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BEATLES
BEHAVIOURAL CHANGE TOWARDS
Climate-Smart Agriculture

CO-CREATING BEHAVIOURAL CHANGE TOWARDS CLIMATE-SMART FOOD SYSTEMS

D1.3 Co-creation activities v2

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Executive Summary

The BEATLES project, running from 2022 to 2026 under the Horizon Europe program (Grant Agreement No. 101060645), aims to accelerate the transition to Climate-Smart Agriculture (CSA) within the EU. The project aligns with EU strategies such as the Farm to Fork Strategy, the Green Deal, and the Common Agricultural Policy (CAP). BEATLES focuses on co-creating innovative pathways towards achieving CSA practices through participatory processes involving multiple stakeholders across five Use Cases in Lithuania, Denmark, the Netherlands, Germany, and Spain. The BEATLES project aims to facilitate the systemic transition to CSA by addressing the complexities of stakeholder needs, market dynamics, and policy frameworks. Through continuous co-creation and knowledge exchange, the project strives to create sustainable and resilient agri-food systems aligned with the EU's climate goals.

Utilizing a Living Labs or Multi-Actor Approach (MAA), the BEATLES project engages stakeholders in annual Co-Creation Workshops (CCWs) to develop and implement CSA practices. The project is structured around five Work Packages (WPs) addressing different aspects of the transition to CSA: identifying lock-ins and levers for CSA adoption, conducting behavioral experiments with stakeholders, assessing environmental, economic, and social impacts, developing fair business models and market conditions, and providing policy recommendations and tools.

In 2023, BEATLES engaged over 80 stakeholders across five co-creation workshops at Use Case level. These workshops discussed value chains, sustainability practices, and policy alignment. Major lock-ins identified included a lack of capacity, consumer interest, and policy support, while levers highlighted included sustainable practices, customer awareness, and carbon taxes.

The 2024 workshop agendas, reported here, focused on Work Packages 4 and5 of the BEATLES project, addressing fair business models and policy support. The workshops also tabled 25 selected CSA practices and their implementation in the five Use Cases, this for the future purposes of the project.

The five co-creation workshops explored stakeholder perspectives on fairness in value chains, identified changes needed for fair value propositions and business models, and mapped changes on an impact feasibility matrix to prioritize actionable strategies. Policy support for CSAs involved reviewing barriers and incentives for CSA adoption and recommending policy interventions for each Use Case. For Denmark, the recommendations included a national carbon tax, biogas production, and slurry management. Lithuania's recommendations focused on investment in climate-smart strategies and support for small farms. In the Netherlands, a long-term policy vision and support for 'On the Way to Planet Proof' certification were advised. Spain's recommendations emphasized technical training and research into local apple varieties.

Upcoming CCWs in 2025 will focus on environmental and social sustainability (WP3), with a final workshop in late 2025 synthesizing four years of co-creation outcomes. The project will intensify collaboration with similar EU projects and enhance CSA advocacy.

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List of Abbreviations, Terms and Definitions

Abbreviation/Terms	Definition
AEIDL	European Association for Innovation in Local Development
AUA	Agriculture University of Athens
BEATLES	Behavioural Change Towards Climate-Smart Agriculture
BM	Business Model
CA	Conservation Agriculture
CAP	Common Agricultural Policy
CCW	Co-Creation Workshop
CSA	Climate-Smart Agriculture

Abbreviation/Terms	Definition
CSP	CAP Strategic Plans
CSRD	Corporate Sustainable Reporting Directive
DM	Dry Matter
EC	European Commission
ESG	Environment Social Governance
EU	European Union
GA	Grant Agreement
GAEC	Good Agricultural and Environmental Conditions (within CAP)
GHG	Greenhouse Gases
HNV	High Nature Value
INTIA	Navarro Institute of Agrifood Technologies and Infrastructures
KPI	Key Performance Indicator
LEAF	Linking Environment and Farming https://leaf.eco/
Levers	Opportunities, facilitator, enabler
Lock-ins	Challenges, barriers, blockages
LPC	Low Power Centrifugal (fans)
MFE	Mineral Fertilizer Equivalent
MSP	Multi-Stakeholder Platform
PP	Planet Proof
RDP	Rural Development Programme
REA	European Research Executive Agency
SEGES	Knowledge Centre for Agriculture and the Danish Pig Research Centre (changed to SEGES Innovation in 2015
SEI	Stockholm Environment Institute
SKOV	SKOV A/S www.skov.com/en/
SMK	Stichting Milieukeur www.smk.nl/en/
UC	Use Case
UCPH	University of Copenhagen
UK	United Kingdom
Value chain	Consecutive steps or activities in the creation of a finished product
VRF	Variable Rate Fertilizer
WP	Work package
WUR	Wageningen University and Research

1. Introduction

1.1 Background and methodology

The BEATLES project[1] (2022-2026) aspires to change the way agri-food systems currently operate and to accelerate the systemic and systematic transition to Climate-Smart Agriculture (CSA)[2] and smart farming[3] technologies. CSA refers to agricultural systems that increase food security in the face of climate change, enhance adaptive capacity of farmers to the impacts of climate change, and mitigate climate change where possible.[4] Transition to CSA is to be fully aligned with the ambitions of the European Union (EU) Farm to Fork and Biodiversity Strategies, the Green Deal (Climate Neutrality by 2050), the Common Agricultural Policy (CAP) 2023-2027 at national and EU levels, and the EU Data Strategy and Digital Compass.

There is increasing interest within the EU in generating and mainstreaming new knowledge on innovative CSA practices. However, implementation of CSA practices requires a deep understanding of stakeholder needs, robust training, and effective transfer of knowledge, which makes transition to CSA a complex process. Knowledge is used here to refer to data, information, and wisdom.[5] The complexity of the transformation process and the need to acknowledge and enable multiple pathways with sometimes conflicting goals warrants special attention.[6] This was not sufficiently articulated within the EU Farm to Fork strategy and constitutes a major shortcoming. Agricultural innovations have been shown to respond better to local challenges when they are co-created through participatory processes.[7] Co-creation activities offer a platform wherein value chain stakeholders can deliberate on conflicting goals and trade-offs. Co-creation activities with value chain stakeholders also have the potential of generating an integrated development agenda that takes the needs and expectations of stakeholders into consideration.[8]

Co-creation is a central part of the BEATLES project[9] as it serves as a link between the project work packages (WPs), the Use Cases and their various value chain stakeholders in the following countries:

- Lithuania (wheat farming), led by AgriFood Lithuania DIH
- Denmark (pig farming), led by Food & Bio Based Cluster
- The Netherlands (onion and potato farming), led by DELPHY
- Germany (organic dairy farming), led by Naturland

[1] https://beatles-project.eu/
[2] Climate-Smart Agriculture https://www.fao.org/climate-smart-agriculture/en/
[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] Rosenstock et al. (2016). The scientific basis of climate-smart agriculture: A systematic review protocol. CCAFS Working Paper no. 138. Copenhagen, Denmark.
[5] Utter et al. (2021). Co-creation of knowledge in agroecology. Elementa: Science of the Anthropocene 9 (1): 00026. https://doi.org/10.1525/elementa.2021.00026
[6] Eliasson et al. (2022). Transformations towards sustainable food systems: contrasting Swedish practitioner perspectives with the European Commission Farm to Fork Strategy. Sustain Sci 17
[7] FAO, Agroecology Knowledge Hub www.fao.org/agroecology/knowledge/10-elements/co-creation-knowledge/en/?page=114&ipp=5&tx_dynalist_pi1%5Bpar%5D=YToxOntzOjE6IkwiO3M6MjoiMTAiO30%3D
[8] Girvetz et al. (2017). 'CSA-Plan': strategies to put Climate-Smart Agriculture (CSA) into practice. Agriculture for Development 30:12-16.
[9] https://beatles-project.eu/use-cases/

- Spain (organic apple farming), led by INTIA

The BEATLES project calls for a "Living Labs"[10]or Multi-Actor Approach to co-creation. This involves multi-stakeholder interaction in a forum (co-creation workshops, CCWs) representing the value chain, targeting sustainable and innovative climate-smart practices and technologies. Each of the five BEATLES Use Cases[11] functions as a base for the Living Labs. The Work Packages make use of the Use Cases for their research and participate in the learning and knowledge exchange that characterises the co-creation agendas in the annual Co-creation Workshops run by the Use Case lead agencies. For BEATLES, the following components have been included in taking the Living Labs, multi-actor approach:

- agenda co-creation by the UC and WP leads for the five annual workshops
- training and bilateral preparatory meetings with Use Case coordinators
- running the workshops by the UC leads in the respective countries
- writing of reports by the UC leads for each workshop
- production of an annual project deliverable summarising the results of the workshops

The items tackled in the annual co-creation workshops are closely linked to the activities within the various Work Packages:

- general overview on lock-ins preventing and levers promoting the adoption of CSA practices and technologies specific to the five Use Cases (Work Package 1, led by University of Copenhagen)
- individual, systemic and policy factors surrounding the transition to CSA practices and technologies tested in behavioural experiments with Use Case stakeholders (Work Package 2, led by University of Copenhagen)
- environmental, economic and social impact assessments of implementing CSAs within the Use Cases (Work Package 3, led by National Technical University of Athens)
- market segments, fair value propositions, business model innovation and validation within the transition to CSA practices (Work Package 4, led by Wageningen University & Research)
- evidence-based policy recommendations at regional, national and EU levels, policy tools, support for agri-business advisors, mutual learning and capacity building for policy action within the context of the transition to CSAs (Work Package 5, led by AEIDL, the European Association for Innovation in Local Development).

The 2023 co-creation activities of the BEATLES project focused on the lock-ins and levers of the transition to CSA.[12] The 2024 co-creation activities focused on topics within WP4 and WP5, fair business models and policy support, respectively

1.2 Outcomes of the 2023 co-creation activities

Over 80 stakeholder representatives from the 5 Use Case value chains were mobilized and engaged during the first co-creation workshops in 2023 in Denmark, Germany, Lithuania, the Netherlands and Spain. The following points were discussed at the co-creation workshops:

[10] Cascone, G. et al. 2024. Promoting innovations in agriculture: Living labs in the development of rural areas. J.Cleaner Production 443 (141247) https://doi.org/10.1016/j.jclepro.2024.141247
[11] https://beatles-project.eu/use-cases/
[12] https://beatles-project.eu/wp-content/uploads/2024/06/D1.2-Co-creation-activities-v1.pdf

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

The following general lock-ins preventing and levers promoting the transition to CSA practices were highlighted during the 2023 co-creation workshops:

Lock-ins

- 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 entered the CSA era yet - 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 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 will 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 will 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 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 specific business and policy-related lock-ins and levers including recommendations on how to address these are summarised below (also see Appendix A.1). These served as background for the identification of priority areas to help focus on in the formulation of the 2024 co-creation workshop agendas.

In terms of business models and market conditions, the reported lock-ins included lack of consumer interest and willingness to pay extra for CSA, low interest in food produced using CSA, and the absence of strategic finance from banks for CSA. To overcome these challenges, it was recommended that CSA practices should be made economically feasible to facilitate adoption. This relates to the need to carefully consider prices for CSA products that customers will be willing to pay. The potential of using carbon taxes to incentivise stakeholders to shift towards CSA was highlighted as a major lever. A sustainability reporting system was suggested as a way for banks to nudge value chain stakeholders to engage in CSA practices.

