Project: 101060645 — BEATLES — HORIZON-CL6-2021-FARM2FORK-01

BEATLES
BEHAVIOURAL CHANGE TOWARDS
Climate-Smart Agriculture

CO-CREATING BEHAVIOURAL CHANGE TOWARDS CLIMATE-SMART FOOD SYSTEMS

D 1.2

Use Case Co-Creation Workshops – First Round 2023

PROJECT ACRONYM: BEATLES
PROGRAMME: HORIZON Europe
GRANT AGREEMENT: No 101060645
TYPE OF ACTION: HORIZON Research & Innovation Actions
START DATE: 1 July 2022
DURATION: 48 months

Funded by
the European Union

Document Information

Issued by:	Stockholm Environment Institute
Issue date:	June 30, 2023
Due date:	June 30, 2023
Work package leader:	University of Copenhagen (UCPH)
Start date:	July 1, 2022
Dissemination level:	Public

Document History

Version	Date	Modifications made by
0.1	12-06-2023	Draft prepared by SEI and reviewed by AEIDL and AUA
0.2	23-06-2023	Revised version by SEI and reviewed by AEIDL and AUA
1.0	29-06-2023	Final version submitted to the EC

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Executive summary

Co-creation between stakeholders surrounding the transition to Climate-Smart Agriculture (CSA) practices is central to the BEATLES project (https://beatles-project.eu/). Work Package (WP) 1 sets out to clarify the state of current knowledge on adoption of CSA practices from systematic literature mapping, surveys, and interviews with selected value chain stakeholders (Deliverable 1.1)[1] and to carry out annual co-creation workshops within each of the BEATLES Use Cases (this Deliverable, 1.2).

The aim of the co-creation workshops is to identify, discuss, and tackle the lock-ins and levers surrounding adoption of CSA practices within the BEATLES 5 Use Case food systems (wheat, dairy, pig, apple and onion/potato) also within the context of the niche work packages within the Project dealing with behavioural experiments (WP2), sustainability assessments (WP3), innovative business models (WP4) and relevant policy recommendations and tools (WP5).

The first year's workshops have created the foundation within BEATLES by identifying the various components of the value chain within each Use Case, involving stakeholders representing these components and initiating discussions surrounding the barriers ('lock-ins') and opportunities ('levers') in the transition towards CSA practices (adaptation to climate change, mitigation of greenhouse gases and increased sustainable production). The stakeholders participating in these workshops included farmers, farmer associations, food processors, retailers, investors, certifying organisations, NGOs, policy makers, researchers and consumer organisations. In total, some 80 stakeholders attended these workshops.

These first workshops were tasked to address the following agenda items:

- Overview of the BEATLES project and the co-creation process that will run until 2026
- Describe the Use Cases and related value-chain components in detail
- Identify the stakeholders and their niche roles within the value chains
- Describe the baseline situation and practices for each of the Use Cases regarding value chain sustainability, markets/business and policies
- Describe possible CSA-related transitional changes along the value chains and the potential impacts on sustainability, markets/business and policy alignment
- Delineate the lock-ins and levers related to the process of CSA reform and provide recommendations regarding these barriers and opportunities
- Items for follow-up in future exchanges and co-creation workshops eg adding more stakeholders and additional topics

The stakeholder meetings, the interviews with stakeholders, and systematic literature mapping in WP 1 all contribute to a better understanding of what is doable, what is more difficult in aligning towards the EU Green Deal, Farm to Fork and Biodiversity strategies, and how policies such as the Common Agricultural Policy (CAP) can be reformed for optimal implementation. This deliverable (D1.2) is composed of a summary of the 5 Use Case discussions and includes the individual reports from each of the Use Case workshops. It builds on the work of the Use Case lead partners that carried out stakeholder mapping and interviews within each of their case studies.

In terms of the state-of-play with lock-ins and levers hindering or promoting the transition to CSA practices the following highlights can be noted. These are outlined in terms of relevance to the scope and objectives of the BEATLES WPs:

[1] https://beatles-project.eu/public-deliverables/

Lock-ins

WP 1 Decision-making processes

- Stakeholder interaction to create innovative solutions leading to CSA practices is lacking

WP 2 Behavioural experiments

- Lack of capacity, knowledge and training on the part of stakeholders hinders progress towards developing CSA practices

WP 3 Sustainability assessment

- EU has no common sustainability model for agriculture
- The value chains are not keyed towards climate change adaptation, GHG mitigation or sustainable production
- LCA carbon footprint analyses have only limited value and don't motivate the investment costs for CSA; they are also not linked to carbon taxes

WP 4 Business models

- Consumer interest is lacking along with understanding and willingness to pay
- Cost of CSA cannot be passed down to the consumer, so subsidies are necessary
- Market interest in food systems built using CSA practices is lacking
- Strategic finance for CSA investments from banks is not available

WP 5 Policy

- CAP does not yet include CSA activities - CAP tends to defeat the purpose of transitioning to CSA implementation
- EU has yet to develop directives dealing with CSAs responding to the Green Deal and Farm to Fork strategies which at present lack implementation components
- National strategies, policies and guidelines are lacking in the area of food system CSA implementation
- EU policies dealing directly with CSA implementation are lacking
- Countries importing from the EU often do not have CSA stipulations and thus are not willing to pay extra.

Levers

WP 1 Decision-making processes

- Growing customer awareness about climate change is a driver and proper marketing and labelling can help increase the interest in CSA-based products
- Growing customer awareness about healthy foods and eating habits that also are climate friendly could help shift the transitions to increased CSA practices

WP 2 Behavioural experiments

- The high costs of fossil fuel, electricity and fertilizer force producers to be more frugal and more efficient in their farming practices
- Low costs for digitalisation can provide short cuts towards increasing efficiency and more accurate accounting of resource use

WP 3 Sustainability assessment

- Improvements in value chain efficiency with reduced waste and increased recycling all lead to reduced climate change impacts
- Sustainable practices in many cases can be economic/profitable in the long run, in terms of enhancing soil fertility, water holding capacity and building resilience against drought and wind erosion

WP 4 Business models

- Introduction of carbon taxes can be a major incentive to shift towards CSA practices

WP 5 Policy

- Stricter laws concerning leakage of phosphorus and nitrogen from fields to water courses reduces the overuse of manure on fields thus reducing GHG emissions
- Revision or reform of CAP holds promise as a central catalyst to achieve the goals of the Green Deal and Farm to Fork Strategies.

Key recommendations were made by the workshop participants for addressing these lock-ins and for harnessing the levers. These are also outlined in this report in terms of relevance to the scope and objectives of the various BEATLES WPs.

The identification of the value chain components and mapping of stakeholders within each of the BEATLES Use Cases has prepared the ground for exchange beyond these first workshops. Follow-up to this first round will take the form of online exchanges in Multi-Stakeholder Platforms (MSPs) in preparation for the second round of workshops in 2024 and further follow-up until the end of the project in June 2026. Beyond exchange between the stakeholders in each Use Case, these platforms will allow for greater interaction with the other BEATLES Work Packages striving to assess aspects relating to sustainability (WP3), innovative markets (WP4) and policy (WP5). The lessons learned in terms of organizing and running these co-creation workshops are the following: participation and contribution of relevant stakeholders at the workshops is key. The UC leads should encourage more relevant stakeholders to join subsequent workshops. In terms of duration of workshops, enough time should be allocated for thorough and in-depth discussions among participants.

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List of Abbreviations, Terms and Definitions

Abbreviation/Terms	Definition
BM	Business Model
CA	Conservation Agriculture
CAP	Common Agricultural Policy
CCW	Co-Creation Workshop
CSA	Climate-Smart Agriculture
DC	Danish Crown (Danish meat producer)
Levers	Opportunities, facilitator, enabler
Lock-ins	Challenges, barriers, blockages
MSP	Multi-Stakeholder Platform
RDP	Rural Development Programme
PP	Planet Proof
SEGES	Originally the Knowledge Centre for Agriculture and the Danish Pig Research Centre (changed its name to SEGES Innovation in 2015)
System boundaries	Limits of a system
UC	Use Case
WP	Work package
Value chain	Consecutive steps or activities in the creation of a finished product

1. Introduction

The BEATLES project[2] (2022-2026) aspires to change the way agri-food systems currently operate and to accelerate the systemic and systematic transition to climate-smart agriculture and smart farming[3] technologies. This process is to be fully aligned with the ambitions of the European Union (EU) Farm to Fork and Biodiversity Strategies, the new Common Agricultural Policy (CAP) at regional and EU levels and the EU Data Strategy and Digital Compass.

The **co-creation and stakeholder participation** in systemic interventions in BEATLES will provide opportunities for reflection and learning throughout the project and will build feedback into the design and implementation of interventions towards behavioural shifts. The acceptance of the climate-smart agriculture and smart farming technology solutions will be consolidated by orchestrating a dialogue between farmers, advisors, processing industry, retail, investors, policy makers and consumers in multi-actor workshops. This dialogue will help to **establish a mutual understanding** of the benefits that can be obtained from the transition to a sustainable, climate-smart agriculture. In the context of co-creation, the mechanisms, rules and goals of the existing food systems will be questioned and challenged, and ideas about sector-related interventions will be co-developed. Co-creation and participatory approaches will be employed to co-decide and co-design the:

a) lock-ins and levers to be tested via behavioural experiments,

b) sustainability assessment framework and the indicators for assessment,

c) fair value propositions and business models, and

d) evidence-based policy recommendations and tools.

In BEATLES, co-creation is an active, creative process to build mutual commitment to change towards sustainable, climate-smart food systems.

The 2023 multi-stakeholder co-creation workshops are the first of a series planned in the BEATLES project. Co-creation workshops will be held annually by each of the 5 Use Cases (UCs)[4] during the duration of the project. The co-creation activities are organised within the context of the 5 UCs and their various value chain components and stakeholders. The 5 UCs are as follows:

- Wheat farming in Lithuania
- Dairy farming in Germany
- Pig farming in Denmark
- Apple farming in Spain
- Onion and potato farming in The Netherlands

Although there will be co-creation workshops in 2024, 2025 and 2026 tackling various themes (sustainability, business models and policy) there is a need to provide continuity and preparedness within the stakeholder groups within each Use Case during the interim periods. To accomplish this, online Multi-Stakeholder Platforms are being set up, one for each Use Case in order to organise key files and share knowledge relevant to the various WPs within BEATLES.

[2] https://beatles-project.eu/

[3] Smart farming is a management concept focused on providing the agricultural industry with the infrastructure to leverage advanced technology – including big data, the cloud and the internet of things – for tracking, monitoring, automating and analysing operations (https://tinyurl.com/yp76sssn)

[4] https://beatles-project.eu/use-cases/

This will allow for exchange between the BEATLES partners and the stakeholders as the project progresses. When the co-creation workshops are then held each year, the level of preparedness will be optimised.

1.1 Objectives of the first co-creation workshops 2023

The main objective of the first co-creation workshops was for the identified stakeholders in the value chain of the various Use Cases to describe their roles and co-define a set of 'lock-ins' and 'levers' at individual, systemic, and policy levels that impede or foster the transition towards climate-smart agriculture (CSA). The expected outcomes/outputs were as follows:

- To identify the value chain components and respective stakeholders within the 5 Use Cases
- To align the 5 UCs with the various Work Package focus areas within BEATLES, namely knowledge base, future CSA behavioral experiments, sustainability analyses, innovative business markets and policy assessments
- To initiate the process surrounding stakeholder clarification and consensus-building on acceptable CSA policies and practices highlighting lock-ins (barriers) and levers (opportunities) and trade-offs therein

1.2 Basis and conceptualization of co-creation in support of Climate-Smart Agriculture

The need for co-creation among stakeholders within agriculture supply chains has been made clear across the world in recent years in the work aimed at creating Climate-Smart Agricultural (CSA) systems. The three pillars that constitute CSA are climate change adaptation, greenhouse gas mitigation and increased sustainable production. Here are a few examples of new CSA knowledge exchange platform initiatives created within the FAO, CGIAR and EIT within the EU. They all are based on co-creation, multi-stakeholder approaches and knowledge sharing.

*"GACSA is an inclusive, voluntary and action-**oriented multi-stakeholder platform on Climate-Smart Agriculture (CSA)**. Our vision is to improve food security, nutrition and resilience in the face of climate change. GACSA aims to catalyse and help create transformational partnerships to encourage actions that reflect an integrated approach to the three pillars of CSA."* - **Global Alliance for Climate-Smart Agriculture (GACSA)** https://www.fao.org/gacsa/en/

"Co-creation and sharing of knowledge: agricultural innovations respond better to local challenges when they are co-created through participatory processes" **– Agroecology Knowledge Hub FAO** https://www.fao.org/agroecology/knowledge/10-elements/co-creation-knowledge/en/

"Converging global mega-trends of climate change, population growth and urbanisation are creating unprecedented new pressures for agriculture and food production. To feed a world of over nine billion people by 2050, today's agriculture must get 'climate-smart': It must undergo a step-change in resilience, resource-efficiency and productivity over the next three decades." **Climate Smart Booster** http://csabooster.climate-kic.org/

"The adoption of climate-smart agricultural production processes and technologies is a vital strategy in attempts to mitigate the global impacts of climate change without compromising on food security. However, supporting farmers to permanently implement new technologies and approaches requires a deep understanding of their needs, robust training, and effective

transfer of knowledge." – **CGIAR** https://www.cimmyt.org/news/why-co-creation-is-vital-for-sustainable-agriculture/

The complex and interlinked challenges that are being grappled with in producing food in adequate quantity and quality with sustainability and ethical considerations, need strategic collaboration and partnerships between stakeholders at multiple levels of society representing farmers, business, government, civil society, academia, and consumers. For this to work, a common understanding must be established between partners on the challenges they encounter and ways of collectively addressing these challenges. This can happen through co-creation which is a collaborative and interactive process in which stakeholders attempt to solve a shared problem by exchanging ideas and resources serving to co-initiate, co-design and co-implement strategies, policies, regulatory frameworks or technological solutions.

Figure 1 illustrates the complexity of a multi-stakeholder approach merging the food supply system, socio-economic drivers and environmental drivers all of which have a role in the process of co-creation in agriculture systems.

Figure 1: Visual representation of a system transformation

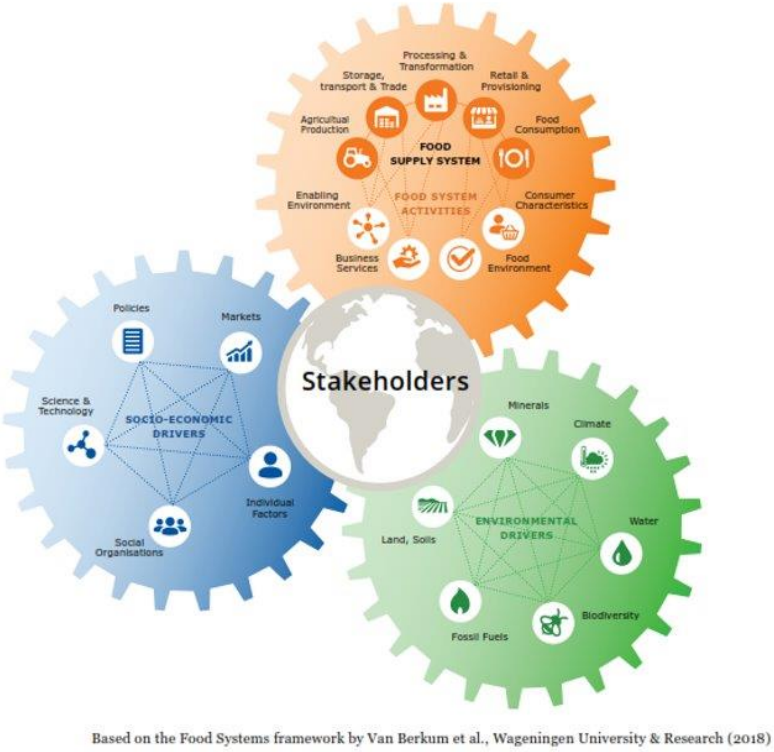

Figure 1. Food system co-creation between stakeholders representing growers, suppliers, markets, consumers, policy and environmental/sustainability drivers. (Thorpe et al 2021)[5]

A central aspect of CSA is the element of adaptation to climate change. Here entire value chains can be involved in an integrated fashion in order to help solve the challenges surrounding food production and delivery under the threat of drought, flooding and temperature changes. Figure 2 provides an example from Australia where co-creation has produced an assessment and scenario for a climate-change adapted food chain involving potatoes used for the production of potato chips. Here climate change reduced crop productivity with negative knock-on effects on product supply, creating transport delays and penalties for not meeting contracted supply

[5] Thorpe J., Guijt J., Sprenger T. and Stibbe D. 2021. Multi-Stakeholder Platforms as System Change Agents: A guide for assessing effectiveness. IDS Institute of Development Studies and Wageningen University & Research. 24p

agreements and orders all leading to competitive losses. In the adaptation strategy relocation is involved, new processes introduced, and additional complexities added to the supply chain in order to build resilience.

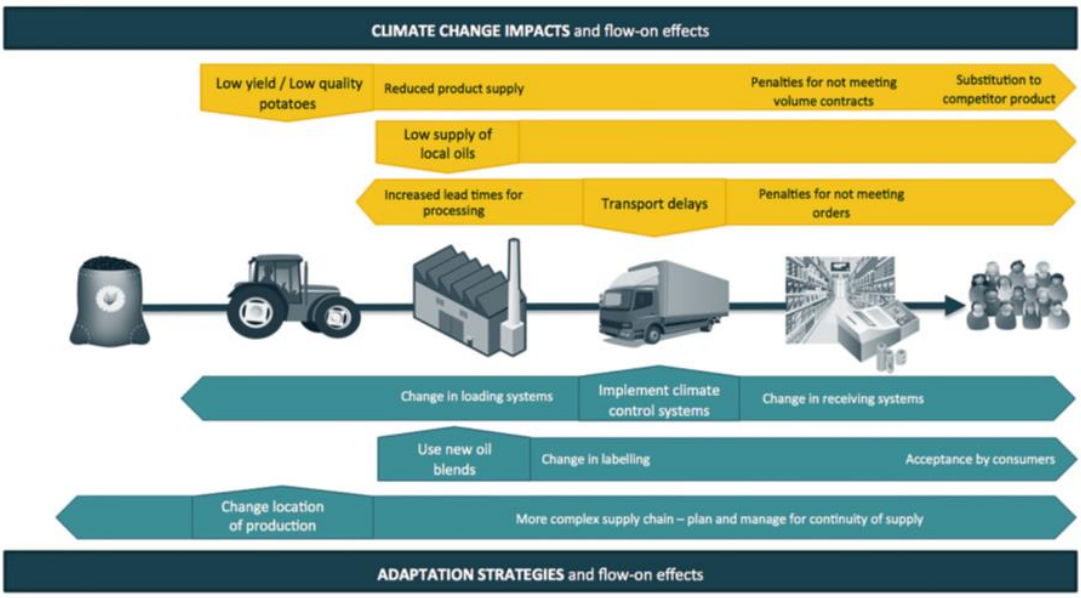

Figure 2. Example of a climate change-adapted food chain (Kim-Camacho et al 2016 CSIRO)[6]

Figure 3 describes the various phases of the co-creation process among stakeholders in the transformation towards climate-smart agriculture systems. This involves 7 phases covering initial exploration, co-definition, shared diagnosis, identification of solutions, on-farm experiments, assessment of the co-design process and disengagement and strategies for scaling up. The tools involved in accomplishing these 7 phases include social network analysis and surveys, participatory workshops, monitoring system of knowledge, performance and adoption changes, climate change scenarios and CSA calculator, experiments and field school, life cycle assessment, and analysis of the policy mix.

6 Lim-Camacho,L., Crimp,S., Ridoutt,B., Ariyawardana,A., Bonney,L., Lewis,G., Howden,S.M., Jeanneret,T. and Nelson,R. 2016. Adaptive value chain approaches: Understanding adaptation in food value chains. CSIRO, Australia. EP163611. 37p.

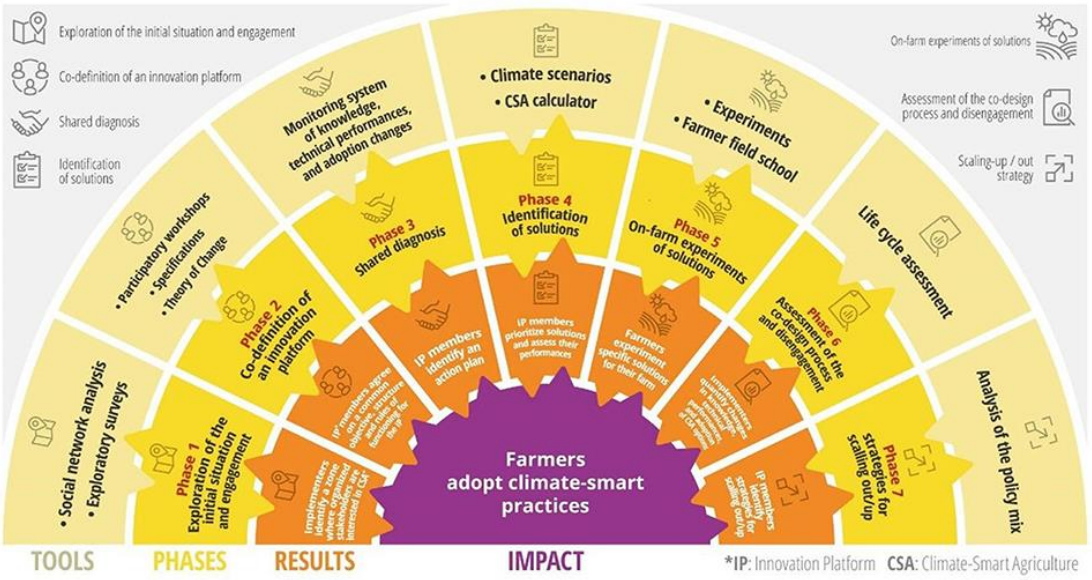

Figure 3. Phases of the multi-stakeholder co-design process in adopting Climate-Smart Agriculture. (Andrieu et al 2019)[7]

Figure 4 illustrates an agriculture production scheme delineated with a systems boundary for the purposes of building consensus on CSA practices. In this case markets and policies are not part of the defined system.

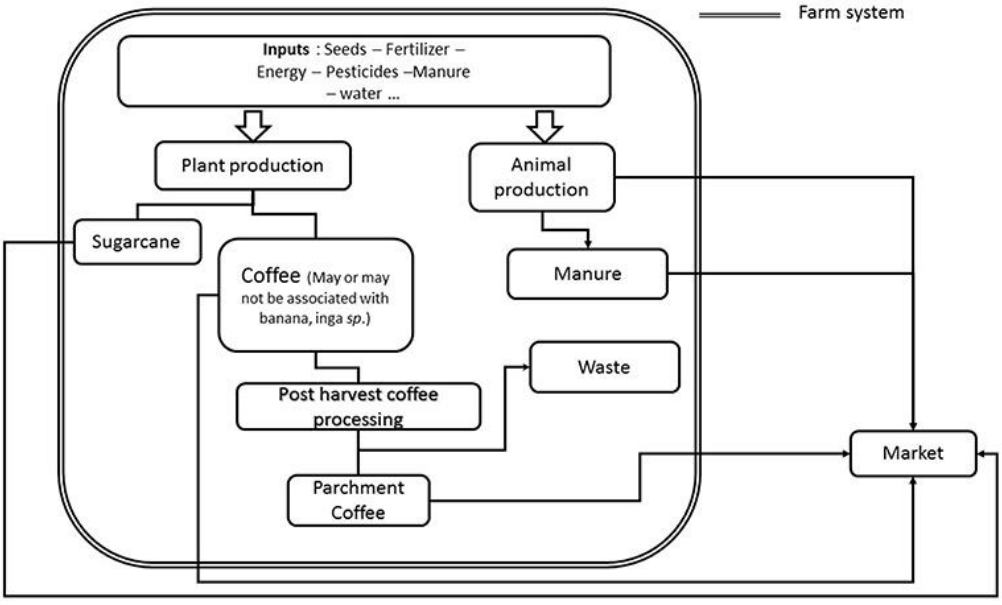

Figure 4. An agriculture production scheme delineated with a system boundary for the purposes of a co-creation multi-stakeholder CSA process (Andrieu et al 2019).

7 Andrieu N, Howland F, Acosta-Alba I, Le Coq J-F, Osorio-Garcia AM, Martinez-Baron D, Gamba-Trimiño C, Loboguerrero AM and Chia E. 2019. Co-designing Climate-Smart Farming Systems with Local Stakeholders: A Methodological Framework for Achieving Large-Scale Change. Front. Sustain. Food Syst. 3:37. doi: 10.3389/fsufs.2019.00037

1.3 Strategy and methods – setting up and running the workshops

BEATLES adopted the following strategy to initiate, conduct, and monitor co-creation activities. Each Use Case established a group of value chain stakeholders and organised separate co-creation workshops within. These activities were conducted in the following order:

1. Guidelines/instructions for participation at the workshop were developed.
2. Relevant stakeholders were identified across the value chain of UCs. This was based on a set criteria as outlined in
3. , below.
4. A checklist of items to include in the workshop agendas was set out and agreed to between the BEATLES Work Packages (WP) and UC partners.
5. Input was requested and compiled in the form of presentations from the WPs to the co-creation workshops including a training session for the UC leads by the WP leads.
6. Workshop objectives, timelines and workplans including milestones were compiled based on the needs and focus areas of the WPs.
7. The UC partners planned and conducted the co-creation workshops during March to May 2023.
8. A reporting template was circulated among UC partners.
9. A capacity to continue the dialogue among stakeholders in each UC in between the annual workshops will be initiated in 2023 in the form of multi-stakeholder platforms (MSPs) using Microsoft Teams. This will allow for dialogue and learning between the UC stakeholders and the WP partners. A separate MSP will be created for each UC.
10. BEATLES has also circulated GDPR consent approval forms to the stakeholders for participation in workshops and online sessions.

lists the criteria used in the process of selecting stakeholders for each UC workshop.

Table 1. Criteria for selecting stakeholders

- **Generic value chain categories** – farm producer, processing, storage/transport, packaging, retail, labelling, advertising, investors, consumer, waste/reuse systems, advisors, researchers
- **Awareness about climate change impact** across the value chain and how it may be affecting their present and future business niche
- **Knowledgeable about role(s) in the food system value chain** in terms of being aware of EU and national policies, regulations and technologies affecting investment "lock-ins and levers" relating to climate change impacts of their practices
- **Informed about the existence of environmental reporting,** Corporate Social Responsibility (CSR) and Codes of Conduct relating to their business
- Awareness of or access to **information and data** within their value chain niche
- **Working language** – local languages or English
- **Availability to attend online**, a UC Co-creation Workshop once/year to provide opinions and feedback to BEATLES WP representatives

A standard workshop agenda was prepared based on the priority areas of the BEATLES project and with inputs from the Work Packages (WPs):

- WP 1 – identification of "lock-ins" and "levers" in decision-making by agri-food actors (knowledge base, stakeholder interviews, co-creation workshops)

- WP 2 – implementation and management of Use Case CSA behavioral experiments
- WP3 – social impact analysis, environmental assessment, and CSA feasibility studies
- WP4 – development of innovative business models, shaping market conditions (initial discussion)
- WP 5 – policy and institutional frameworks affecting the move towards CSA practices

All CCWs (Co-Creation Workshops) were given a package of PPTs to present based on each of the BEATLES WPs. These included a general introduction to the project, specific findings from the literature mapping, surveys and interviews (WP1) relevant to each Use Case, delineation of the system to undergo sustainability analyses (WP 3) and initial exposure to business models (WP4) and policy aspects (WP5) being tackled within BEATLES. The key content from WP 1 PPTs has been included in this deliverable in the Annex. WP 2 (lab and field experiments) are slated to begin during the second year of the project.

Table 2 provides the details of the 5 co-creation workshops regarding when and where they took place, the identified value chain components and the stakeholders present plus the number of participants.

