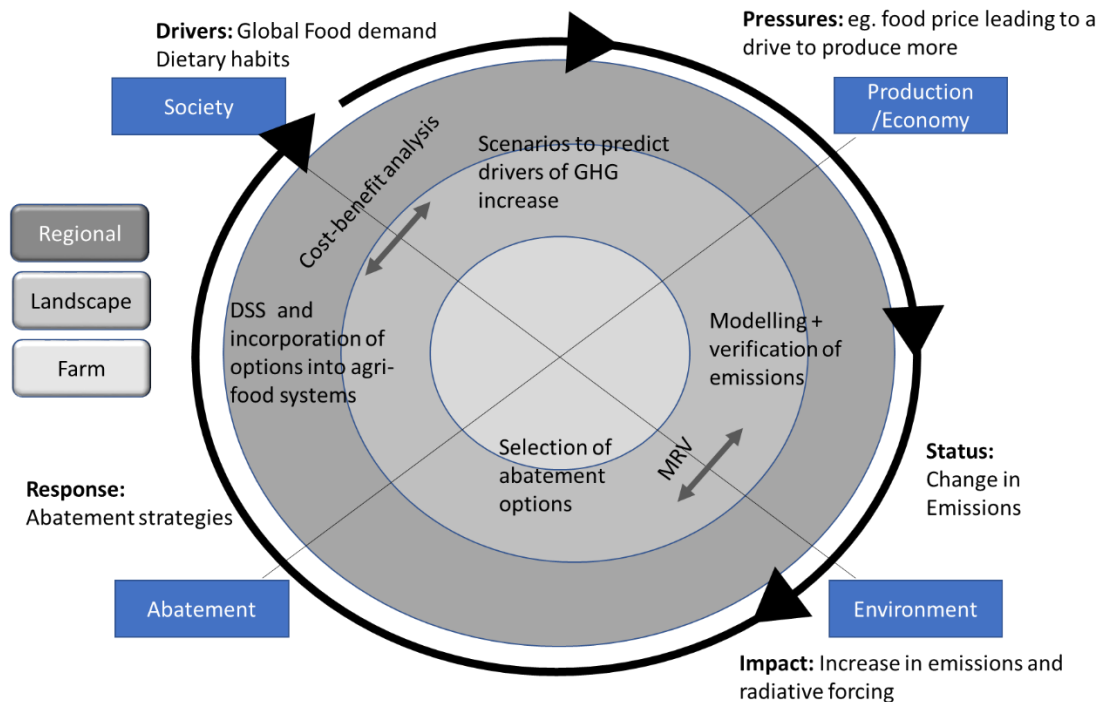


Figure 2: Schematic of the DPSIR cycle

The cycle has also been criticized for its simplistic uni-directionality. However, this can be addressed by using a multiple DPSIR cycle approach recently suggested by Maxim et al. (2009). Here multiple pressures (non-connected or interconnected) can be assessed (Figure 3).

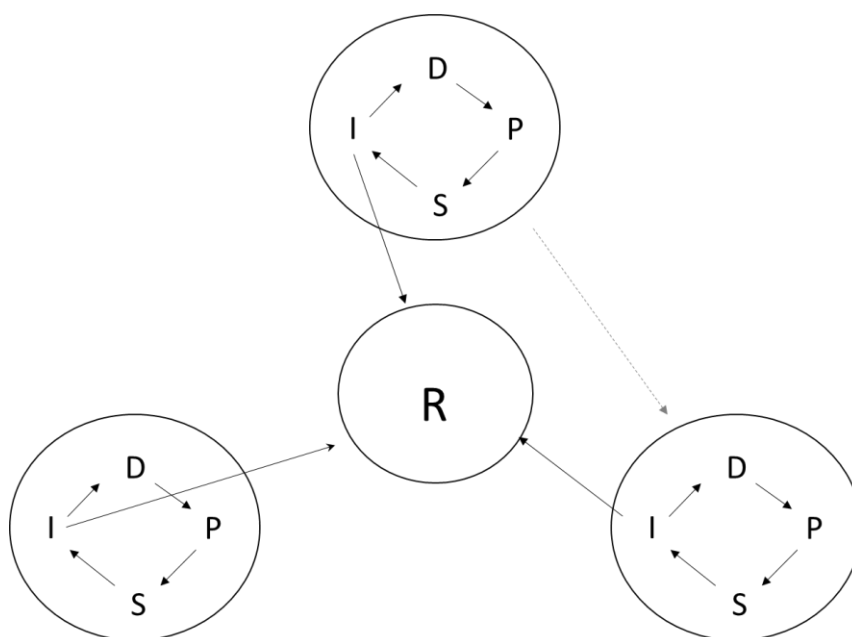


Figure 3: Schematic of multiple DPSIR cycles. Hashed lines indicate linked Drivers/Pressures/Impacts

A collation of data on technical abatement options for producers and processors across each sub-sector (Beef, sheep, dairy) and for different production systems (pastoral or confinement) should be performed either in individual countries or across regions including a description of how each management strategy should be implemented.

The early management attention to the Response-step (R) must be accompanied by a systematic collation of data on technical abatement options and their efficacy. In addition, a description of the management strategy for different farm typologies and/or sub-sector should be compiled.

Scenario analyses can be run to evaluate the expected improvements in absolute GHG emissions and/or emissions intensity. The DSPIR cycle is then iterated, with the inclusion of new scenarios that incorporate the impact of alternative policy measures, fiscal measures, etc. on agri-food activity and emissions.

5.4. Understand the legislative, jurisdictional and social context of the issue and the decisions to be made

It is important to take into account the country-specific context when designing the creative arena in terms of its concrete and achievable goals, planning the processes for achieving the goals and shaping the cooperation. It is a matter of building the creative arena according to its context and of creating goal-oriented operational structures for all actors. Points of orientation are, on the one hand, political realities and socio-economic/political priorities in the country or region on which goals are based. In order to be able to define the goals and objectives of the creative arena, it is, therefore, necessary to understand a) the international frameworks and the various national legal frameworks. For example, various countries may have widely varying targets for greenhouse gas emissions or prioritise ammonia/water quality, while all must converge towards the overall EU targets.