Regarding policy, the reported lock-ins were mainly related to lack of policies and directives that promote and regulate CSAs at EU and national levels. Several recommendations were made on how to address this gap. The most important recommendations that were raised are the following: the Common Agricultural Policy (CAP) needs to incorporate CSA practices in order to promote the Green Deal and its Farm to Fork Strategies, a shift from financial support to assisted knowledge support to farmers is needed, climate tax must be easy to interpret and use, and advocacy for CSA should be supported at national and EU levels. The main reported lever is in relation to CAP which holds promise as a central catalyst to achieve the goals of the Green Deal and Farm to Fork Strategies. Recommendations on how to harness this lever are the following: CAP needs to be more comprehensive and focus more on promoting niche green practices, CAP support should be oriented towards sustainability results and made easily accessible for farmers developing sustainable agricultural practices.

1.3 Workshop agendas in 2024

A generic workshop agenda was prepared in consultation with the various Use Cases. The issues discussed reflected the specific needs of WP4 on fair business models and WP 5 on policy. Insights from the first co-creation workshops in 2023 in terms of business and policy related ‘lock-ins’ and ‘levers’ were used to help frame the agenda points. In addition, 25 CSA practices were selected by the Use Cases in consultation with the WPs for discussion at this and future co-creation workshops. Training sessions were organised ahead of the co-creation workshops with each Use Case lead to introduce the methodology of the workshop sessions. The CSAs selected by each Use Case including their description are elaborated in Section 2.6 and summarised in Appendix 2 of this report. The generic agenda was modified during the planning process to reflect the specific needs of the Use Cases. As a result, the five co-creation workshops had slightly different agendas.

1.3.1 WP4 "Transition toward fair business models and shaped market conditions"

WP4 "Transition toward fair business models and shaped market conditions"[13] aims to produce a portfolio of business models that will provide roadmaps for effective integration of CSA practices into food systems operations. These business models are to be co-created, through interactions between agri-food stakeholders in multi-actor workshops. A key goal is to produce value propositions and business models that are perceived as fair by all actors in order to achieve their commitment to change practices and behaviours. These business strategies are to be used to improve farm management.

The agenda items dealing with business model innovation covered the following:

- Explore stakeholder's position about fairness
- Gather stakeholder perspectives on how they define fairness, whether they find the value chain to be fair? Why or why not? And to identify what must change to make it fair or what must remain for a fair value chain.
- Co-identify the needed changes towards fairness
- Complement identified changes with the initial results from the value-mapping exercise conducted by the WP4 project team
- Cluster identified changes based on impact and feasibility and select the most promising changes
- Identify key actors affected by the changes who can make the changes happen

1.3.2 WP5 "Transition through policy recommendations and tools"

The second part of the workshops was on policy support linked to the transition to CSA practices and technologies.

WP5 "Transition through policy recommendations and tools"[9] aims to develop a series of regional, national and EU policy recommendations to support policymakers and implementers in the design and implementation of policy measures that support the adoption of CSA. Policy recommendations and tools are to be co-designed in multi-actor workshops.

The objective for this policy session was to identify general barriers/lock-ins and incentives in relation to policy interventions relevant to each of the Use Cases. The work was centred around priority questions (Table 1).

Table 1. Priority questions related to WP5 (policy recommendations and tools).

Co-creation workshops at UC level	Priority questions related to WP5 (policy recommendations and tools). Thinking within the specific UC-agrarian practices adopted:
Year 2 (2024)	• Knowing the available public support, in particular by the CAP what are the specific barriers or lock-ins to adopt CSA practices? • What are the specific incentives or opportunities?

[13] https://beatles-project.eu/work-plan/

The following methodology was used to prepare for and carry out these sessions (Table 2).

Table 2. Methodology behind the workshop session dealing with policy

Agenda item	Description	Methodology
Introduction and presentation of policy findings	The UC leader frames the work in Task 1.3 and WP5 (policy priority questions Table 1) and presents to the group the main findings from the analysis of the CAP Strategic Plans, other policies and interviews with the experts.	AEIDL (European Association for Innovation in Local Development) made available to the UC leaders a factsheet in English and national language with the main policy insights thus far. In this session the factsheet (EN and/or national language) is used to extract the main messages to present, validate and discuss with the participants as follows: • Main Common Agricultural Policy interventions supporting the value chain and selected CSA practices • Other policies relevant for the CSA transition • Main barriers or lock-ins • Main opportunities/incentives The UC lead sends the factsheet in advance to participants. The factsheets are not officially published but are to be used in the context of the co-creation activity. **Outcome:** Participants' feedback to the factsheet is welcomed. AEIDL will update factsheets in case changes are needed. However, these will be updated in the coming year with more information on the other practical CSAs, etc.
Gathering ideas from participants	Knowing the available public support: • What are the specific barriers/lock-ins and incentives for adopting CSA practices?	Once participants have received the main information from the factsheets, the UC leads ask participants to **prioritise barriers and incentives** and explain more in detail. The UC leads take notes and include these in the workshop reports. AEIDL jointly analyses and uses that information to organise the follow-up EU multi-actor working group. **Outcome:** UC leads need to report about specific barriers/lock-ins and incentives for adopting their CSA practices, going beyond what is already in the factsheets, focusing on a couple of barriers and incentives and adding these to the workshop reports.

1.4 Participation at the Co-creation Workshops in 2024

The co-creation workshops were held in February and March 2024 in each of the five Use Case countries. The stakeholder participants included farmers, retailers, technology

providers, policymakers, advisors, government representatives, consumer representatives, researchers, seed producers, breeders and processors (Table 3). Although the KPI for the co-creation workshops is 15 participating stakeholders for each of the five workshops, the average for 2024 was 11.6. In 2023 the average was 16. On the other hand, the diversity of stakeholders in 2024 was wide.

Table 3. Schedule and stakeholder participation at the five co-creation workshops (CCWs) held in 2024

Use Cases	Date & venue of CCW	Type of meeting	Value chain stakeholders represented (including numbers)	Participants
Wheat farming, Lithuania	13/3 2024, Radisson Collection Astorija Hotel, Vilnius	Hybrid (digital & in-person)	Farmer **(2)**, farmer association **(1)**, technology provider **(1)** retailer **(1)**, policymaker **(1)**	**6**
Organic dairy farming, Germany	29/2 2024, Heissenhof Inzell	Hybrid (digital & in-person)	Farmer **(2)**, breeding association **(1)**, dairy processing **(2)**, feed producer **(1)**, retailer/trader **(2)**, agricultural advisor **(2)**, policy/government officer **(2),** consumer **(2)**	**14**
Pig farming, Denmark	8/3 2024, Herning	In-person	Farmer **(1)**, feed supplier **(2)**, researcher **(1)**, policymaker **(2)**, technology provider **(7)**, advisor **(1),** business developer **(1),** investor **(1)**	**16**
Organic apple farming, Spain	5/3 2024, Pamplon, Navarra	In-person	Farmer/processor (juice) **(3)**, policymaker **(1)**, researcher **(2)**, advisor **(3)**	**9**
Onion and potato farming, Netherlands	20/3 2024, Alvanto Sint Annaland	In-person	Seed producer **(1)**, farmer **(2)**, potato breeder **(1)**, supplier **(1),** advisor **(3)**, policymaker **(2)**, processor **(1)**, researcher **(1)**, certifier **(1)**	**13**

2. Use Case value chains and selected CSA practices/technologies

Each of the BEATLES Use Cases was requested to briefly describe its value chain components and provide some relevant statistics in order to set the scene for each of the co-creation workshops. In addition, they were each tasked with selecting five CSA practices/technologies to be used in the various WP in-depth work. The following summarises the Use Case value chains:

2.1 Wheat farming Lithuania

Winter wheat is Lithuania's most prevalent arable crop, covering over 750,000 hectares annually (38% of the total arable land). Cultivated by medium-sized farms, cooperatives, and large agricultural businesses, Lithuania's grain sector is organized and market-oriented, producing over 4 million tons annually for local and export markets. However, wheat farming significantly contributes to climate change, environmental degradation,

and biodiversity loss. To address these issues, systemic change towards climate-smart farming practices is required, supported by aligning productivity-focused business models with sustainability regulations.

Despite a decreasing number of farms, winter wheat remains a key staple, with 845,000 hectares cultivated in 2022, yielding 4.9 tons per hectare. There are 691 organic farms growing winter wheat, which constitutes 48% of organic cereal production. These farms face challenges in maintaining high yields while adhering to eco-friendly principles, such as managing pests without synthetic pesticides and maintaining soil fertility through sustainable practices. Limited access to specialized equipment also hinders organic farming efficiency.

The shift to climate-smart agriculture faces additional challenges, including farmer reluctance to change, consumer unwillingness to pay more for sustainable products, lack of business incentives, unclear policies, and difficulties in obtaining necessary technologies. Addressing these barriers from individual, systemic, and policy perspectives would encourage sustainable practices, reducing GHG emissions, improving soil health, and enhancing farm productivity and economic performance. Socially, this would boost rural community wellbeing and sustainable rural economic development, promoting wider adoption of climate-smart practices.

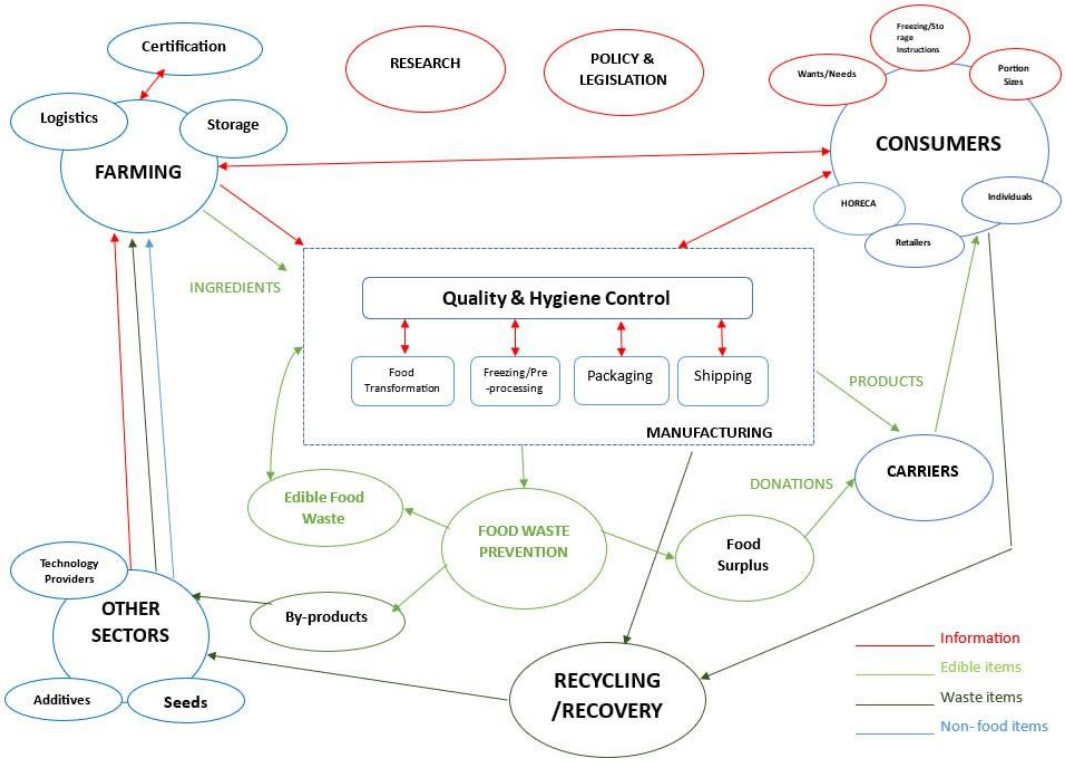

Figure 1. Value chain of the wheat farming Use Case in Lithuania

2.2 Organic dairy farming Germany

By the end of 2023, Germany had 50,581 farms with dairy cattle. This was approximately 2,400 or 4.4% fewer than in December 2022, according to Dairy Global.[14] The population of dairy cows has been decreasing steadily since 1980 in Germany and is now at 3.8 million