Table 2. Schedule and stakeholder participation at co-creation workshops (CCW)

Use Cases	Date & venue of CCW	Type of meeting	Value chain components	Value chain stakeholders represented (including numbers)	Participants
Wheat farming, Lithuania	23 March 2023, Vilnius	Hybrid (digital & in-person)	Farming, storage, quality and hygiene control, packaging, transportation (shipping), recycling/recovery, retail, consumer	Farmer **(2)**, farmer association **(4),** researcher **(3)**, food processor/producer **(3)**, policy-maker **(5)**, innovator/technology provider **(9)**, NGO **(1)**, Retail/food distributor **(1)**, media **(1)**, Bank **(1)**	30
Dairy farming, Germany	19 April 2023, Palling	Hybrid (digital & in-person)	Grassland management, feed production, cattle breeding, milk processing, milk storage, milk delivery, calf marketing, manure management, retail.	Farmer **(4)**, farmer association **(1)**, feed producer **(1),** retail **(2)**, agricultural advisor **(2)**, policy/government officer **(3)**	13
Pig farming, Denmark	3 May 2023, Tjele	In-person	Feed production and supply, pig farm/breeding, advisory service, technology provider, research, transportation, slaughterhouse, retail, rendering, consumer	Farmer **(1)**, innovator **(4)**, researcher **(1),** fertilizer producer **(1)**, investor **(1)**	8
Apple farming, Spain	25 April 2023, Narrava	In-person	Organic primary production, storage, conventional primary production, transportation/distribution, processing, organic certification, regulation, retail, consumer, research	Farmer **(1)**, farmer association **(6)**, policy/regulator **(1)**, retail **(3)**, research **(4)**	15
Onion and potato farming, Netherlands	24 May 2023, Zevenbergschen Hoek	In-person	Supply, cultivation, certification, retail, advisory services, handling, selling, consumers	Farmer **(2)**, farmer association **(1)**, seed and other supplier **(3),** advisor **(2)**, policy/regulator **(1)**, project coordinator **(1)**, retail **(1)**, researcher **(1)**, research funder **(1),** certificator **(1)**	14

Representation of stakeholders at the different workshops varied. At the Lithuania workshop, the majority of participants represented companies/organisations working with innovations and technology development. In the case of Germany, farmers were the most represented. The Danish workshop had mostly stakeholders working with innovation and technology development. Farmer associations were predominant at the Spanish workshop. Lastly, suppliers of seeds and other types of farm-based services were represented most at the Netherlands workshop.

Figure 5 illustrates the co-creation process within BEATLES. CSA knowledge is generated through the research WPs carrying out literature mapping, interviews with stakeholders, surveys of consumers and studies examining innovative markets, policies and sustainability. These feed into the work of the 5 Use Cases that generate knowledge about their respective value chains and respective member stakeholders. Through the Co-creation Workshops (CCWs) the elements and priorities identified within BEATLES are then discussed leading to observations on CSA lock-ins and levers (barriers and opportunities) which then will be tested further in the annual CCWs and lead to a series of recommendations on CSA development within the EU.

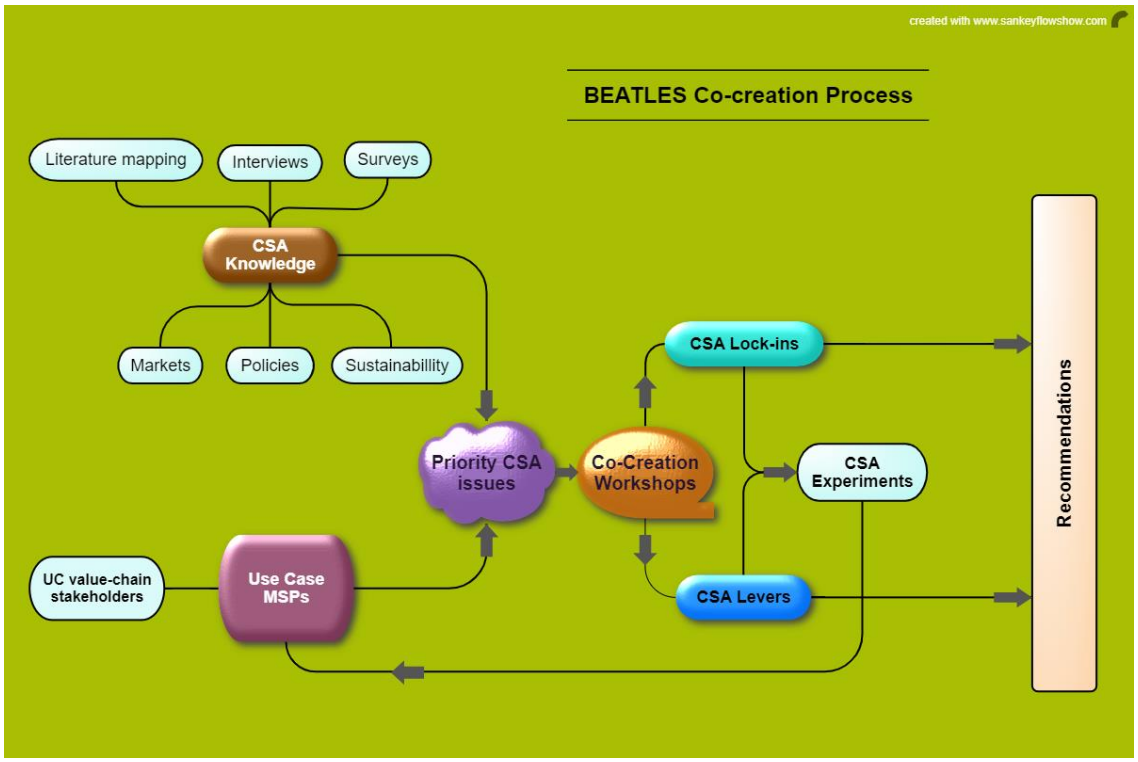

Figure 5. Co-creation process within the BEATLES project

1.4 Topics covered in the UC workshops

Following internal deliberations and several meetings between the Use Case and Work Package partners within BEATLES, a common checklist was erected in order to establish agendas (Table 3) in setting up the co-creation workshops. The objective was to provide a foundation for the co-creation process within BEATLES for each of the Use Cases. The stakeholders received an explanation of what the BEATLES project was all about and how important their role would be in order to provide a reality check for the project over its execution period to mid-2026.

Table 3. Content checklist for the 5 Use Case co-creation workshops

1. **Introduction, define system boundaries, identify key problems** Presentation of agenda and introduction of stakeholders
    a. Overview of the BEATLES project and the co-creation process that will run until 2026
        i. Objectives and timing 2023-2026 – review the overall co-creation process
        ii. List of the UCs and WPs and role of the stakeholders
        iii. Multi-Stakeholder Platform formation – future use
        iv. Update and methods for using the UC MSPs as an exchange tool during the one-year periods between the co-creation workshops
    b. Topics to be covered during the co-creation process
        i. Describe the UC and related value-chain components in quantitative detail
        ii. Describe the baseline situation and practices for each of the UCs regarding value chain sustainability, markets/business and policies
        iii. Describe possible CSA-related needed changes along the value chain for each UC and the potential impacts on sustainability, markets/business and policy alignment
        iv. Delineate the lock-ins and levers related to each CSA reform
        v. Describe the BEATLES UC CSA experiments to be carried out within WP2 which will be fed back into the MSPs and Co-creation Workshops to follow
        vi. Delineate a strategic outreach profile for each UC including professional networks, branch organisations and news bureaus

2. **Description of the Use Cases (UC)**
    a. Define system boundaries and identify relevant topics for practitioners:
        i. Which components do we see in our UC, which actors are missing?
        ii. How are the actors interlinked? Distinguishing product, money and knowledge flow if necessary
        iii. Where could the system be more sustainable/climate friendly? Which are the bottlenecks for the extension of organic and fair products? Where is there room for improvement?
        iv. What would be needed for this improvement? What should the project focus on?
        v. WP5 Policy measures: what is needed from policymakers to make these improvements? Ask specifically for policies in the agricultural sector but also across the value chain

3. **WP 1 Systemic identification of "lock-ins" and "levers" in the decision-making by agri-food actors -** Reporting from the mapping, survey and interview work. Facilitated discussion with stakeholders on lock-ins and levers to cover:

    a. Existing CSA technologies and practices (including, UC-specific)
    b. Farm to fork decision-making factors for the transition to CSA (individual, systemic and policy)
    c. What are possible WP2 experiment topics?
    d. Special focus on how the experiments might solve the problems and challenges of the practitioners regarding the spread of climate-smart initiatives - discussing this with stakeholders

4. **WP 5 Transition through policy recommendations and tools**
    Key questions for the workshops:
    a. What are the main European policies that influence (limit and favour) the definition of national and regional policies, programmes and plans linked to the transition to CSA and the adoption of related agrarian practices?

b. What are the main national and regional policies influencing the adoption of farming practices linked to the transition to CSA? (with input from UC leads)
c. Thinking about the criteria set out in those policies (regional, national and European), what are the main barriers/lock-ins to the transition to CSA? What are the main incentives?

5. **WP 3 Sustainability and behavioural change assessment**
Key activities and data needs:
   a. What CBA data exist for the UC?
   b. What data exist for the UC so that a Social LCA can be carried out?
   c. What data exist for the UC so that an Environmental LCA can be carried out?
   d. Illustration of the system models within the value chain

6. **WP 4 Transition toward fair business models and shaped market conditions**
Introduction to innovative business markets

Conclusions and next steps

7. **Resolution on the priority CSA topics** for the UCs re sustainability, markets and policy

8. **Next steps for follow up** within the WPs and UC-MSPs -
   a. unresolved questions, data queries, value chain components yet to be addressed, additional interviews with stakeholders, etc.
   b. Plan for follow-up within the Multi-Stakeholder Platform (MSP) for the UC and for 2024

The workshops were conceptualised based on the checklist in Table 3 and following discussion and validation with the UC and WP partners. These first workshops in 2023 were tasked with mapping out the "lock-ins and levers" to CSA development in each of the 5 Use Cases in addition to identifying the components of the value chains and respective stakeholders. The follow-up exchange required now prior to the next co-creation workshop in 2024 is therefore important in order for the Use Cases to further fulfil the ambitions of the BEATLES project. The developing online Multi-Stakeholder Platforms will provide a capacity for interim exchange and follow up from these first workshops and in planning for the next workshops. The next workshops in 2024, 2025 and 2026 will be tasked with a closer focus to the topics of WPs 3, 4 and 5 (namely sustainability, markets and policy). An additional activity within each Use Case will be the behavioural experiments in WP 2, still to be formulated.

Table 4 provides an overview of the most common Climate-Smart Agriculture (CSA) practices as derived by the literature mapping and interview work within BEATLES (Deliverable 1.1)[8]. CSA practices include cropping systems, livestock and manure management, pest and weed management, soil and fertilizer management and overall agriculture systems. When applied to the food system value chain climate-smart activities cover a wider selection of niches including crop and slaughterhouse processing, waste management, storage, packaging, transportation, advertising, consumption and consumer waste. Steering the application of these practices with an array of experienced lock-ins and levers fostering or hindering development involves implementation of policy and innovative markets.

[8] https://beatles-project.eu/public-deliverables/

Table 4. Common CSA practices within the EU (derived from BEATLES Deliverable 1.1[9], 2023)

Crops	Livestock	Manure management	Pest management	Soil management	System modifications
Variety improvement against disease	Breed improvement	Acidification of slurry	Integrated pest management	Biofertilizer	Mixed farming
Cover crop	Precision livestock farming	Anaerobic digestion	Integrated weed management	Smart irrigation	Organic agriculture
Intercropping	Integrated husbandry	Manure composting	Biological pest control	Conservation tillage	Smart greenhouse production
Crop rotation	Feed improvement	Manure separation	Precision chemical weed management	Smart including site-specific fertilizer application	Renewable energy
Vertical farming	Pasture grazing and permanent grasslands	Ventilated housing	Precision mechanical weeding	Integrated soil fertility management	Carbon farming
Crop diversification	High protein legume-based feed	Holistic management (feed/manure)	Variable rate spraying	Reduced N & P fertilization	Eco-farming
N-fixation crops	Smart milking technology		Greenhouse production	Smart fertigation	Guidance systems
	Health management		Other smart crop protection methods	Mulching	Regenerative farming

The central tasks of these first stakeholder co-creation workshops were therefore to identify the value chain components and their respective stakeholders within each Use Case, identify the selection of CSA practices that the stakeholders are aware of or are already implementing and finally identify the lock-ins (barriers) and levers (opportunities) in the transition towards more CSA practices.

The following section summarises what was discussed in the 5 Use Case workshops. It also adds some material that was generated by the Use Case stakeholders when they were interviewed as part of Work Package 1 on policy and market aspects of CSA adoption. It also adds some essential findings from mapping the literature in Deliverable 1.1 on the topic of CAP and its impacts on the transition to CSA practices.

[9] BEATLES Deliverable 1.1 "Integrated framework of decision-making factors" provides a mapping and analysis of the full range of decision-making factors that affect agri-food systems transition to climate-smart agriculture (CSA). It includes literature mapping and surveys and interviews with stakeholders (farmers, consumers and businesses) focussed on the transition towards CSA practices within the EU.

2. Outcomes of the co-creation workshops

The workshops were successful in laying the ground for co-creation within the BEATLES project. The strengths were in developing the technical descriptions of each Use Case including the value chain components and respective stakeholders. There were robust exchanges identifying lock-ins and levers (including barriers and opportunities) with respect to the ongoing transition towards CSA practices. Aspects of sustainability, policy and markets were included. The reports from each UC workshop are included in this report and follow this section which summarizes the outcomes.

In general, the participants showed a high level of understanding and awareness of climate-smart practices in their individual activities within the Use Case areas. At the same time, it was clear that there are many barriers to change, and these dominated the discussions. Lock-ins are many and they reflect capacity, knowledge, investments, business, subsidies (or lack of them), lack of national guidelines and policies and more. When it came to organic farming (dairy and apple), the importance of the consumer in creating novel product demand was emphasised. When it came to incentives and levers, subsidies dominated the discussions. Here CAP could take on an important role in focusing more on CSA and CA (conservation agriculture) practices.

To summarise the proceedings and outcomes of the five Use Case co-creation workshops the following aspects were extracted from the individual reports filed by the Use Case lead partners. The results are dominated by findings relating to CSA practices and lock-ins and levers affecting the transition to increased implementation of CSA practices. In addition, the workshops introduced aspects relating to sustainability, business and market and policy aspects.

A checklist format in a series of tables is used for clarity and brevity.

2.1 Inventory of CSA practices in the 5 Use Cases

The CSA practices are sorted under a set of categories ranging from energy, biodiversity, animal longevity, animal feed, conservation agriculture, circularity, recycling, manure management, organic agriculture, water resources, innovative markets and data-driven technology approaches.

Table 5 summarises the CSA practices organised under the different categories discussed during the 5 workshops. There are clear similarities with the broader selection of CSA practices listed in Table 4 which covers the most common practices being carried out within the EU based on systematic literature mapping and interviews with selected stakeholders carried out in WP1.

Table 5. Inventory of CSA practices specific to the BEATLES Use Case value chains as identified during the Co-Creation Workshops (the yellow-shaded cells are topic areas; the columns are to be read in a downward direction)

Wheat farming Lithuania	Dairy farming Germany	Pig farming Denmark	Apple farming Spain	Onions & potato farming Netherlands
Energy ⬇	Animal longevity ⬇	Energy ⬇	Energy ⬇	Energy ⬇
Energy savings	Breeding	Energy optimisation in barns using energy saving installations	More efficient machinery for processing	Growers full registration of energy use on farm level
Alternative green energy	Animal health and wellbeing	Energy optimization in fields (reduction of diesel use with reduced tillage)	Renewable energy	Growers calculate greenhouse gas emissions with a calculation module from www.planetproof.eu
New farm techniques	Production adapted to the local conditions ⬇	Biodiversity ⬇	Use of electric machinery (whenever possible)	Growers exceeding the norm need to make an improvement plan; in 2025 they have to meet the norm
Biomass energy generation	Grazing on pasture	Free range production	Biodiversity ⬇	From 2026 onwards all electricity used should be from sustainable sources
Renewable energy partnerships	Good feed efficiency/use of feed by cows	Use of forest areas, setting-aside of lowland and non-productive land	Auxiliary fauna reservoirs	5% lower energy use than the norm
Sustainability practices ⬇	Dual use breeds	Animal feed ⬇	Use of bee hives	Own production of green energy
Organic farming and fertilizers	High share of feed as forage (grassland & clover), less concentrate	Green protein feed	Sheep/horse grazing in apple orchards to maintain vegetation cover	Application of technical innovations for lower energy use
Recycling	Production based on area (restriction of number of cows per hectare)	Degree of feed self-sufficiency on pig farm itself	Cultivation of local varieties	Biodiversity ⬇
Recyclable packaging	Circular economy and regional production ⬇	Conservation agriculture ⬇	Conservation agriculture ⬇	Per 2025 every grower needs to have a farm nature plan
Minimum or no tillage	Regional fattening and processing of meat (organic, raised on grassland)	Reduced tillage	Use of green manures/composts/fertilizers	Per 2024 maintenance of biodiversity and nature elements on the farm is obligatory

Wheat farming Lithuania	Dairy farming Germany	Pig farming Denmark	Apple farming Spain	Onions & potato farming Netherlands
Crop rotation & intercropping	Regional protein sources and feed production	Manure management ⬇	Organic production	Biodiversity strips along fields
Expanded green areas	Use of side products from organic food processing	Frequent slurry applications	Cover crops	Extra crop diversity
Farmer support agreements & discounts	Organic agriculture ⬇	Acidification of slurry (to reduce ammonia and nitrous oxide losses)	Manure composting	Create nesting facilities for animals and birds
Catch/cover crops	Following the stricter Naturland standards compared to EU-organic standards	ESGreen tool	Reduction of crop treatments	Monitoring of biodiversity
Data-driven technology approaches ⬇		Reduction of methane from slurry tanks	Use of apple tree pruning waste	Soil quality & fertilisation ⬇
Precision farming		Opportunities in fertilisation (spreading and production)	Recycling ⬇	Every farmer has to calculate a soil organic matter balance at the farm level. Negative balance not accepted. A calculation tool is available on internet
Farm management systems		Data-driven technology approaches ⬇	Reuse of packaging	A minimum of two mitigation measures should be applied on fields that are susceptible for water and wind erosion.
Soil testing		digital platform to connect farmers with consumers	Packaging reduction	Farmers need to have a fertilization plan for the whole farm, showing that the criteria for fertilization and soil fertility are met.
Climate data integration			Innovative markets ⬇	Growers should register procurement, stock and use of fertilizers for the whole farm
Automated irrigation systems			Sales in local markets (short chain and direct sales)	Growers need to comply with the crop norms for N and P. P is limited based on soil status, for N there are crop-specific norms. N limit for potatoes is 275 kg/ha, for onions 170 kg/ha
			Efficiency in distribution (joint distribution of food)	Water resources ⬇
			Use of locally produced inputs	Growers must have a water plan if they want to irrigate, including

Wheat farming Lithuania	Dairy farming Germany	Pig farming Denmark	Apple farming Spain	Onions & potato farming Netherlands
				irrigation systems used and tools to minimize water use
			Processing with local fruit varieties	Growers must register volumes of water used, per crop, at least every week
			Self-sufficiency of raw materials	
			Data-driven technology approaches ⬇	
			Implementation of computerized order management, stock control and storage	

2.2 Lock-ins and levers affecting the transition to increased implementation of CSA practices identified within the 5 Use Cases

2.2.1 The lock-ins and levers including recommendations reported by stakeholders during the co-creation workshops are outlined in Table 6. Additional factors relating especially to CAP were derived from systematic review in D1.1. and presented in Lock-ins and levers especially relating to CAP (EU Common Agriculture Policy)

The 'lock-ins' and 'levers' associated with the implementation of CAP and the implications for policy, sustainability, and business are outlined in Table 7. These were compiled from the systematic UC stakeholder interviews and literature review in Deliverable 1.1. CAP, in particular, is a source of concern in the implementation of CSA practices. It has the potential to both hinder and promote this transition. It may be the single most important focal point if the EU is going to succeed in carrying out the Green Deal, Farm to Fork and Biodiversity Strategies.

Table 7. The two tables represent policy and institutional, technical, financial/business, social and awareness/collaboration factors. In terms of policy and institutions, clarity of policies e.g. within CAP, alignment of policies, harmonization of strategies, models, methods, tools, and standards (wheat, dairy, pig, apple farming) and coordination of value chain stakeholders with policy-makers (wheat, pig, apple farming) can be discerned as key messages for mainstreaming CSA practices. Training, capacity development, evidence-based research and development/improvement of tools were commonly reported at the workshops as key actions to support technical innovations towards

CSA. The financial factors commonly raised have to do with support to farmers, particularly small-scale farmers, targeting of subsidies for CSA-linked business incentives to support and mainstream CSA (wheat, dairy, apple farming), cost of machinery (apple farming), demand and willingness to pay extra for CSA products (wheat, diary, pig, onion/potato farming), and value chains extending beyond national boundaries (pig, onion/potato farming).

The following list is an indicative summary of the lock-ins and levers discussed in the 5 workshops.

LOCK-INS

- the lack of capacity, knowledge and training on the part of stakeholders hinders progress towards developing CSA practices
- consumer interest is lacking along with understanding and willingness to pay,
- cost of CSA cannot be passed down to the consumer, so subsidies are necessary
- CAP hasn't yet adopted the CSA agenda - CAP tends to defeat the purpose of transitioning to CSA implementation
- EU has no common sustainability model for agriculture
- EU has yet to develop directives dealing with CSAs responding to the Green Deal and Farm to Fork strategies which at present lack implementation components
- National strategies, policies and guidelines are lacking in the area of food system CSA implementation
- EU policies dealing directly with CSA implementation are lacking
- Market interest in food systems built using CSA practices is lacking
- Countries importing from the EU often do not have CSA stipulations and thus are not willing to pay extra
- The value chains are not keyed towards climate change adaptation, GHG mitigation or sustainable production
- Strategic finance for CSA investments from banks is not available
- Stakeholder interaction to create innovative solutions leading to CSA practices is lacking
- LCA carbon footprint analyses have only limited value and don't motivate the investment costs for CSA; they are also not linked to carbon taxes

LEVERS

- Sustainable practices in many cases can be economic/profitable in the long run, in terms of enhancing soil fertility, water holding capacity and building resilience against drought and wind erosion
- Growing customer awareness about climate change is a driver and proper marketing and labelling can help increase the interest in CSA-based products
- Growing customer awareness about healthy foods and eating habits that also are climate friendly can help shift the transitions to increased CSA practices
- Improvements in value chain efficiency with reduced waste and increased recycling all lead to reduced climate change impacts
- Introduction of carbon taxes can be a major incentive to shift towards CSA practices
- The high costs of fossil fuel, electricity and fertilizer force producers to be more frugal and more efficient in their farming practices
- Low costs for digitalisation can provide short cuts towards increasing efficiency and more accurate accounting of resource use
- Stricter laws concerning leakage of phosphorus and nitrogen from fields to water courses reduces the overuse of manure on fields thus reducing GHG emissions
- Revision of CAP holds promise as a central catalyst to achieve the goals of the Green Deal and Farm to Fork Strategies

Table 6. Reported lock-ins and levers from the 5 Use Case Co-Creation Workshops (blue and bright green-color fields, resp.) impeding or fostering development of CSA plus recommendations (light green-color fields)

	Wheat farming Lithuania	Dairy farming Germany	Pig farming Denmark	Apple farming Spain	Onion/potato farming Netherlands
Lock-ins	- Lack of clear national action plans on CSA & sustainable practices. - Lack of evidence-based and scientific basis to targets & strategy. - Guidelines lacking for efficient management of land without compromising sustainability of soil, water, etc. - Digitalization of the sector not receiving proportionate attention. - Goal of 25% ecological farms by 2030 is not being subsidized. - Additional support lacking for smaller-scale farmers or those newly establishing a farm compared to large established farms. - Consumers are unwilling to pay more for sustainably produced grain products. - Lack of business incentives for farmers to prioritize climate smart farming practices.	- Strong agricultural lobby groups dominate the debate on sustainable dairy farming. - Consideration of high milk production as sustainable (low CO_2 footprint/liter) misses other factors such as longevity and biodiversity. - Tank/feed vs. plate debate – with animal husbandry competing with food for humans. - Consumers not always willing to pay extra for products. - CAP subsidy scheme is complicated to understand and apply for by farmers. - German fertilization policies and policies regarding calves are complicated to apply. - Smaller farms are unable to deal with bureaucratic barriers. - The aspects of CAP having high potentials for change are voluntary e.g. reduction of animals/hectare.	- Farmers free to choose different approaches. - Unclear and frequently changing institutional framework. - Process for obtaining support for precision tools for manure application to fields is challenging. - Pig farming not as circular as cattle farming since pig farmers don't need to produce own feed. - No common sustainability model within EU to measure and monitor climate impact from food production systems. - Climate-friendly measures, such as importing feed lowers farm's own footprint but is not more climate-friendly. - Strict regulation of pyrolysis due to concerns regarding long-term effects of substances like PFAS. - Reliance on pesticides e.g. Round Up in conservation agriculture is not sustainable. - Industry largely designed for the production of mostly fresh meat for export. - Lack of focus on carbon footprint of products	- Bureaucracy overload – excessive and growing. - Lack of technical knowledge among producers - Lack of investment capacity and marketing subsidies. - No CAP direct subsidies to fruit growers in Navarra. - Rigid and excessive control of production by authorities - Instead of getting rewards for good performance, organic farmers get extra economic costs and controls. - The new organic production regulation (848) restricts farmers from producing the same varieties through organic and conventional means. - High cost of machinery and inputs for organic production. - Lack of contact between small producers and distributors. - High quality standards for glass during bottling to withstand the transformation process. - More emphasis is placed on the producer side of value chain leading to over production of apples and problems of selling these	- CAP regulation for pillar 1 are very detailed and complicated. - Request for CSA produce is mainly restricted to the Dutch market. Most of onions and table potatoes are exported with little or no request for CSA - Low willingness to support the creation of a separate value chain for Planet Proof produce due to uncertainty of selling under the label - Conflict of interest between value chain stakeholders.

	Wheat farming Lithuania	Dairy farming Germany	Pig farming Denmark	Apple farming Spain	Onion/potato farming Netherlands
			taking national and international impacts into consideration. - Danish carbon footprint is largely in other countries. - Inadequate support to advisors/consultants in supporting farmers with tools and information. - Consumers are not willing to pay more. - Farmers are often busy and may not afford changes in their farming practices. - Conservative farmers are more resistant to climate-smart practices. - Competition makes key stakeholders like Danish Crown difficult to reach and collaborate with. - Advisors/consultants play a key role in disseminating information to farmers but they are profit-making.	- Sector is highly individualistic.	
Lock-ins recommendations	- More innovations could target precision agriculture specifically. - Need more focus on agricultural productivity and resilience. - Innovations needed to combine both value proposition and greener more sustainable practices. - Free and easy to use digital platforms needed to assist farmers to change to CSA practices.	- Climate-friendly agricultural practices need to be economically feasible to facilitate adoption. - Capacity development on grassland use and nutrient management is needed. - Need to improve consumers' understanding on organic, climate friendly agriculture, climate smart dairy farming. - Pricing and investment costs need to be carefully	- Need to also consider reporting of feed consumption to enable calculation of climate footprint. - Need for training and counseling on precision agriculture. - Information campaigns needed to change mindsets and get farmers interested in conservation agriculture. - Reforms such as the climate tax must be easy to understand and not time consuming.	- Need to seek common objectives and join efforts across the value chain. - Political measures needed to encourage both production and marketing across value chain. - Need to develop varieties that are resistant to pests and diseases, and also commercially interesting. - Small organic farmers need sustained support. - Need for manpower and capacity development on management of	- Need to create a separate value chain for Planet Proof products.