In order to help all actors (in the core group) to have the same level of knowledge, to get to know each other and to generate group cohesion, motivations and ownership, workshops, study trips and excursions can be used to help stakeholders better understand the context surrounding the need for emissions reduction.

5.5. Define who to involve and why

Effective multi-actor processes, including multi-actor co-creation, stakeholder engagement and innovation brokering, create conditions where different knowledges, perspectives, priorities, objectives and resources etc. of a wide variety of actors are facilitated to come to light and shape project processes and outcomes.

Prior to co-designing and collaboration, the principal actors/stakeholders must be identified. These actors should be characterised based on

- their role and knowledge-base within the agri-food sector,
- how and where within the production/demand chain they can contribute to sectoral sustainability,
- how they relate to other actors,
- their willingness to engage.

Broad categories of actors should include:

- Primary actors:** Farmers/primary producers, food processors, farm advisory services, farm organisations.
- Secondary actors:** Financial services, policymakers, media (agri-food magazines, etc), NGO's (environmental organisations, consumer organisations), retailers.

The distinction between 'primary actors' and 'secondary actors' is highlighted in the context of Horizon 2020 projects. A primary actor is described as a 'partner taking part in project activities' while a secondary actor is described as a 'person expressing a view/stake at a certain moment during the project' (van Oost, 2015)

An interesting way to present the actors that should (could) be involved is to present them on a 2D graph with an X-axis showing their interest on the subject and on the Y-axis showing their potential influence in changing. Choosing a red color and green color for differentiating willingness is also interesting (Figure 4).



Figure 4: the Interest/Influence diagram allows to position the different actors regarding the innovations. Using colors (red: breakers, green: pushers, orange: mitigate) allows to have a clear view and to mobilize the proper energy to motivate the full arena. Actual position of the dots on the graph are fictional.

5.6. Understand the timing and process of decisions

There should be a clear understanding of the overall objectives, timelines and the process of decision making. A set of ground-rules (see 5.12.1.2) governing procedural questions, as well as process and content characteristics, should be jointly established between all members of the core group. The timelines and the decision process should be explicitly stated, proposed, negotiated and accepted by all

in order to avoid misunderstandings or the dominance of one (or a subset) of actors. These multi-actor processes are generally conceived as joint decision-making and/or learning processes. In order for a successful outcome, effective process facilitation will be required. This facilitation or process management is ideally a shared responsibility but can also be assisted by ClieNFarms members (as third parties). This will ensure that focus on the overall aims are maintained whilst also preventing asymmetry in discussions or potential conflict.

5.7. Design the plan (choosing one or more methods)

The development of a robust joint work plan is required in order to provide a focal point for all actors. This will, in turn, provide the foundation for successful implementation of the creative arena. Here, responsibilities, capacities and the process architecture can be discussed. Tasks should be distributed according to interests, knowledge and competencies of individual members of the core group. If required, subsets of actors can divide into 'focus groups' or 'think tanks' whereby specific technical expertise can be exploited in order to address a specific issue (eg. the modalities of a domestic offsetting scheme or 'carbon-farming').

Regular meetings of all partners and the joint formulation of a strategy to create a clear structure for cooperation help the group dynamics, define a common goal and keep it in view. Assigning responsibilities, for example in a work plan, also helps to make the joint commitment more binding and actively involve all actors.

Design of the plan should consist of two main phases: a) Direction-setting and b) an Implementation phase. The direction-setting phase should be focussed on the establishment of ground rules and agendas, the organisation of sub-groups, a data-gathering task, a solutions exploration task and final agreement. The implementation phase of the plan subsequently deals with building support from wider stakeholders, as well as developing structures for implementation and the monitoring of implementation. Within the creative arena, we will have two sets of plans 1) a farm-level plan and 2) a national/supra-national policy plan.

5.8. Raise funding

A lack of, or imbalance in financial resources, can significantly limit effectiveness and efficacy or skew objectives and focus if some partners are more financially independent than others. It can be helpful to link the activities and responsibilities in the partnership with pre-existing, financed activities of the participating organisations and thus make the best possible use of synergies. As well as to think about the partnership and its activities in fundraising and project applications and, if necessary, to be able to provide financial support for individual creative arena tasks. Any limitation of funding should be acknowledged as otherwise there is a tendency for programmes to 'pick the low-hanging fruit'. Also poor funding may mean that while participatory farms benefit most from process, the mass of users will not be engaged at all. Adequate timelines and other resources are therefore needed in order to make the process work. The ClieNFarms project has budgetised funds for setting and running the creative arenas.

5.9. Recruit participants

Participants should be representative of each of the Primary and Secondary actors identified in Section 5.5. It should be ensured that, where possible, there is adequate geographic and gender representation. In addition, Cronin et al. 2022 argue that the analytical integration of both micro- and macro- level innovation system perspectives is required in order to fully encompass a co-innovation process that includes multinational, multi-actor co-innovation partnerships. A 'long list' of candidate participants should be collated by project partners, from which a smaller shortlist can be generated in order to identify

core group members. The informed consent must be obtained from all subjects involved in the study and all data must be handled in accordance with the GDPR.

The main data for our analysis will be the workshop that consists of the range of stakeholders. Prior to this workshop, a set of questions concerning the current state of play, stakeholder perceptions to emissions and future challenges, best practice techniques and methods of implementation will be generated and distributed to stakeholders in order to a) establish a baseline from which to work with all actors and b) enhance the efficiency of workshop(s) and other engagement with the creative arena.

The questions of which actors will be involved, how they will be involved and what kind of knowledge is needed from the actors will be discussed prior to the workshop. In terms of engagement of stakeholders, the first step is to identify the issues which are relevant and/or where gaps may exist and also to find out why, from stakeholders' (diverse) perspectives, they should become involved.

5.10. Promote the event

Depending of the diversity of stakeholders required, the promotion of the event may be of different types: from internal networks, from press advertising, for targeting specific persons. Invitations for the first two CA's were sent to a range of stakeholders.