[14] https://www.dairyglobal.net/

head.[15] Germany is the fourth largest milk producer in the world[16], the mean number of dairy cows per farm increased from 31 in 1999 to 70 cows per farm in 2021. In 2021, 1 in 5 farms kept more than 100 dairy cows.[17]

The organic dairy farming Use Case in Germany is located in the south of Bavaria and close to the Austrian border. The dairy is structured as a cooperative, with part of the products being certified based on organic criteria. Among the organic certification, the company produces Demeter-certified products[18] as well as Naturland Fair certified products. Of the 1800 dairy farmers of the cooperative, 650 are producing according to Naturland or Demeter standards. This means parts of the cooperative members are members of the Naturland association, which is also issuing the Naturland Fair certification and is in charge of organising the Use Case for the BEATLES project. For differences between the European organic certification and the private label Naturland refer to CCW report 1 (Deliverable 1.2 2023)[19].

The supply chain of the UC is described in the figure below:

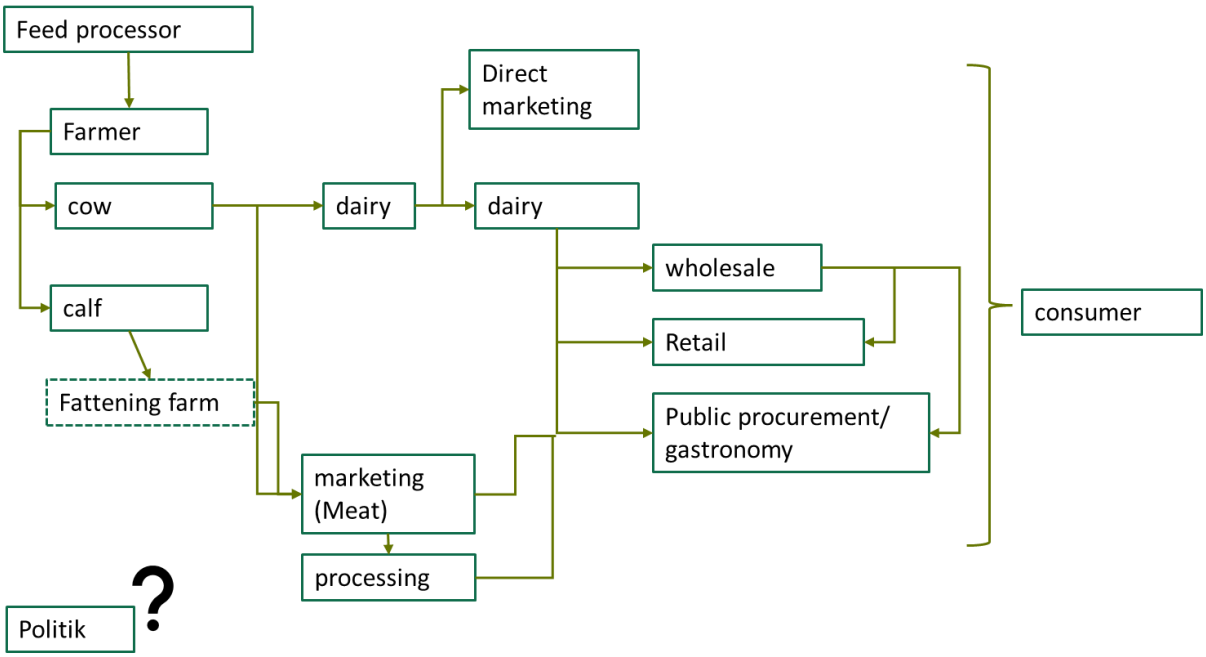

Figure 2. Value chain for the organic dairy farming Use Case in Germany

2.3 Organic apple farming Spain

The area destined for organic production in Spain increased 3.5% in 2020 compared to the previous year, reaching 2.4 million ha. The average annual growth trend of the eco area was 4.8% between 2015 and 2020 putting organic at 10% of the total agriculture area in Spain, highest in the EU. The objective is to reach 25% before 2030.[20] Spain accounted for about

[15] https://www.statista.com/statistics/1251607/dairy-cow-population-germany/
[16] Hemme, T. 2020. IFCN Dairy Report 2020. International Farm Comparison Network
[17] https://literatur.thuenen.de/digbib_extern/dn065418.pdf
[18] Quality certification. https://demeter.net/demeter-products/
[19] https://beatles-project.eu/wp-content/uploads/2024/06/D1.2-Co-creation-activities-v1.pdf
[20] https://www.cultifort.com/en/spain-leader-organic-agriculture-europe/

one-third of the EU fruit plantations and about 8% of the area within EU-28 devoted to apple orchards.[21]

Farmers are the central part of the value chain, as well as the largest group in the Navarra UC. Nevertheless, different types of stakeholders and challenges across the whole value chain have been identified. There is great diversity among the farmers participating in the UC, from farmers who produce apples and sell them without any processing to companies to producers who transform or store their production and sell it in shorter value chains.

In the other hand, we have different processing or distribution companies, who either sell fresh fruit or process it.

In addition, the participation of researchers, consumers and advisors enriches and makes possible to address the following main topics or challenges already identified during the 2023 co-creation activities:

- Storage and calibration
- Commercialisation and local supply to industry/distribution
- Processing (juice, cider and others)
- Primary production challenges (organic production at the field level)

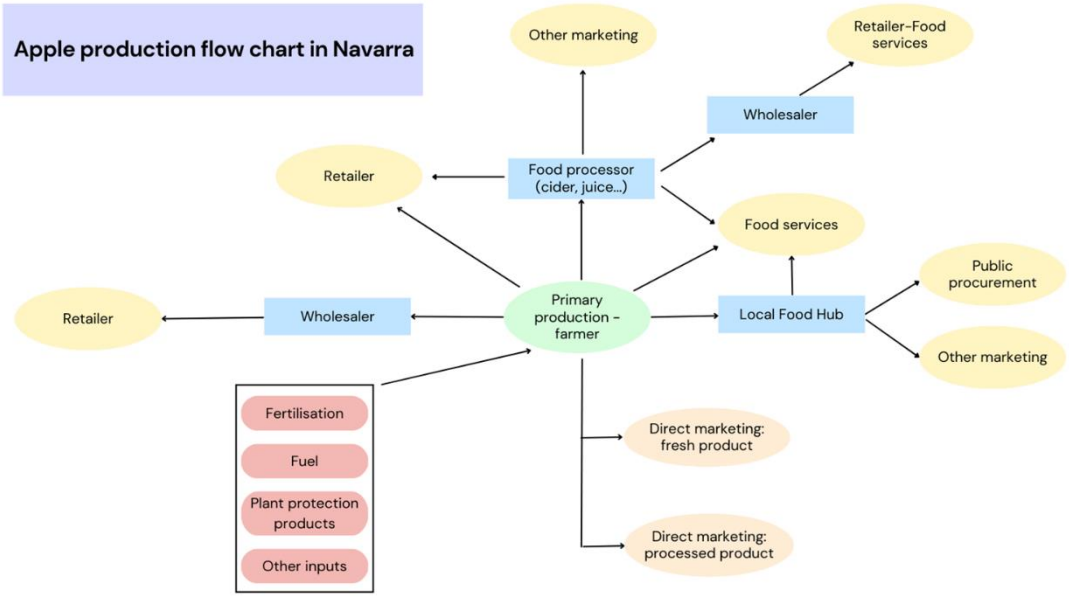

Figure 3. Value chain for the organic apple farming Use Case in Spain

2.4 Pig farming Denmark

The Danish Use Case covers a great part of the value chain from primary production to end users. Most active participants represent technology providers, advisors, financial sector, and research. The main challenges of the pig production in the moment, is to reduce

[21] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Agricultural_production_-_orchards

greenhouse gas (GHG) emissions from the production and consumer willingness to buy (Danish) pig meat.

The production of pigs and pork meat is a major source of income for Denmark for many years. Around 90% of total production is exported, making it the largest contributor to foreign earnings and essential to the balance of trade. The Danish pig industry is amongst the best in the world in terms of breeding, quality, food safety, animal welfare and traceability, and increasingly also with respect to the environment.

There are around 5,000 pig farms in Denmark, which produce ca. 28 million pigs per year, with most pigs slaughtered at the co-operatives Danish Crown and Tican. Danish pork is exported to over 140 countries around the world. Live pigs are also exported to many countries including Germany and Poland.

At European level, pork contributes 8.5 % of the total EU-27 agricultural output, which is the highest share compared to other meat sectors, with 35% of the meat market. This makes it an extremely important industry in terms of employment, turnover, and food supply and therefore critical in a European context. The meat industry across Europe is facing enormous challenges in to significantly reduce its environmental emissions, while remaining economically competitive. The pig production sector is likely to be impacted by the evolution of the policy environment, including a new CAP, the recently published European Green Deal and Farm to Fork strategy, which promote greener and more sustainable agriculture and food systems. This is likely to mean changes in the industry regarding environment and animal welfare. As a result, the industry requires a series of actions to improve amongst others environmental impacts across Europe.

Denmark is among the most environmentally effective producers of pork. Environmental impacts have halved since 1985 for CO_2 and phosphorus, with ammonia reduced by 73% over the same period. The industry can reduce climate effects from pig farms by practicing frequent discharge of slurry, which reduces methane emissions, as well as improving the stall internal climate. Other improved technologies and methods for ventilation, feeding, breeding, and waste treatment can contribute to reducing climate impact of pig production.