	Wheat farming Lithuania	Dairy farming Germany	Pig farming Denmark	Apple farming Spain	Onion/potato farming Netherlands
	- Existing support mechanisms should be more aligned with policy. - Shift from financial to knowledge support needed. - National & EU support to NGOs needed for CSA advocacy. - Need to spread awareness and disseminate CSA practices. - Need for increased collaboration between farmers and scientific consultants and research bodies. - Need to bridge policy and practice. - Need for awareness among farmers and consumers on the economic and environmental implications of CSA.	considered to make sure consumers are willing and able to pay for products.	- Need to consider the entire value chain both within and outside Denmark.	agroecosystems e.g. thinning, pollination. - Storage and processing infrastructures are needed. - Need to explore different technical solutions to optimize production. - Hygienic-sanitary regulations need to be flexible for small producers with diversified activities. - Joint actions by stakeholders are needed to improve commercialization and profitability.	
Levers	- High national commitment for cultivation of winter wheat. - Climate smart agriculture can contribute to sustainable soil organic carbon management and carbon sequestration.	- CAP subsidies keep dairy farmers in business. - Annual third-party audits ensure that organic, social and fair criteria are met by all actors in the value chain. - Public procurement still has a high potential to increase the consumption of organic and fair products.	- There is general agreement that climate smart agriculture is the way to go but the economic implications remain uncertain. - Frequent slurry ejection from finisher barns can reduce nitrogen and methane losses.	- Increasing interest at political level for organic farming. - Apple production in Navarra is supported with about 4 million euros per year. - Rural tourism can add value to organic apple production e.g. through visit to farms. - Local apple varieties can be a resource of great interest in terms of rusticity, adaptation, organoleptic diversity. - Glass recycling cost included in price paid by consumers. - Navarra has good conditions for the	- Resistant varieties can reduce pesticide input a lot in potato (late blight resistance) and onions (powdery mildew). - Seeds suppliers are willing to sell the resistant varieties to farmers who are also willing to grow them. - Certification organisation willing to consider resistant varieties in the criteria.

	Wheat farming Lithuania	Dairy farming Germany	Pig farming Denmark	Apple farming Spain	Onion/potato farming Netherlands
				production of different varieties of apples.	
Levers Recommendations		- CAP needs to be more comprehensive and focus more on promoting extensive grassland use. - CAP needs to be easily accessible for farmers. - Political influence needed for price development in terms of subsidies, transparency, sanctions. - Need to ascertain the effectiveness of subsidies, sanctions, and the combination of both subsidies and sanctions.	- Sustainability report can be used in banks as a requirement for financing. - NGOs can provide valuable input from a consumer perspective but require motivation for participation. - CO_2 footprint based on LCA analyses is important but still at early stages in Denmark. - New initiatives must be voluntary to ensure success.	- Need to encourage the transfer of traditional knowledge on apple production in Navarra to other areas. - Need to share lessons with recycling efforts in other countries e.g. Asturian cider bottles or beer bottles in Germany.	- Need to initiate a pilot - Coalition of the willing' to make trials of Planet Proof value chain.

2.2.2 Lock-ins and levers especially relating to CAP (EU Common Agriculture Policy)

The 'lock-ins' and 'levers' associated with the implementation of CAP and the implications for policy, sustainability, and business are outlined in Table 7. These were compiled from the systematic UC stakeholder interviews and literature review in Deliverable 1.1. CAP, in particular, is a source of concern in the implementation of CSA practices. It has the potential to both hinder and promote this transition. It may be the single most important focal point if the EU is going to succeed in carrying out the Green Deal, Farm to Fork and Biodiversity Strategies.

Table 7. 'Lock-ins' and 'levers' relating to CAP (EU Common Agriculture Policy) with respect to policy, sustainability, and business (derived from interviews of the Use Case stakeholders in the Deliverable 1.1)

Lock-ins	Levers
- CAP is overly broad, and the instruments are too generic. These are often implemented very differently across member states. As a result, CAP is not effective in practice to achieve sustainability goals that CAP is meant to achieve. - CAP promoted biodiversity conservation models in farmland areas are unable to prevent the decline of common farmland bird species in agricultural protected areas. - CAP agri-environmental incentives assume a rational choice approach by farmers which results in unrealistic expectations in policy planning. - Agricultural payments act as disincentives or do not take into account the adoption of sustainability practices in cases where agricultural payments are not specified. - The incentives and disincentives introduced through CAP change over time. For instance, in the case of France CAP favoured both the loss of grassland during 1992-2003 and the restoration or re-expansion of grassland during 2006–2010. - Regional disparity in the implementation of CAP is explained by the the adoption of more sustainable practices in Western and Southern member states than they do in Central and Eastern ones where aid intensity and market conditions result in the biggest added value of CAP in economic terms. - Lack of alignment between tax incentives and CAP subsidies is an incentive for intensive use of fertilizers. - CAP direct payments do not align with the EU food security goals and wider environmental goals. - CAP policy and funding frameworks have not been detailed enough, requiring further coordinated actions at different levels. - The design of Less Favoured Areas (LFA) payments may affect sustainability outcomes as well as the economic incentives of local producers.	- CAP is one-third of the EU budget and can potentially support the promotion of climate smart agricultural practices (CSA) practices. - CAP can act as a driver for behavioural change at value chain and individual farmer levels. - CAP recognizes that increasing or maintaining soil organic carbon (SOC) content under arable farming is a priority. This needs to be tailored to specific local conditions and cultural contexts. - Participatory methods and tools having producers at the centre of developing agricultural sustainability have great potential in improving CAP measures. A more farmer-centred approach that incorporates their own narratives (even family histories) is essential to foster more sustainable farming practices. - CAP contributes to the adoption of more sustainable practices in Western and Southern Member States than they do in Central and Eastern ones where aid intensity and market conditions result in the biggest added value of CAP is in economic terms.

Lock-ins	Levers
- CAP overall is focused on large-scale high-input activities with capital-intensive agriculture which prevents the transition to agroecological farming systems. - CAP does not provide sufficient economic incentives or subsidies and other forms of economic support to prevent soil degradation. - CAP measures lack granularity to tackle diffuse environmental problems such as water pollution. - EU regulatory frameworks for CSA particularly regarding soil carbon sequestration are too generic, having too short timescales, not properly embedded in CAP and unevenly applied across the EU and do not include agriculture in emissions trading.	- CAP support to organic farming after the 2003 reform has been positive. But the effects of support for certified organic production in the form of agri-environmental subsidies is different from that of non-certified organic production, with the former being exclusively driven by agri-environmental subsidies.

2.3 Sustainability aspects

Work Package 3 provided to the 5 workshops an overview of the coming work on developing sustainability frameworks for each Use Case. The approach is to define the practical boundaries for each Use Case in order to carry out Life Cycle Assessments (LCAs) covering social, environmental and economic aspects. The overall approach is illustrated in Figure 6.

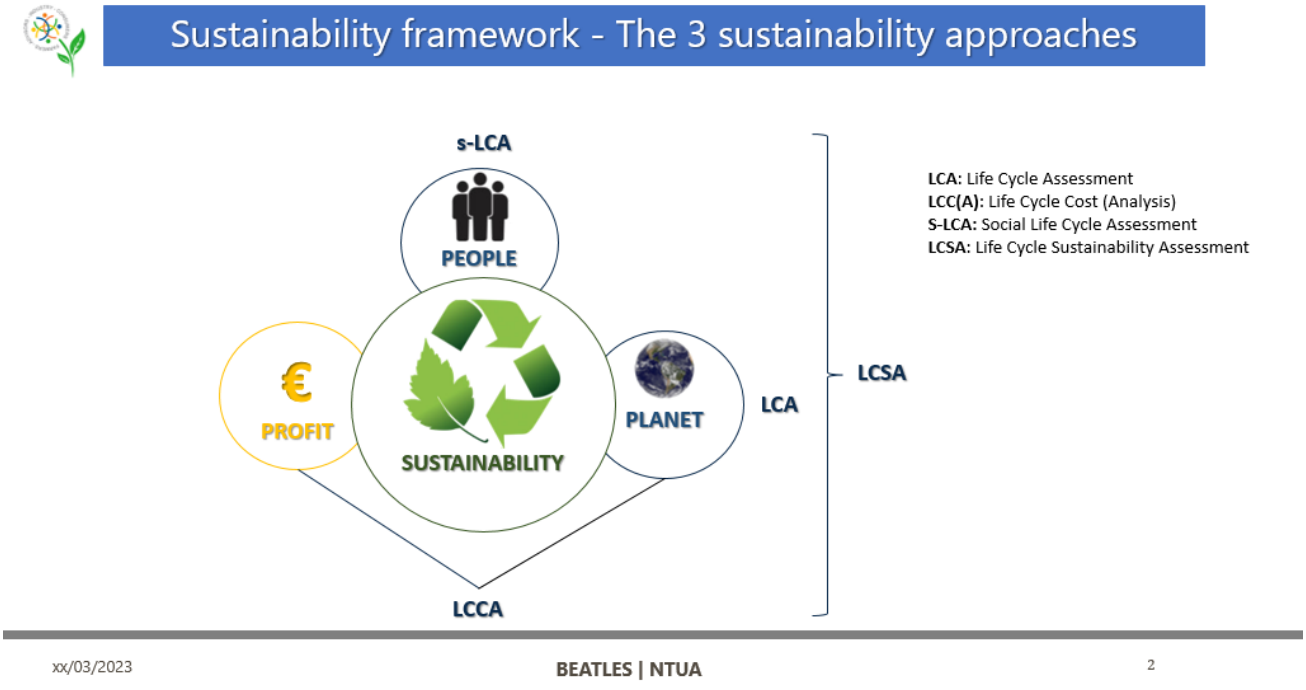

Figure 6. Overall approach in carrying out Life Cycle Assessments (LCAs) of value chains such as the BEATLES Use Cases

The ultimate goal of S-LCA is to promote improvement (or assessment) of social conditions throughout the life cycle of a product. For this reason, it explores the behaviour of the stakeholder organisations making products. It also assesses the social/geopolitical norms of the nations in which the product is manufactured, used and disposed. Qualitive data are

collected though questionnaires distributed to stakeholders. Examples of the questions are as follows:

- *Will the application of CSA practices lead to new job creation?*
- *Are workers affected by climate change-related disasters an important social impact indicator?*
- *Is GHG footprint (CO_2 footprint) an important social impact indicator?*

The first step in carrying out LCAs is to agree on a delineation of the boundaries for the assessment. The drawing of these boundaries was initiated in the co-creation workshops and these have been added to each of the Use Case reports in this deliverable.

2.4 Business and market aspects

Work Package 4 on innovative markets provided to each workshop a brief overview of the tasks and activities to be tackled in collaboration with the Use Cases. The following tasks were listed:

- Identify market segments for the promotion of climate-smart agricultural practices and products
- Develop a fair value proposition for each Use Case
- Co-design alternative business models

The following upcoming activities were highlighted:

- Business model workshops
- Interviews with stakeholders

The discussions during the workshops surrounding the strategies thought necessary to stimulate adoption of CSA practices led to a collection of observations summarized in Table 8.

Table 8. A selection of key messages and recommendations for business strategies (derived from the systematic review in D1.1.)

Suggested business and market strategies to stimulate adoption of CSA practices
• Learning and knowledge exchange need to be facilitated through research and education, experimental farms, training centres for CSA. Farmers need assistance from stakeholders in implementing CSA practices. • Innovation networks, multi-stakeholder networks/ multi-stakeholder collaborative business model, platforms, groups or associations consisting of different stakeholders e.g. policy makers, farmers, consumers, etc have the potential of boosting CSA through the creation of a trustable environment where actors can share and commit, remove economic, legal, and social barriers, create common markets for farmers to diversify production. • A harmonized business strategy for CSA adoption is needed. • Trust and transparency are key factors particularly among network members. This is important for engaging stakeholders and stimulating CSA adoption. • Large investment requirements for CSA innovations make them unattractive. Hence the need to emphasize the environmental and human benefits. Consumers who are aware of environment-friendly products tend to be more concerned about the impact of their consumption on the environment. Similarly, consumers who are aware of environmental challenges, ethical means of production and food safety risks are more likely to prioritize environment-friendly products. • Culture and context are important factors to consider particularly for understanding informal networks and interaction between farmers and other stakeholders within the CSA value chains

2.5 Policy aspects

Work Package 5 on policies and tools provided the following questions to each of the Use Case workshops as an initial step:

- What are the main European policies that influence (limit and favour) the definition of national and regional policies, programmes and plans linked to the transition to CSA and the adoption of related agrarian practices?
- What are the main national and regional policies influencing the adoption of farming practices linked to the transition to CSA?
- Thinking about the criteria set out in those policies (regional, national and European), what are the main barriers/lock-ins to the transition to CSA? What are the main incentives?

Here is the example provided for the Lithuania wheat farming case related to the European regulatory frameworks affecting the Use Case/value chain:

- CAP enhanced conditionality
- Habitat Directive
- Pesticide statistics regulation (revision in the Farm to Fork Action Plan)
- Council Directive 91/676/EEC (pollution caused by nitrates from agricultural sources)
- Trade measures

Follow up in future co-creation workshops will center on the policy aspects.

Use Case Co-Creation Workshop Reports

3. Wheat farming - Lithuania

3.1 Objective of the first co-creation workshop

The main goal of the first workshop on the Lithuanian Use Case was to set the scene for the upcoming years and introduce the objectives of the BEATLES project with a specific focus on the Lithuanian use case – wheat farming. It also served as an important platform to test and complement the existing list of stakeholders to ensure that actors across the value chain are represented, both those more and less progressed in shifting towards more climate-smart practices. The workshop was also an opportunity to expand our knowledge of the existing climate-smart agriculture (CSA) practices in wheat production in Lithuania. The workshop format also allowed to identify the priority items/related to climate-smart agriculture (CSA), as well as barriers, incentives and opportunities related to CSA in the wheat sector in Lithuania.

The workshop took place on the 23rd of March 2023 as part of Lithuanian Economic Forum (an international meeting), with live broadcasting and live translation services provided. The meeting (in person) was available for all event participants, while the broadcast was open online to the public. The workshop was attended by 38 participants in person and multiple others observing online.

The report is structured as follows: firstly, it presents the key insights regarding climate-smart practices and problem areas, lock-ins and levers. Second, it summarises the key insights and recommendations uncovered during the workshop. It then discusses the key gaps observed in the current design of the BEATLES use case, followed by the items to be discussed in the future co-creation workshops planned to 2026.

3.2 Use Case overview

Winter wheat is the most prevalent arable crop in Lithuania. Winter wheat is grown on more than 845,000 hectares[10] of farmland every year (ca. 38% of Lithuania's total arable land), cultivated by medium-sized (100-500 ha) individual farms or cooperatives, or large agricultural businesses (>500 ha). The Lithuanian grain sector is well organized, modern and market-oriented, producing more than 4 million tons of wheat annually[11] which supplies the local food, feed and seed markets, and is the leading national agricultural export. The value chain is illustrated in Figure 7.

[10] Hectares supporting winter wheat production in Lithuania. 845,000 ha. https://osp.stat.gov.lt/statistiniu-rodikliu-analize?hash=8fef6585-0d4a-4b9b-aefa-3cc528a70adb#/ (Section "Area planted with agricultural crops | thousand ha"- "Žieminiai Kviečiai"/Winter wheat- 2022)

[11] "Žemės ūkio augalų derlius | tūkst. tonų / Harvest of agricultural plants | thousand tons 1,2,3", - Žieminiai Kviečiai/ Winter Wheat- 4,124 t per annum. https://osp.stat.gov.lt/statistiniu-rodikliu-analize?hash=8fef6585-0d4a-4b9b-aefa-3cc528a70adb#/

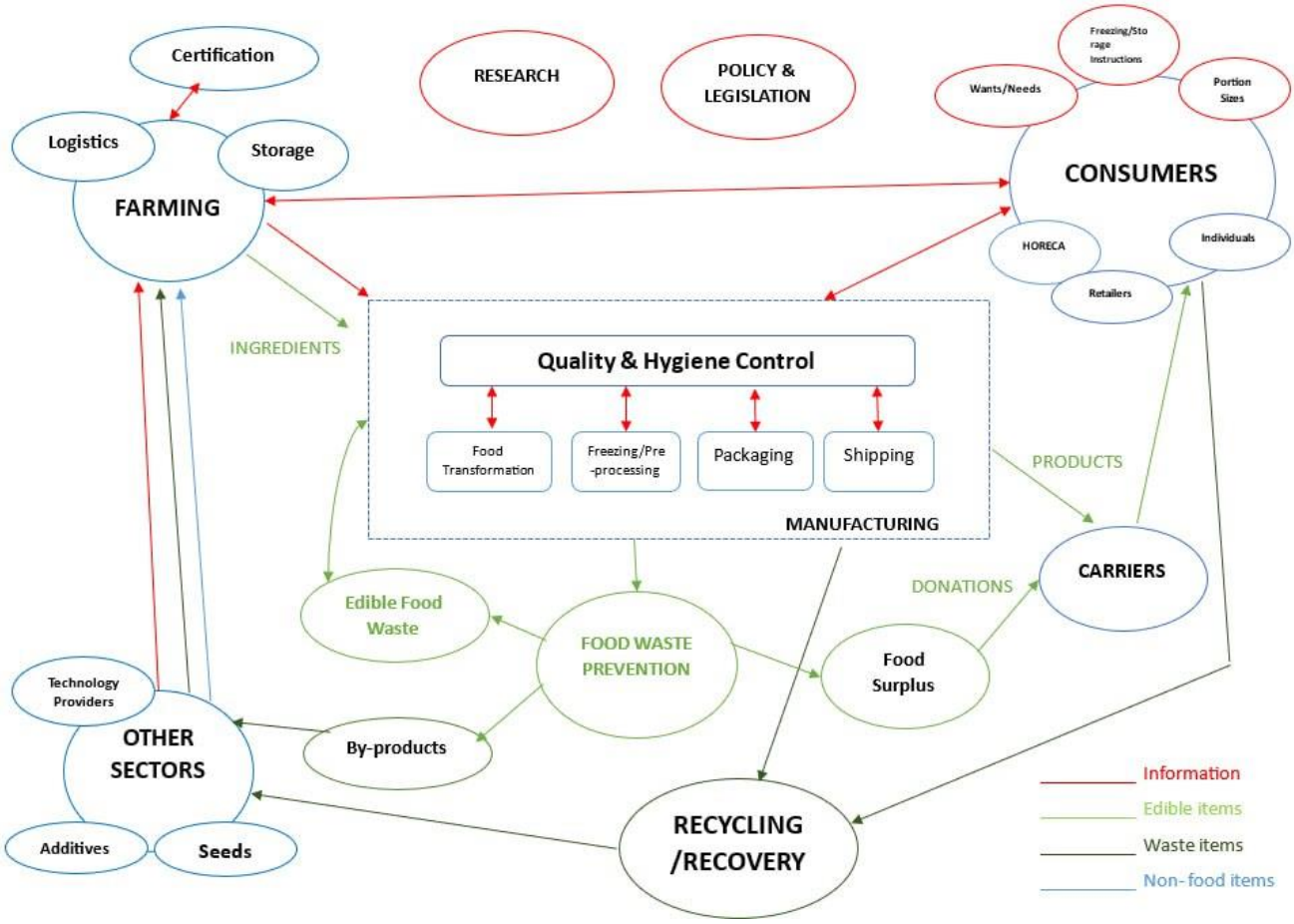

Figure 7. Wheat production value chain and key stakeholders relevant to the project

However, in the context of the national agri-food system and due to the extent of the sector, wheat farming is also one of the main contributors to climate change, environmental degradation and biodiversity loss. Thus, considering raising environmental and sustainability concerns, as well as major international policy initiatives (such as the European Green Deal), systemic change will be required by the Lithuanian grain sector to transition towards climate-smart farming practices. This transition needs to be supported by addressing the 'lock-ins' and barriers withholding or delaying this transition, especially regarding the alignment of farmers' productivity-focused business models and sustainability-oriented regulatory requirements, with regard to current farming practices, farmers' decision making and behaviour.

Lithuania, known for its fertile agricultural lands, provides a significant contribution to winter wheat production in the region. Although the overall number of farms in the country has been decreasing[12], winter wheat, a key staple crop, is cultivated extensively across the country. According to data from Statistics Lithuania, during the year 2022 winter wheat cultivation covered an extensive area of 845,000 hectares. The productivity achieved in this cultivation reached the yield of 4.9 tons per hectare, establishing winter wheat as one of the most productive crops in the country. There is an estimate of 691 organic farms[13] growing winter

[12] "Ūkių skaičius vnt", 2020. https://osp.stat.gov.lt/statistiniu-rodikliu-analize?hash=8f5a548a-8f27-43c6-afdf-cff5a9f07518#/

[13] "Žieminiai kviečiai", 2023. https://www.vartotojai.lt/ekologiniu-ukiu-zemelapis/

wheat throughout the country and wheat comprises 48% of the total yield of organic cereal production[14].

However, these farms producing winter wheat face certain challenges in maintaining high yields while adhering to eco-friendly principles. One of the primary challenges is the management of pests and diseases without the use of synthetic pesticides and fungicides, which requires diligent monitoring and implementing alternative pest control strategies such as crop rotation, biological control, and resistant varieties.

Another challenge lies in maintaining soil fertility and health through organic soil amendments and sustainable practices to ensure optimal nutrient availability for the winter wheat crop. Furthermore, eco farms often face limited access to specialized equipment and technology tailored for organic farming, which can hinder efficient cultivation and harvesting processes. Despite these challenges, eco farms in Lithuania remain committed to sustainable winter wheat production, aiming to balance ecological stewardship with the cultivation of high-quality grains for a resilient and environmentally conscious agriculture sector.

The cultivation of winter wheat in Lithuania possesses significant challenges when it comes to practicing climate-smart agriculture. On top of various environmental challenges such as increasing unpredictability of weather patterns, including irregular rainfall and temperature fluctuations, there are some more foundational challenges that hinder the shift towards smart agricultural practices in winter wheat production: farmer's lack of knowledge and reluctance to change; consumers' unwillingness to pay more for sustainably produced grain products; lack of business incentives for farmers to prioritize climate-smart farming practices, and others. Addressing these barriers from an individual, systemic and policy perspective would encourage farmers in Lithuania to embrace more sustainable approaches that not only mitigate the impacts of climate change but also contribute to the long-term viability and resilience of winter wheat production.

Applying climate-smart agriculture could consequently lead to a reduction in GHG emissions by the whole arable (grain) farming sector as well as improved farm soil health and quality in terms of sustainable soil organic carbon management and carbon sequestration. In addition to a reduced impact of farming on biodiversity and soil quality, the applications of these practices could also have an impact on sustainability-oriented farm productivity and economic performance. And finally, from a social perspective, this would increase the rural community wellbeing and sustainable rural economy development that would make the climate-smart practices more favourable to be adopted by wider communities outside the regions.

BEATLES Work Package 3 provided to the workshop a preliminary framework to assess sustainability including social, economic, and environmental life cycle analyses. Critical to the analyses is the need to delineate a practical boundary for each of the Use Case value chains. These are depicted in Figure 8. Follow-up in the next co-creation workshops will be required in order to agree on such delineations amongst the stakeholders from the Use Case. This illustration is therefore included in this first deliverable as a record and basis for this follow-up.

[14] "Organic crop production" 2021. https://osp.stat.gov.lt/statistiniu-rodikliu-analize?hash=95d8e025-5b0d-4de9-b5ec-9260f82e4c80#/

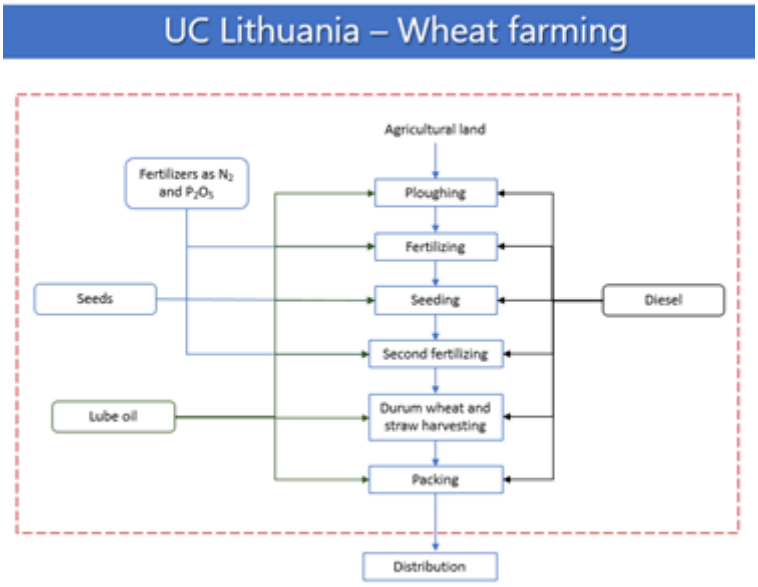

Figure 8. Preliminary delineation of the wheat farming value chain for the purposes of carrying out comprehensive sustainability analyses (social, environmental and economic).

3.3 Current CSA practices

The workshop reviewed presently applied CSA practices under three categories – energy, sustainability and technology-based practices. Figure 9 provides the details of these activities in the wheat farming sector in Lithuania.

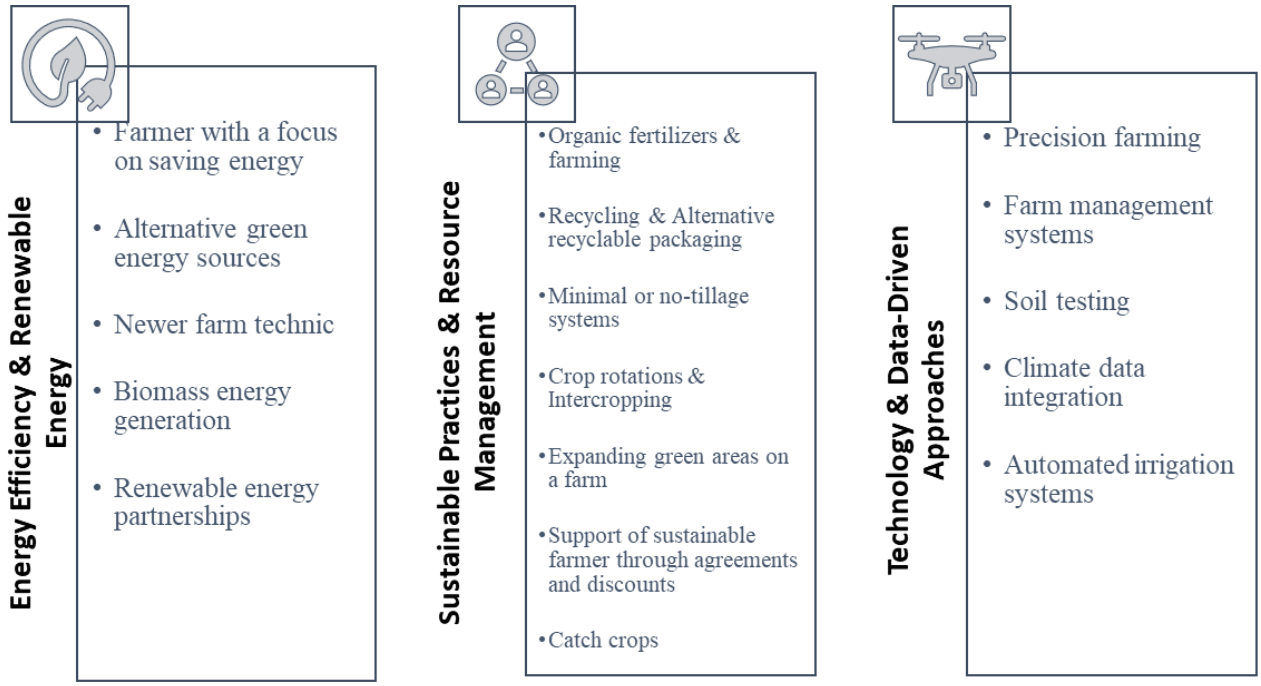

Figure 9. Identified Climate Smart Agriculture practices in the wheat sector in Lithuania

3.4 Lock-ins and levers in transitioning towards CSA practices

Throughout the workshop, different problems and lock-in factors that hinder the adoption and spread of CSA practices were highlighted. Suggestions were also made by participants on how such challenges can be tackled based on experience in other sectors or countries. In this sub-section, the lock-ins and levers are structured around the summarising topics: policy, financial resources, technological innovations, farmer knowledge, awareness, and behaviour.

3.4.1 Policy

Comments related to national and even European policies came up on multiple occasions during the workshop. Participants raised the need for clear national-level policies with a concrete plan for fostering climate-smart agriculture. Participants, including a representative from the Ministry of Agriculture, agreed that currently, there is a vision to move towards more sustainable farming practices and targets set to achieve GHG emission goals. However, what is still lacking is a clear action plan for how it will be achieved. This remains relevant at the farm level as well, as there is no clear understanding of what practices a farmer should adopt to contribute to achieving national sustainability or climate change adaptation goals.

It was mentioned, though, that the existing national policies and strategies for agriculture have important shortcomings in terms of promoting more sustainable practices. The policies lack evidence-based and scientific ground regarding what is being promoted and what targets are set. It was indicated that more focus should be brought to agricultural productivity and resilience. The current strategy lacks a scientific basis and guidelines for managing the land most efficiently and getting the most from one hectare of land without compromising the sustainability of the environment and resources (soil, water, etc.). The digitalisation of the agricultural sector does not receive proportionate attention as well.