5.11. Implement the plan

5.11.1. Running the creative arena

The following section describes both a) how a Creative Arena should be run in practice and b) how the first two Creative Arena's, held in Ireland functioned in practice. The first Creative Arena was centred around reducing greenhouse gas emissions within the Dairy Sector and was held on 24th January 2023 at Teagasc Moorepark, Co. Cork. The second Creative Arena was held on 16th May 2023 at the Midlands Hotel, Portlaoise, Co. Laois and focussed on reducing emissions from the dairy calf-to-beef sector.

D2.1 Conceptual and methodological framework for creative arena (living lab)

The creative arena by itself can be structured into 9 steps. A rapid description of this different steps are given in the following (Figure 5).

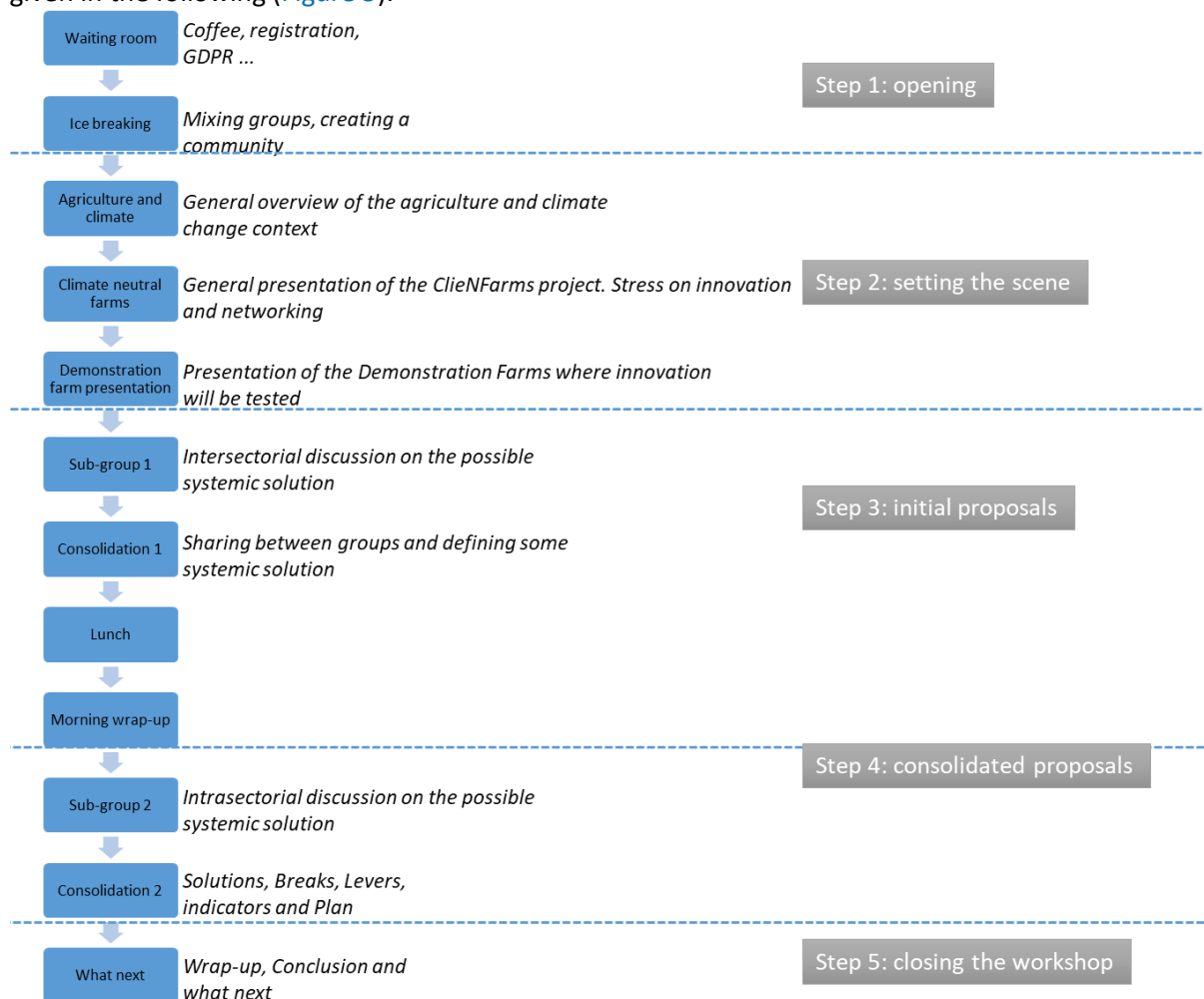


Figure 5: the different steps of an “ideal” creative arena

1. The waiting room

The first step is a welcome coffee with the registration phase. All interactions with participants must be in compliance with the General Data Protection Regulation (GDPR), DL8.1. This requires that consent must be obtained for video and photo recording or the logging of personal data. In addition, any request should be transparent and clear and provide participants with an ‘opt-out’ option in order to meet legal requirements and all documentation associated with GDPR requests should be auditable.

Creative Arena’s (Ireland)

Both Creative Arena’s commenced at 09:30 with 30 minutes for tea/coffee, during which the participants were introduced to each other. This allowed for ice-breaking to occur and for some general introductions to be made. The participants were then directed to a set of round tables with the name of each participant located at a certain table. During this initial part of the Creative Arena, different stakeholders (farmers, policy makers, advisory, research, food/fertiliser industry) were mixed together in order to generate a range of viewpoints. During the two CA’s, participants were asked to fill out a non-identifying questionnaire, giving their age, sex, primary stakeholder focus, secondary focus (if any), location (by Irish province) and highest level of education. There was a Facilitator assigned to each table. Prior to each of the CA’s, there was a meeting of the CA co-ordination team and the facilitators, who were furnished with a Facilitator Pack, detailing the timetable and describing the ‘Rules’ for each Activity (of which there were six in total).

2. Welcome, ice-breaking and rules

A short welcome address from the main facilitator, followed by a set of procedural rules should be established in concert with the core group in order to organize interactions between the actors. These rules should cover a) agenda-setting, b) how to decide on who should deal with specific issues (single actors, bilateral settings, sub-groups, plenaries, etc), how to qualify information (as confidential, for internal or external use), how to take decisions (majority, unanimity, veto, ...). Rules can evolve over time, as the process develops. However, at the beginning of the process, rules, timelines and the decision process must be to be stated explicitly, proposed, negotiated and accepted by all in order to avoid that some actors impose their rules on the others. It is followed by an ice-breaking exercise, a game or activity that is used to introduce people to each other so that they feel more relaxed together.