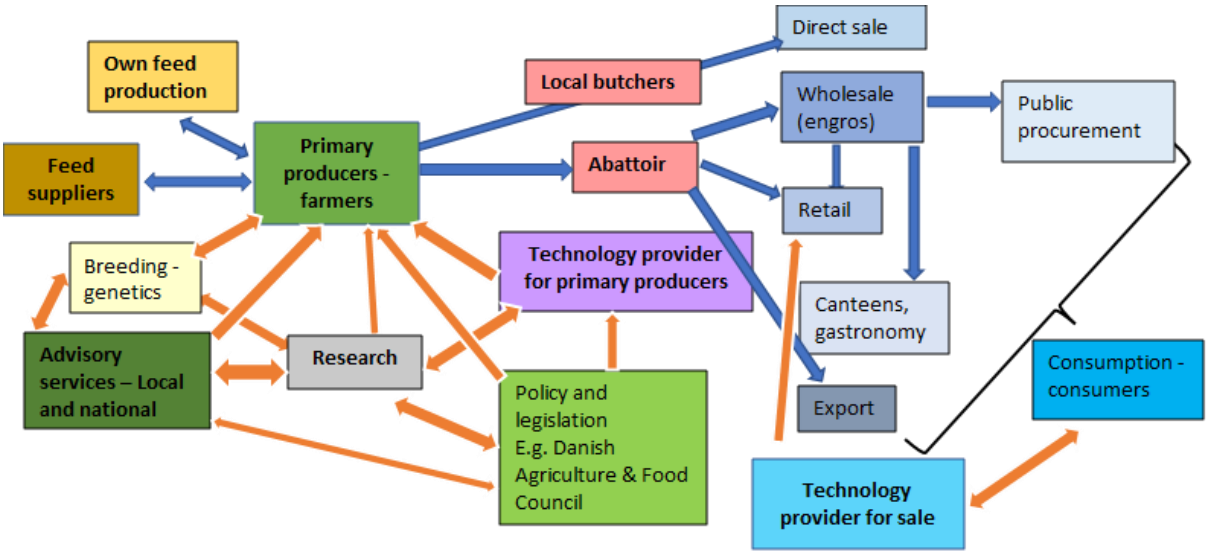

Figure 4. Value chain components in the Danish pig farming Use Case

2.5 Onion and potato farming Netherlands

Brief description of the Use Case – defining its scope and system boundaries. The Dutch Use Case (UC) is about the value chain for climate-smart production of onions and table potatoes under the "On the Way to Planet Proof" label (PP). The two value chains are different in the sense that onion production in the Netherlands is mainly for export outside Europe, e.g. to African countries including Senegal. Outside Europe, sustainability requirements are less or even absent. Table potatoes are for a larger part meant for the Dutch market, product buyers do require more and more CSA produce. This makes the chains different in terms of sustainability. Many farmers grow onion and potatoes in the crop rotation, so the difference between the value chains is for the part that comes after the growers. Product storage takes place on the farm, until product delivery. Both products are stored from September to May, delivery during the whole period. Table potatoes are mostly grown on a contract 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' (PP) 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 see https://www.planetproof.eu/en/.

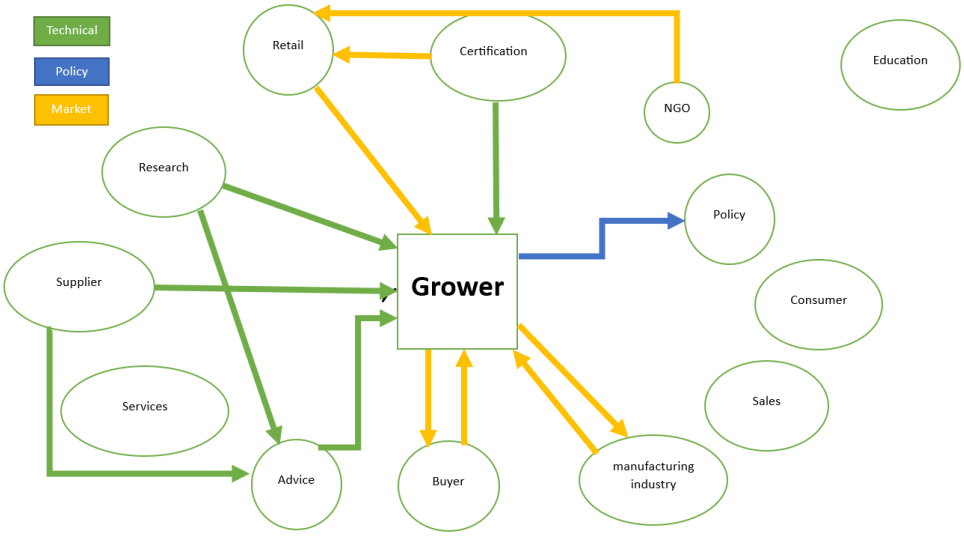

Figure 5. Influence and/or impact on stakeholders in the Netherlands onion and potato Use Case value chain

2.6 Choice of CSAs for each Use Case

Each use case was tasked with choosing five CSA practices that would be tackled by the BEATLES Work Packages and in the co-creation workshops. Details are found in Appendix A.2. Table 4 summarises the various CSA practices and technologies chosen by each of the Use Cases. These are to be used to further focus the various Work Packages within the BEATLES project until its completion in 2026.

Table 4. CSA practices and technologies identified by the BEATLES Use Cases sorted by category (green-shaded cells show occurrence)

CSA category	specific CSA practice or technology	participating BEATLES Use Case				
		Denmark	Netherlands	Lithuania	Germany	Spain
energy management	solar power		x	x	x	x
	methane reuse	x				
manure management	slurry acidification	x				
	pen/barn ventilation	x				
	slurry cooling	x				
	frequent emptying of slurry	x				
soil management	composting					x
	minimal/no tillage			x		
	targeted fertilizer application		x	x		
	soil fertility		x	x	x	x
	soil conservation			x	x	x
	precision agriculture		x	x		
	carbon sequestration		X	x	x	x
water management	conservation measures		x			
livestock management	breeding				x	
	longevity and welfare				x	
	improved nutrition				x	
	less waste				x	
	rotational pasture grazing				x	
	specialized feed formulations				x	
crop diversification	green feed	x				
	green manure		x			x
	rotation					x
	nutrient offtake optimized		x			
	perennial grasses/trees				x	
	legumes				x	
	cover crops		x			x
	intercropping			x		
pest/weed management	integrated pest management		x			x
	chemical applications		x			
	floral bands					x
	grazing					x
waste and runoff management	composting					x
	wetland management			x		
	riparian buffer zones					
	reduced runoff		x			
Transportation	local feed production				x	
	local markets				x	x

3. WP4 session results: Fair business model innovation - Co-identifying the needed changes towards fairness

3.1 Objectives of the sessions

One of the key objectives of the BEATLES project is to develop fair business strategies for the transition to sustainable, productive, and climate-smart agri-food systems[22]. To pursue this objective, WP4 has been tasked to develop fair value propositions and co-design fair business models. Central to these tasks was the pivotal concept of fairness. In BEATLES, four dimensions of fairness have been distinguished that together form the complex construct of fairness[23]:

1. **Distributive fairness** – focuses on outcome distributions or allocations based on needs, equality, and equity.
2. **Procedural fairness** – pertains to fairness of the procedures used to determine outcome distributions based on consistency, bias suppression, accuracy, correctability, ethicality and representativeness.
3. **Interpersonal fairness** –the degree to which people are treated with politeness, dignity, and respect by those executing procedures.
4. **Informational fairness** – focuses on the quality of the information provided about the procedures resulting in outcome allocations.

The concept of fairness was one of the focal points of discussion during the five Use Cases co-creation workshops held in Lithuania, Germany, Netherlands, Spain, and Denmark during 2024.

3.2 Overview of the sessions

Within this context, Work Package 4 co-developed and contributed an agenda which formed the first session of the co-creation workshops in 2024. The agenda was designed to achieve two specific objectives. First, to co-explore stakeholders' grounded positions on fairness. Second, to co-identify the changes needed to achieve fair business model innovation.

In this summary, the process of how the specific objectives were carried out and the respective outcomes are not included since this is an integral part of the change management framework of Deliverable 4.3 Portfolio of Business Models v1, to be delivered by WP4 (M36). But for an overview, we enumerate the questions posed to answer the specific objectives. First, the following questions were posed to the stakeholders:

1. What does fairness in the value chain mean?
2. Is the value chain fair? Why and why not?
3. What are the changes needed towards fairness?

[22] Concept & Objectives (beatles-project.eu)
[23] BEATLES Deliverable 4.1. "Portfolio of fair value propositions v1". Report on the segmentation analysis and the set of fair value propositions. https://beatles-project.eu/wp-content/uploads/2024/06/D4.1-Portfolio-of-fair-value-propositions-v1.pdf

This was followed by a short presentation of the four dimensions of fairness distinguished within the BEATLES project. The stakeholders were then asked to prioritize the changes needed towards fairness based on how they perceive them to contribute to fairness informed by the four dimensions above. This was done using dot voting, a tool used to make decisions in a group setting by allowing stakeholders to vote on options represented on sticky notes. It helped improve decision-making by ensuring every stakeholder was heard and considered. Following the dot voting, stakeholders were asked who they think could contribute to bringing about the needed changes. Finally, the stakeholders were asked to map the co-identified changes on an impact feasibility matrix. Impact here referred to the degree to which an idea has the potential to contribute to fairness in the value chain.

3.3 Outcomes of the sessions

Ultimately, the session served as a platform for stakeholders to share their perspectives on fairness and discuss how to improve fairness in the value chain within the five Use Cases. Summarized in Table 5 is the list of co-identified changes toward fairness mapped by the workshop participants. Also enumerated in the table are the corresponding key actors co-identified by participants who they think can contribute to making the changes. The changes listed and the key actors were extracted verbatim from the individual reports submitted by the Use Case lead partners. The co-identified changes towards fairness are arranged per Use Case starting with Denmark Use Case and based on which quadrant they were mapped by stakeholders during the co-creation workshop. The definitions of the quadrants are depicted in the Figure 6 to provide illustrative guidance.

Table 5. List of co-identified changes needed towards fairness during the co-creation workshop of the five Use Cases.