3.4.2 Financial resources

Bearing in mind the remarks on the need for a clear national-level agriculture policy, the discussion also covered the theme of public funding. It was discussed that the existing support mechanisms should be more targeted and aligned with the policy priorities and goals we aim to achieve, as the current system does not foster change. The example of ecological farms was provided. The policy sets out the aim to have 25% of farms licensed as ecological by 2030, however, this goal is not followed with the support to achieve it. It was suggested that public expenses, subsidies, and other support should be directed towards this goal. More specifically, public support should nudge farmers to uptake more sustainable practices.

When updating the support mechanisms, participants also suggested providing additional support for smaller-scale farmers or those newly establishing a farm compared to corporations owning huge areas of land. However, the views regarding such suggestions were contested and varied among the stakeholders. In addition, an idea was raised (by a representative of an environmental NGO) to change the *type* of support for farmers and focus more on spreading knowledge, providing training, or analysis related to their farm (e.g. testing soil, the need for fertilisers, etc.). Finally, it was discussed that national or EU-level support for NGOs to do CSA advocacy, networking, and good practice exchange at the European level would be relevant for the stakeholders.

3.4.3 Technological innovations

Technological innovations were an often-mentioned lever that could assist in quicker and more impactful adoption of CSA. Technological solutions can help mitigate climate change by providing better monitoring, inspection, and advisory services to the farmers and using the by-

products, such as methane, to fuel tractors to make farming more circular. It was discussed multiple times during the workshop that agriculture is a quickly digitising sector that is very adaptable to innovative technologies. The following needs for technological innovations were identified during the workshop:

- More innovations could target precision agriculture specifically.
- Innovations could aim at eliminating the negative effects of weather conditions. Farmers could be better informed and prepared to avoid weather impacts.
- Innovations should be designed in a way that incorporates both the value proposition component for the farmer (saves on costs) and, at the same time, directs the farmer towards greener and more sustainable practices.
- An important strand of technological innovations would be the enabling of electronic platforms that help farmers to take up or change their typical practices to be more climate smart. Such platforms should be free of charge, simple to use, generate assessments and provide recommendations on how to improve.

3.4.4 Knowledge, awareness, behaviour

While to policy makers and researchers, climate-smart agriculture has been on the map for already a few years, this is less the case with practitioners and farmers. Thus, there is a need to spread awareness about the purposes and opportunities that CSA creates, as well as to disseminate good practices that work. Additionally, it has been raised that collaboration between farmers and scientific consultants brings better results. This requires competent consulting (and research) bodies that could provide tailored support to farmers. Quality consultations are needed to help achieve goals set out at the policy level where individual farmers can contribute. For example, national-level policy documents foresee measures to reduce GHG emissions at the farm level; however, farmers find it difficult to navigate and select the measures that are relevant to them.

To promote climate-smart agriculture, the suggestion was made to focus on awareness raising and disseminating information on the possibilities, opportunities, and good practices. These are supposed to be not only based on “moral” value to preserve the world but also incorporate the business case, explaining how such practices could make economic sense. Such awareness campaigns should target farmers and the general public to inform both the supply and demand sides of the value chain.

Table 16 in the Annex provides an additional and more comprehensive list of lock-ins and levers derived from the mapping, survey and interview work in WP1.

3.5 Key insights and recommendations

To sum up, the workshop resulted in the following insights and generated the following recommendations for promoting the transition to CSA:

- Emphasis should be not only on sustainable farming but on regenerative and resilient farming
- Increased investment and education of farmers on climate smart strategies and practices are necessary. For this to happen, the following questions should be considered: who should lead and support this initiative? What policies are needed to facilitate this initiative?
- Creating awareness among farmers should be as important as the subsidy schemes designed to support farmers.

- Fostering collective action among farmers at the EU level is necessary. This would grant access to certain networks and information within the EU, ensuring peer-learning among farmers.
- Scientists need to be included in the decision-making process, national-level strategy design, and consultations at the farmer level.

3.6 Gap analysis and items for the next co-creation workshop

This section covers the aspects that were brought up during the workshop and are important to consider in further implementation of the Use Case for the subsequent co-creation workshops. We identify here what has been so far missing in the Use Case and needs to be added.

Firstly, it was clear that the involvement of stakeholders could be further expanded across the value chain by: i) involving more actors beyond primary wheat production, as they provide important factors for supply-demand (e.g. retail, packaging); ii) involving more farmers and stakeholders across the value chain who already employ environment-friendly practices and could share their experiences and explain how certain barriers were solved in their case.

In addition, when designing the data collection tools on climate-smart practices and sustainable agriculture, it is important to consider the end-user factor. More specifically, the demand-supply interaction should always be considered, and attention should be paid to raising end-user awareness on considering the sustainability of purchased goods with environment-friendly consumption (e.g. reducing food loss and waste, considering packaging options, etc). In addition, project activities should keep in mind the needs and attitudes of the consumer and how these could impact the process or motivation of farmers to adopt climate-smart practices.

In the next co-creation workshop, it is needed to further expand on specific aspects covered and dig deeper into discussing them with the stakeholders. For example, there was no time to expand on specific policies (regional, national or EU-level) that are the most relevant to the wheat farming stakeholders in Lithuania.

In terms of follow-up, the Multi-Stakeholder Platform set up will be used to expand stakeholder representation across the value chain (including storage, transport, wholesalers and consumers) and to communicate further with them about climate-smart practices.

3.7 Summary

The workshop entailed a brief presentation of the preliminary results of the analysis of the BEATLES interviews with wheat stakeholders. It also included the presentation of identified specific climate-smart agriculture practices. The presentation in the workshop and the overall Use Case work so far covered mainly the practices in primary wheat production. During the discussion, it was raised multiple times that other stages/actors of the value chain (scientists, food packaging companies, wheat transportation companies, marketing companies, food processing companies) should be incorporated into further project activities as are relevant to the issues covered.

An important point made during the workshop was the importance of the concepts we use when talking about the “greener” or “climate-smart practices” (concepts used interchangeably in the report). Given that multiple concepts are used to describe the intention to move towards more environment-friendly agriculture, the participants raised the idea that clearer distinctions between them should be made. An example of organic agriculture, a more common term in Lithuania, was provided, explaining that organic doesn’t always mean sustainable. In addition, it

was suggested to bring more attention to regenerative agriculture when talking about climate-smart practices. With no single definition of "regenerative agriculture" and interpretations varying between practitioners, it can broadly be defined as "an approach to farming that uses soil conservation as the entry point to regenerate and contribute to the delivery of food production and other ecosystem services"[15].

As workshop participants indicated, CSA is unthinkable without employing efficient and up-to-date technologies and equipment, including farming equipment including tractors. Fortunately, technical innovations are developing rapidly in the agricultural sector, making farming more efficient in work management and in use of resources (water, fertilisers, etc). While no specific technologies related to climate-smart practices in wheat production were elaborated on by stakeholders during the workshop, it was mentioned that no-till farming (agricultural technique for growing crops or pasture without tillage which disturbs the soil) could be considered as such, and more technological solutions tailored for precision farming are needed.

The importance of sustainability as such was contested among the participants. Some said this was an important factor for farms and industry to survive through the recent pandemic and ongoing geopolitical crisis of the past years when the cost of fertilisers, fuel and electricity have increased. It was mentioned that farms that adopted more sustainable and climate-smart agricultural practices were impacted less (e.g. by introducing more circularity into their farm management or installing solar panels for electricity).

[15] EU CAP Network, https://eu-cap-network.ec.europa.eu/events/regenerative-agriculture-opportunities-and-challenges_en

4. Dairy farming - Germany

4.1 Use Case overview

The workshop discussed and verified the various components of the dairy farming value chain as illustrated in Figure 10. The following stakeholders were not present during this first co-creation workshop: consumers, meat processing and cattle fattening farms and farmers with direct marketing (farmers that sell their products on farm directly to consumers as this can be an alternative selling channel for farmers).

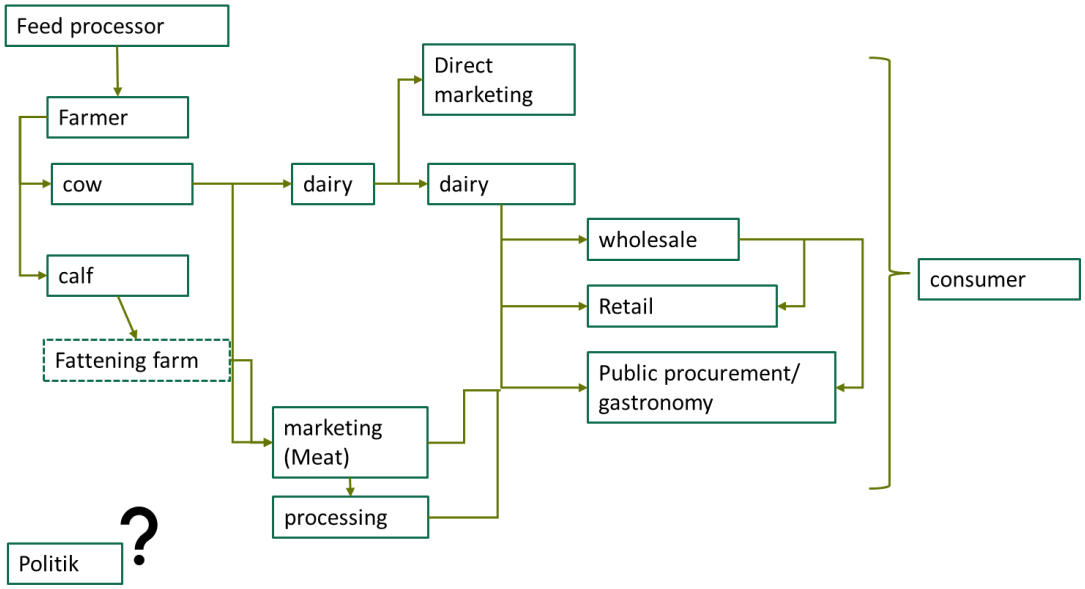

Figure 10. UC components within the dairy farm value chain

4.2 CSA practices within the Use Case

The workshop identified currently used CSA practices (Table 9). The listed practices describe the elements of a holistic climate-friendly production system. The participants wanted to emphasize especially the benefits of grassland and organic dairy production on grassland as a form of climate-smart dairy farming that should be supported. When asked, which of the practices the Use Case should especially focus on, the participants said that the whole bundle of practices (Table 9) is what they perceive as climate-friendly ecosystems agriculture. Some specific measures and practices on their own wouldn't make dairy farming climate-friendly per se.

Table 9. CSA-practices including additions from stakeholders during the co-creation workshop

General CSA topic	Practice
Longevity and high total amount of milk produced during the whole life of a cow (goal > 100.000 liter)	• Breeding • Animal health and wellbeing
Production adapted to the local conditions.	• Grazing on pasture • Good feed efficiency/ use of feed by cows • Dual use breeds • High share of feed as forage (grassland & clover), less concentrate • Production based on the area (restriction of the number of cows per hectare)

General CSA topic	Practice
Circular economy and regional production	• Regional fattening and processing of meat (organic, raised on grassland) • Regional protein sources and feed production • Use of side products from organic food processing
Organic agriculture	• Following the stricter Naturland standards compared to EU-Organic standards (see annex for a comparison)

4.3 System boundaries for sustainability analysis (WP3)

During the co-creation workshop, the different system components illustrated in Figure 10 were verified with the stakeholders using a simplified model of the system to see if certain components were missing. Afterwards, the components in the system provided by WP3 for LCA (Life Cycle Assessment) work were considered. This resulted in the detailed Figure 11 along a proposed boundary line. The components added by stakeholders during the workshop were marked in yellow.

In general, the system referred to is a “Naturland certified” dairy farm that is producing a high share of the feed on grassland and on the local farm which significantly reduces climate change impact.

Figure 11 shows the “Naturland certified” organic dairy system including the system boundaries (in red) and the additions made during the co-creation workshop (highlighted in yellow).

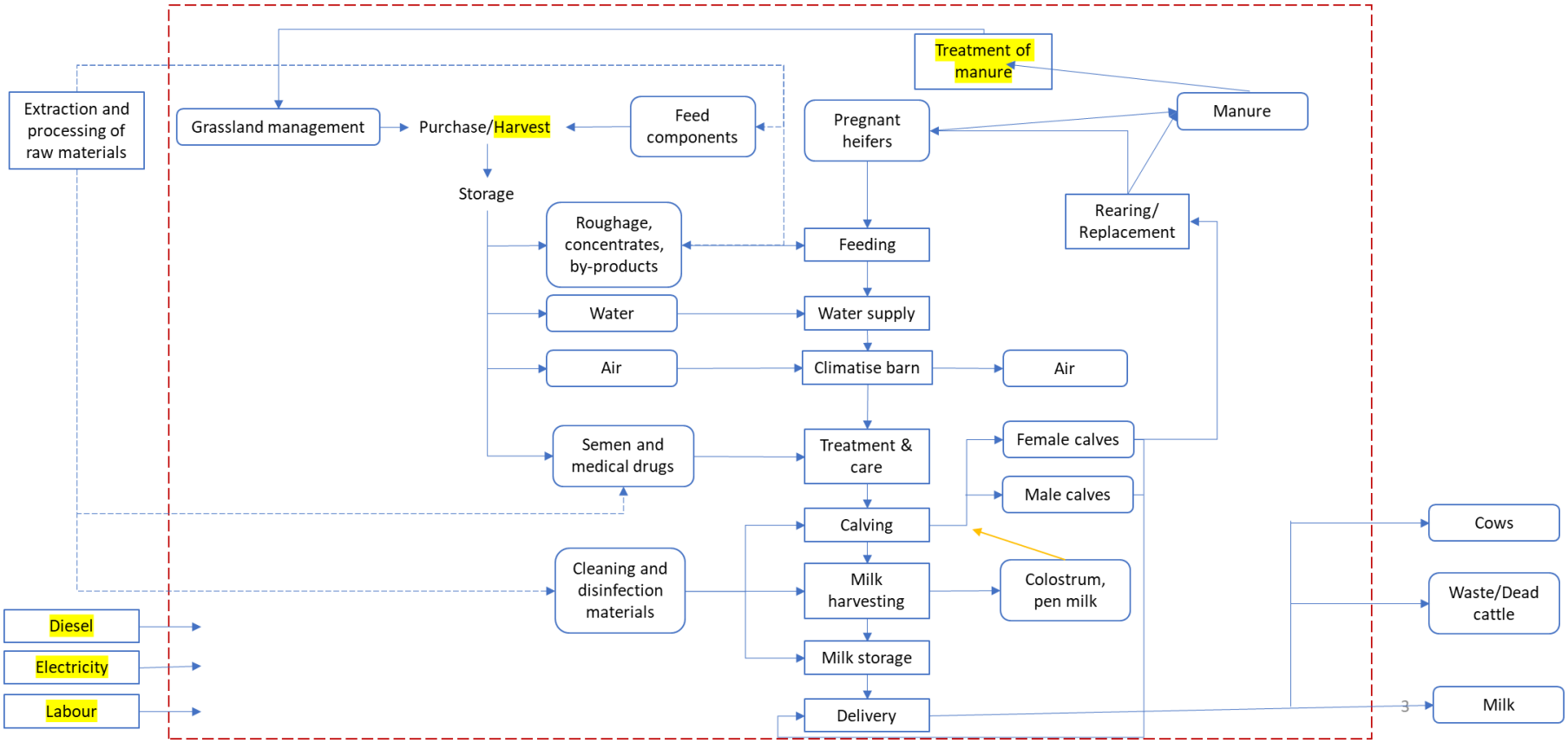

Figure 11. Naturland-certified dairy system including all processes and components with additions from the workshop highlighted in yellow

4.4 Overview of innovative markets (WP4)

WP4 dealing with innovative business and markets was briefly touched upon. More emphasis on this topic will take place as the project progresses. Regarding the Business Modell (BM) Activities, two farmers stated: "*all BM that I have is that I try to make as little (long-term) investments as possible and that I try to not hurt myself because a longer sick leave would mean bankruptcy. Meanwhile I am trying to balance my work so that I have also at least a little bit time left for my family*."

So, there might be room to improve the entrepreneurial mindset in adaption to the reality of the farmers' daily life. It seems to be worlds apart in technical terms, language and time frames, to identify the existing full ownership and responsibility for all activities as an entrepreneurial achievement and endeavour.

4.5 Priority regional, national and EU policies (WP5)

The workshop observed that CAP plays a very central role for dairy farming and farming in Germany in general through providing subsidies to farmers which are essential for their economic profitability (otherwise most farms would not be able to continue production).

German fertilization policies and policies regarding calves are not strict but the subsidies are complicated to apply for. This has created the development of loopholes, especially for bigger conventional farms since these have better support systems to overcome bureaucratic barriers compared to smaller farms.

Parts of the CAP that can have positive impacts on increasing biodiversity and have a lot of potential for change are voluntary, e.g., the reduction of animals per hectare, "4 flowers programme" (diversity in grassland) (AUKM[16], Organic Regulation Pillar 1)

In general, the new CAP subsidy scheme is very complicated to apply for, and the agricultural authorities do not have the capacity to advise all farmers in order to provide maximum possible subsidies. This is due to the complicated new rules and many changes in the wording. It is the first time in the last 40 years that this situation has occurred.

General recommendations for the agricultural policy regarding organic dairy farming:

1. Put grassland first – increase the subsidies and the importance of grassland compared to arable land.
2. Simplify the process to apply for subsidies to make it less complicated for farmers to apply. Use improved digitalization to make this easier for farmers.

4.6 Comparing conventional, EU organic and Naturland organic dairy farming

Differences between Naturland's organic, EU-organic and conventional dairy farming were reviewed during the workshop. "Organic and fair" was seen as a

[16] AUKM (Agrarumwelt- und Klimamaßnahmen) German Agri-Environmental and Climate Action "green agriculture" platform

climate-smart practice. Naturland Organic Standards include restriction of synthetic fertilizer, synthetic pesticides, fungicides and chemical weed control.

The EU-Organic regulation[17] covers several aspects of production. Table 10 provides an overview of the regulations for dairy and cattle production. Based on the legislation, differences between organic and conventional dairy production occur in most cases, such as decreased productivity in organic farming, higher returns per unit product and differences in the suitability and requirements of certain breeds and life expectancy of the cows (Grodkowski et al. 2023)[18].

Table 10. Overview of the EU-Organic Regulations for dairy and cattle farming (Grodkowski et al. 2023)

	What Is Allowed or Prohibited in Organic Farming	Regulation
Breed selection	Local breeds preferred	REGULATION (EU) 2018/848, Annex II part II point 1.3.2 point d
		REGULATION (EU) 2018/848, Annex II part II point 1.3.3
Welfare	The need for high levels of welfare and conditions so natural behavior can be exhibited	REGULATION (EU) 2018/848, pkt. 44
Insemination	Allowed	REGULATION (EU) 2018/848, Annex II part II point 1.3.2
Estrus stimulation	Allowed on a case-by-case basis as a form of treatment	REGULATION (EU) 2018/848, Annex II part II point 1.3.2, point b
Multiple Ovulation and Embryo Transfer (MOET)	Prohibited	REGULATION (EU) 2018/848, Annex II part II point 1.3.2, point c
Animal cloning	Prohibited	REGULATION (EU) 2018/848, point 23
Tethering or isolation of livestock	Allowed on a case-by-case basis after obtaining permission (maximum of 50 animals)	REGULATION (EU) 2018/848, Annex II part II point 1.7.5
Access to pastures	Required	REGULATION (EU) 2018/848, Annex II part II point 1.7.3
		REGULATION (EU) 2018/848, Annex II part II point 1.9.1.1 point e
Litter-free animal housing	Prohibited	REGULATION (EU) 2018/848, Annex II part II point 1.9.1.2 point b
Feed composition	At least 60% of the dry matter in daily rations must consist of roughage, fresh or dried fodder, or silage	REGULATION (EU) 2018/848, Annex II part II point 1.9.1.1 f
GMO feeds	Prohibited	REGULATION (EU) 2018/848, Art. 11, point 1
Dehorning	Allowed in justified cases	REGULATION (EU) 2018/848, Annex II part II point 1.7.8
Castration	Physical castration will be allowed in order to maintain the quality of products and traditional production practices	REGULATION (EU) 2018/848, Annex II part II point 1.7.10
	Required use of anesthesia during castration procedure	REGULATION (EU) 2018/848, Annex II part II point 1.7.9
Milk replacers	Prohibited	REGULATION (EU) 2018/848, Annex II part II point 1.4.1. sub point g
	90 days after birth for bovine and equine animals	COMMISSION IMPLEMENTING REGULATION (EU) 2020/464 Ch. II, sect. 1, Art 2, point a
Use of antibiotics	Prophylactic use of antibiotics is prohibited	REGULATION (EU) 2018/848, pkt. 43
		REGULATION (EU) 2018/848, Annex II part II point 1.5.1.3
	Antibiotic treatment authorized when necessary to treat disease entities	REGULATION (EU) 2018/848, Annex II part II point 1.5.2.2

Naturland's organic standards are based on EU-Organic certification but are stricter and more ecosystem-oriented.

[17] "Within the EU, organic farming laws are unified and strictly enforced. At the level of community law, the most important legal document relating to organic production is Regulation (EU) 2018/848 of the European Parliament and of the Council of 30 May 2018 on the Organic Production and Labeling of Organic Products and Repealing Council Regulation (EC) No. 834/2007" (Grodkowski et al. 2023).

[18] Grodkowski, G et al. Organic Milk Production and Dairy Farming Constraints and Prospects under the Laws of the European Union. Animals 2023, 13, 1457. https://doi.org/10.3390/ani13091457

The following aspects differ when comparing Naturland and EU regulations for organic dairy farming:

- Maximum number of animals per ha Table 11

Table 11. Overview of allowed stock densities in the Naturland Standard

Animal stocking density is related to dung units. A dung unit (DU) is defined as the animal stocking density with an annual output of faecal matter and urine containing not more than 80 kg nitrogen or more than 70 kg of phosphate (P_2O_5).

Species or strain of animal	maximum number of animals per hectare
equines over 6 months (equidae)	2
calves, veal calves	5
other cattle under one year old	5
male cattle 1 - 2 years old	3.3
female cattle 1 - 2 years old	3.3
male cattle over 2 years old	2
breeding heifers	2.5
fattening heifers	2.5
dairy cattle	2
cows not suitable for breeding	2
other cows (e. g. mothers or foster mothers)	2.5

- **Legumes in arable farming:** Minimum percentage of legumes in the main crop (e. g. clover grass) in crop rotation is required, a prerequisite which must be complied with before additional organic fertilisers can be purchased. Legumes bind the nitrogen from the air and are the most natural form of fertiliser. Growing legumes enriches the variety of crop rotation and reduces disease pressure.
- **Fertiliser:** No synthetic fertiliser may be used and additionally:
    - Clearly defined requirements of organic fertilisation: Total amount of fertiliser (from the farm's own livestock and external fertilisers) restricted to 1.4 DU/hectare = 112 kg nitrogen/hectare/year. (Higher amounts are only permitted for special crops, e. g. in vegetable growing.)
    - Permissible amount of commercial organic fertiliser or farm manure which may be purchased is restricted to 0.5 DU/hectare (except where required for certain specialised crops)
- **Pasture access:** Dairy cattle/mother cows, sheep and goats: compulsory pasturage during the growing season (applies to all new farms as of 2018; with a transitional arrangement for farms which are already members of Naturland up to the end of 2029 at the latest).
- **Feed produced on farm:** Self-sufficiency with farm-grown fodder is to be aimed at; at least 50% of the fodder must come from the farm itself (nutrient cycle) – also in the case of pigs and poultry! (or from a farm which supplies fodder under a contractual agreement approved by Naturland and, in return, applies the manure from its partner's farm to its own fodder crops).
- **Silage feed**: Prohibition of all-year-round feeding with silage for mother cows and dairy cows
- **Animal welfare checks** to increase the life span of the cows which also results in lower CO_2 emissions per liter milk. A stronger focus on cow longevity is put in organic farming. But in this special region, conventional

breeding is tending more in this direction and often similar genetics are used.

This Use Case "Naturland organic and fair" dairy is located in southern Germany, close to Austria. The dairy is a cooperative of around 1800 dairy farmers of which 650 are producing according to Naturland or Demeter standards. Additionally, the dairy products are certified according to Naturland fair standards which focus on fair trade relationships throughout the value chain with a special focus on fairness for producers. All actors that participated in the co-creation workshop and in the UC itself are part of a Naturland fair-certified supply chain for organic and fair dairy products. Therefore, all products are strictly organic and annual third-party audits are conducted to ensure required organic, social and fair criteria are met by all actors in the value chain.

Two additional points were discussed:

- Debate and constantly upcoming discussion about the societal preferences and potential threat coming from the **increased consumption of plant-based milk** – among the participants a controversial debate arose since some stakeholders feel highly threatened by the development of the vegan market while others see this as a minor threat to their business with organic and fair dairy products.
- The **major crosscutting issue of the workshop** was: how can the complex topic of climate-friendly and organic dairy farming (based on grassland) be communicated to the consumer in a way that consumers are willing to pay higher prices for climate-smart organic and fair products and at the same time stop supporting unsustainable production? The question was raised as an overall challenge to climate-smart organic and fair dairy and couldn't be easily resolved during this workshop, thus requiring follow-up.

4.7 Lock-ins and levers

The following challenges in relation to the above-explained climate-friendly practices:

LOCK-INS

- **Knowledge is limited:** To produce efficiently and sustainably, grassland needs to be adapted to the different local conditions (more extensive the less fertile the soil is); good nutrient management requires extensive knowledge by the farmer/advisors.
- **Economic feasibility restricted:** Climate-friendly agricultural practices need to be economically feasible, otherwise farmers will not adopt them; one major aspect is the price and effort of the practice/system itself but also the willingness of consumers to pay an extra price for the products.
- **Consumer knowledge limited:** Consumers lack a clear definition and knowledge of what organic or climate-friendly agriculture is. Consumers can then become victims of greenwashing attempts. Common sense is also missing regarding the definition of climate-smart dairy farming to answer the question which type of milk production system should be supported (e.g. are cows feeding on grassland/pasture better than cows kept in barns?)
- **Controversial public perspectives:** The agricultural lobby in Germany is very strong and dominates the societal debate about sustainable dairy farming by only considering cows with high milk production as sustainable. Since the

CO_2 footprint per liter milk is low, this creates a wrong picture since other factors such as longevity and biodiversity through pastures are also important factors for sustainable dairy farming.

- **Advantages of dairy production on grassland and from by-products of the food industry:** The ongoing debate that animal husbandry is often competing with food for humans suggests that a lot of the resources that go into producing animal feed could be used instead for human food. This is highly discussed within German society and is an argument for young people to become vegan. On the other side, if milk is produced only from grassland and feed from by-products from food industry, it can have a positive effect on biodiversity through the maintaining of extensive grassland helping preserve the cultural landscape. The challenge centers around consumer communication regarding benefits and disadvantages of vegan vs dairy consumption.
- **No willingness to pay higher prices:** Consumers lack an appreciation for grassland dairy farming in the form of willingness to pay higher prices for extensively produced products.
- **Lack of product transparency for consumers:** Consumers are not given information about the production systems of the milk products they buy. They don't know if the product was produced on pasture making it environment friendly. Organic labels might give a hint but not for EU-Organic so most consumers are not aware of all the connections.
- **Impacts of political situation:** The current (world-) political situation and resulting high inflation is forcing consumers to spend less money on foodstuffs.
- **Competitive products from abroad:** Competitive milk products from countries outside of Germany where rules and expectations towards environmental protection are less strict and where labor costs are less, lead to lower prices on the German market.

In a parallel discussion online, some participants discussed the challenges and potential solutions regarding the marketing of organic products. Results are summarized in Table 12:

Table 12. Findings from the online discussion regarding challenges in the adoption of climate-smart practices

Challenges for the marketing of organic products	Possible solutions	Responsibility
Lack of awareness and knowledge regarding organic and fair standards and production	Consumer education e.g., via campaigns	Policy makers; farmers and retailers
	Combining subsidies with sustainability criteria and harder sanctioning for practices with negative environmental effects (still open questions: what is more effective: subsidies or sanctions?)	Policy makers
Organic products are too expensive	True cost calculations to raise awareness and educate why organic products are more expensive. Bottom-up and top-down: not only consumers alone are responsible for a transformation of the food system (through paying more for expensive products or making informed choices), but also politics also need to navigate and influence the price development (subsidies, transparency, sanctions)	Consumers, policy makers

Table 17 in the Annex provides an additional and more comprehensive list of lock-ins and levers derived from the mapping, survey and interview work in WP1.