3. Introduction: sharing actual knowledge on climate change + short presentation of ClieNFarms

In order to set-up the scene a short presentation on the climate change, role of agriculture in GHG emission and potentiality on C storage and sequestration will be given. This presentation will be followed by some slides on the ClieNFarms project showing the network of I3S and farmers.

4. Presentation of the concept of Demonstration farms

In order to demonstrate the concept of a low emissions farm, the principle of the demonstration farm and the already efforts toward climate neutral farms will be presented. As each I3S represent a specific production system, it is important to clearly focus on the production at hand, even if some opening will be required due to the systemic

Creative Arena's (Ireland)

After an initial welcome by Deirdre Hennessy and Natasha Brown of Teagasc, the procedural rules were described, including a) the need to hear everyone's opinion at a table and arriving at a consensus where possible. A presentation on the current composition and quantum of Irish agriculture and land-use emissions was presented.

Creative Arena Structure:

The activities for each Creative Arena were broken into two workshops (per CA), a Morning and and Afternoon Workshop: Workshop 1 comprised Activity 1 and 2 in mixed stakeholder groups .The Afternoon Workshop included Activity 3, 4, 5 and 6 with the same stakeholders together

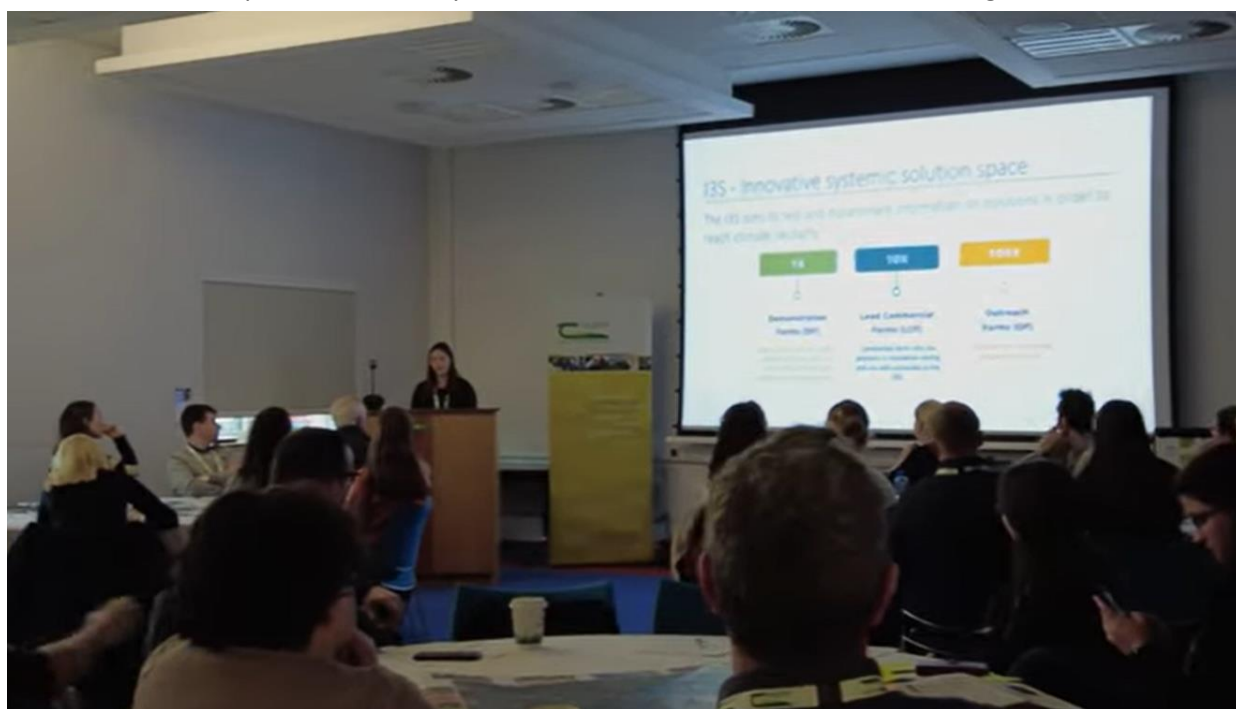


Figure 6: Natasha Brown (Teagasc) explaining the concept of the Creative Arena during CA1 at Moorepark in January 2023.

5. First opening: Role playing

This first opening session is based on a brainstorming approach with different groups. The groups will be created by mixing and hybridizing professional domains. An optimal of eight persons per group will be targeted. The number of groups will then depends on the number of people attending the meeting. Each group will be led by a facilitators (a ClieNFarms member).

The idea of this first opening is to develop a collective intelligence to propose systemic solutions based on the previous presentations and focus on the demonstration farms. Brainstorming on technical, organisational, financial and policy solutions will be performed. In a second step, a list of indicators suitable to assess the proposed systemic solution will be created.

Creative Arena's (Ireland)

Activity 1 of the Creative Arena consisted of the following:

1. To break the ice, each person introduced themselves and their role in Industry.
2. Give 10 post-it notes to each participant of the correct colour (colour on name badge to help identify)
- Farmers = Green, - Researchers = Orange, - Advisors = Pink and - Industry = Yellow
3. Each participant to write solutions on the post-it notes that will help to reduce absolute GHG emissions or increase carbon sequestration (max 10 each)



Figure 7: Map of Farm for Creative Arena (Activity 1)

4. Select someone to put their first solution onto the map, and discuss
5. Ask those with the same solution as the person speaking to put the post-it down at the same time
6. Repeat until all solutions are down on the map, and have been discussed
7. Give each participant 3 stickers. Stick on the three solutions they consider to be most relevant (impactful and implementable). NB: This is at a system level, not just within the farm gate.