	Key actors	HI, HF	HI, LF	LI, HF	LI, LF
Denmark Use Case					
Incentives with biological processes	Policymakers				
The consumer and retailer need to be closer to the manufacturer. Willingness to create a greater commitment.	Retail co-owners like REMA 1000 and Gram Estate (agriculture)				
ESG report for Mr. and Ms. Denmark. There is a lack of incentive from the consumer to buy more climate-friendly produce	Societal trend and consumers				
Commercialization of climate-smart products – needs to involve the retail part, as it is their responsibility to showcase the products for the consumers. We need to approach this backwards	Retailers, consumers, policymakers, farmers				
Optimization, requirements, structure, and practicality of regulations must change. Policymakers and consumers need more knowledge about how production is done in a more practical way.	Policymakers				
The use of ESG reports. The data and impact of CSAs become clearer when presented in an ESG context revealing where fairness exists.	Regulation, policymakers				

	Key actors	HI, HF	HI, LF	LI, HF	LI, LF
Germany Use Case					
Increase demand for organic products	Policymaker, dairy, farmer association, retail (advertisement), farmers, media				
Holistic definition of fairness and climate-smart	Media, science (include farmers and practitioners)				
Origin labelling	Policymaker, retail, gastronomy, tourism				
Fair subsidies also for small farms	Policymaker				
Consumer education (Honest advertisement and information, Campaigns, Fair education and marketing, Communicate added value in a fair way)	Schools, policymaker (on nationwide level). "Öko-Modellregionen", Dairy				
Changing the current market regulations and practices	Policymaker				
Public procurement (to increase demand for organic and fair products)	Policymakers (also on communal level)				
Increase in planning security for all actors	Policymaker, all actors of the value chain				
Regulate retail (food retail) through cartel office	Policymaker				
Removal of taxation on organic and regional staple food products					
Same rules and regulations for all food imports					
Lithuania Use Case					
Changing the distribution of financial support to climate-friendly practices and promotion of organic farming	Farmers, policymaker, grain buyer				
Increasing consumer awareness of and trust in products bearing the organic label	Farmers, technology provider, grain buyer				
Increasing farmers' access to innovative technologies	Policymaker, tech provider				
The cultivation technology and technical solutions must be chosen	Farmers, grain buyer, tech provider				
Changing the geopolitical situation	Farmers				
Increasing cooperation between small and medium-sized farmers to improve their competitiveness	Farmers, tech provider, policymaker				
Netherlands Use Case					
Reward growers for extra costs, risks and for a sustainable produce / fair distribution of margins	Across all actors				
Make the value chain transparent	Across all actors				
Less regulation and more facilitation towards sustainable produce	Value chain				
Trade and retail already are earning money with Planet Proof; now it's time for the growers to get their share	Farmer				
Spain Use Case					
Promotion of consumer associationism and short marketing channels. Optimization of technical resources: collective solutions for storage, calibration, etc.	Farmer, public administration, consumer, processor, commercialiser				
Awareness-raising work with consumers about the importance and impact of	Farmer, public administration, consumer, processor				

	Key actors	HI, HF	HI, LF	LI, HF	LI, LF
buying local and sustainably produced products					
Use of more efficient machinery	Farmer, advisor, researcher, processor, commercialiser				
Transition towards more sustainable agricultural practices	Farmer, public administration, advisor, researcher, processor				
Research/ increased knowledge of local fruit varieties for their promotion and improvement of yields (e.g. pollination behaviour)	Public administration, advisor, researcher, farmer				
Flexibilization of hygienic-sanitary requirements in processing	Public, administration, advisor, farmer, processor				

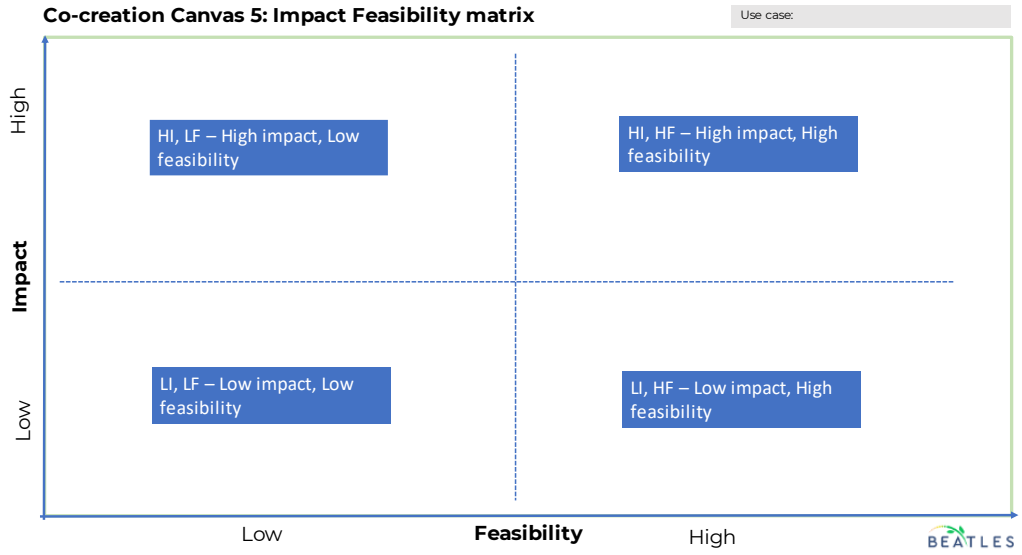

Figure 6. Impact feasibility matrix used for assessing the suggested changes to achieve greater levels of fairness

The mapped changes needed towards fairness will form the basis for the co-design of fair business models. Concurrently, analysis of rich data gathered from the five co-creation workshops is in progress. The result of the analysis will be part of Deliverable 4.3 by Work Package 4 to be delivered by month 36 of the project.

4. WP5 session results: Policy – Public support for CSAs

WP5 has addressed two of the five selected CSA practices/technologies within each Use Case as follows:

- Denmark: The analysis of public support available for the CSA practices selected in this Use Case focused on those related to slurry management and energy optimisation.
- Lithuania: The analysis of public support available for the CSA practices selected in this Use Case focused on no-tillage system and precision farming.

- Spain: The analysis of public support available for the CSA practices selected in this Use Case focused on organic production and cover crops.
- The Netherlands: The analysis of public support available for the CSA practices selected in this Use Case focused on those related to enhanced biodiversity at the farm level and limitation of water pollution using precision fertilizer techniques.
- Germany: The analysis of public support available for the CSA practices selected in this Use Case focused on organic production and animal feed from forage.

The objective of the BEATLES WP5 policy session (Transition through policy recommendations and tools) responded to the Year 2 priority questions (Tables 1 and 2)- knowing the available public support, in particular by the Use Case CAP Strategic Plan: what are the specific barriers or lock-ins and incentives for adopting CSA practices? What are the specific incentives? AEIDL shared with invited stakeholder representatives draft factsheets describing the policy context for the transition to CSA practices and technologies relevant to each of the Use Cases. The review by the workshop participants was to focus on identifying barriers/lock-ins hindering and incentives/opportunities promoting the adoption of CSA within each Use Case. The following are the summaries by the UC leads based on the discussions that took place during the co-creation workshops. These are also connected to specified stakeholders that were in attendance.

4.1 UC Denmark (pig farming)

The Danish co-creation workshop discussed barriers and incentives to the policy measures and these are summarised in Table 6.

Table 6. Attitudes surrounding barriers and incentives to policy measures as derived from the Danish co-creation workshop stakeholders

Stakeholder type	Specific barriers/lock-ins	Details and comments	Specific incentives and opportunities	Details and comments
All	Lack of incentive structure. Uncertainty about policies and the economy	The current structure does not favour and prioritize many actions but more the actions that are 'in' and new, but not necessarily the most efficient. Financial uncertainties and political agendas create barriers.	Information and documentation.	Knowledge is valuable and documentation necessary in order to make the value chain fairer. If the retail and consumers are the 'pulling factor' in the green transition of pig production or any food chain, they need to be assured, that the effect on reducing climate footprint and emissions is significant. Credibility and trust are the key issues.
Technology provider, farmer, municipal officials	Time horizon in relation to re-election in city council and European Commission	Problematic that time 'stands still' until the next election – especially the case in the EU Commission.	Implementation in collaboration with development	Even though implementation is in progress, further development must continue in order to ensure continued optimization.
Municipal officials	Re-electing politicians and their agendas is an obstacle and a challenge.	Green transition will not be promoted if city council politicians don't support it to the max. Civil servants can have as many ideas as they want. There must be consensus throughout the entire political system and collaboration on a	Inspiration from other industries.	

		common agenda at all levels of the political system.		
Research, advisor, feed industry, farmer, technology providers	Implementation in collaboration with development	Both a barrier and opportunity. Even though implementation is in progress, further development must continue to ensure continued optimization.	A good business case for climate credits, for example, could be an incentive.	

4.2 UC Lithuania (wheat farming)

The Lithuanian co-creation workshop discussed stakeholder attitudes surrounding barriers and incentives to the policy measures and these are summarised in Table 7.

Table 7. Attitudes surrounding barriers and incentives to policy measures as derived from the Lithuanian co-creation workshop stakeholders

Stakeholder type	Specific barriers/lock-ins	Details and comments	Specific incentives and opportunities	Details and comments
Farmer	No policy measures support precision agriculture (VRF), i.e. purchase of necessary equipment and soil tests	Not included in the public financial support.	Financial support for obtaining necessary equipment and compensation for soil tests/maps	Equipment (smart spreader), soil tests and maps should receive financial support. In exchange, it could be requested from the farmer to fertilize the fields in line with the results of the soil tests for 5 years. One municipality in Lithuania is already offering to contribute to cover the costs of soil tests for farmers. In some EU countries, the national government covers the costs of soil tests every 3 years.
Farmer	The first design of the eco-scheme for no-till farming was complex, as it required both 2 productive and 1 non-productive eco-scheme selection (which discourages farmers)	-	Now the restrictions are easing up by no longer requiring that non-productive fields participate in the eco-scheme (no need for min 2 eco-schemes)	Already in place.
Farmer	No support for equipment specifically for organic farming (rotor harrow, cultivators)	-	Targeted support for equipment specifically for organic farming (rotor harrow, cultivators)	-
Policy maker	-	-	Maximize farmer income through wheat processing in the farm and selling not the wheat but the processed product	Increased income of farmers could lead to greater individual investments by farmers, not counting on the state for support
Policy maker Farmer	-	-	Centralized state support for farmers (maps, tests, consultations/education) and processing capacity building by establishing at least one state-owned processing company that would increase the	-

Stakeholder type	Specific barriers/lock-ins	Details and comments	Specific incentives and opportunities	Details and comments
			bargaining power of farmers	
Farmer association	Small, medium farmers lack knowledge on the exact costs for their production	After knowing their exact costs, farmers could see the benefits by certain CSA practices	-	-
Grain buyer	Biological impacts of using no-till (new plant diseases)	-		
Farmer	"Fear" of new technology (not knowing how to use it, the process looks too complicated).	-	State-level education, demonstrations, soil samples.	

4.3 UC Netherlands (onion and potato farming)

The Dutch co-creation workshop discussed stakeholder attitudes surrounding barriers and incentives to policy measures and these are summarised in Table 8.