4.8 Gap analysis

The following gaps will need to be addressed within the Use Case (evidence, value chain components, stakeholders, experts):

- Inclusion of the meat industry, local fattening farms and meat processors
- Consumers – inclusion of consumer groups
- Inclusion of different retailers e.g. general as well as those specialized in organic products

4.9 Key insights and recommendations

- Communication to society about the differences between organics and conventional production systems is a key to increase the willingness to pay.
- The BEATLES project should consider that results from the organic Use Cases cannot be simply compared to the conventional Use Cases and reflection on how to bring the different perspectives together should be done
- Stakeholders from the Use Case are interested in exchanging with retailers and consumers about their perspective on organic agriculture and to understand better why there is such a low willingness to pay for high quality products that are good for the environment.

4.10 Items for the Multi-Stakeholder Platform and next Co-Creation Workshop in 2024

- Timing for the second co-creation workshop - after November 1, 2024 in order to accommodate farmers' growing and harvesting schedules
- The "in person" meeting format was good – it would be interesting to bring in more representatives from retail and consumer side to have a good discussion – maybe with professional moderation
- Results from this Use Case should be in a later step compared with the views and opinions from other dairy farmers from other regions in Germany because the current way the Use Case is built up is very specific for the region.

4.11 Summary

This report summarizes and documents the results from the first co-creation workshop in the Use Case organic and fair dairy in Germany. Some participants attended the meeting online while the majority participated in person. The workshop discussed the definition of climate-smart agriculture in the context of this organic and fair dairy Use Case and challenges in the implementation of climate-smart organic practices with a special focus on societal and political barriers. The main outcomes of the workshop were:

- Climate-smart dairy production consists of a mixture of extended animal longevity and enhanced life-day performance (through breeding and enhanced animal welfare), production adapted to the region (e.g. grassland, dual purpose breeds, area-based livestock husbandry, high share of forage in feed), circular economy and regional production (local protein sources, use of by-products from food industry as feed) and high organic agricultural standards (such as the Naturland standards).
- A major challenge is weak consumer knowledge and perception of organic and climate-friendly agriculture and related (lack of) choices for climate friendly but potentially more expensive products. If EU Green Deal goals of 25% Organic Agriculture are to be met by 2030 focus has to be set on consumer awareness to activate farmers to continue and strengthen their conversion efforts.
- Policies such as the CAP should be more comprehensive, more accessible for farmers and focus more on promoting extensive grassland use.

5. Pig farming - Denmark

5.1 Use Case overview

Figure 12 provides an overview of the Use Case value chain components from feed production, animal farms, slaughterhouse, wholesale, and consumption plus the linkages with research advisory services, policy, and technology provision. The value chain includes feed producers, pig farmers, slaughterhouses and butchers, retail, technology providers, consumers, advisors, researchers, and policy makers.

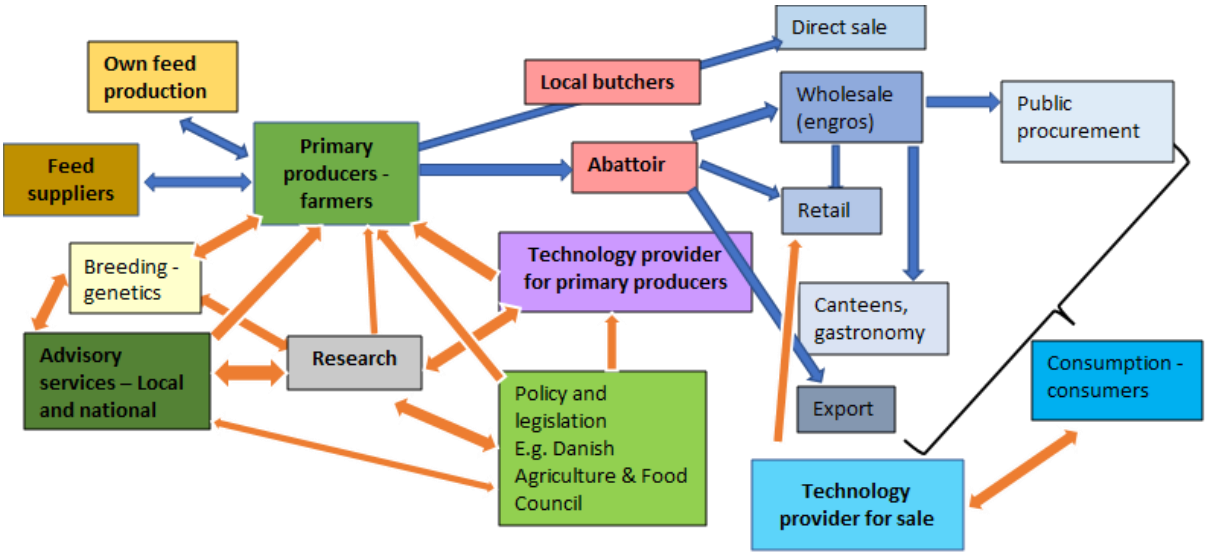

Figure 12. Value chain components in the Danish pig farming Use Case

5.1.1 Gaps and missing stakeholders in the value chain

Danish Crown Group (DC)[19] is the largest meat-processing company in Europe and a key stakeholder. DC is difficult to engage in cooperation with the other 'high level' stakeholders like SEGES Innovation[20], probably due to competition or resistance to share business strategies.

NGOs can provide valuable input from a consumer perspective, but also these organisations are difficult to include as they have developed their business into more of a consultancy service, and therefore require payment for participation.

Retailers are also missing in the value chain of the Use Case especially considering the current debate and work of introducing a sustainability or climate label into the stores. However, there is a member of the group working with increasing transparency for consumers on the products (infotainment on the products via direct link into a video link of farmers). According to the UC stakeholder YARA[21], challenges also lie in retail - when the farmer buys fertiliser, the climate does not

[19] https://www.danishcrown.com/en-gb/

[20] https://en.seges.dk/

[21] https://www.yara.com/

count and therefore YARA focuses on the large food producers (Arla[22]/DC) and the retail sector. There is a need for traceability down to the individual producers who buy climate-friendly fertilisers. CO_2 footprint based on LCA analyses will become more important, but the development and work with LCAs are at an early stage in Denmark (i.e., the results are not yet implemented in products in shops). SEGES is working on a project on climate-neutral rye bread, wherein the entire value chain is analysed.

5.2 Value chain CSA practices

The topics cover:

- Biodiversity (in terms of type of production, organisation, and use of forest for free-range pigs, set-aside lowland and non-productive land)
- Green protein for feed
- Degree of feed self-sufficiency (focus on crops for own consumption)
- Conservation agriculture (CA) practices and energy optimisation in barns and fields (energy saving installations and reduction of diesel use due to reduced tillage)
- Frequent slurry application
- Acidification of slurry
- ESGreen tool https://www.seges.dk/esgreentool
- Reduction of methane from slurry tanks
- Digital platform to connect farmers with consumers
- Opportunities in fertilisation (spreading and production)

5.3 Lock-ins and levers

Both barriers and drivers were discussed in a joint context.

DC rewards farmers who use various measures on the 'climate pathway', but feed efficiency is the only documentation they ask for, as well as information on types of crops. In the future, feed consumption must be stated so that the climate footprint is also calculated. The day a sustainability report can be used in a bank as a condition for financing, it will make sense to pay for such a report. There are challenges surrounding the financing of new technologies mainly dealing with precision practices. This is a general problem since many farmers are willing to acquire precision tools e.g., for allocating manure and they understand the economic and climate benefits, but they are often slowed down by the financial process. When the technology has a central role in calculating CO_2 tax and hence clearly illustrates the benefits and when a climate report is provided for the funding options (subsidies and bank), then the implementation will speed up.

All practices have advantages and disadvantages and there is a lack of knowledge or rather a lack of a knowledge chain. This includes information and education on using e.g., GPS equipment or other smart technology. It was suggested that the responsibility of disseminating knowledge lies with advisors/consultants, but then the barrier could result in economics, as advisors/consultants are running businesses and not very often get external funding to offer free courses for farmers. But perhaps they should?

[22] A dairy company and cooperative with facilities in several countries. https://www.arla.com/

Challenges often arise because there is a lack of knowledge or advice at a specific stage, and then the process can stall, which is critical for the development of the entire value chain and can result in solutions or compromises being made at the expense of both the economy and the environment. Precision agriculture requires a lot of digital insights and processing of data, education, and counselling. Producers may not always have the time or incentive to invest, and the technology is therefore not yet fully exploited.

The potential of CA was discussed, and the possibility of assessing challenges for producers in a case study in the project. There are many different varieties within CA practice. That is, you can be a full line CA practitioner, or you can adapt some of the approaches/techniques. This 'freedom' can both be an advantage but also a barrier, as the political frameworks (agricultural reform), and getting familiar with these new regulations (e.g., 'varying frameworks'), can make it difficult to navigate within for the farmer. Conservation agriculture may rely on the use of the pesticide glyphosate ROUNDUP, and this is not sustainable due to it being phased out. This means that the farmers need to find alternatives.

Challenges with export and changes in the market were also discussed. The problem is also that too many piglets are going out of the country (approx. half go to Germany and Poland), processed meat is decreasing, and fresh meat is increasing in Europe. The fresh meat market is booming, but the opposite is true for processed meat. Biocover[23] has had a dialogue with DC, who want more documentation if they are to include their technology. If it can reduce CO_2 on e.g., wheat production, they can join. Arla's model has lots of other parameters. It was discussed that in relation to the EU there are many confusing parameters that make it difficult with a unit model. It is much more difficult to make a model with pigs than cattle because the latter is more circular, in the sense that milk production circulates manure, i.e., they have a high grass and crop production which is used as feed, compared to pig farmers that don't necessarily need to produce their own feed. ARLA's sustainability model has been in the making for many years, and DC's 'Climate pathway'/LCA model is not as far along.

Table 18 in the Annex provides an additional and more comprehensive list of lock-ins and levers derived from the mapping, survey, and interview work in WP1.

5.4 Preliminary results from the stakeholder interviews (WP1)

The preliminary results from the interviews with the Use Case stakeholders show that:

- Factors such as age and education, attitudes, farm size, perceived costs/benefits associated with the practices, influence behaviour while other factors, such as gender and household size do not play a major role.
- Most importantly, adoption of climate-smart agriculture practices does not depend solely on farmer characteristics but on the behaviour of other value chain stakeholders, such as advisors, industry players, policy makers and consumers.
- Social norms, information sources, extension and advisory services, and policy framework significantly affect farmer transitions to CSA practices.

[23] https://stateofgreen.com/en/solution-providers/biocover/

- The variables that explain farmer adoption of CSA practices could provide the foundation for research, strategy, and policy implementation to incentivize and promote wider uptake.
- The current policy frameworks are insufficient in the case of sustainability driven behavioral change (even less for digital and smart agriculture).
- EU policies still support unsustainable behaviour.
- EU lacks policies that support technology adoption in agriculture.
- A significant body of research shows that still today CAP favors or is not able to avoid outputs with negative climate impact.

5.5 Value chain boundaries for sustainability analyses (WP3)

It was observed that Life Cycle Analyses (LCAs) are difficult to perform from the data that stakeholders can provide, as they represent very different areas of the value chain.

Climate and sustainability labels will probably become part of the products, but the challenge is LCA analyses, transparency for the consumer, etc. and the many other types of schemes and labels that are currently in place. PEF - European scheme labelling was also discussed, and there must be a need to be able to move up in category for it to provide an incentive to be adopted. YARA has carried out a European study on willingness to pay extra for climate impact-reduced meat and there are significantly more in southern Europe than in Denmark that are willing to pay more. ARLA could also be interesting, even though they operate with a different production system.

BEATLES WP3 provided to the workshop a framework to assess sustainability including social, economic, and environmental life cycle analyses. Critical to the analyses is the need to delineate a practical boundary for each of the Use Case value chains. These are depicted in Figure 13. Follow-up in the next co-creation workshops will be required to agree on such delineations amongst the stakeholders from the Use Case. This illustration is therefore included in this first deliverable as a record and basis for this follow-up.

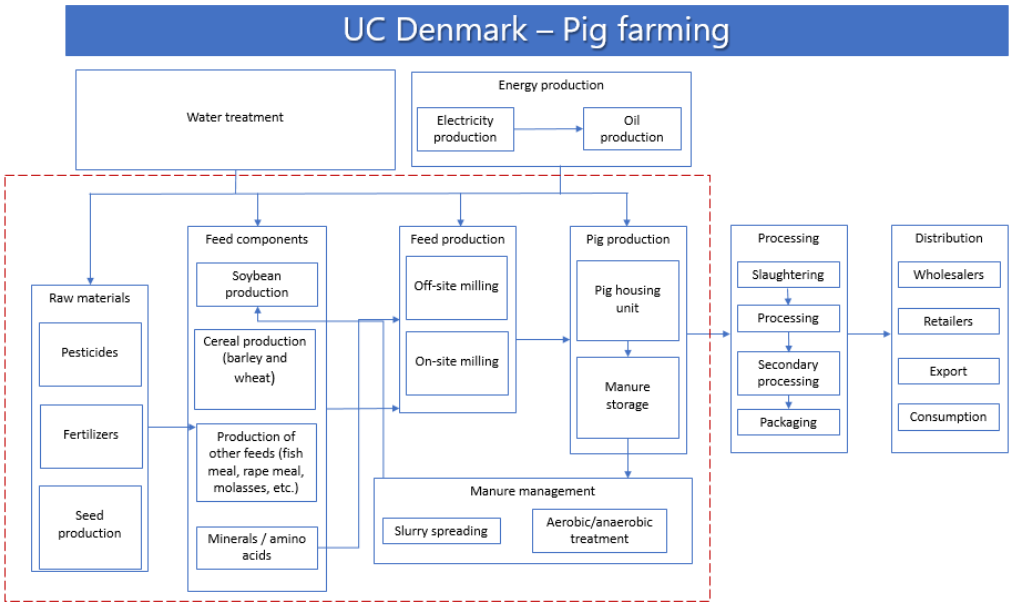

Figure 13. Preliminary delineation of the pig farming value chain for the purposes of carrying out comprehensive sustainability analyses (social, environmental and economic).

5.6 Brief treatment of innovative markets (WP4)

WP4 was introduced, describing its three main objectives as well as the planned next steps in this WP:

- Identification of market segments for the promotion of climate-smart agricultural practices and products
- Develop a fair value proposition for the Use Case
- Co-design of alternative business models

5.7 Priority regional, national and EU policies (WP5)

5.7.1 EU policies

5.7.1.1 CAP strategic plans

The following three links were provided for the stakeholders:

CAP Strategic Plans

https://agriculture.ec.europa.eu/cap-my-country/cap-strategic-plans/approved-csp-0_en?f%5B0%5D=document_country_document_country%3Ahttp%3A//publications.europa.eu/resource/authority/country/DNK

Animal by-products Regulation

https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32009R1069

Common organisation of the markets in agricultural products

https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32013R1308&qid=1684315999992

5.7.2 Regional and national policies

The agricultural reform in 2023 related to the new period of CAP is the key policy that farmers adapt to, outlined by the Ministry of Food, Agriculture and Fisheries of Denmark – The Danish Agricultural Agency and is taking its exit in CAP. To strengthen the role of European agriculture in the future, the CAP has evolved over the years to address changing economic conditions and respond to the demands and needs of citizens. The Common Agricultural Policy 2023-2027 entered into force on 1 January 2023. Support for farmers and rural stakeholders in the 27 EU Member States is based on the CAP legal framework for 2023-2027 and the choices set out in the CAP Strategic Plans approved by the Commission. The approved plans are designed to make a significant contribution to fulfilling the ambitions of the European Green Deal, the Farm to Fork Strategy and the Biodiversity Strategy.

5.7.2.1 The agricultural reform:

https://lbst.dk/tvaergaaende/eu-reformer/landbrugsreformen-2023

5.7.2.2 Legislation of pig production:

https://www.retsinformation.dk/eli/lta/2015/1148

https://www.retsinformation.dk/eli/ft/199912L00037

https://svineproduktion.dk/viden/paa-kontoret/love-_regler-og-standarder

5.7.2.3 Food safety:

https://eur-lex.europa.eu/legal-content/DA/TXT/?qid=1466151939539&uri=CELEX:02002R0178-20140630

5.7.2.4 Animal welfare:

https://en.foedevarestyrelsen.dk/animals

5.8 Overall comments from stakeholders

Priority items were brought forward during the workshop, including agreement on a system boundary of the value chain and specific CSA practices and problem areas. The most important factor was financial concern, CO_2 tax and the lack of consistency in political frameworks. Political frameworks and demands for regulation and legislation change too quickly for farmers to have the necessary steadiness for implementing practices. The importance of a more timing-predictable policy framework was also discussed. Challenges for producers are often that field plans and cultivation strategies cannot be very long-term, as new guidelines and requirements often get in the way. Conservation agriculture (CA) requires a wholehearted effort to be successful and provide results that benefit production, the producer and biodiversity. As CA requires that the mindset is fully focused on CA throughout production, it is important and exciting to introduce new farmers to these new types of farming. They need to see the idea and take it forward in their lives and on their farms, which is where education and agricultural schools come in. The challenges of playing it safe versus taking a risk were discussed in terms of liquidity and the fact that new initiatives must be voluntary to succeed. You should not be forced to do something, and it requires information.

It was stated that there are two things that can change that: the political framework of EU and investments. In addition, it was discussed how finances can be returned to the industry if a climate tax is implemented. It was also discussed that the economy is crucial as the consumer does not want to pay more, what should be subsidized in the future, only new technologies or also all the old ones? Convenience was also

discussed - does the farmer have time and can he manage to make changes? Even if he is subsidised - is the profitability in place in the longer term? A general comment from stakeholders is that it 'needs' to be as easy (convenient) as possible. New adaptations must be easy and not time consuming, but the fact and issue is that new habits take time, and farmers are not very patient.

It was discussed that there is a lack of focus on carbon footprint of products that takes both national and international impact into consideration. The challenge lies in the fact that the Dane as a consumer is one of the biggest climate culprits as a large part of the carbon footprint is in other countries' accounts, where especially fossil fuels are the barrier. If a CO_2 tax is introduced, the farmer is ok with changes if there is still an economy in his farm. Some climate-friendly measures, such as buying feed abroad, lower the farm's own footprint, but it is not climate-friendlier, hence it can be a flawed incentive structure.

Regarding more discussion on a climate tax and economy, the producers can in principle choose to buy all their feed abroad if the CO_2 tax becomes too expensive and if they do not want to support a more sustainable form of production. The group however agreed, that either you adapt to climate smart practices, or you are out of business. All the stakeholders agreed that adaptation to climate smart practices is the right way to go, but there are many concerns about economic consequences. The government has stated that a CO_2 tax will not reduce jobs, but there is a concern if this is the same as risking to go out of business. They see it as a 'dictate' that either you adapt, or you are automatically out of business.

The proactive and innovative farmer will more quickly adapt because he can see the positive benefits both from an economic, production and personal perspective, but the older, more conservative farmer may have much more resistance because it may appear as a 'dictate'. Green accounts, that contain information on at least 3 areas (nutrients, pesticides and energy), and slightly cheaper financing must be the driver, but green accounting must be the basis for being able to borrow money. The account that the farmer provides, must contain a large focus on green transition and solutions to be granted a loan. CO_2 must be sequestered to become neutral and if climate-smart technology is used, it must give a return on green accounting and thus an incentive to have a 'licence to produce'.

According to comments from the stakeholders, pyrolysis is currently the only way to sequester carbon from pig slurry in a more permanent way, but it is necessary that the framework conditions to make it attractive are present. For now, the technology is available, but the regulations are harsh - and they need to be, because the product is not investigated/evaluated, the long-term effect has not been proven, and based on the concerns regarding PFAS in the underground (soil and hence groundwater, which is our drinking water reservoir), biochar is an approach with high potential in capturing CO_2 but is still very new. To ensure that PFAS is removed during pyrolysis, there are harsh regulations and requirements for documentation. This means that a sort of simple CSA initiative, such as pyrolysis, is easily complicated. This is a general barrier; initiatives easily being too complicated. For now, one must apply for dispensation for every single field receiving biochar and that is unsustainable. The biomass from slurry in biogas production will never be anything other than a waste product, as fibres are difficult to spread, the mass is therefore relevant as a source of biochar. It is necessary that there are no PAHs and PFASs etc. in the biochar, therefore all plants must be inspected frequently. Legislative barriers are also a challenge outside Denmark so one must wait until legislation is in place in other countries as well.

5.9 Summary and follow up

The workshop covered where the challenges lie and covered large parts of the value chain. The interaction throughout the value chain is important, the consumer must be willing to buy the product, but the political framework, or rather the predictability of it, is crucial to give producers "peace of mind" to work in a more sustainable direction.

It is difficult to look at Danish pig production in isolation, as the entire value chain needs to be considered (fields, biogas, unproductive areas, feed production versus buying, energy production, etc.) and all these areas affect the production of pigs. A farmer is not just a farmer anymore. Considering how much more he will focus on, there are many areas in which he can implement CSA. Livestock production can never be climate-neutral, and therefore production and associated technologies must be considered as an overall focus area in production. This places demands on the food producer of the future, and education is therefore an important element.

Several items were discussed for further development within the Multi-Stakeholder Platform and the next Co-Creation Workshop in 2024 (follow-up agenda items). Organizing online seminars on specific topics was suggested including invitation of other relevant stakeholders, that may not be interested in 'full line' participation within the Use Case. Proposed topics involve management, leadership, and large investments if we are to do something about pig production itself. Although you may be a pig farmer, there is scope for action, e.g., regarding GHGs like nitrous oxide. Also, education and inclusion of education of farmers as well as investment opportunities are relevant topics in future discussions. The proposed solutions will be addressed in the next workshop. A field trip to a CA (conservation agriculture) farm was also suggested to get more inspiration from a primary production perspective.

It was discussed how within the Use Case to accommodate the financial incentives that are the major barrier for farmers. ARLA's model is the first incentive model where the most important factor is nutrient use efficiency in relation to yield, but the challenge is that it does not measure how much yield there is based on feed units, and that the climate footprint of the fertiliser does not count either. For a pig model, the focus should be on minimising nitrogen, phosphorus, nitrous oxide, and methane emissions at all costs. DC (Danish Crown) calculates impact based on the pig unit itself, and SEGES would like to develop the tool together with DC, but it is important that it is not just again another new model. An additional challenge is that DC is not interested in co-operation with SEGES due to competition.

Stable framework conditions are necessary, and challenges exist with consultants resisting because they will lose hours when different technologies become implemented. The challenge of overuse of nitrogen and lack of control of manure fertiliser application in relation to the norm was discussed. Legislation reduced the incentive by being removed, which increased the sale of commercial fertiliser overnight. There is great potential in precision fertilisation (with commercial fertilisers), but it requires a change in behaviour as a surprisingly small proportion of farmers use the technology. The barriers remain unknown and YARA is keen to investigate this further. The challenges are possibly that it requires an app for registration and some processing, and despite SEGES having made it easier a few years ago, it has not moved as many over as expected. This could also be an opportunity for a behavioural study in these projects. It was agreed among stakeholders, that the general challenge with applying technology is perhaps often to have time to use it and become a good user (requiring time for education). Without that the technology will not be used and becomes a wasted resource.

6. Apple farming - Spain

6.1 Use case overview

Figure 14 provides the value chain components in this BEATLES Use Case.

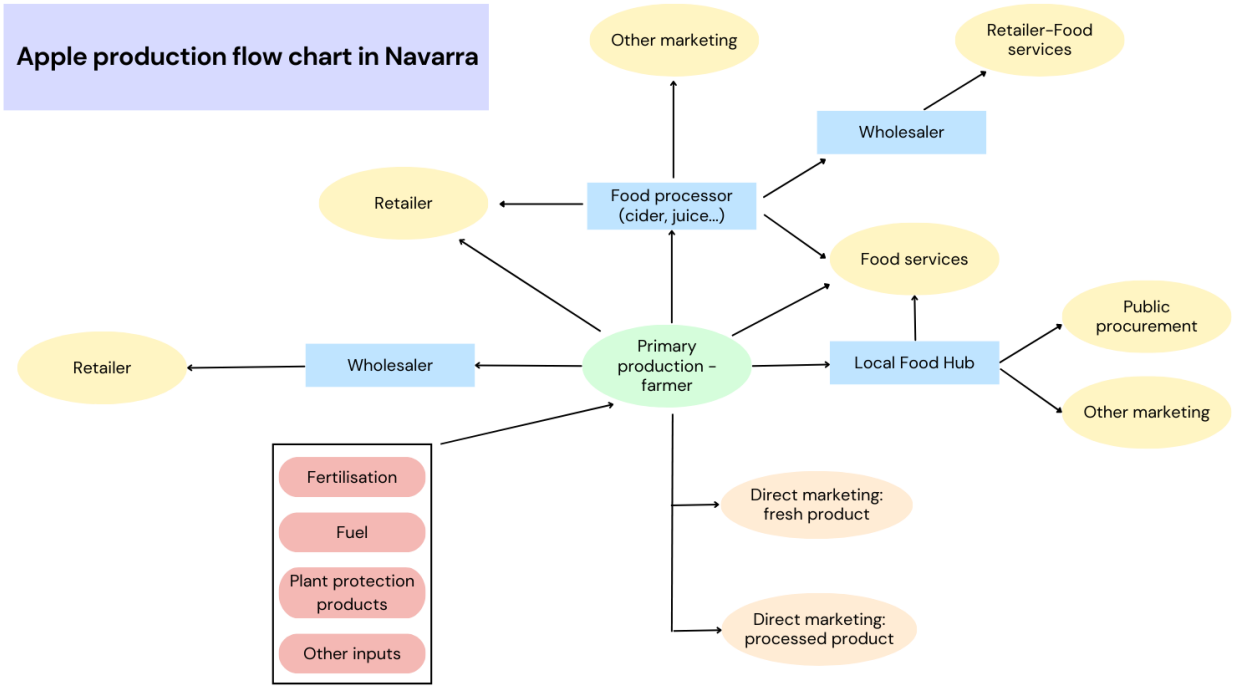

Figure 14. Apple production flow chart in Navarra.

6.2 CSA practices

The CSA practices that exist within organic apple farming in Spain are the following:

- Organic production
- Processing with local fruit varieties
- Self-sufficiency of raw materials
- Sales in local markets (short chain and direct sales)
- More efficient machinery for processing
- Vegetable covers
- Renewable energy
- Auxiliary fauna reservoirs
- Reuse of packaging
- Efficiency in distribution (joint distribution of food)
- Manure composting
- Use of beehives
- Sheep/horse grazing in apple orchards to maintain vegetation cover.
- Use of locally produced inputs
- Packaging reduction
- Implementation of computerized order management, stock control and storage.
- Use of green manures/ composts/ fertilizers

- Reduction of crop treatments.
- Use of electric machinery (whenever possible).
- Cultivation of local varieties
- Use of apple tree pruning waste.

6.3 Lock-ins and levers affecting the transition to CSA practices

6.3.1 Lock-ins

The following lock-ins (barriers) hinder the transition towards CSA practices:

- **Practical factors:**
  - Lack of technical knowledge.
  - Knowledge about production costs and sales prices (profitability) is necessary.
- **Environmental factors:** floods, drought.
- **Political factors:**
  - Lack of financing in general: lack of investment capacity, investment aid, marketing aid.
  - Bureaucracy overload
- **Organizational factors:** there is a need to seek common objectives and join efforts.

6.3.2 Levers

Various levers (drivers) exist that can influence the transition towards more CSA practices within the organic apple farming industry.

- **Individual/organizational drivers:**
  - Economic: investment in more appropriate technologies
  - Sector/ industry organization
  - Technical support: More suitable varieties in each area and knowledge about their management.
  - Activity too diversified (sometimes, lack of time…)
  - Improvement of knowledge about specific management programs.
  - Improvement of knowledge about sustainable packaging.
  - New ideas on processes (R&D&I)
  - Process profitability
  - Hygienic-sanitary regulations in force: flexibility.
- **Systemic drivers:**
  - The need for greater appreciation of the products by consumers.
  - Access to new markets.
- **Political drivers:** need for public support and subsidies: equipment/infrastructure/machinery/digital investment.