Figure 8: Map of Farm for Creative Arena with Options Included (Activity 1)

The Second Activity consisted of the following:

1. Each participant got a set of ~ 10 printed cards with solutions (everyone in the group will have the same solutions)
2. It was ensured that cards of correct colour were given to stakeholder type (colours were on the name badges)
3. Participants were asked to discuss the solutions based on their likelihood of implementation potential and place along the line



4. Once all solutions were on the line, participants were asked to rank their solutions from 1 (least impact) to 5 (most impact). A number was put in the box on the card
5. **Take photo of the line**



Figure 9: Listing measures in terms of implementation

Activity 2 – Part B

1. Based on likelihood of implementation line, each participant took their top 3 and bottom 3 solutions
2. Based on the rating of impact (done by Karl Richards & Gary Lanigan) on the back of the card, the measures were split again (1-3 star = low impact; 4-5 star = high impact)
3. Measures were placed in the correct place in the matrix below. NB there could be the same solution in multiple boxes.

Low impact (1-3 star) High likelihood of implementation	High impact (4-5 star) High likelihood of implementation
Low impact (1-3 star) Low likelihood of implementation	High impact (4-5 star) Low likelihood of implementation

4. Briefly discuss as a group, particularly comparing impact given by group vs expert



Figure 10: Ranking measures effectiveness

6. First consolidation

In this first consolidation phase, the different groups from the previous step will present their proposals. A systemic meta-plan will be drawn. Systemic because the idea is to add on a proposal other solutions in order to increase the impact on the agricultural system and then propose a better solution to reach a climate neutral farms.

If different “divergent” solutions are proposed, participants will have to choose for the most appealing. First breaks and levers will be identified by a general discussion.

Creative Arena's (Ireland)

Outcomes of Activity 1.

Both creative arenas identified reduction of chemical N fertiliser and the enhancement of C sequestration as the two most important areas to address, especially in the shorter term. Farmer and Industry thought that measurement of SOC sequestration in grasslands was the most impactful measure, whilst policymakers, researchers and advisors thought reducing N fertiliser was most important. Crucially, many farmers failed to see the link between increasing lime use (and P/K) and reducing N fertiliser. The link was far clearer in terms of the use of clover or legumes and N fertiliser reduction.

Many processors were concerned about the public perception of feed additives and their impact on Irish dairy's 'green' image.

There was also a clear divergence between Creative Arena 1 (Dairy) and Creative Arena 2 (dairy calf to beef finishers), with the finishers thinking they had less scope to reduce as their

7. Second opening: sharing ideas – sectorial approach

The second opening is based on sectorial groups (farmers and advisors together, sourcing together, ...). From the previous choice, how the different sector might help to get a successful functioning. What are the specific breaks that the sector may help to overcome? Is there any new breaks not revealed in the previous step. Range of policy and fiscal instruments that could be utilised to support adoption of measures will be explored.

Creative Arena's (Ireland)

In both Creative Arena's, stakeholders were placed at tables which co-incided with their own stakeholder group (ie all farmers, all researchers etc were placed together).

1. The high impact, low uptake potential solutions from your matrix in activity 2 were selected (bottom right)
2. For a solution, each participant wrote 2 pre-requisites and 2 barriers on post-its
3. All participants placed post-its on flip chart together and Facilitators rearranged these putting similar answers together
5. These barriers and prerequisites were discussed and any additional pre-requisites and barriers were added
6. This was repeated for all mitigation options.

8. Second consolidation and plan

The different group (sectors) will present their thoughts through a collective cognitive map allowing to create “the ideal solution” and to identify breaks and levers. Discussion will be an important element to stress the risk of failures. Indicators to follow the implementation of the systemic innovation and the impacts on the farm but also on the surrounding will be discussed. A plan of the implementation steps using a Gantt-like methods will allow for the different milestones to be collectively decided.

9. Closing the workshop and follow-up

In this final part, a general wrap-up of the workshop will be performed. Future dates will be proposed, such as farm open days (see D3.5) and other events allowing for discussions and evaluation.

A satisfaction/interest sheet will be given to the different participants in order to improve our creative arena and to obtain coordinates of people who may be interested in following the experiment.

Concluding point

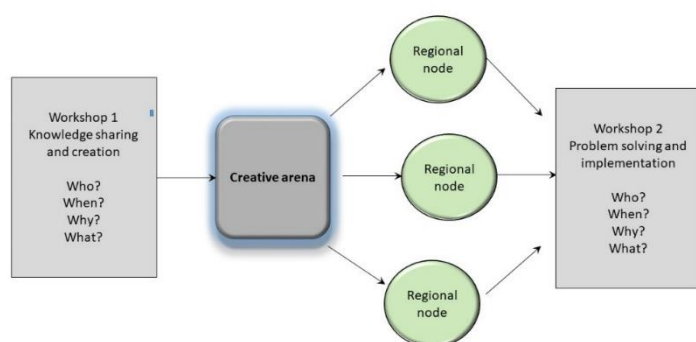


Figure 11: Schematic of the structure of engagement with stakeholders and project actors

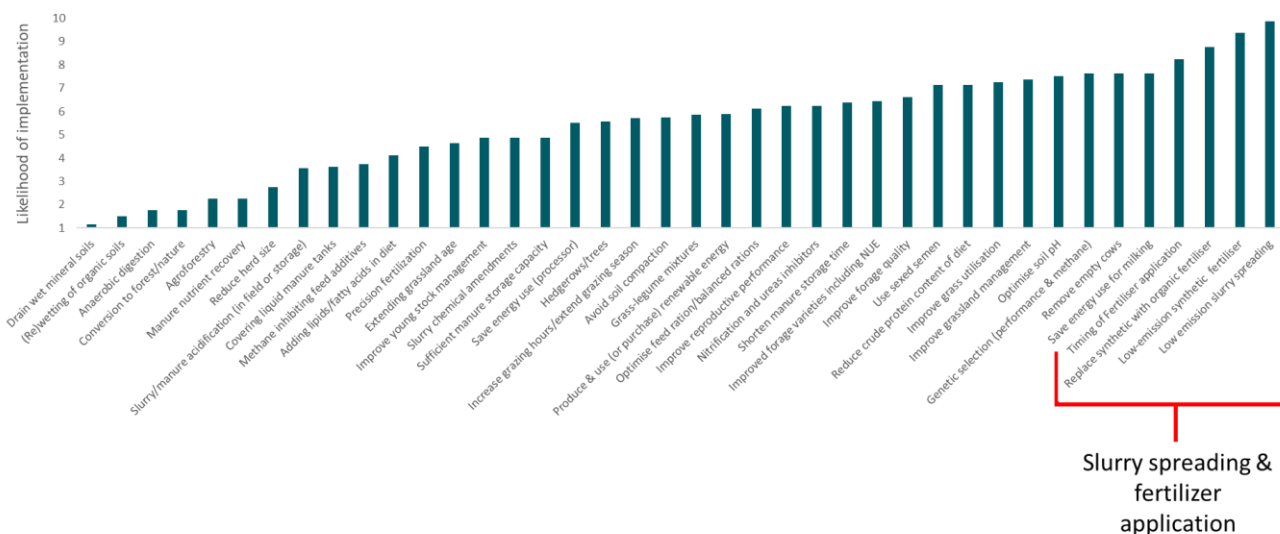
The structure of engagement and the choice of tools will depend on the context. It is foreseen to have an initial workshop to instigate knowledge sharing and co-creation. This will be expanded out in the creative arena by generating content, such as videos, we-based instruments, fliers, policy briefs etc. These and other tools can be used at regional workshops/engagements, where multi-actors/ stakeholders can interact at a more local level. Subsequently, a second workshop can investigate implementation and