Table 8. Attitudes surrounding barriers and incentives to policy measures as derived from the Dutch co-creation workshop stakeholders

Stakeholder type	Specific barriers/lock-ins	Details and comments	Specific incentives and opportunities	Details and comments
Farmer	There is no clear policy from the government	The government has ambition and goals but no stable long-term policy. Policy is changing too often; farmers don't know how to anticipate into the future.	Long-term vision and policies	A lot of changes are needed in agriculture to meet the long-term/ future requirements for sustainable produce. This needs investments by farmers, but they are unsure if the investments they make will be still relevant in the near future. There are a few examples of changing regulations that make farmers unsure/hesitant to invest
All	No interference from the government in the value chain	Although the government wants more sustainable agriculture and acknowledges that the value chain partners play an important role, they are not willing to interfere, they demand the 'sector' to arrange this.	Supportive/active role of the government	There is a 'Future-oriented vision crop protection'. Government and several stakeholders from the private sector, NGOs, pesticide industry, breeders, drinking water companies and waterboards signed a covenant about the transition towards sustainable crop protection. The government has taken the role of directing the transition and stimulates the development of a strong and innovative agricultural sector. The government is setting preconditions for the sector but does not play an active role in the value chain.
Farmer and others	No reward for the growers for sustainable produce, as in PP.	Farmers growing under the PP (Planet Proof) label need to comply to a lot of requirements for the five selected CSA practices. The result is higher costs for production and additional costs for the certification process. Especially a burden for smaller growers. They are not (fully)	The government could play an active role in the support of PP production.	There are a few 'easy' options. One is to compensate farmers for the costs of certification. A second option could be to reward PP producers the Gold-CAP status. Part of the Dutch CAP is the Eco-premium. There are three levels, bronze, silver, gold. Each level has specific requirements, gold the most, bronze the least. An option is to grant every PP the gold level, as is the case

Stakeholder type	Specific barriers/lock-ins	Details and comments	Specific incentives and opportunities	Details and comments
		compensated for these extra costs, let alone that they don't get a reward for sustainable produce, a societal wish/demand.		for organic growers. An option could even be to adapt the PP criteria if needed. The certificate owner, SMK, is open for such a discussion. Stronger pressure on value chain partners (farmers organisations, NGOs and policy) can also help to arrange better prices for farmers. NGOs seem to have other priorities currently.
All	Differences in regional policies	The CAP money (apart from the direct payments) in The Netherlands is divided over provinces, and every province has a different CAP program, different topics and subsidies. This is not per se a problem, but it would be much better if there also was a national budget directed to achieving national goals.	National program	At least part of the CAP budget could be in a national fund and available to support the development of sustainable/climate-smart agriculture.
Farmers, SMK	PP is a national label	PP has been developed in The Netherlands and therefore still a niche market. Although there are producers in some other EU countries (Spain, Italy, Germany and perhaps a few others) it has a limited outreach as there is no demand from PP produce from other countries.	EU Standard for CSA	It would be good to develop an EU standard for CSA and promote, or even request this in the European value chains. There are several labels in the market in different countries that can comply with such a standard. This creates a level playing field for farmers in Europe. There is an initiative, cooperation between LEAF (UK), HNV (France) and PP where they work on mutual recognition of each other's labels. SMK is orientating on CSRD (Corporate Sustainable Reporting Directive), which might provide perspective for such an approach
Farmers and others	Generic rules discriminating between farmers	The EU Nitrates Directive resulted in very strict regulation for N and P supply. For N there is even stricter regulation for certain areas (N-polluted areas). This regulation is independent from the real situation. Every farmer has to comply to the same rules. This feels unfair to farmers doing their best to be more sustainable.	Policy from measures to goals	Set clear goals, develop an instrument that calculates the results of individual farms, allowing farmers to apply more N & P if they meet the goals through clever and sustainable management.
All	Legislative approach from the government	The regulation in agriculture gets more and more detailed. Farmers have to comply to many and very detailed requirements. The result of this is that many legal experts are working at the MoA and very few have content expertise.	No easy solutions or opportunities.	Regulation is EU-steered and translated into national regulations. As long as regulation is not changed from detailed measures to achieving goals and proving the goals are achieved, this barrier will not be solved.

4.4 UC Spain (organic apple farming)

The Spanish co-creation workshop discussed stakeholder attitudes surrounding barriers and incentives to policy measures and these are summarised in Table 9.

Table 9. Attitudes surrounding barriers and incentives to policy measures as derived from the Spanish co-creation workshop stakeholders

Stakeholder type	Specific barriers/lock-ins	Details and comments	Specific incentives and opportunities	Details and comments
Farmers/ processors	The subsidies from the CAP are poorly distributed; they should be exclusively for those who are actually working the land.	This comment is shared by most of the participants	The budget allocation available for direct aid has established minimums.	For some producers this can be seen as an incentive to expand to this minimum.
Farmers/ processors	The CAP leads to relaxation and neglect in land management	CAP in general does not foster positive practices in land management, but rather the opposite, and this is seen as a barrier		
Advisors/ researchers	Vegetative cover: there are no obstacles to their adoption, but specific measures for their management are lacking.			
Farmers/ processors	The budget allocation is poorly designed. The budget should be in harmony with the farm surface area.			

4.5 UC Germany (organic dairy farming)

The following stakeholder opinion summary was generated by Naturland following the co-creation workshop.

- Making agriculture more ecologically friendly has been a goal since the 1990s in the EU
- In the last years, the matter has been promoted mainly though the European Green Deal and the Farm to Fork Strategy
- The goal has been to convert conventional agriculture towards organic farming or at least more environment-friendly agriculture
- Concepts like “green by definition” or “green by concept” provided significant benefits for the organic sector, since organic farms were exempt from many GAECs (Good Agricultural and Environmental Conditions) within CAP but during recent years and months, these aspects have lost active support from the EPP (European People’s Party) which originated the Green Deal
- Other relevant policies for grassland use include within the next two years, the German organic regulation will make pasture access for 180 days/year mandatory
- A specific problem for organic and climate change measures is that often there is competition for the funding. Subsidies are more accessible for sustainable methods by conventional farmers, or they are designed to only support organic agriculture
- Another topic/regulation relevant to climate change and especially water resources is “Düngeverordnung” i.e. fertilizer regulation in Germany
- The Bavarian subsidy scheme “KuLap” provides organic agriculture support for building up of humus using at least 40% coverage of clover grass

- **Barriers to adopting CSA practices/technologies:**
  - Not all measures from CAP and Kulap can be combined with each other
  - Bureaucracy and software failure - government IT-systems did not work properly in 2023. Measures could not be booked and combined in a way that the legislation allowed them to be. Only 30% of the measures taken by farmers could be booked.
  - "Green by definition" for organic farmers does not apply anymore. Conversion of grassland to arable land and GAEC 8 (4% of areas taken out of cultivation), lead to the loss of a major advantage with organic farming.
  - The organic subsidy is too low for the actual benefits that society gains from organic farming.
  - Bureaucratic difficulties discourage farmers from applying for subsidies for measures taken (or at least not for all that would be possible).
- **Opportunities to adopting CSA practices/technologies:**
  - Naturland and the German Organic Food Association drafted a concept note contributing to revising the CAP in 2027.

5. Conclusions

The purpose of this Deliverable was to report on the preparation, implementation and results from the co-creation workshops held in 2024 carried out by the five BEATLES Use Cases, while also recalling the main results of the previous workshops in 2023. The objective was to focus on BEATLES Work Package 4 dealing with fair business strategies and Work Package 5 dealing with policy measures, both in relation to adoption of climate-smart practices. The Use Cases were also asked to identify five climate-smart practices/technologies that could be applied to all the Work Packages within BEATLES.

5.1 Fair value propositions

The workshops tackled fair value propositions and fair business models and provided suggestions regarding what changes are necessary to create greater levels of fairness. The following summarises the changes put forward by the stakeholders in each Use Case.

The following suggestions on necessary changes were made in the workshop in **Denmark**: Incentives aligned with biological processes are necessary to enhance sustainability efforts. To foster greater commitment, consumers and retailers need to be more closely connected to manufacturers. Environmental, Social, and Governance (ESG) reporting should be improved to encourage consumers to purchase more climate-friendly products, addressing the current lack of incentive. The commercialization of climate-smart products requires active participation from retailers, who must effectively showcase these products to consumers, utilizing a back casting approach. Regulatory optimization is essential, with changes needed in requirements, structure, and practicality, and both policymakers and consumers require more practical knowledge about production. Presenting the data and impact of Community Supported Agriculture in an ESG context can help clarify fairness and effectiveness.

The following suggestions on necessary changes were made in the workshop in **Germany**: The increased demand for organic products calls for a holistic definition of fairness and climate-smart practices. Origin labelling and fair subsidies for small farms are essential to support this shift. Consumer education, through honest advertisement, information campaigns, and fair marketing, is crucial to communicate the added value of organic products. Current market regulations and practices need to be reformed, including public

procurement to boost demand for organic and fair products. Planning security for all actors should be enhanced, and food retail should be regulated by the cartel office. Removing taxes on organic and regional staple foods and applying the same rules and regulations for all food imports, will further support this transition.

The following suggestions on necessary changes were made in the workshop in **Lithuania**: To promote climate-friendly practices and organic farming, the distribution of financial support needs to be restructured. Efforts must be made to increase consumer awareness and trust in organic labels, alongside providing farmers with better access to innovative technologies. The selection of cultivation technologies and technical solutions should be carefully considered to ensure effectiveness. Additionally, the changing geopolitical situation calls for adaptive strategies. Enhancing cooperation among small and medium-sized farmers is essential to improve their competitiveness in the market.

The following suggestions on necessary changes were made in the workshop in **Netherlands**: Growers should be rewarded for the additional costs and risks associated with producing sustainable goods, ensuring a fair distribution of margins. Transparency in the value chain is crucial to support this fairness. Regulations should be reduced, with more emphasis on facilitating sustainable production. While trade and retail are already profiting from Planet Proof initiatives, it is now essential for growers to receive their fair share of the earnings.

The following suggestions on necessary changes were made in the workshop in **Spain**: Promoting consumer associationism and short marketing channels, along with optimizing technical resources through collective solutions for storage and calibration, is essential. Raising consumer awareness about the importance and impact of buying local and sustainably produced products is also crucial. The use of more efficient machinery and the transition towards more sustainable agricultural practices will further support this goal. Additionally, increasing research and knowledge of local fruit varieties, such as their pollination behaviour, can improve yields and promote these varieties. Finally, making hygienic-sanitary requirements in processing more flexible will help facilitate these transitions.

5.2 Recommendations surrounding policy measures

Regarding policy measures the workshops tackled incentives and barriers based on what was presented by AEIDL (Work Package 5) factsheets. The draft factsheets summarised the national CAP Strategic Plans specific to each Use Case country. The following summarises the incentive recommendations for each of the Use Cases:

Denmark: Over the past year and a half, discussions have centred on implementing a national carbon tax, which could garner public support for the sector, especially concerning animal welfare and modernizing facilities. Additionally, there is a focus on the production and use of biogas and reinforcing national cross-compliance on slurry management to control ammonia levels. Efforts are also being made to improve land use and meat production. Communicating to society the direct benefits of public investment in the pig sector and enhanced production standards is essential for maintaining the rural fabric.

Lithuania: To enhance sustainability, there is a need to increase investment and education for farmers in climate-smart strategies and practices. Additional support should be provided to small and medium-sized farms. Co-financing possibilities in rural development interventions should be exploited, and the impact of policies should be scaled up using the Recovery and Resilience Facility Fund. Additionally, efforts must be made to stimulate behavioural change among policymakers.

Netherlands: To enhance the agricultural sector, there is a need to organise and boost its joint investment capacity. This includes reinforcing the advisory system and re-evaluating eco-scheme funding and its impact. Leveraging national expertise in spatial planning, joint management plans should be promoted. Training for young people and new entrants in environmentally focused production methods, innovation, and green education is crucial. Establishing a long-term investment framework would offer promising perspectives for producers, necessitating long-term oriented policies. A comprehensive CAP calendar and support plan should be developed to inform producers of public support options from the start, linking them to farm management plans. Simplifying bureaucracy by consolidating contact points for producers and creating a connection between policy and practical implementation is essential, allowing for smoother transitions and better support for farmers.

Spain: To support small-medium farms, interventions should be designed with specific criteria for production and marketing assistance at this scale. Technical training for farm management and compliance with eco-schemes and rural development commitments is essential. Public support and resources should be allocated for research into local apple varieties, alongside promoting projects like quality designation for dry-farmed apple trees in mountainous areas. Cooperation interventions should continue using pilot and operational group models linked to this value chain. Additionally, support for experimentation, research, and consultancy needs to be strengthened.