Table 19 in the Annex provides an additional and more comprehensive list of lock-ins and levers derived from the mapping, survey and interview work in WP1.

The following stakeholders were interviewed to generate the results presented in Table 19:

- Primary apple production (varieties for fresh consumption and cider production).
- Apple processing (outsourced and own): juice, cider, compote.
- Distribution (local, large-scale distribution)
- Marketing (direct sales, short supply chains, export).

6.4 Sustainability (WP3)

The PPT provided on the WP3 life cycle assessment was presented. Participants were informed about the data that will be requested to perform the analysis. This was discussed and doubts were answered. Further details are to be shared with participants.

WP3 provided to the workshop a framework to assess sustainability including social, economic and environmental life cycle assessment. Critical to the analyses is the need to delineate a practical system boundary for each of the Use Case value chains. These are depicted in Figure 15. Stakeholders will continue discussing within the MSP and the next co-creation workshops to agree on the system boundaries. This illustration is therefore included in this first deliverable as a draft and basis for this follow-up.

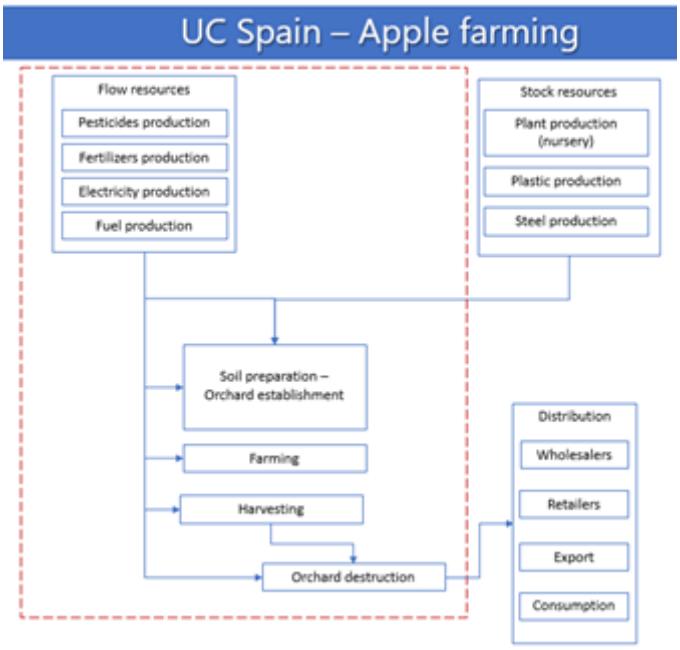

Figure 15. Preliminary delineation of the apple farming value chain for the purposes of carrying out comprehensive sustainability analyses (social, environmental and economic)

6.5 Business model innovation (WP4)

WP4 was introduced and the main objectives outlined:

- Identify market segments for the promotion of climate-smart agricultural practices and products
- Develop fair value proposition
- Co-design alternative business models

Participants were informed that during 2023 a series of interviews (May-December) and business model workshops (May 29 – June 9) will be held. Exact dates are to be determined.

6.6 Policies influencing the Use Case (WP5)

After introducing the concepts of "soft" and "hard" policies participants were asked the following questions:

What are the main European policies that influence (limit and favour) the definition of national and regional policies, programmes and plans linked to the transition to CSA and the adoption of related agrarian practices?

- CAP

EU Regulation 2018/848, on Organic Production and the labeling of organic products.

- Legislation related to Fruit and Vegetable Producer Organizations (OPFH):
  - Delegated Regulation (EU) 2017/891, of the Commission, of March 13
  - Royal Decree 532/2017, of May 26 (BOE no. 129, of 05/31/2017)
  - Execution Regulation (EU) 2017/892, of the Commission, of March 13
  - Regulation (EU) 1308/2013 of the Parliament and of the Council, of December 17
  - Hygienic-sanitary regulations
  - Food safety regulations

What are the main national and regional policies influencing the adoption of farming practices linked to the transition to CSA?

- Rural Development Program of the Government of Navarra (RDP).
- Provincial Decree 13/2023, which regulates organic agricultural production.
- Financial aid to fruit and vegetable operating programs and funds.
- Hygienic-sanitary regulations
- Food safety regulations

Thinking on the criteria set out in those policies (regional, national and European), what are the main barriers/lock-ins to the transition to CSA? What are the main incentives?

The following accounts were given by participants in response to the policy related questions:

Jokin Resano – Government of Navarra

“In Navarre there are no CAP direct aids to fruit growing. The aid that fruit growers receive comes through the RDP. Specifically, by sub-measure 10 (agri-environmental. This year, for the establishment of green roofs), sub-measure 11 (aid for organic farming. This year, there will be producers who will receive no aid, due to lack of budget), and sub-measure 16.2 for pilot projects”.

Javier Mendía – Gumendi

"Regarding organic apple production, political measures should be taken throughout the entire value chain to encourage both production and marketing so that both increase harmoniously, since an oversupply can be counterproductive."

On the other hand, Javier perceives a great rigidity within the production control, and even an excess of it. He considers unfair the variety development system and the legislative framework for commercial regulation, development of plant material, etc. He considers that farmers rights are violated, that large companies and seed and phytosanitary companies are favoured, which have excessive profits, and, in the same way, private certifiers.

Pedro Gumiel - Gumendi

"Direct measures should be created to encourage conversion to organic production."

"Regarding organic apple production, it is important to develop varieties that are resistant to pests and diseases, and also commercially interesting."

Aitor Etxeandia – Agricultural engineer

He adds that, both for the people who produce and for the technicians who support them in their work, there is an excessive and growing associated bureaucratic work. The procedures are becoming more and more arduous and complicated.

Lander Sagaseta - Organic apple producer (table, cider, transformation)

He considers that organic producers have extra economic costs and controls, instead of incentives for "doing it well/better".

It seems necessary to take action to promote organic farming, consumption and raise awareness among people.

Nino - Organic apple producer

He considers that in the last years there have been advances at the political level in relation to organic production and that producers are more aware about environment care.

He demands greater support from the EU for small farmers.

Carlos Marzo - INTIA

He says that the new organic production regulation (848) does not allow the same producer to grow varieties of similar appearance simultaneously in organic and conventional production. This is intended as a measure to prevent fraud but can be detrimental to the promotion of organic production and to producers who are expected to progressively convert to CSA.

Juanma Intxaurrandieta – INTIA

Juanma, as a policy expert, mentions measures in relation to organic fruit growing included in the new RDP (Rural Development Programme). He informs that the apple production OPCHs (Organisations of Fruit and Vegetable Producers) in Navarra receive around 4 million Euros per year.

6.7 Key insights and observations

The following is the outcome of group discussions by participants:

6.7.1 Apple production

Current situation and challenges

- Apples can be produced throughout Navarra
- Crop instability and lack of quality

- Lack of knowledge on agroecosystems
- High pest and disease pressure
- Lack of manpower
- Geographical dispersion of the producing sector
- Lack of associationism in the production sector
- High cost of machinery and inputs for organic production

General remarks and propositions

- Complement farming activity with rural tourism initiatives, visits to farms
- Dignification of agricultural work
- It would be necessary to promote other fruit productions in Navarra (there is a potential)
- Necessary research, experimentation and technical knowledge in management issues (thinning, pollination, etc.)
- Great heritage of local varieties that can be a resource of great interest (rusticity, adaptation, organoleptic diversity). Necessary awareness, dissemination, experimentation and technical knowledge.
- It is necessary to take advantage of the existing knowledge in the areas that traditionally produce apples in Navarra and pass it on to producers in other areas.

6.7.2 Apple storage and sizing

Challenges and needs

- Post-harvest diseases
- Storage and processing infrastructures are required
- There are no calibration machines available
- Lack of contact between small producers and distribution (MercaIruña)
- The north of Navarra is far from services and infrastructures

6.7.3 Transformation

Propositions and needs

- Creation of publicly owned initiatives piloting centers
- Creation of technical production itineraries to focus production on different purposes (fresh, different transformations), so that resources can be optimised when producing (e.g. the product devoted to transformation has less value, but the same production costs)
- Flexibility of hygienic-sanitary regulations for small producers /with diversified activity
- Reuse of packaging should be applied. There are lock-ins, such as the logistics involved, the difficulty of washing, and the fact that the quality of the glass must be very high to withstand the transformation process over and over again (they are not the qualities that are used now). The glass recycling cost is included in the price paid by consumers (Ecoenves business). As opportunities, there are reuse case studies, such as the case of Asturian cider or beer bottles in Germany. Bottled cider production has the advantage that the production-marketing-return circuit would be short.

6.7.4 Marketing and supply

Current situation and challenges

- Apples are produced throughout Europe (handicap due to competition)
- Stagnant demand for apples in the market
- Price instability
- Oversupply of fresh apples (more interest on the producers side).
- Difficulties to find organic and local fruit in points of sale
- Organic apple: lack of price gap compared to other differentiations and the big brands marketing
- It is perceived that consumers are not willing to pay more to be eco/local.
- The problems are not in production but in commercialization
- The sector is highly individualized, joint actions are required to improve profitability (eco apple production)
- Privileged situation in Navarra (potential to produce, wide variety and diversity), but commercially there are many barriers.

General remarks and propositions

- It is necessary to encourage consumption in communities.
- The consumer needs more transparency in food prices (nobody knows the intermediate margins in conventional marketing chains).

6.8 Field visit

The day finished with a visit to the INTIA experimental farm in Sartaguda.

Firstly, Carmen Goñi, an INTIA technician, presented the pest, disease and weed warning station. It is a collaborative crop health information management system operating for more than 30 years. Its objective is to offer timely, precise and real information on pests, diseases and weeds to allow the best control strategies to be adopted at all times.

The information is disseminated through a public and collaborative website with different possibilities of interaction depending on the user's profile. There is also a mobile application.

Carlos Marzo, an INTIA technician explains the trials that INTIA is developing on this farm and others, and the work carried out around apple production:

- Trials with apple varieties in organic production (Sartaguda farm). Its vigor, productivity, adaptation to the environment, and hourly costs of its management are studied.
- Trials with cider apple varieties (Doneztebe/ Santesteban farm, in the north of Navarra), conservation planting of local varieties and conclusions of the Toki Pommes project.

6.9 Summary

The workshop was very participatory with broad representation of the entire value chain of organic apple.

In relation to policy issues, there seems to be a widespread feeling that aid is not directed to small production and consider that these should not only support primary production but also marketing, especially for the oversupply of organic apple that currently exists. Participants also noted that the bureaucratic tasks are excessive and increasing, as well as unfair fees for the work of certification and

control of organic production that should be aimed at encouraging through less bureaucratic burden and through better financial compensation to those who produce more sustainably.

Regarding the working session to delve into the greatest difficulties, needs or strengths of the entire value chain of the apple, the main needs identified are that currently the difficulties are more in the marketing of apples than in their production. The following actions were recommended by participants: the need to inform consumers about the differences between the two productions, the need to support collective initiatives in the production, processing or marketing of apples, the need for relaxation of health and hygiene regulations for small transformations, and the need for technical support to promote the reuse of packaging. The great heritage of local varieties as a resource of great interest was emphasized.

Participants agreed to discuss the problem related to the storage of apples.

A suggestion was made to hold the next BEATLES co-creation workshop at INTIA's Juansenea farm in Doneztebe/ Santesteban in the north of Navarra. This will allow participants to learn about the trials that are implemented there.

7. Onion and potato farming – The Netherlands

7.1 Use Case overview

The Use Case examined technical aspects of the production at the growers' level and the markets and policy aspects influencing the value chain.

The workshop began with a round of introductions. During the introduction the question was raised about the definition of climate-smart agriculture (CSA). And about the scope: do we only look at the Netherlands or also wider, as much of the Dutch agricultural production is exported to many other EU and non-EU countries. Also, food security was mentioned as an important aspect which in the opinion of some of the participants needs to be part of CSA. Dutch agriculture is still operating on the principle established after World War II: No hunger ever again, food security in other words. CSA should not endanger food security, that was the concern mentioned by some of the participants.

For the Dutch Use Case we focus on the following technical aspects of CSA: use of pesticides, soil and water management, energy consumption and production. All these aspects are included in the "On the way to Planet Proof" certification scheme. And we will also consider the export markets in the UC, as exporting products is an important activity for many stakeholders in the onion and potato value chains. The two value chains are different, the onion value chain is more export-oriented than the table potato value chain. And requirements for sustainable production are almost non-existent for exports outside Europe.

After the introduction and initial discussion, we presented the project, activities and expected results with the ppt's provided by the other WP's. Then we presented a short summary of the results of the interviews and surveys.

7.1.1 Identification of value chain partners and gaps

At the start of this topic, we asked all the participants to identify their position in the value chain, directly operating in the value chain or in the context. This gave insight into missing participants for the UC. We also asked for missing links in the chain, all meant to make the picture complete and get the needed information to add missing partners/links to the UC. The categories of stakeholders represented at the workshop are the following:

- Suppliers are e.g. suppliers of seeds, pesticides/fertilizers/equipment.
- Advisory and services include extension services, contract workers, transporters.
- Handling mostly comprises packaging and washing.
- Buying, handling and selling often is in the hands of one company.
- Policy comprises national and regional policy organisations.
- Category 'other': what links are missing in the picture, that we need to include in the UC?

Based on the exercise, it was concluded that focus should be on a few more stakeholder categories in the group: a representative of the Ministry of Agriculture and a NGO, and 1 or 2 extra representatives of the potato industry. And a representative of a new/niche player in the value chain (Onze Markt). Onze Markt (www.onzemarkt.nl) is a startup company. A 'consumer movement' en food label, aiming for a more 'honest' and transparent food system, bringing sustainable products to the supermarket, informing consumers about the share of the consumer price that goes to the different parts of the value chain.

7.1.2 Identification of boundaries of the value chain

Stakeholders were asked to what extent they influence/impact farmers and other value chain stakeholders regarding CSA activities. The results reflects the opinion of the group and does not mean that there are no other ways of impact between stakeholders. For instance, impact of the government funding (fundamental) research on CSA. The results of this exercise are illustrated in Figure 16. Stakeholders without direct influence on the value chains are outside the UC.

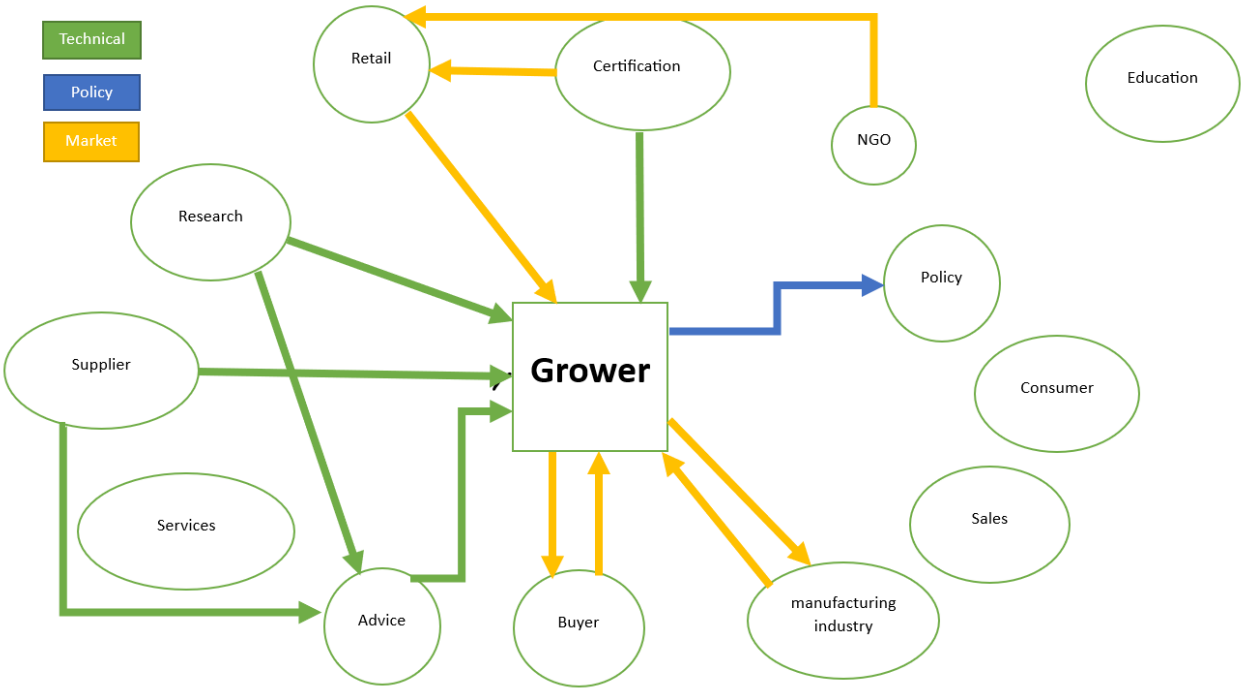

Figure 16. Influence and/or impact on stakeholders in value chain

BEATLES Work Package 3 provided a draft framework to assess sustainability of CSA including social, economic and environmental factors. Critical to the analyses is the need to delineate system boundaries for each of the Use Case value chains. These are depicted in Figure 17. These boundaries will be further discussed by stakeholders at the next co-creation workshops to agree on the limits. This illustration is therefore included in this first deliverable as a record and basis for this follow-up.

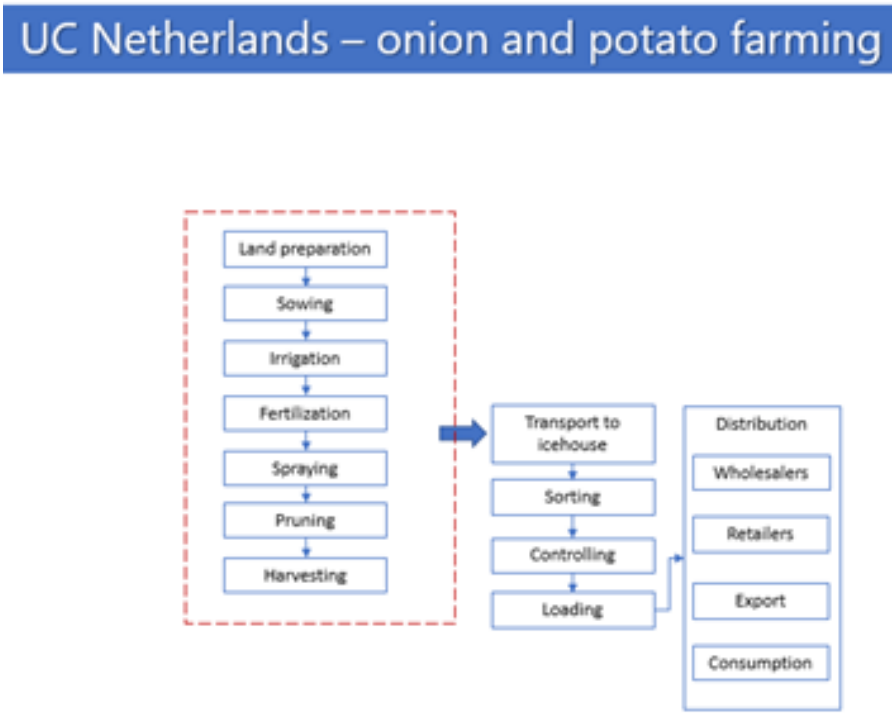

Figure 17. Preliminary delineation of the onion and potato farming value chains for the purposes of carrying out comprehensive sustainability analyses (social, environmental and economic).

7.1.3 On the way to "Planet Proof"

The Dutch UC and the associated value chain operate under the Planet Proof label (PP). The onion and potato value chains are different in the sense that onion production in the Netherlands is mainly for export outside Europe, e.g. to African countries like Senegal. Outside Europe, sustainability requirements are less strict or even absent. Table potatoes are for a larger part destined for the Dutch market and product buyers do require more and more CSA produce. This makes the chains different from a sustainability point of view. Many farmers grow onion and potatoes in crop rotation, so the difference between the value chains is glaring after the farm. Product storage takes place on the farm, until product delivery. Both products are stored from September to May, and delivery happen during the whole period. Table potatoes are mostly grown on a contract basis with a product buyer. Most onions are 'free', meaning that the farmers are free to sell to any buyer offering the highest price.

The 'On the way to Planet Proof' certification scheme has requirements for the following topics: Energy and climate, crop protection, biodiversity, soil quality and fertilisation, water, material for packaging and waste streams. For more detailed information about the certification scheme check https://www.planetproof.eu/en/.

7.2 CSA practices in the value chain

To achieve the 'On the way to achieving Planet Proof (PP)' standards, there is a long list of CSA requirements growers must comply with. These requirements pertain to energy and climate, crop protection, biodiversity, soil quality and fertilization, water, use of materials and waste streams. Some of the criteria are at farm level. At the crop level there are additional requirements surrounding the use of fertilizers and crop protection. Table 13 gives an overview of the most important requirements.

Table 13. CSA requirements under the Planet proof certification system

Energy and climate	
Registration	Growers must have full registration of energy use at *farm level*
Calculation of greenhouse gas emission	Growers calculate greenhouse gas emissions with a calculation module, available on the website www.planetproof.eu
Improvement plan	If growers exceed the norm, they have to make an improvement plan to meet the norm by 2025
Energy source	From 2026 onwards all electricity used should be from sustainable sources
Measures stimulated but not yet obligatory (among others)	• 5% lower energy use than the norm • Own production of green energy • Application of technical innovations for lower energy use
Crop protection	
Crop protection management plan	Growers should have an IPM[24] crop protection plan per crop.
Registration	Growers should register the use of pesticides on crop and field level, procurement and stock of pesticides.
Allowed pesticides	PP has a list with allowed pesticides on crop level. Not all pesticides registered in The Netherlands are allowed to use for PP production. The list with PP approved pesticides is based on environmental criteria.
Total input	Per crop the input in kg active ingredient/ha is restricted. For onions the limit is 10 kg, for potatoes 7.5 kg.
Extra requirements	Chemical soil disinfection is not allowed in PP
Extra requirements	Biological control of onion fly in onions is obligatory
Extra requirements	Use of glyphosate is restricted
Measures stimulated but not yet obligatory (among others)	• Use of resistant varieties • Non-chemical measures for crop protection, such as use of insect nets • Non-chemical measures for the control of nematodes • No use of herbicides
Biodiversity	
Farm plan	By 1-1-2025 every grower needs to have a farm nature plan
Biodiversity elements	By 1-1-2024 maintenance of biodiversity and nature elements on the farm is obligatory
Measures stimulated but not yet obligatory (among others)	• Biodiversity strips along fields • Extra crop diversity • Create nesting facilities for animals and birds • Monitoring of biodiversity
Soil quality & fertilisation	
Organic matter balance	Every farmer has to calculate a soil organic matter balance at farm level. Negative balance is not accepted. A calculation tool is available on internet
Erosion	A minimum of two mitigation measures should be applied on fields that are susceptible to water and wind erosion.
Fertilisation plan	Farmers need to have a fertilization plan for the whole farm, showing that the criteria for fertilization and soil fertility are met.
Registration	Growers should register procurement, stock and use of fertilizers for the whole farm.

[24] Integrated Pest Management

Use of N and P	Growers need to comply with the crop norms for N and P. P is limited based on soil status, for N there are crop specific norms. N limit for potatoes is 275 kg/ha, for onions 170 kg/ha
Water	
Water plan	Growers must have a water plan if they want to irrigate, including irrigation systems used and tools to minimize water use.
Registration	Growers must register volumes of water used per crop on a weekly basis.

7.3 Identification of lock-ins and levers relating to specific components of the value chain

Lock-ins

- Request for CSA produce is mainly present in the national markets. Much of the Dutch onions and table potatoes are exported to countries within EU and outside EU. In these export markets there is little or no request for CSA produce, and therefore no options to get a price premium.
- Product buyers request PP certification from all their farmers/suppliers, although only a rather small percentage is sold as PP product. The makes it difficult to get a premium price for them.
- Value chains are not transparent, it is unclear what part of the consumer's price goes to what partner in the value chain. This makes discussion about fair pricing difficult.
- Low willingness among value chain partners to create a separate logistic chain for PP products.

Levers

- Promote alternative and transparent business models, such as 'Onze Markt (Our Market)'. In this new initiative a fully transparent value chain is created. Onze Markt started with potatoes, with the ambition to expand to other products. They sell to local supermarkets. But latest news is that after a takeover of this supermarket, this initiative will die, the reasons are yet unclear.
- Resistant varieties can reduce pesticide input a lot in potato (late blight resistance) and onions (powdery mildew). Resistant varieties are an important link in robust cropping systems for sustainable production, thus an important element in CSA. Although such varieties are available, they don't make it to the market, mostly because the seeds are more expensive and yields sometimes are somewhat lower.
- Seeds suppliers would like to sell, and farmers are willing to grow these varieties, plus the certification organization is happy to include this requirement in the criteria, but other partners in between are not supporting this, mainly because of economic reasons. It would be interesting to start a pilot, 'a coalition of the willing', to work on an initiative in the "On the Way to Planet Proof" value chain.

Table 20 in the Annex provides an additional and more comprehensive list of lockins and levers derived from the mapping, survey and interview work in WP 1.

7.4 Identification of priority regional, national and EU policies (WP5)

Several policies have impact on farm management. National and regional policies as well as the implementation of EU policies like Farm to Fork and CAP regulations.

7.4.1 Fertilizer input, regulation for N and P

The Netherlands is considered a complete nitrate sensitive country for the EU Nitrates Directive. This means that fertilizer restrictions for N and P are implemented all over the country. Use of nitrogen and phosphate are limited, exact amount allowed is depending on crop and soil type (see Table 14 for Nitrogen) and to soil status (Table 15 for phosphate).

As from 2023, farmers have to comply with regulations on crop rotation (including 'resting' crops in the rotation) and on latest possible time of harvesting crops, in combination with the obligation to grow green manure crop directly after harvest. Not complying with the regulation leads to a lower N-quota for the next crop.

Because of too high emissions of nitrogen to Nature 2000 areas, Dutch farmers fear for extra regulation on the use and emission of nitrogen. Exact measures are still discussed by decision-makers.

Dutch national and regional policies fund projects for sustainable soil & fertilizer management and provide investment subsidies for specific technologies, such as for precision farming.

Table 14. Nitrogen input restrictions in kg N, depending on crop and soil type, 2023

Gewas	Klei 2023	Noordelijk[10], westelijk[11] en centraal[12] zand 2023	Zuidelijk[13] zand 2023	Löss[4] 2023	Veen 2023
Grasland (kg N per ha per jaar)					
Grasland met beweiden	345	250[14]	250[14]	250[14]	265
Grasland met volledig maaien[1]	385	320[14]	320[14]	320[14]	300
Tijdelijk grasland[2] (kg N per ha per periode)					
van 1 januari tot minstens 15 april	60	50	50	50	50
van 1 januari tot minstens 15 mei[3]	110	90	90	90	90
van 1 januari tot minstens 15 augustus[3]	250	210	210	210	210
van 1 januari tot minstens 15 september[3]	280	235	235	235	235
van 1 januari tot minstens 15 oktober[3]	310	250	250	250	265
vanaf 15 april tot minstens 15 oktober	310	250	250	250	265
vanaf 15 mei tot minstens 15 oktober	280	235	235	235	235
vanaf 15 augustus tot minstens 15 oktober	95	80	80	80	80
vanaf 15 september tot minstens 15 oktober	30	25	25	25	25
vanaf 15 oktober	0	0	0	0	0
Akkerbouwgewassen (kg N per ha per teelt)					
Consumptieaardappelrassen hoge norm (zie tabel 2c)[15]	275	260	208	204	270
Consumptieaardappelrassen overig[15]	250	235	188	184	245
Consumptieaardappelrassen lage norm (zie tabel 2c)[15]	225	210	168	164	220
Consumptieaardappel, vroeg (loofvernietiging voor 15 juli)[15]	120	120	96	96	120
Pootaardappelrassen hoge norm (zie tabel 2d)	140	140	140	140	140
Pootaardappelrassen overig	120	120	120	120	120
Pootaardappelrassen lage norm (zie tabel 2d)	100	100	100	100	100
Pootaardappelen, uitgroeiteelt (loofvernietiging na 15 augustus)	180	165	165	165	170
Zetmeelaardappelen[15]	240	230	184	184	230
Suikerbieten	150	145	116	116	145
Cichorei	70	70	70	70	70
Voederbieten	165	165	132	132	165
Wintertarwe[5]	245	160	160	190	160
Zomertarwe	150	140	140	140	140
Wintergerst[5]	140	140	140	140	140
Zomergerst	80	80	80	80	80
Triticale[5]	160	150	120	120	150
Winterrogge[5]	140	140	140	140	140
Haver[5]	100	100	100	100	100

Table 15. Phosphate input restrictions in kg P_2O_5, depending on P-soil status

Tabel 3 - Grasland (P-CaCl2/P-Al)										
	P-AL-getal									
P-CaCl2-getal	< 21		21 - 30		31 - 45		46 - 55		> 55	
< 0,8	Arm	120 kg	Laag	105 kg	Laag	105 kg	Neutraal	95 kg	Ruim	90 kg
0,8 tot en met 1,4					Neutraal	95 kg	Ruim	90 kg		
1,5 tot en met 2,4	Laag	105 kg	Neutraal	95 kg	Ruim	90 kg			Hoog	75 kg
2,5 tot en met 3,4	Neutraal	95 kg	Ruim	90 kg			Hoog	75 kg		
> 3,4	Ruim	90 kg			Hoog	75 kg				

Tabel 4 - Bouwland (P-CaCl2/P-Al)										
	P-AL-getal									
P-CaCl2-getal	< 21		21 - 30		31 - 45		46 - 55		> 55	
< 0,8	Arm	120 kg	Arm	120 kg	Arm	120 kg	Laag	80 kg	Laag	80 kg
0,8 tot en met 1,4									Neutraal	70 kg
1,5 tot en met 2,4					Laag	80 kg	Neutraal	70 kg	Ruim	60 kg
2,5 tot en met 3,4			Laag	80 kg	Neutraal	70 kg	Ruim	60 kg	Hoog	40 kg
> 3,4	Laag	80 kg								

7.4.2 Use of pesticides

The Dutch government is responsible for the registration of pesticides. Due to national and EU regulations more and more pesticides lose their registration. Many of the banned pesticides are not replaced by new and more environment-friendly ones. Stakeholders in the domain of plant protection, together with the Dutch government agreed on National Action Plans for crop protection. The main goal is to develop 'robust' cropping systems, less depending on the input of chemical pesticides. Furthermore, The Netherlands has strict regulation for the reduction of emission of pesticides during application. There are detailed requirements for emission reduction techniques on spraying equipment.