application of solutions.

A key part of the ClieNFarms project is to maintain contact with the full range of stakeholders and actors. We intend to curate a webspace where stakeholders can post comments and ideas during the project duration. ClieNFarms social media engagement strategy will also be included in maintaining contact with stakeholders using networks such as Facebook, LinkedIn, Twitter (WP6). In addition, WP1 will organise regular and long-term knowledge exchanges among the I3Ss and stakeholders. The knowledge exchanges will be organised following different logics and the several dimensions of the project.

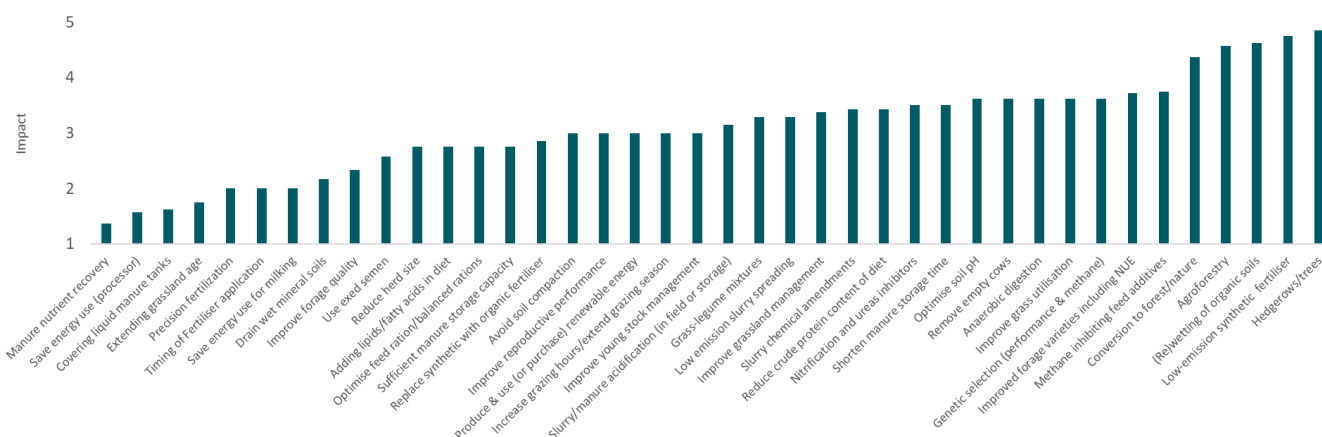
Outcomes from the first two Creative Arena

Likelihood of implementation of known solutions



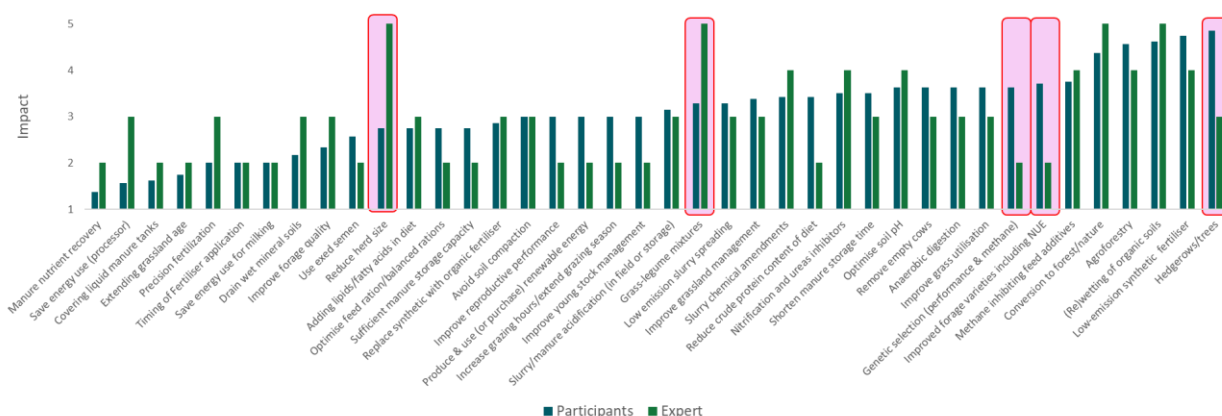
In terms of implementation, the most implementable solutions were considered to be a) reducing or replacing mineral fertiliser and b) low-emission manure spreading. Conversely, the least likely solutions included LULUCF measures such as re-wetting of peat soils, forestry and agroforestry as well as technical measures, such as anaerobic digestion, slurry separation. Reducing herd sizes was also seen as unlikely.

Participants assumed impact of known solutions



Conversely, the measures assumed to be hard to implement also were assumed by participants to be the most impactful for reducing emissions – Hedgerows/trees, re-wetting of organic manures, forestry and feed additives. Manure management strategies and the use of precision fertiliser practices were thought to be the least impactful.