Germany: Policy support for organic agriculture is mainly given under the rural development pillar. Nevertheless, in combination with current prices for organic products and high production costs, CAP support for organic farming is not enough to incentivise transition to organic farming. Furthermore, the organic sector is suffering from removing "green by definition" approaches like the exemption of organic farms from some GAECs. Additional focus for promotion of organic farming should also be other policies than CAP that can increase the demand and consumption of organic food, such as public procurement regulations or raising consumer awareness. With regard to organic production, there is a need for educational campaigns to help strengthen public procurement requirements for organic food.

Regarding the support for grassland, the current CAP is not offering a lot of support for grassland-based dairy farms. Introducing policy support for area-based grazing would provide a good opportunity to recognise the positive impact of grasslands. Promising measures such as a peatland development programme that provides financial incentives for farmers to (re)convert cropland to grassland, especially wet grassland, can offer numerous environmental benefits, such as improved biodiversity, water quality, carbon sinks and soil health. It also provides a grazing premium in ecosystems and the formation of humus for grassland.

Overall, there remains a need to develop a more comprehensive policy framework focused on climate-friendly value chains that can provide guidance and incentives for companies to adopt sustainable practices along their supply chains.

5.3 Next steps

There will be two more co-creation workshops (CCWs) within the BEATLES project. The next one is CCW 3 slated for early 2025 specialising on environmental and social sustainability within Work Package 3. This workshop will examine each of the chosen CSAs listed in Table 9 above. The 4th and final CCW will be held towards the end of 2025 and will pull together and reflect over four years of work carried out to clarify the main co-creation messages and recommendations arising from the BEATLES project.

That CSA has yet to become a central climate change adaptation platform within EU agriculture has a lot to do with attitudes of producers, retailers, consumers, and policymakers at EU and national levels. So the two years remaining within the project will attempt to intensify the CSA dialogue within the 5 Use Case value chains within BEATLES. Intensifying collaboration with similar research projects will also be on the co-creation agenda.

A. Appendices

A.1 Business and policy-related lock-ins and levers identified during the 2023 co-creation workshops

	WP4 (Business models)	WP5 (Policy)
Lock-ins	- 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	- EU policies dealing directly with CSA implementation are lacking - CAP does not yet include CSA activities - EU has yet to develop directives dealing with CSAs responding to the Green Deal and in particular the Farm to Fork strategy - Lack of national strategies, policies and guidelines 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
Recommendations	- 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	- 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 - Shift from only financial support to assisted knowledge support to farmers - 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 - Flexible hygienic-sanitary regulations 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
Levers	- Introduction of carbon taxes can be a major incentive to shift towards CSA practices	- Stricter laws concerning leakage of phosphorus and nitrogen from fields to water courses reduces the overuse of manure on fields - Reform of CAP holds promise as a central catalyst to achieve the goals of the Green Deal and Farm to Fork Strategies
Recommendations	- Sustainability reporting should be used by banks as a requirement for financing	- 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

A.2 CSA practices and technologies

A.2.1 Pig farming in Denmark

1. Slurry acidification (selected for WP5)

Slurry acidification is a treatment used to reduce NH_3 emissions to allow farms to comply with national or EU legislation. The reduction in pH decreases ammonia emissions because the proportion of ammoniacal N that is present as NH_3 is reduced. When the pH is decreased from typically around 7.5 to 5.5, the gaseous acid-base compound concentration

of NH_3 decreases from 1.8% to 0.02%. The slurry can be acidified at different stages in the manure handling chain. Acidification in the animal house involves pumping acidified slurry into the storage area beneath the slatted floors. Acidifying the slurry at the start of the manure management chain means that emissions are reduced in animal housing, in slurry storage, and after field application. Ammonia emissions from pig housing were reduced by up to 70% when slurry was acidified from pH 7.5 to pH 6 and by 67% following subsequent field application by band-spreading. Another approach is to add the acid in the slurry storage tank just before the slurry is applied to fields or the acid can be applied in-line on the slurry tanker during field application. This approach is cheaper than in-house acidification as less equipment and sulphuric acid are needed for decreasing the pH of the slurry. Ammonia emissions were reduced by 58% during field application when the pH was decreased from 7.8 to 6.8. However, field acidification only reduces NH_3 emissions in the field and does not reduce emissions from animal housing or manure storage. The improved fertilizer value of nitrogen (N) is another advantage of slurry acidification. Lower NH_3 losses following acidification mean more slurry total-N and plant-available N remains in the slurry applied to fields, resulting in an increased mineral N fertilizer equivalent (MFE) value compared to the untreated slurry.

2. Frequent discharge of slurry (selected for WP5)

The purpose of frequent discharge is to move the slurry as quickly as possible from the hot barn to the cooler storage conditions in the slurry tank or to the biogas plant in order to reduce methane emissions. Methane, which is a powerful greenhouse gas, is formed in large quantities in the slurry in the warm barn conditions. There are different types of discharge systems to get the slurry out of the barn:

- Vacuum discharge, where stoppers are pulled
- Slurry discharge where dampers are pulled
- Line winch, which pushes the slurry out of the channels on a daily basis

The most common system is vacuum ejection, where slurry plugs are placed either in the centre aisle or inside the pens, depending on the design of the barn. The slurry plugs are pulled via a rod that is guided down through the slot opening. It is important to start with the slurry plug in the section furthest away from the pre-tank. The slurry runs in a pipe from the section and collects in a transverse channel (main pipe) that leads the slurry into the pre-tank. In the pre-tank, the inlet must be lowered and there must be a water trap to prevent gases from the pre-tank from entering the barn. It is also important that the main pipe is vented at both ends and that there are two vents in the centre of the main pipe.

Frequent slurry spreading is a legal requirement in all existing finisher barns and all new barns for which environmental approval has been applied for from 1 May 2023. According to new legislation from 1 May 2023, slurry ejection must be carried out in all finisher barns when there is a slurry height of 10 cm, which is an average slurry height in the barn section, but not more frequently than every seven days. A logbook must be kept of when the slurry is discharged, and the slurry height noted. The logbook must be kept for five years. The positive effect on methane emission is most effective if the manure is delivered to biogas. Hereby the price is also positively affected, but not the price of the e.g. kg pig sent for slaughter.

There is no requirement for frequent slurry application in existing sow and piglet houses - the requirement for frequent slurry application only applies to new housing projects that apply for environmental approval after 1 May 2023. The municipality may grant an exemption if frequent discharge is not technically possible or if the costs of remodelling are disproportionately high, e.g. if there is a backwash system. Slurry plugs placed under the paths do not provide an exemption.

3. Biogas (selected for WP5) is an environment-friendly, renewable energy source produced by the breakdown of organic matter such as food scraps and animal waste. Biogas a renewable fuel that's produced when organic matter, such as food or animal waste, is broken down by microorganisms in the absence of oxygen, in the process of anaerobic digestion. This process is called anaerobic digestion. For this to take place, the waste material needs to be enclosed in an environment where there is no oxygen. The anaerobic process of decomposition (or fermentation) of organic matter has been happening in nature for millions of years, even before fossil fuels, and continues to happen all around us in the natural world. Today's industrial conversion of organic waste into energy in biogas plants is simply fast-forwarding nature's ability to recycle its useful resources. The facility normally consists of bioreactors in steel tanks and reactors in concrete tanks with corresponding storage tanks. The biomass for feeding is mixed in a mixing tank once a day, from where it is pumped to the bioreactors. The total volume of a reactor tank could be approx. 23000 m^3. The decay temperature is set to 46-47°C. The gas produced can be used to fuel vehicles, heat our homes and to generate electricity. The degassed biomass is returned to the farmer and is used as an improved fertilizer.

4. Green protein (locally produced proteins and refining). In this UC, locally produced proteins (fava beans have been produced by using conservation agriculture. Processing and biorefining of green protein for pig feed is still on a pilot scale, as the process remains costly. Nonetheless, the practise is very promising to substitute imported soy. The initial step of the processing happens in the field, where the green biomass is harvested. As the entire platform relies on fresh biomass, the harvested biomass is processed immediately, to reduce the risk of macronutrient degradation of the desired products (i.e. protein and simple carbohydrates). Once harvested, the green biomass is transported from the field to plant. Here, the green biomass is macerated to increase the surface area and disrupt the plant cells so the cell content can be pressed out of the biomass more efficiently. This is done by a number of different machinery types, and include both cutting, shredding and pulping of the biomass. The technology used for pressing is screw pressing. The screw press separates the process stream into a liquid and a solid fraction. The liquid fraction "green juice" includes the desired soluble proteins and carbohydrates along with free amino acids, enzymes, lipids, inorganic nutrients, and various soluble biomolecules such as tannins and carotenoids etc. The solid fibre fraction, "press-pulp" or "press cake", is rich in lignocellulose (cellulose, hemicellulose and lignin) as well as the non-separated soluble compounds that is present in the moisture that is left in the press cake. The press pulp normally has a DM content of 30-40% and can efficiently be ensiled directly after the screw press and utilized for ruminant feed, or further biorefined into biomaterials, biofuels, and bioenergy.

Following the wet-fraction step, the liquid stream is filtrated, which ensures that the green juice is free from particulates and fibres. The filtrated fibres are recirculated into the screw press and separated once again in the wet fractionation. The next step is the separation of protein from the green juice. by heating the juice to 80-90°C, which will cause denaturation and coagulation of the proteins. The heating of the juice is often achieved using heat exchangers. Upon precipitation, the final liquid/solid separation is applied, typically using a decanter centrifuge. The centrifugation produces a moist solid fraction of about 40-50% DM of the protein concentrate, which contains the precipitated proteins together with other plant constituents such as lipids and carbohydrates that have precipitated out together with the proteins. The liquid fraction is a residual juice often termed "brown juice" and contains the remaining soluble compounds, such as oligo- and mono-carbohydrates or organic acids (in case of fermentation), free amino acids, inorganic nutrients, etc.

5. Ventilation and air cleaning

Description of a ventilation system, which is SKOV's[24] most energy efficient system, is LPC fans with Dynamic Multistep control. In the beginning of the 1990s the typical ventilation system used approx. 10 kWh per produced finishing pig. Today the most efficient SKOV system uses only approx. 2.5 kWh in a system without air cleaning. In the current system with spot extraction and air cleaning the power consumption is higher. Per produced finishing pig approx. a total of 4 kWh can be expected split between 2 kWh from the 90% by-pass ventilation, 1 kWh from the central exhaust for spot extraction and 1 kWh from the air cleaner. 10% of maximum ventilation capacity is exhausted via the advanced spot extraction system. The high efficiency in the spot extraction is obtained by utilizing the natural air flow patterns in the slurry pit created by the heat production of the animals. Therefore, the exhaust channel for spot extraction is placed below the lying area of the pigs. Another important factor in ensuring high efficiency is the dimensioning of ratio between the opening area in the slats and the air capacity in the spot extraction system. Approximately 60% of the ammonia emission is gathered and approximately 40% of the odour emission in the system with spot extraction and air cleaning. Via a huge central exhaust channel below the surface the air with high ammonia and odour concentration from the spot extraction system is lead to and cleaned by two chemical plus biological air cleaning systems from Inno Plus with an ammonia and odour reduction of 96 and 77%, respectively.