Dutch national and regional policies fund projects for sustainable crop protection management and provide investment subsidies for specific technologies, such as for innovative spraying technology and precision farming.

7.4.3 CAP regulation

The CAP regulation for pillar 1 was renewed on 1-1-2023. The new regulation is very detailed and complicated, creating a lot of frustration among farmers and advisors. For more details, in Dutch, see https://www.rvo.nl/onderwerpen/glb-2023.

Part of the CAP regulation is funding for projects and investments that support the goals of CAP.

7.5 Key insights and observations

Retailers have a strong influence/impact on CSA practices of farmers. This is because they dictate the requirements the growers have to comply to. This is mainly the case for fresh produce, like onions and table potatoes. In some cases, a premium price is paid for CSA produce, which is a strong incentive for growers. Some players in the table potato value chain do pay an extra price, up to 1.300 €/ha when optimum product quality is provided. In recent years, a few vegetable food processors have requested the PP certificate and pay a small premium price. CSA requirements are often in place in niche value chains:

- Certification holder has also significant impact, as they maintain and develop the CSA criteria as an independent body. Retail organisations request the certificate from the growers as license to deliver.
- NGOs have strong impact on retail organisations, and therefore indirectly on growers. Under pressure from NGOs, retail organisations decided to request PP certification of their suppliers.
- Many other stakeholders have impact on CSA practices but to a lesser extent:
    - Advisors, they help farmers to comply to the requirements.
    - Suppliers, supplying inputs that help to comply to the requirements. E.g. biological control, bio stimulants, DSS systems, equipment for mechanical weed control, precision farming technologies.
    - Branche Organisation Arable farming (BOA). This organisation collects money from growers and value chain partners for research programs for CSA.
    - Policy through regulation. But all farmers have to comply with policy regulations, not specific for CSA. They determine the baseline.
    - Research: Research results help farmers to reduce pesticide and fertiliser inputs.
    - Researcher and advisors, being members of the expert group that maintains the CSA criteria in the PP certification scheme.
    - Regional government, as they have a subsidy program with subsidies for investments in innovative equipment that enables CSA.
- Stakeholders with little or no direct impact on growers:
    - Consumers. Retailers determine what consumers can buy, not the other way around.
    - Traders and packers. They operate as service providers in the value chain and don't have impact on farmers' CSA practices.
    - Education. Education trains the farmers of the future. The conclusion was that the role of education should be stronger, as there is too little attention for CSA in the current curriculum.
    - It also became apparent that growers themselves have very little impact on other stakeholders. The only impact they have on the PP criteria is that they can request for derogation in case of high infection pressure for pest & diseases. The PP certification has this option build in the criteria. And of course to decide not to sell for the price offered for the products. But that is a difficult position.
    - Further analysis was that certain innovations for CSA are available and ready for practice but don't reach practice yet because of 'barriers' in the value chain, see for more information under conclusions.

7.6 Follow up

- Delphy will update the UC stakeholders with project progress and results.
- Delphy will ask some more stakeholders to extend the UC with missing links and invite them to the follow-up co-creation workshop.
- Interviews with farmers. Participants are requested to think about farmers that could be asked for an interview by Christopher Galgo/WP4.
- Behavioural experiments will be one of the next activities, participants perhaps can be part of this.
- PP certificate holder (SMK) offers to cooperate in future activities (searching farmers for interviews, and for experiments, collecting feedback if asked for).

- Delphy will provide information about Beatles to SMK and SMK will share this with PP growers and stakeholders. Interested stakeholders can perhaps join the UC.
- Stakeholders show interest in the fair and transparent business models the project will provide.
- Discussion with some stakeholders after the meeting led to the suggestion to explore the opportunity to organize a pilot with resistant varieties of onions and table potatoes.

7.7 Summary

The objective of the workshop was to capture the priority issues discussed by the stakeholders regarding climate smart agriculture (CSA) attributes closely connected to the use case (UC), including barriers, incentives and opportunities.

The following are the conclusions of the workshop:

- Change towards more CSA is possible, but there are important barriers on the way towards this goal:
- CSA practices often lead to higher cost prices of product, and the willingness to reward CSA produce is often too little, although there are some good examples.
- Many growers are willing to change to CSA, but also needs a business case. And who bears the risk? Only the grower?
- Better if growers organize themselves in cooperations, this gives them a stronger position in the value chain.
- The government can support growers through subsidies for specific investments needed for CSA. Re-design or adapt the CAP program to specific needs in practice could be an option.
- Support of CSA should be in line with development of market demand. Support without growing markets will spoil the price of CSA produce.

There are good examples of CSA production of vegetables and arable crops. Scaling up this CSA production is hindered by several aspects in all parts of the value chain:

- Farmers need a higher price, which in many cases they don’t get.
- A co-operation between all value chain partners is necessary, this sometimes doesn’t work because of a conflict of interest/lock-ins in markets.
- A large share of the Dutch produce is exported to markets that don’t require CSA produce.
- Subsidy programs can be better tailored to stimulate CSA.
- Pilots could be a good way forward to include resistant varieties for a large reduction of pesticide input.
- Stakeholders are interested in the development of fair and transparent business models.

8. Summary, key messages and recommendations

8.1 Purpose and dynamics of the co-creation process within BEATLES

All workshops succeeded in building the foundation for co-creation within the BEATLES project. The Use Case leads mapped the key stakeholders and reached out to them communicating the purpose of the BEATLES project and inviting them to these first workshops. The value chain components in each Use Case were identified and discussed. The different work packages within BEATLES were presented to the stakeholders. CSA practices were co-identified and discussed in each workshop and issues surrounding lock-ins preventing penetration of CSA practices and levers promoting their development were highlighted and discussed.

Participants at the workshops represented different stakeholders in the various value chains – ranging from farmers and farmer associations, companies/organisations working with innovations and technology development, retailers, researchers, regulators and policy makers, suppliers of seeds and farm-based services, investors and consumers. Some value-chain stakeholders were more prominently represented than others. The level of participation at the workshops depended on the availability of the invited individuals/stakeholders at the proposed time for the workshops. In terms of the structure of the workshops, it was recommended that more time be allocated during subsequent workshops in order to allow for more in-depth discussions. Professional moderation at future workshops was also recommended. In terms of stakeholder representation, it was recommended that more participants from the retail and consumer side should be present at future workshops. It was also observed that the Multi-Stakeholder Platforms (MSPs) set up for each Use Case will be necessary to allow follow-up on important issues and prepare for the subsequent workshops.

The dynamics of the co-creation process within the BEATLES project are illustrated earlier in the deliverable in Figure 5. Here the workshops have a central role in pulling together the Use Cases and the Work Packages, in order to develop the priority thrusts surrounding the adoption of CSA practices. The coming workshops in 2024, 2025 and 2026 will be able to focus on the other priority topics - sustainability assessments, innovative business solutions and policy assessments.

8.2 Reported lock-ins and levers

As this report shows, the identified lock-ins and levers are varied in terms of scope and importance – policy and institutional, technical, financial, and social. In terms of policy and institutions, clarity of policies e.g. within CAP, alignment of policies, harmonization of strategies, models, methods, tools, standards and coordination of value chain stakeholders with policy makers are all key messages for mainstreaming CSA practices. Training, capacity development, evidence-based research and development/improvement of tools were commonly reported at the workshops as key actions to support technical innovations towards CSA. The financial factors commonly raised have to do with support to farmers, particularly small-scale farmers, targeting of subsidies for CSA-linked business incentives to support and mainstream CSA, cost of machinery, demand and willingness to pay extra for CSA products, and value chains extending beyond national boundaries. Most of these factors are in line with what is revealed in the systematic literature review as reported in Deliverable 1.1. This is particularly the case with factors

pertaining to the targeting and effectiveness of CAP as an instrument to promote and mainstream CSA.

The following lock-ins and levers were prominently identified during the workshops. These are outlined in terms of relevance to the scope and objectives of the BEATLES WPs:

LOCK-INS

WP 1 Decision-making processes

- Stakeholder interaction to create innovative solutions leading to CSA practices is lacking

WP 2 Behavioural experiments

- Lack of capacity, knowledge and training on the part of stakeholders hinders progress towards developing CSA practices

WP 3 Sustainability assessment

- EU has no common sustainability model for agriculture
- The value chains are not keyed towards climate change adaptation, GHG mitigation or sustainable production
- LCA carbon footprint analyses have only limited value and don't motivate the investment costs for CSA; they are also not linked to carbon taxes

WP 4 Business models

- Consumer interest is lacking along with understanding and willingness to pay,
- Cost of CSA cannot be passed down to the consumer, so subsidies are necessary
- Market interest in food systems built using CSA practices is lacking
- Strategic finance for CSA investments from banks is not available

WP 5 Policy

- CAP has yet to include CSA activities - CAP tends to defeat the purpose of transitioning to CSA implementation
- EU has yet to develop directives dealing with CSAs responding to the Green Deal and Farm to Fork strategies which at present lack implementation components
- National strategies, policies and guidelines are often lacking in the area of food system CSA implementation
- EU policies dealing directly with CSA implementation are lacking
- Countries importing from the EU often do not have CSA stipulations and thus are not willing to pay extra

LEVERS

WP 1 Decision-making processes

- Growing customer awareness about climate change is a driver and proper marketing and labelling can help increase the interest in CSA-based products
- Growing customer awareness about healthy foods and eating habits that also are climate friendly could help shift the transitions to increased CSA practices

WP 2 Behavioural experiments

- The high costs of fossil fuel, electricity and fertilizer force producers to be more frugal and more efficient in their farming practices
- Low costs for digitalisation can provide short cuts towards increasing efficiency and more accurate accounting of resource use

WP 3 Sustainability assessment

- Improvements in value chain efficiency with reduced waste and increased recycling all lead to reduced climate change impacts
- Sustainable practices in many cases can be economic/profitable in the long run, in terms of enhancing soil fertility, water holding capacity and building resilience against drought and wind erosion

WP 4 Business models

- Introduction of carbon taxes could be an incentive to shift towards CSA practices

WP 5 Policy

- Stricter laws concerning leakage of phosphorus and nitrogen from fields to water courses could reduce the overuse of manure on fields thus reducing GHG emissions
- Revision or reform of CAP holds promise as a central catalyst to achieve the goals of the Green Deal and Farm to Fork Strategies.

The following recommendations were made by participants at the workshops as ways of addressing the lock-ins and harnessing the levers. Strategies to operationalize these recommendations constitute an important agenda point for future discussion by stakeholders within the MSPs and in the subsequent co-creation workshops. These recommendations are valuable insights for the various WPs as they prepare lab/field experiments, sustainability assessments, business models and policy reviews.

8.2.1 Recommendations for addressing lock-ins

The following is a list of recommendations generated in the 5 Use Case Workshops addressing the reported lock-ins. These are outlined in terms of relevance to the scope and objectives of the BEATLES WPs:

WP 1 Decision-making processes

- There is a need to spread awareness and disseminate information on CSA practices
- There is a need to increase awareness among farmers and consumers on the economic and environmental implications of CSA
- Capacity development on grassland use and nutrient management is needed
- There is a need to improve consumers' understanding of organic, climate-friendly agriculture and climate-smart dairy farming
- Training and counseling on precision agriculture is needed
- Information campaigns are needed to influence mindsets and get farmers interested in conservation agriculture
- There is a need to support and strengthen collaboration between farmers, scientific consultants, and research organisations/institutes
- There is a need to establish common objectives and joint efforts among value chain stakeholders
- There is a need for manpower and capacity development on management of agroecosystems e.g. thinning, pollination
- Storage and processing infrastructures are needed.

WP 2 Behavioural experiments

- Free and easy-to-use digital platforms are needed to facilitate farmers in the transition to CSA practices
- There is a need to explore different technical solutions to optimize production

WP 3 Sustainability assessment

- More innovations should target precision agriculture practices
- More emphasis should be placed on agricultural productivity and resilience
- Innovations are needed to combine both value proposition and greener sustainable practices
- Feed consumption needs to be tabulated to enable proper calculation of climate footprint
- The entire value chain both within and outside national boundaries must be considered
- There is a need to develop crop varieties that are resistant to pests and diseases, and also commercially interesting

WP 4 Business models

- Climate-friendly agricultural practices need to be economically feasible to facilitate adoption
- Pricing and investment costs need to be carefully considered to make sure consumers are willing and able to pay for climate-friendly products

WP 5 Policy

- Existing support mechanisms should be more aligned with current policies
- There is a need to bridge policy and practice
- CAP needs to incorporate CSA practices in order to promote the Green Deal and Farm to Fork Strategies
- A shift from only financial support to farmers to assisted knowledge support is needed
- Reforms such as a climate tax must be easy to interpret and follow and not time consuming
- Political measures are needed to encourage both production and marketing across the food system value chains
- Small organic farmers need sustained support
- Hygienic-sanitary regulations need to be more flexible for small producers with diversified activities
- There is a need to create a separate value chain for climate-friendly products
- National & EU support to NGOs is needed for CSA advocacy.

8.2.2 Recommendations for harnessing levers

The following is a list of recommendations generated in the 5 Use Case Workshops addressing the observed levers. These are outlined in terms of relevance to the scope and objectives of the BEATLES WPs:

WP 1 Decision-making processes

- NGOs can provide valuable input from a consumer perspective
- There is a need to encourage the transfer of traditional knowledge to other agricultural areas
- There is a need to share lessons on recycling efforts in other countries

WP 2 Behavioural experiments

- There is a need to ascertain the effectiveness of subsidies and sanctions, and their combination
- There is a need to initiate pilots – 'Coalition of the willing' to perform trials of green value chains

WP 3 Sustainability assessment

- CO_2 footprint assessment based on LCA analyses is important but still at early stages

WP 4 Business models

- Sustainability reporting should be used by banks as a requirement for financing

WP 5 Policy

- CAP needs to be more comprehensive and should focus more on promoting niche green practices such as extensive grassland use in dairy farms
- CAP needs to be made more easily accessible for farmers developing sustainable practices
- CAP support needs to be more oriented to sustainability results
- Political influence is needed for price development in terms of subsidies, transparency and sanctions
- New initiatives must be voluntary to ensure success
- CAP support needs to be more oriented to sustainable results

8.3 Impacts of policies in striving towards CSA practices within the Use Cases

The following is an expert summary of the current state of play regarding policy issues and the transition towards greater CSA penetration within the 5 Use Case value chains. These were provided by AEIDL[25] who are managing Work Package 5.

- Adoption of CSA cannot be tackled at farm level alone (despite this being the research focus of BEATLES), but needs to be tackled throughout the value chain (as evidenced by Wheat Farming in Lithuania UC) including packaging, transport, food processing and marketing actors, as well as foreign imports (eg Danish UC import of foodstuff from third countries not counted towards carbon footprint) AND produce exports to non-EU markets where CSA does not yet constitute a competitive advantage for EU agriculture (Danish pig UC, Dutch onion UC).
- There remains a significant conceptual gap in the definition of what constitutes CSA and what is "greener", with confusion towards the latter more prevalent at national and value chain level than what is the case for EU regulatory frameworks.
- There is no common sustainability model within the EU to measure and monitor climate impact from food production systems which in turn confuses consumers (Danish UC, German UC). This creates a disincentive to CSA adoption.
- Public perception is captured by existing value chain actors so there is focus on some elements of CSA (eg milk production in German UC) and other equally important ones (e.g. animal longevity and biodiversity through pastures) are overlooked.

[25] European Association for Innovation in Local Development (Serafín Pazos-Vidal) https://www.aeidl.eu/

- Consumers in particular, need to be made aware of the oversimplistic equation of vegan and organic being intrinsically good compared to other more conventional value chains that also adopt CSA (German UC).
- For producers, a key issue is that public perception is in itself a barrier for further use of CSA. Consumers are not prepared to pay a higher price for CSA produce and are content with those labelled as "green". Thus, the achievement of 25% organic agriculture by 2030 requires far more consumer awareness measure funded by CAP, not just Pillar II (eg Spanish UC) but also Pillar I (German and Lithuanian UC).
- Furthermore, organic does not always mean sustainable, and this runs contrary to the perception of the consumer. The same applies for "regenerative agriculture" for which there is not a single and widely accepted definition.
- All this points to the need for robust external and independent certification schemes over and above what exists for some value chains already. This is a problem given the diversity of geographies and value chains, as pointed out by the German UC (dairy).
- CSA farming is expensive, experimental and in many value chains still in its infancy. For instance, pyrolysis of pig slurry is a proven way to sequester carbon, but it is expensive, with a tentative and robust regulation due to still under-researched impact of the longer-term use of this technology (eg. Danish UC). Though understandable, these are nevertheless barriers for widespread use of CSA technologies.
- Neither there is a clear financial incentive at CAP, particularly in Pillar I, to foster that technological change. Still evidence from the Lithuanian UC points towards the fact that in an inflationary context, farms with CSA practices are more resilient to price shocks.
- However there needs to be a realisation by both policymakers and consumers (as well as NGOs) that some value chains (eg Danish pig UC) can never be entirely climate neutral, hence a balance needs to be struck between environmental goals and food security.
- Similarly, some of the existing regulations though might be intended to achieve a particular public policy outcome (market regulation and prevention of fraud, as in the Spanish apple UC) also act as a disincentive for CSA as they allow the simultaneous production of similarly looking organic and conventional produce.
- Financial incentives are not smart enough as they are not performance related and still too much output-focused. They represent a significant control burden on producers, with incentives to production acting as a drawback to profitability as supply might exceed demand (Spanish UC). Stronger enforcement of performance-related incentives and infringements may be necessary (German UC). A value-chain approach may also result in learning from other value chains and countries (e.g., bottle recycling schemes).
- Financial incentives do exist in some value chains, however even when they do (eg Arla) they fail to capture all factors that impact in CSA such as the use of fertilisers.
- As identified in D1.1, CAP and its national implementation of agri-environmental regulatory frameworks can in themselves be, in practice, a barrier and a disincentive for the widespread adoption of CSA. This is the case of the overuse of nitrogen, nitrous oxide emissions and the widespread use of commercial fertiliser as an unexpected knock-on effect of restricting the use of industrial fertilisers (Danish UC). This points again to the need to adopt a holistic, whole-value-chain approach when introducing new policies and frameworks to incentivise CSA and disincentivise unsustainable practices. For instance, existing policies tend to underplay the role of retailers and, indirectly, NGOs influencing retailers, in driving up demand for CSA produce from farmers, often more than the consumers themselves (e.g Dutch UC).
- Likewise, the adoption of ambitious CSA needs to be done applying the EU principle of proportionality. Small producers cannot have the same regulatory burden as large-scale

producers and this needs to apply to CSA as well (Danish, German and Spanish UCs) both in terms of CSA requirements but also in terms of a lighter regime of certification, which is detrimental and adds an undue cost burden to small producers. This may point towards the need to adopt an EU Better Regulation approach to CSA policies.

- Similarly, however, there is often a disconnect between EU ambitions and national plans and guidelines for CSA, with the latter insufficiently applying EU policies on soil, water or land management with insufficient use of evidence to formulate decisions (Lithuanian UC).
- Marketing has been consistently highlighted as an area of improvement, with further support from CAP beyond Rural Development schemes.
- However, education both to producers and consumers is highlighted as a greater area of improvement with many not aware of the value of CSA produce in achieving EU environmental outcomes. This in turn affects the willingness of consumers to pay higher prices (Dutch UC).

8.4 Future agenda items/action points

Co-creation Workshops within the 5 Use Cases are to be held in 2024, 2025 and 2026. These will tackle the main theme areas of the BEATLES project namely, sustainability analyses, innovative business strategies and markets, and policies.

Workshop participants outlined specific agenda items and action points for further discussion within the Multi-Stakeholder Platforms (MSPs) and at subsequent co-creation workshops.

At the Lithuanian workshop, participants stressed the need to involve more actors beyond primary wheat production (including storage, transport, wholesalers and consumers). Learning and sharing among stakeholders, particularly farmers already engaged in environment-friendly practices was recommended. A good understanding of end-user perspectives and the attitudes of consumers was highlighted as key for uptake and sustainability of CSA. The need to review certain national, regional and EU level policies pertaining to wheat production was highlighted as an important aspect to consider for future discussion.

Participants at the German workshop would like to compare the results generated from the German Use Case (which is restricted to a specific region) with data from other dairy farms in other German regions.

Participants at the Danish workshop emphasized education of farmers as well as investment opportunities as relevant topics for future discussion. A field visit to a conservation agriculture farm was recommended as a strategy to better understand primary production perspectives.

Challenges surrounding the storage of apples was highlighted by participants at the Spanish workshop as a specific topic for further discussion in the short term.

Collaboration with the Planet Proof (PP) certification scheme holder (SMK)[26] was mentioned by participants at the Netherlands workshop as a future action to facilitate contacts with farmers for interviews and experiments. The system boundaries of the onion and table potato value chains are also topics for further discussion by stakeholders at the next co-creation workshops.

The lessons learned in terms of organizing and running these co-creation workshops are the following: participation and contribution of relevant stakeholders at the workshops is key. The UC leads should encourage more relevant stakeholders to join subsequent workshops. In terms of

[26] https://www.smk.nl/nieuws/eisen-2023-voor-plantaardige-producten-on-the-way-to-planetproof/

duration of workshops, enough time should be allocated for thorough and in-depth discussions among participants.

Annex

Compilation of lock-ins and levers (barriers and drivers) for the 5 BEATLES Use Cases based on stakeholder interviews prior to the co-creation workshops

This annex is a compilation of the systemic lock-ins (barriers) and levers (drivers) affecting decision-making by the agri-food actors within the Use Case value chains. This was prepared specifically for and presented at each UC workshop. The material is derived from Work Package 1, which included interviews with the same Use Case stakeholders that attended the workshops. This valuable reference material represents the front end to the co-creation process within the BEATLES Project with respect to the lock-ins and levers surrounding the transition to climate-smart practices and will be built upon throughout the project to 2026.

The tables on the following pages cover the 5 Use Cases

Table 16 Lithuania – Wheat farming

Table 17 Germany – Dairy farming

Table 18 Denmark – Pig farming

Table 19 Spain – Apple farming

Table 20 Netherlands – Onion and potato farming

Table 16. Systemic "lock-ins" (barriers) and "levers" (drivers) affecting decision-making by the agri-food actors within the Lithuanian - wheat farming Use Case

Lithuania - Wheat farming			
Value chain component	**Initiatives**	**Drivers**	**Barriers**
Primary production	Intercropping Smart farming - Digital data management, Saving fuel with less driving in the field, Local production of fertilizer/nitrogen	Financial support from government, Tax reduction	Trust issues in the robotic and automation systems especially when it comes to data security. Also financial issues
Provider of agro-technology for primary producers	Initiatives noticed in primary production: Selecting to grow wheat with large roots to increase the absorption of nutrients. Soil improvement practices. Reducing water consumption through the use of fungicides and pesticides.	Internal policy - Policy nudges; Clear understanding of the added value from the sustainably produced wheat; Compensation for higher actual costs	
Provider of agro-technology for primary producers	Bacterial production (amino acids, bacteria, manure) has been becoming increasingly popular after the increase in costs of fertilizers	Main incentives for farmers to take up climate smart practices are economic benefits (when it brings more benefit than cost compared to traditional farming) or regulations (by national or EU authorities).	
Eco-labels, certificates for sustainable farming	Educational activities for farmers on sustainable farming	The best motivator is governmental support or sanctions if the support does not work (fines, penalties etc)	The organization in the governmental body. They work according to the statutes of the organization. They will follow the governmental programs.
Logistics, export, Connects big producers and export companies	A lot of examples, but everything stops at cost. Solar solutions, Automation, Packaging alternatives, Circular solutions	For the most part- drivers are governmental regulations or support	Cost is a barrier For example - hard to find packaging that would meet the hygiene standards, would fit in the production line, and also would be profitable.
Primary production	Fertilization plans. Smart fertilization equipment (spreaders) with soil testings. Digital tools Automatic steering systems	Knowledge, education, training, financial incentives, Neutral consultants (many consultants identified as biased with hidden agenda to sell certain product)	There is a need to promote the farmers to be more active, to be part of cooperatives, educate so that they would see "biger picture" and escape the bubble of the chemical sellers.
Sells fertilizers, seeds, agrochemicals,	Practices that improve productivity	Market trends	Economic barriers Today the situation is that farmers do not have a market for eco-products,

Lithuania - Wheat farming			
Value chain component	**Initiatives**	**Drivers**	**Barriers**
consultancy, buying and selling grains	Better and more resistant varieties of seeds, micronutrient fertilisers,	Increased resilience to climate change in the primary sector	mostly because there are no need and pressure from the consumers.
Different grain products - bread, flour and other	Loyality program for farmers - all sustainable farmers get a discount after 2 and 3 years. Gives a discount for cleaning and drying grains - so that farmers would not use chemicals doing that. Technology to clean and dry grain without a chemicals.	Financial incentives	Financial incentives
Primary production	Looking for a away to save money. Better utilization of machinery To replace inorganic fertilisers Soil surveys, reduces the amount of water to be sprayed, Increases the amount of green area	Financial, cultural - emotional, support measures for technology	Needs better local regulations on how were he can take the compost from and how where use it
Primary production	Increasing amount of green areas; Intercrops; minimal tillage; Smart drainage system; Better and newer tractors (saving on fuel) Strip - till technology	Information from universities. Governmental regulation and different scientific, governmental projects Financial incentives	Financial incentives It is hard to invest in smart technology - it is expensive and returns comes very slowly.
Online shop for the farmers	Support digitalization Robotisation of small farms	For small businesses, it's important to save time by spending more time on design and robotizing processes. This way, you can protect your resources	The main obstacle is investment. Also the mindset - young families who move to the countryside are very entrepreneurial and implement a lot of technology, but unfortunately this is not true from all farmers
Companies that buy raw materials from farmers. Sell products to wholesalers and supermarkets.	Waste-free production (grain residues are further used for composting, humus production); e.g. use buckwheat hulls instead of diesel fuel in our boiler house; Modernised factory, increased production efficiency and productivity; Solar Park Buckwheat hulls are sold to greenhouse for compost humus	Social, economic and of course political	Barriers can be economic - projects with a long payback period, stopping grants

Table 17. Systemic "lock-ins" and "levers" (barriers and drivers) affecting decision-making by the agri-food actors within the German - dairy farming Use Case