D2.1 Conceptual and methodological framework for creative arena (living lab)



The largest discrepancy between the participants and expert opinion for the impact of individual measures were in terms of a) reduced herd size and b) grass-legume mixtures where the expert opinion was that these measures would have a high impact while participants only saw these measures as medium impact. By contrast, participants saw genetic selection of bovines and improved forage as being impactful while expert opinion was minimal impact of these measures. Participants viewed hedgerow/individual trees as being highly impactful while they were medium impact for expert opinion.

5.11.2. Some tools to help

In the previous section, we already presented some tools commonly used in collective participatory workshop. Table 2 gives some other possibilities that might be used depending on the size of the groups and the diversity of stakeholders.

Table 2: List of tools for engagement and problem solving

Objective	Tool	Tools
Interrogate and Providing new knowledge	Resource mapping	Use prompt cards with key words, map with timelines
		Use stories, narratives
	Brainstorming	Use lists without sorting - rapid idea expression
	Metaplan / Venn diagrams	Give participants are given a fixed number of note papers (2-5), asked to write one idea per piece of paper
	Carousel	Rotate fixed groups between stations to get a variety of opinions
	Concept mapping	Captures and links ideas
	SWOT	Think systematically about the strengths, weaknesses, opportunities and threats of an issue

D2.1 Conceptual and methodological framework for creative arena (living lab)

Prioritisation & Ranking	Ranking and/or voting	Can be used to place ideas in rank order.
	Multi-criteria analysis	Allows economic, social and environmental criteria, including competing priorities, to be systematically evaluated
	Socratic Wheel	Use to rank multiple criteria
Addressing challenges	Tree mapping	Rather than linking all issues are linked, tree analysis visualises links between the causes and solutions to a problem.
	Identify gaps & conflicts	Identification of a lack of power and absence of incentive and how gains/losses are distributed
	Forcefield	Understand causes of challenges and countervailing forces

Discourse should be facilitated by creating a positive collaborative atmosphere in meetings. Actors should be stimulated to 'think outside the box' in order to conceptualise and implement innovative or more disruptive solutions. Avoiding confrontation and encouraging inclusiveness by sitting in circles, in an open environment, and allowing networking or 'one-on-ones' during extended coffee breaks may help in creating such an atmosphere. Empathy can be created through reflection on various roles and personalities, and one-on-one exchange in smaller groups. Analysis and visioning tools like the rich picture or a visioning session to create common understanding and a common purpose. Often, dialogues need more space for struggle to create a common understanding among stakeholders. Use tools such as fish-bowls" or oxford-style debates to make people state their opinions and confront each other (Chevalier & Buckles 2013). Discussion should converge towards the end of meetings/workshops and produce tangible results, which are documented and communicated. In order to drive a process, there needs to be a sub-group responsible for convening, moderating and catalysing the process within the core group. It is essential to reflect on the capacities and the compositions of the team in order to improve the process facilitation of a multi-stakeholder partnership.

Stakeholder engagement and knowledge exchange requires the following to occur: a) Engagement, b) interrogation of existing knowledge, c) creating new knowledge, d) addressing problems and e) application of knowledge

Table 3: different elements of stakeholders' engagement in the participatory workshop

Objective	Method	Tools
Engagement	Active listening	Verbal
		Open questions
		Periodic summaries
		Note-taking/flip charts
		Synthesis & Conclusions
		Non-verbal
		Suspend judgement & remove self-bias
		Use humour, silence, body language

		Show empathy/appreciation
	Orientation	Discuss and clarify what participants want from the process
		Process observations
	Framing	Unpack issues separately so they are addressed individually
		Identify the sequence of issues and park some (contentious) issues for later
		Provide information in advance
		Stakeholder Rainbow - shows how different actors are impacted
		Social analysis - Collaboration, Legitimacy, Impact and Power

5.12. Evaluate process and results

Tree-mapping, ranking and weighting methodologies of measures and policies will be utilised as Creative arena outputs. In addition critical path analysis will be utilised to plan the shortest route to uptake of measures. Network visualisations will be used to facilitate a more engaged interpretation and understanding of relationships. To assess the multi-actor strategic networks, statistical or visual network analysis can be employed. Visual network analysis differs from Social Network Analysis as it is not focused on statistical assessments of networks (Hyland and Macken-Walsh, 2022).

5.13. Produce and disseminate the final report

Each I3S Creative Arena workshop will produce a final report. This report will detail the actors and stakeholders involved, methodologies used (prompt cards, role playing etc.), the results and associated analyses of the data and final conclusions.

6 From concept to reality: Example Plan for Creative Arena Workshop: Ireland

The first real creative arena workshop will be run end of August in Ireland. In the following we present the different elements on the step '5.11. Implement the plan'.

The overarching premise of the creative arena will be to facilitate participants from a diversity of backgrounds to find creative solutions to complex environmental/agronomic challenges in a more holistic/integrated way that can be useful for policy making.

6.1. The Creative Arena model

The key purpose of this ClieNFarms workshop is to collect information from small focus groups in a structured way. The workshop will include explicit tasks and role play activities performed in these smaller breakout focus groups. In general, based on previous iterations of these workshops, we have found that the success of this workshop model relies fundamentally on having a diversity of participants who will have their own frame of reference for the particular topics being explored. This purposeful

design allows stakeholders with divergent opinions to work together, bringing their respective expertise and perspectives to find solutions for complex environmental and agronomic challenges. Here, participants included stakeholders from a variety of professional backgrounds will include: policy makers from the Department of Agriculture, Food and the Marine and the Environmental Protection Agency, members of the academic community, PhD students and a farmer.

6.2. Context framing and scenario setting

The workshop will open with an explanation of the key concepts. This will include an explanation of the GHG sectoral targets (for both agriculture and LULUCF) as well as solutions laid out in the Teagasc GHG Marginal Abatement Cost Curve Report (Lanigan et al. 2018). The basis of the report relies at a local level on:

- a. methane reduction via increased efficiency and breeding,
- b. nutrient input reduction via use of legumes and improved soil nutrient management
- c. improved landscape and soil management so that all ecosystems maximise C sequestration and minimise soil carbon losses.