6. Slurry cooling and slurry handling

Underneath all the slurry pits there are cast cooling pipes in concrete. It reduces the temperature of the slurry which both reduces the emission of ammonia and odour as well as delivering the required heating capacity. The cooling pipes are connected to a centrally placed heat pump. This pump delivers all the required heating for floor heating in the pens, mobile calorifiers for drying out and preheating before insertion of a new batch of pigs, heating of office and warm water. On this farm there is installed an automatic system for draining the slurry pit. The advantage is that frequent slurry removal each week reduces the odour emission as well as improving the quality of the slurry for the subsequent biogas production.

A.2.2 Onion and potato farming in the Netherlands

1. Biodiversity (selected for WP5). Biodiversity is one of the topics in the Planet Proof (PP) certification.[25] Farmers have to include nature and landscape elements on 5% of the total farm acreage. Biodiversity measures contribute to make the cropping system more resilient against pests, thus reducing the input of pesticides. The costs of the measures of course depend on the kind of measure. Farmers are free to choose the measures that fit best to their farm context. A rough estimation of the costs, based on the assumptions 1) total acreage 100 ha, 2) average net margin per ha at 2000 Euro, 5 ha biodiversity & landscape elements, 2.5 ha biodiversity and landscape elements already in place, 2.5 ha extra for PP, total costs 2.5 x 2000 = 5000 Euro.

2. Soil and nutrient management (selected for WP5). Important criterion in the certification is to have a positive organic matter balance on farm level. The result of a positive organic matter balance is sequestration of carbon in the soil (climate change mitigation). And on the longer term this contributes to a better soil heath and a lower need

[24] https://www.skov.com/en/
[25] https://www.planetproof.eu/en

to use artificial fertilizers (climate change mitigation) and a better water holding and infiltration capacity of soils (climate change adaptation).

3. Crop protection. Reducing the input of pesticides is an important goal in the PP certificate, an important element in the transition of sustainable agriculture. systems towards green and climate resilient food production.

4. Water management. PP aims for efficient water use from sustainable sources. Due to climate change rainfall and rainfall patterns change significantly. Periods of intensive rainfall and of drought are more frequently over the last decade. Especially in dry summers, the groundwater levels drastically sink, urging for the need of sustainable water use (climate adaptation). Extra costs occur for investments in irrigation systems, but as this is a topic for all farmers, you can't calculate this as extra costs for PP certification.

5. Green energy. PP has requirements on the maximum greenhouse gas emissions and rewards lower emissions (climate change mitigation) and stimulates the use and production of green energy. Due to the very volatile energy prices, it is hard to calculate extra costs. Investments in the production of green energy can be profitable but are currently not possible in large parts of the country because of insufficient grid capacity.

A.2.3 Wheat farming in Lithuania

1. No-tillage farming (selected for WP5) is the most widely adopted CSA practice in Lithuanian winter wheat sector (most popular eco-scheme), when farmers work the cultivated land without turning over the soil. This technology increases soil improves soil fertility, saves the soil from erosion and crops from disease, and conserves soil moisture.

2. Intercropping (winter intercrops, seed, or post-seed) is among the most popular CSA practices adopted in farms producing winter wheat. Intercrops help to maintain ecological balance and to incorporate nitrogen and other substances not taken up by plants into the biological cycle crops. The eco-scheme dedicated to intercropping requires farmers not to harvest intermediate crops after harvesting the main crops, not to use intercropped areas for livestock grazing, and not to use plant protection products and/or fertilisers on cover crops.

3. Precision agriculture (selected for WP5) (VRF - Variable Rate Fertilisation) is an increasingly adopted practice in bigger cereal farms, however, still has a lot of potential for further increase of usage. In essence, this practice means applying materials (fertilizers) in such a manner that the application rate is varied based on precise location needs. This allows to maintain a balanced composition of nutrients in soil, reduce contamination of surface waters, and in turn save the fertilizer costs for farmers.

4. Renewable energy (solar) has been selected as a focus CSA practice to see how energy efficiency could be fostered in cereal producers. Since winter wheat producers are less likely to use biogas plants (only a few are recorded in Lithuania, more typical for livestock farms), we are looking into solar plants that are still rather rarely installed in Lithuanian farms.

5. Extensive wetland management is one of the least popular eco-schemes in Lithuania that aims to manage environmentally important wetlands to preserve the flora and fauna they support. This practice (and eco-scheme) is not directly related to the wheat sector or produce of wheat. However, cereal production typically means monocultural fields, as well as increasing the arable land at the cost of meadows and wetlands. Thus, this practice has been included to see if and to what extent managing wetlands could balance out the environmental impact of extending arable land and mono-cultural fields.

A.2.4 Organic dairy farming in Germany

1. Organic/Naturland (selected for WP5): comprised of 40% forage, 10% maize, 10% grains for feed, 40% clover grass – reduced number of animals, and other parameters according to Naturland standards.[26]

Farming according to Naturland standards compared to EU organic or conventional systems included management practices that contribute to an improved environmental (biodiversity, water protection) but also climate performance. These practices include:

- Limited stocking density related to dung units to avoid overfertilization of the area and related nutrient loss which leads also to climate-relevant emissions
- Improved soil health through use of legumes and manure leading to increased humus contents and eventually storing of CO_2.
- Closed and regional nutrient cycle induced by the obligation to produce at least 50% of the feed on farm reduces the risk of over fertilisation and keeps the transport distances short.
- Increased animal welfare leading to higher longevity and reduced emissions.

2. Naturland organic+ feed conversion (selected for WP5) 100% forage: 100% feed from grassland and clover (no maize, grains etc.)

The use of grassland as feed for cows has several advantages compared to a grain and soy-based feeding. Grassland can store carbon, but it is also an inevitable part of the cultural landscape of the region. On the other hand, grassland cannot be used for human diets. Only ruminants such as dairy cows can digest grass and clover and therefore play a crucial part in using grassland for human diets. Feeding dairy cows only with grass and clover is nevertheless often less productive than high performance cows fed with grain and soy. Based on this, this CSA is only sustainable if the total production and consumption of milk is reduced and milk is only produced in regions that favour the use of grassland (such as alpine or maritime areas in Germany).

3. Regional protein source: legumes in crop rotation instead of imported soy

The production of soy in Latin America and import into Germany for animal feed is for various reasons bad for the climate. First, a lot of CO_2 is emitted when primary forest is destroyed for the production of soy. Furthermore, primary forest and especially the Amazon play a crucial role for the global climate and are also sometimes referred to as the "green lung" of the earth since through photosynthesis CO_2 is turned into oxygen. Also, the Amazon plays a crucial role in the global water cycle and for the conservation of biodiversity. Imported soy can be substituted by regional rapeseed extraction meal. Since this has a slight increased amount of raw protein compared to soy, more rapeseed than soy would be needed while the consumption of grain would be reduced.

4. Breeding for longevity: reduced replacement rate of cows

During rearing, cattle and cows raised for the replacement of the dairy herd emit greenhouse gases (especially methane) while not producing any food for human consumption. Often, dairy cows do not get much older than 4 years, meaning that constantly, a lot of young cows need to be reared on farm to replace the dairy cows. If longevity of cows is improved while at the same time yields drop slightly but are still high, the overall milk amount produced by one cow can be improved while at the same time, the emissions during rearing decline when measured per litre of milk produced. Also, often cows produce a higher amount of milk the older they get. Furthermore, old cows tend to

[26] https://naturland.de/en/

be better mothers and also get used to the procedures of the farm and have less stress during routine measures (such as bringing them on the pasture). Improved longevity can be achieved through breeding but also through improved animal welfare on farm.

5. Renewable energy – Agri-photovoltaics

Agri-photovoltaic systems are a good way to keep the area still available for food production but also include energy production as well. It can be an additional source of income for the farmer and shade from the photovoltaic can be beneficial for plant growth during summer. Often farmers rent out the area to a company that sets up the photovoltaics and pays rent to the farmer. The farmer can use the area still for production – in the case of dairy it could be for example used as a pasture for calves or young cows.

A.2.5 Organic apple farming Spain

1. Organic farming (selected for WP5)

Organic apple production in Navarra follows agricultural practices aimed at nurturing ecosystem health, reducing environmental impact, and ensuring long-term sustainability. Rather than relying on synthetic chemicals such as pesticides and fertilisers, organic apple farming prioritises natural and organic methods to enhance soil health, combat diseases and pests, and promote biodiversity. This includes the use of organic fertilisers like compost and green manure, crop rotation to improve soil structure, and integrated pest management techniques utilising natural predators and biological mechanisms. Additionally, organic apple production emphasises biodiversity preservation, water and energy conservation, and waste reduction. Farmers adhere to stringent standards and regulations to uphold the integrity and quality of organic produce, delivering nutritious, high-quality apples sustainably while protecting the environment and supporting overall ecosystem well-being.

2. Cover crops (selected for WP5)

Fruit orchards, in general, maintain a ground cover between the rows of trees in order, in the first instance, to help the passage through the orchard when weather conditions are adverse. In many cases, this vegetation cover is of natural origin and of local vegetation. In specific cases, they can be managed by mowing with a low height, so that the cuts are very staggered. However, nowadays it is necessary to consider the contribution of some seeds/plants over others, which are more interesting from the point of view of biological control, which is the objective of this CSA practice.

The key factors for the implementation of vegetative covers, both in irrigated and non-irrigated plots, have been the search for a more efficient and reasoned use of phytosanitary products and the environmental approach to pest control based on biological control, carbon footprint CO2, and soil loss prevention. The advantages that these covers provide to fruit crops include, among others:

- Shelter for beneficial fauna and trap cropping for different pests
- Buffer for micro- and macroorganisms against drifts of phytosanitary products
- Carbon sink

3. Floral bands

They serve to enhance pest control through methods alternative to the use of phytosanitary products. These methods, chemical and biological, are not mutually exclusive; they can be combined perfectly if necessary. By making intelligent use of these techniques and with good monitoring of pests and their predators, farmers can save on phytosanitary applications. Indeed, the use of flowering strips is a cheaper method for the

producer and has demonstrated benefits for crops. The bands are placed on the edges of the plot and in the sprinkler area, i.e. the areas that are not cultivated are used. Once planted, the flowers do not need maintenance, although it is interesting to monitor the insects that exist there.

4. Grazing

Grazing in apple orchards serves multiple purposes. It performs a clearing task without the need for machinery, which helps improve nutrient cycling, soil fertility, and agroecosystem biodiversity. Additionally, it prevents the spread of pests and diseases from fallen leaves and fruits and reduces mole activity. Furthermore, it can offer an alternative for diversifying farm activities and may have positive social effects, such as fostering collaboration between producers in the area.

5. Renewable energy

Installation of solar panels on a warehouse for reducing electricity supply costs and utilizing this energy for irrigation, thereby achieving 100% renewable energy usage for irrigation. Also, the maintenance of the storage facility is powered by this energy as well.