Germany – Dairy farming			
Value chain component	**Initiatives**	**Drivers**	**Barriers**
Selling animals to farmers and traders	Increase the longevity of cows, so that the animal grows old and achieves a high life output. Short distances for marketing and thus fewer emissions Photovoltaics on the roofs of farms,	Profitability increases on farms when cows are long-living and produce a lot of milk Limit the travel time for transport and to prohibit the far export	Many organic calves do not find a market, because the rearing and fattening of organic cattle is not economically viable. Therefore, there are no local fattening farms. This is also the case for the conventional sector.
Cooperative, dairy	Grassland management and forests as CO2 sinks, consider agriculture as part of the solution. Promote awareness raising on the topic of food waste. Raise awareness among farmers and in the dairy's Attract farmers as consumers and as ambassadors of the products.	Basically in society also less influence from social media and again increasing the importance of science and decision-making based on scientific knowledge, education in general as an important lever. Education and advice for farmers as a major lever, but also communication towards customers.	Low prices - Higher prices are necessary. This must be accompanied by the willingness of consumers to pay higher prices for climate-friendly products Overall, more education is needed on the topics of home economics and healthy nutrition, e.g. in schools.
Trader for gastronomy and catering.	Fair certification, stricter standards than EU organic certification, By only offering high quality products - forcing customers to only use also high quality products Support the marketing of "brother calves" in organic quality	Organic farming can only be achieved through political action in the area of public procurement for public canteens or gastronomy; still a lot of potential to increase the consumption of organic products	Priorities in care procurement: no hospitals offer organic meals, especially in senior care, for kindergarten there it is available because parents ask for it but for old people its not wished –> budget limitations in public care fonds.
Organic wholesaler	Sorghum from Germany, which is suitable for the climate and region. Cultivation with lentils and chickpeas in the region; regional fruit varieties.	Philosophy of the company, external influences: climate change,	Processing step was missing because no mill could do that (sorghum) (it is requiring a special technology and no company had that)

Germany – Dairy farming			
Value chain component	**Initiatives**	**Drivers**	**Barriers**
	Dairy: grazing on pastures - a discussion directly with farmers Local dairies around Berlin to help create a more regional processing	More agricultural advise and know-how is needed – farmers have this know-how	Politically there is a responsibility towards more climate friendly value chains, this would need a political frame e.g. financial support
Production, processing organic products,	Local protein feed supply to avoid imported protein such as soy. Promoting protein from grassland but also in arable land such as regional soy Marketing of organic beef raised on pasture; Mobile slaughtering Waste products from wheat production	Politics: public procurement in public canteens: Consumers: campagne to increase awareness of benefits of organic, often it is not allowed to do marketing that is damaging the conventional farmers because communicating the benefits of organic is offending other farmers, problem also in governmental levels	Hype regarding vegan consumption; often people think that it is good for the environment to stop eating meat while flying a lot and veganism can compensate this; Organic newspapers and journals are also more and more promoting this trend and this is not good for the environment
farmer	Ecologically friendly electricity, photovoltaic on the roof Compost stable: Building up humus through compost as fertilizer on field, applied 2-3 year on grassland and arable land, it helps to store moisture in crops (e.g. maize) during dry and hot periods Feed: Hay and grass/maize silage, own wheat grist, purchased concentrated feed without soy More insect-friendly mowing Alfalfa in own grass drying machine as à domestic protein source No-tillage during autumn, always having the soil covered to avoid erosion Mob-grazing: Good precipitation but already getting a glimpse of the climate crisis because the conditions are already changing (need for adapted grazing) big pasture is separated into smaller pieces, 50% of the pasture is stamped to the ground and 50% eaten by the cows . Benefits: soil is covered, more photosynthesis is possible and faster growth		Photovoltaic on the roof - no good methods to store electricity on the market yet (batteries) Compost stable: funding was really difficult because the official subsidies were almost not granted by the authorities, now the prices for the litter are very high (prices almost tripled), this is a very critical situation right now More insect-friendly mowing method: high costs and more workload

Germany – Dairy farming			
Value chain component	**Initiatives**	**Drivers**	**Barriers**
	because there are still leaves that can do photosynthesis		
Mix feed producer	Concentrate to maximise the amount of milk but not in the organic sector, methane reduction food Plant extract that is reducing the methane emission,		Hard to find farmers that are willing to try out new things Methane reduction (plant extract) food might not be allowed in organic agriculture Feed: plant extract - there has been no practical trials regarding this product
City advisor that support public institutions - about providing food services	Promote seasonal and regional purchasing, this needs to go hand in hand with a changed nutrition pattern within the population, More consumer education is needed In schools the share of organic food is not that high yet, some reasons are that each school is responsible themselves to allocate their catering themselves, one solution would be an own kitchen to supply the schools	In a pedagogical way provide more information to people working in the city to change their buying behaviour Provide information for schools about organic suppliers for their canteens	Some people may not be able to afford high quality food. Especially for old people in nursing homes. People might not eat a lot of vegetables because they never did that in their life. It is important to look at the people and to check what is making them happy. The social and cultural component of food shouldn't be forgotten
Organic feed mill	Advisory service for farmers to minimise nutrient loss Use left overs from food industry, such as wheat side products or sugar beets; also rapeseed and sunflower products are all side products from food processing Using crops that are necessary to use in organic crop rotations – when using these crops in the feed, a market for these crops is created and farmers can cultivate them and increase their soil fertility Establishing soy production in Germany by offering a processing plant for soy and thereby reducing the amount of imported soy Feed for dairy cows that is made 100% out of by-products from the food industry	Need to calculate more than just what a cow is emitting; by calculating emissions from feed production, organic farming with grazing etc. it overall creates less methane since there is a lot of carbon storage in grassland and the feed is produced more environmentally friendly	-

Germany – Dairy farming			
Value chain component	**Initiatives**	**Drivers**	**Barriers**
Producer cooperative	Creating a market for calves from organic dairy cows – brother calves. Reared on grassland and slaughtered after two years	If marketing of organic products is efficient, more farmers will have the financial incentive to produce (and also the benefit of fair partnerships), more farmers will convert to organic farming, hence more climate smart agriculture	Price for these calves or brother animals is more expensive than conventional calves- retail didn't offer higher prices yet; now with the current situation, it is not popular to come up with a new program that involves a higher consumer price
Gastronomy providing services to hotels, restaurants and event areas.	Conversion to organic products Focus more on vegetable and vegan options; for the use of more vegetables it need time to convince the chefs but also to convince the consumers How to optimize the use of left over food, especially in buffet situations	Politically there could be more actions towards increasing the organic share of food being consumed Nice if more restaurants join to be organically certified and offer more organic products. They have an important role to bring changes to society and could help more climate friendly agriculture and consumption. Educate about sustainable food through kitchen parties where the producers can meet the guests and educate.	Everyone says they are sustainable and everyone can use the word: only the ones that get certified are truly sustainable, otherwise its mainly greenwashing; that's why the organic certification even though it is expensive, makes sense – but only if one is very convinced because the control – it is very hard and to pass one needs to be convincing
Research project	Farmers need to be aware of the problem, need to be aware of the contribution to GHG emissions; emphasize that GHG reduction is often linked to more efficiency, so reducing GHG emissions leads also to more financial efficiency	Neighbouring effect: if there is a pioneer close by doing the innovation, farmers are more likely to adapt as well willingness of farmers to educate themselves on new topics and methods	If focus is only on GHG balance then a higher efficiency will reduce the GHG emission per kg milk, but there is a lot of dual purpose breeds and dairy cows are also producing a lot of meat through their calves which should also be reflected in the GHG balance to make it more fair and realistic
Gastronomy	Working with suppliers that are as close as possible; Let the producer decide when to deliver (according to their own plans) Ordering well in advance so that the delivery date is not that important; Organic certification, using mainly organic inputs	It needs a lot of quantity of the same piece otherwise a lot of different dishes needs to be offered; if then non suitable parts of the meat are used then the quality of the dishes decreases; Only some butchers can provide these high quantities in organic quality	Often the quantity needed are a barriers; for meat: The image of organic is still a bit dusty and old-fashioned – tried to change the image through a modern menu card, but it is taking time; it should be the normality for everyone

Germany – Dairy farming			
Value chain component	**Initiatives**	**Drivers**	**Barriers**
Advisor for organic agriculture	Seminar and advise on the topic of breeding for longevity and pasture and other topics Advise for more biodiversity on the farm: planting hedges etc might also lead to more CO2 storage in the soil	Developing of a guideline, practical ideas from science that the advisors can promote, in the organisation,	– often then there is no time for in depth research about new topics; often there is also lacking personal capacity;
Butter and cheese farmer	Drying hay with photovoltaic energy Building up humus and therefore bind CO2 in soil	Farmers need financial incentives to join projects and advise and expertise is needed from outside the organisation (also political goals)	-

Table 18. Systemic "lock-ins" and "levers" (barriers and drivers) affecting decision-making by the agri-food actors within the Danish – pig farming Use Case

Denmark – Pig farming			
Value chain component	**Initiatives**	**Drivers**	**Barriers**
Producer/manufacturer	Technology to separate dry matter from livestock slurry. This treatment enables utilization of the dry matter for biogas production.	Government or EU could introduce a subsidy scheme to motivate farmers Meat producing companies could motivate livestock farmers to produce more climate smart. This can be done by introducing a bonus fee to those farmers	Incentive could be a financial benefit. Alternatively, the government or EU could implement legislation so that it is a legal requirement that farmers reduce their climate impact.
Producer/Manufacturer	Spot spraying on individual weed species, based on recognition and online data analysis. Scanning and mapping fields precisely, to optimize the potential of the fields	Subsidies that enable more farmers to afford precision technology	There is a need for installers of equipment, they can simply not keep up!
Farmer	Conservation agriculture in different degrees. Balance between production and consumption. Solar panels, Biogas associations	Finances	Finances, Framework conditions, CO2 tax. Difficult to find expert knowledge and get the best use of field and soil data. Many systems are not able to 'talk together' and valuable data is lost, if the system or operator of data handling and storage is changed or replaced
Farmer	Withdraw (set aside) of low-lying areas (marginal) fields from production, Locally produced protein, use of renewable energy, Minimize feed waste, avoid ploughing, planting forests. Recycle feed materials that have been produced for human consumption but have been downgraded. Focus on waste of feed	More active political interaction that can encourage to a more climate-optimal operation in the primary production via economic redistribution of agricultural support	Finances
Farmer	Energi optimization, electric engines for ventilation. Technology developed for field work/precision agriculture	Finances are the main driver, it needs to be profitable	There needs to be financial incentives to implement and practice CSA. Not enough with subsidizes.

Denmark – Pig farming			
Value chain component	**Initiatives**	**Drivers**	**Barriers**
Farmer	Circular use of residual products in/from feed – in the organic system. Residual products are better for animal feed than for biogas Local production and marketing – short process from farm to table	Great local support. Satisfaction with own work. There is a lack of funding. They have already financed a large part through crowd-lending (funding)	If it is not possible to find payable financing, then the risk becomes too great
Retailer	Commit suppliers by engaging them to set targets to reduce their carbon emissions Help customers by making greener lifestyle easier through innovation and providing greener products and services Engage employees by rewarding and promoting green action, by educating and making employees climate ambassadors Improved logistics of bread transport	By having suppliers to commit to initiatives aligning with the ambitions of the company, the company is having a better chance	-
Technology provider	Hybrid ventilation gives energy consumption and better stable climate. Hybrid ventilation combines natural ventilation with a floor extraction, significantly reducing energy consumption to ventilation Frequent flushing of manure, performed automatically. This means less odor from the stable and gives an easier daily life by avoiding heavy and time consuming lifting of slurry plugs. Floor extraction supports your environmental approval Smart farming with ventilation, climate and air cleaning in one unit. Smartfarm controls, regulates and monitor of ventilation, heating and cooling in the stable on the central PC – it can be monitored on a smartphone or tablet.	Fair allocation of subsidies	Barriers are the political agenda for allocation and prioritization of areas. E.g. in 2020 subsides and support schemes were only given to acidification of slurry. Technical verification, of e.g., biological air cleaners, are not prioritized and the estimates, given are not always reliant. Subsidies seems to be allocated to what is 'hot and new' and are not considered in a bigger picture (system perspective), where initiatives can support each other instead of competing. Constrains from neighbours is also a huge barrier, especially when farms get bigger, even though the air cleaner applications are used and announced to be part of the construction.

Denmark – Pig farming			
Value chain component	**Initiatives**	**Drivers**	**Barriers**
Technology provider	Technology to separate dry matter from livestock slurry. This treatment enables utilization of the dry matter for biogas production. When the dry matter is converted to biogas - emission of methane from the slurry during storage is reduced. In addition, biogas can substitute natural gas	Government or EU could introduce a subsidy scheme to motivate farmers to invest in climate smart solutions for agriculture. Introducing a bonus fee to those farmers who have invested in climate smart technologies, which lead to reduced greenhouse-gas emissions.	Most farmers will not invest in new technologies unless there is a strong incentive - like financial benefit. Alternatively, the government or EU could implement legislation so that it is a legal requirement that farmers reduce their climate impact.
Private association (organic production)	Recycled equipment for the pigs (feed trough, water trough, etc.) Local sawmill makes fence posts and wood for houses. Locality and sustainability were part of the basic idea. Desire for better irrigation systems, as water is also transported in tanks to the paddock. Joint purchases of e.g. vegetables, especially from local farmers. to supplement meat production.	An investigation of the possibilities must be carried out and then there must be agreement in the group.	Time must be found to examine the possibilities and present them
Technology developer	Technologies and management practices that secures manure to be quickly removed from the pig houses. This will reduce storage time in the stable and lead to reduced emission of methane from the manure. Technologies for cooling of slurry stored in animal houses will reduce methane emission and ammonia emission. Acidification of slurry will reduce both methane and ammonia emission from both animal houses and slurry storage tanks. Acidification e.g. by adding sulfuric acid to the slurry under controlled conditions.	Incentive schemes must be implemented to motivate farmers to invest in climate smart technologies. For example, incentive schemes can be financial support from EU or national governments to farmers who want to buy and install the technology.	Finance
Software developer	Software program for handling logistics when moving and applying slurry Reducing emissions and CO_2 (methane, etc.) from storage	Needs a financial incentive	Rules, legislation, regulations, no subsidies favoring climate smart initiatives at farm level. Depending on how the CO2 tax is designed, it can both be a barrier and

Denmark – Pig farming			
Value chain component	**Initiatives**	**Drivers**	**Barriers**
	Establish a cooperative to import sulfuric acid Acidifying slurry is a tool to minimize ammonia emission, hereby improving the fertilizer and increasing productivity of crops.		a driver. It can be expensive to do the wrong thing, and should be cheaper to do the right thing.
Restaurants, catering services	Reduce food waste and meat consumption. Rather use quality meat and then less amounts than a lot of meat. Meaningful use and sale for coffee grounds. There are many potentials in coffee ground. At the moment, it is taken to DAKA, but this is a poor utilization.	The joy of succeeding, professional pride	Documentation requirements for manufacturers. You must be able to say how much you produce, deliver, requirements for the form of production, etc.
Communication platform	Data on packages. We have put focus on UN goals on a package. Integration of data from the agricultural production into our platform so that users can point their phones on the product and see data such as CO2 emissions etc.	Financial resources and commitment from producers, labelling schemes, and retailers as well as consumers starting to use our services.	If we are not financially supported to fully develop our services

Table 19. Systemic "lock-ins" and "levers" (barriers and drivers) affecting decision-making by the agri-food actors within the Spanish – apple farming Use Case

Spain – Apple farming			
Value chain component	**Initiatives**	**Drivers**	**Barriers**
Production of apples, cider and juice	Processing with local fruit varieties Processing with organic apple Raw material self-sufficiency Sales in differentiated and local markets (short chain and direct sales) More efficient machinery for processing, in order to increase production and cultivated hectares.	Individual/organizational drivers: Income (liquidity to carry out the project with the most appropriate technology). Systemic drivers: consumer appreciation of the product, ability to access new markets. Policy drivers: public subsidies to support projects of this type. For example, aid for equipment/infrastructure.	Environmental factors, such as the floods that made the previous processing plant unusable. River management agency, which applies arbitrary regulations without assessing the case and is preventing the new installation project from going ahead. Hygienic-sanitary regulations in force: the same obligations for a large production plant as for a small processor. The regulations should be made more flexible.
Apple producer	Selected vegetable covers Employment of mechanical weeding machinery Use of micro-aspersion against ghosting Solar panels for irrigation GPS machinery Recirculation with atomisers Anti-phytosanitary and anti-pest nets to reduce pesticides and reduce water from fruit trees	Help with new initiatives to improve our organisation through technical support.	Bureaucracy
Primary production, distribution and marketing	Improving energy efficiency in the refrigerated storage of products Reuse of packaging for vegetables and yoghurt. Maximum efficiency in distribution. Routes to reduce mileage and make maximum use of the capacity of vehicles. Introduction of biodegradable cleaning products. Implementation of tools for better crop planning to improve "crop crowding". Reuse of packaging (oil, other dairy products, etc.). Implement IT tools for order management in collectivities.	Political (economic) factors. Funding is needed to adapt the current refrigeration facilities: by installing solar panels, changing the engine, finding other people or entities that require refrigeration space and want to share the same space. Systemic factors. The chambers do not belong to them, so the actions have to be carried out by the entity that manages the space. : A better organisation of this sector is needed.	Political factors: Lack of funding to enable some form of retrofitting or installation.

Spain – Apple farming			
Value chain component	**Initiatives**	**Drivers**	**Barriers**
	Improve energy efficiency in the refrigerated storage of products.		
Apple production	Composting of sheep manure (buy it ready-made). Grass cutter leaving central aisles that serve as a reservoir for auxiliary fauna, to improve pest damage. Installation of solar panels for energy optimization in water pumping. Setting up of a collective warehouse and apple sizer will reduce GHG emissions by reducing the transport of organic apples.	Political factors. Specific aid for the acquisition of machinery or infrastructure. Organisational factors. A prior process with all apple growers is necessary to give a good orientation to this initiative. Time is lacking. Economic factors. Lack of investment capacity.	Political obstacles (e.g. policy measures, regulations and incentives, financial support and investments, fair trade). Political factors. The fact that it is a project that does not obtain funding from the Government Organisational factors. That apple growers do not find common objectives around this initiative. Economic factors. Lack of funding from the producers.
Primary production of apples, processing of apples	Installation of solar panels for energy optimization in water pumping. Use of bees to improve pollination of apple crops. Introduction of sheep in apple orchards to maintain vegetation cover. Treatments for fungi in apple tree production, which are more sustainable. Collective refrigerated storage and sorting of apples in close proximity.	Political factors. Specific aid for the acquisition of machinery or infrastructure. Organisational factors. A prior process with all apple growers in the region is necessary to give a good orientation to this initiative. Time is lacking. Economic factors. Lack of investment capacity.	Political obstacles (e.g. policy measures, regulations and incentives, financial support and investments, fair trade). Political factors. The fact that it is a project that does not obtain funding from the Government of Navarra. Organisational factors. That apple growers do not find common objectives around this initiative. Economic factors. Lack of funding from the producers.
Distribution of apples, vegetables, fruits, dry products	Purchase of products from farmers who are environmentally aware and who are in the vicinity. Voluntary training courses for members, with many of the topics being geared towards environmental protection. The products marketed are local and seasonal. Reduction of snow. All the fresh produce goes in bulk. They have reduced the consumption of paper bags by charging for them. Implement computerised management for order management, stock control and storage - everything is very manual and requires a lot of dedication	Organizational factors. Lack of knowledge: specific management programmes. Practical factors. These tools require an initial commitment in order to implement them. Political factors. Financial support is required for this type of digital investment.	Economic factors. Lack of investment capacity

Spain – Apple farming			
Value chain component	**Initiatives**	**Drivers**	**Barriers**
Primary producer and processor, juice and beer	Use of green roofs Use of green manures Crop rotations Introduction of horses to cut vegetation cover. Reuse of glass from beer bottles.	Factors related to the characteristics of the practice: Not easy to implement. Economic factors: Requires investment. Organisational factors: More knowledge about packaging is required (labels with less adhesion to the bottle that peel off better in washing).	Factors related to the characteristics of the practice: Not easy to implement.
Distribution of products in large warehouses	Controlled atmosphere chambers to keep fruit longer in a temperature, humidity and respiration controlled environment for the fruits Solar panels for electric energy saving Recirculation of fruit washing water in the field reception before entering the chamber Use of batteries or accumulators Machines for separating pallots according to fruit category Grading machines	New ideas for processes so that companies can advance and improve their day-to-day operations.	Bureaucracy and policy
Production, processing and distribution to retailers and wholesalers	Organic production. Reducing crop treatments even if they are organic/natural. Solar energy on their facilities Initiatives to improve social sustainability as stability for the producers (long term relationships), advanced payments, living wages for workers. Use of compostable plastic in their packaging		Barrier is the lack of knowledge, however, hopefully this project would provide a solution for this problem.
Production of grapes and sweet fruit	Organic production Vegetable cover Organic fertilisation initiative Installation of solar panels Use of efficient machines in the application of plant protection products	Economic aid	Political obstacles (e.g. policy measures, regulations and incentives, financial support and investment, fair trade) Reduction in bureaucracy and financial support
Apples and kiwi-fruit production	Use of electrical machinery (where possible). Use of home-made manure from livestock manure from the environment instead of processed fertilisers from far away.	Organisational factors. Lack of knowledge of the species that would be best suited to the area and management of these species.	There is a lack of technical knowledge and a lack of time to deepen this knowledge and its implementation

Spain – Apple farming			
Value chain component	**Initiatives**	**Drivers**	**Barriers**
	Sown (non-spontaneous) vegetation covers with different species (preferably legume family). Establishment (planting) of some old or traditional varieties seeking a better agro-climatic adaptation and therefore a more efficient use of resources.		
Production of apples and a pple juice.	Green roofs Closed-cycle management of apple tree pruning waste. Acquire more knowledge on pollination of traditional varieties to improve pollination and fruit yields. Cider making (from own production)	Organisational factors. numerous activities: apple production, rural house, juice production and marketing - time needed to these new initiative (to study the profitability of the transformation, label production, etc.). Political factors. There are other people who could be interested in cider production in this area, so it could be interesting to study the search for funding to set up a collective cider production workshop.	Economic factors. Analysis of production costs and sales prices-profitability issues in the production and marketing of cider.

Table 20. Systemic "lock-ins" and "levers" (barriers and drivers) affecting decision-making by the agri-food actors within the Dutch – onion and potato farming Use Case

Netherlands – onion and potato farming			
Value chain component	**Initiatives**	**Drivers**	**Barriers**
Unit that stimulates social development and stands for broad prosperity in the province	Residual heat project Smart management of soil and water Precision agriculture Vegetable crops can contribute as a solution by storing CO2 in products and crops, but this must involve long-term CO2 storage, for example in woody crops as landscape elements, agroforestry but also fiber crops from which products are made. For short-cycle crops, this can be done through soil measures to increase organic matter	Bringing parties together Strive for sustainable agricultural sector. Work out issues that are now in development as well as possible and help the farmers meet them. Social interest remains the driving force. Projects like this can be most successful if operated in a bottom up approach, taking into account the context. Visualize obstacles. Reward according to performance	Finance -Transition to a biobased economy is in nature a very good development, but it is very difficult to get off the ground, especially because of the costs
Environmental Federation	Strip farming project, growing in strips. Awareness of organic products. "Good food club" to bring sustainably grown food to the attention of consumers Attention to healthy soil More mechanical weed control- Fewer pesticides in the ditch that end up there because of cultivation-free zones,	Get the consumer on board as well. Organic agriculture could run harder for biodiversity.	Is there enough cooperation between the conventional and organic sector? Much focus on technology and little on other methods of cultivation (system change such as organic or strip cropping).
Advisor/advocate that represents the interests in the field of supply and purchase conditions between the grower and buyer	Robust potato varieties that require lower nitrogen inputs. These varieties should be more resistant to drought as it is becoming more common. Drip irrigation, level-controlled drainage and underground water storage. Green manure choice plays an increasingly important role. Possibility of tax reservation for weather extremes.	Finances - The earning power of the farmer is always central. Compensation scheme because it is becoming increasingly difficult to take hits.	No earning model possible for the farmer. Climate-smart agriculture is only possible if the tools are there for it. E.g. protein cultivation is encouraged. Weather extremes are becoming more frequent. Farms and crops are becoming more capital-intensive, therefore weather and climate considerations are becoming more important, as is risk management.
Test (research) farm	Basin and drip irrigation, level controlled drainage. "Phytobuckets" - placed with growers. Mechanical weed control with the goal of less us of crop protection products.	Look at pilot farms more often to check if it is true (systems work properly). In politics, assumptions are often made when making a policy document. This order should be changed so that things are applied only when the effect is proven. This will help build support for plans	Money

Netherlands – onion and potato farming			
Value chain component	**Initiatives**	**Drivers**	**Barriers**
	Improved water harvesting, with this we can take another step forward. "Boil management", here we need to think of long-term adaptations. Continue to learn also in the field of new crops.		
Food foundation - net work	Robotisation - The weed-weeding robot as an experiment in organic farming. Protein transition - Towards more sustainable protein sources such as shellfish (mussels) in Zeeland. Reduce waste - Colleges are working with Footprint data valorisation. To do this, the data must first be properly mapped to add value for others in the chain.	Smarter resource use involves looking at the point at which greenhouse gases are released and where savings can then be made. This should be considered according to the lifecycle model. Energy supply must tilt from fossil to green. In addition, energy should be used more efficiently.	Time, money and vision can be barriers. For instance, there must be funding for projects. There must also be enough participating parties willing to go for an initiative. It is often the case that the short term takes precedence over the long term, which prevents people from taking this kind of initiative.
Producer as well as a processor and whole saler of potatoes	Snap (short) links in the chain, reducing transport. Reduced tillage such as tilling and direct sowing. "Peil-controlled" drainage. Bottom scans for place-specific planting to get as many potatoes in the right size as possible. Refinement, room for other techniques so solutions can be worked on faster. Breeding should be used in the right way and not be done by parties that want to sell products. Self-learning algorithms e.g. in hoeing and plant recognition.	The company is already motivated to work with climate-smart agriculture. What they would still like to see: long-term policy (stable) to be able to invest, A clear agricultural vision.	Financially, climate-smart agriculture requires large investments.
Potato processor, selli ng frozen fries.	Farmer-citizen communication on plant protection products and explaining plant quality requirements. Surface water monitoring and looking for a way to do pollution reduction. "Race development". More time-moment quantity-specific work in cultivation with e.g. crop protection products and fertiliser. Identify plots that need more or less care - plant-specific technologies. Nature-inclusive business. The balance is disturbed by the monoculture we want to	Long term link - Getting started with climate-smart agriculture is challenging because there is no direct (long-term) link with growers. We can instruct them (growers) but there is no room for the long term. Investments have to be made in the short term, while the returns will only be seen in the long term.	Availability of raw material. Either the potatoes are not there or the cost price is too high – which have an impact on sales position at the international level.

Netherlands – onion and potato farming			
Value chain component	**Initiatives**	**Drivers**	**Barriers**
	create. We really don't need to go to strip farming of 1.5 metres, but there is an intermediate solution. We need to start looking for that. Water supply could be more efficient by, for example, saving water that falls in winter for summer.		
Advisor - cultivation and storage and soil, drainage	Advice on tyres to reduce fuel consumption. Precision farming; many growers have GPS therefore there is clearly less and better driving. Strip cultivation; customer experiences and research Drip irrigation Boil and water management Biobased crops e.g. use of Miscantus	-	-
Producer of french fries and flakes.	Drip irrigation. These were trials of about 5 years. But it does not provide enough added value for the grower. Usually there is a small additional yield, but the cost is substantially higher. Fertigation, this does not provide enough yield to cover costs. Nitrogen - measuring of biomass with sensors on the sprayer and using this to control nitrogen application. In the current system: prepping techniques, solar panels on storage facilities, mechanical cooling, green manures, mechanical weed control and NKG. There are also many opportunities in "regenerative agriculture"	If customers are willing to pay more for a sustainable product it would make things a little easier. Development is that it is a hot topic whereas a few years ago it was not. Governments that do not have an unambiguous policy that fits - and developments get in the way. And we ourselves (producers) also have a role in this: we have opportunities to stimulate climate-smart agriculture	Costs, Lower yields, lower quality and higher costs. Government. Not that government is directly seen as a barrier, but government can be a barrier.