In addition soils should deliver multiple functions simultaneously to a greater or lesser extent, depending upon land use/management and soil type. The main soil functions that are delivered through agricultural landscapes provided focus for the workshop and include:

1. primary productivity,
2. water purification,
3. carbon cycling and storage,
4. habitat,
5. nutrient cycling.

These concepts, once explained, are then brought to life and contextualised by use of a farm model as shown below (Figure 6).



Figure 6: Farm model

The description of the farm model will provided in the context of a) soil types and b) land-use and land management.

The farmers will be presented in this fictitious scenario represent two very different farmers with almost polarised ambitions for their farming futures. Ann, one of the farmers is a young progressive, educated farmer, who is anxious to expand her dairy business. Conversely, John is middle aged, has off-farm income, operates a suckler beef enterprise and has limited ambitions in relation to expanding his farm operation. Their commonalities include that both share a boundary with the river as well as grazing rights on the hill. John has not soil sampled whilst Ann has full knowledge of her soil resource.

Workshop participants will then divided into two groups that will be selected on a random basis.

6.3. Part 1 Idealised Farm Management Design

Task 1: Design an idealised farm management framework, unconstrained by considerations on implementation, based on the catchment model described. Ann wants to intensify her dairy system to allow her to increase output value by 40% while John needs to maintain his current income. Also, the GHG and ammonia emissions must be reduced by 22% and 5% respectively in line with government policy. A soil type map will be made available for the participants in order to choose solutions taking into account the soil and its impact on GHG emission and C sequestration possibilities (Figure 7).

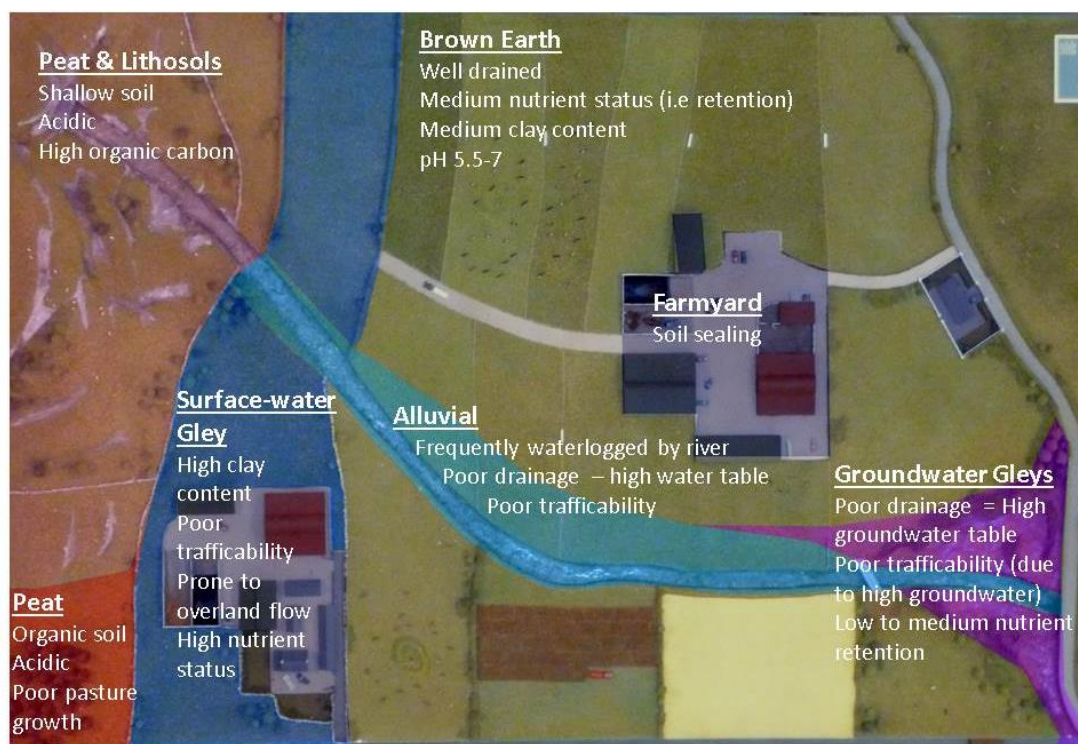


Figure 7: Soil types of farm model

6.4. Part 2 Policy Design

In preparation for task two, the group will be presented with the existing policy framework that drives the current GHG profile within the appropriate farming typology/sub-sector. The pathways, from EU/National scale to the local farm management scale will be presented, along with the existing policy instruments. Policy instruments fall into three categories: market, mandatory and voluntary. The competing demands for productivity, soil functions, that result in emission and the current policy drivers will be described, at the respective spatial scales within a category of existing policy instruments.

In the same focus groups as used in task 1, participants will be asked how they could transition the farm from its initial state, towards their idealised low-emissions farm management framework developed in

Task 1, using existing or new policy tools. Specifically, the goal will be to find ways to optimise GHG footprint and reduce ABSOLUTE GHG emissions as driven by policy instruments, with particular emphasis on primary productivity and GHG/gaseous emissions. The groups will be invited to consider new options for policies along with those that already exist.

To facilitate participants to meaningfully consider perspectives outside their own positionality, they will be assigned roles within the focus groups **beyond their standard remit**. For example, members of the group who generally are required to think from the environmental perspective will be assigned the role as being from the Department of Agriculture. Ministers for the Environment, as well as, Ministers for Finance will also be assigned to challenge participants to think outside their frame of reference and to develop policies that offered value for money from a governance perspective.

The workshop will conclude with a final open discussion. The following are the key discussion pieces that emerged from this part of the workshop.

7 Conclusions

The success of the Creative Arena for co-creation will depend on:

- a) a robust conceptual framework within which to work,
- b) a list of robust and customisable measures to occupy the solution space,
- c) a good mix of stakeholders and especially local increased farmer participation,
- d) a good range of tools with which to engender engagement and interaction.

It is also vital that follow-up engagement (which is planned within various WP's of the project) occurs and is coordinated.

There will not a unique type of creative arena. Each I3S will have to tailor its own. The diversity of situation will be an interesting material to propose a more robust and generic approach.

8 Acknowledgements

The authors wish to thank the different contributors from ClieNFarms in improving this deliverable.

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