



Innovative upgrades to value and packaging of small quantities of liquid food products

Imca Sampers, Geneviève Gésan-Guiziou, Thierry Benezech, Samuel Le Féon, Caroline Pénicaud, Marine Penland, Stéphanie-Marie Deutsch, Elodie Lerolle-Rio, Virginie Herbreteau, Odile Parizel, et al.

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Innovative upgrades to value and packaging of small quantities of liquid food products



FOODRUS

PLOUTOS

COFRESH

LOWINFOOD

EFFoST

7-9 November
Dublin, Ireland

★ ★ ★ **2022** INTERNATIONAL
CONFERENCE



Innovative upgrades to value and packaging of small quantities of liquid food products

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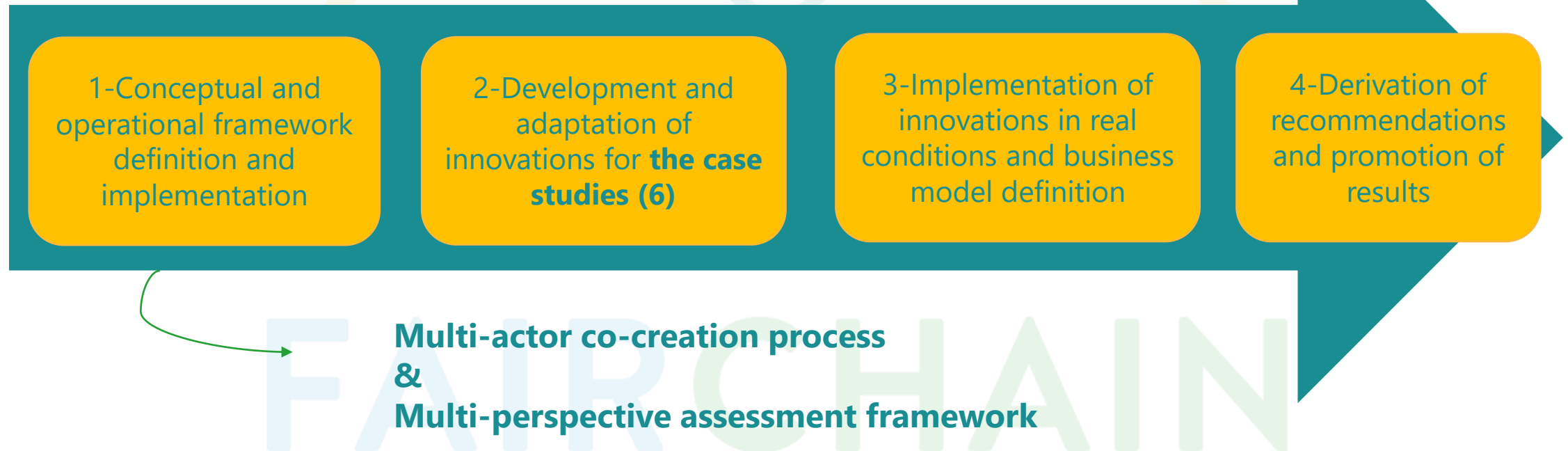


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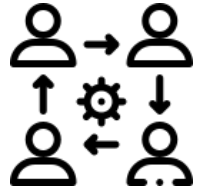
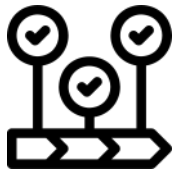
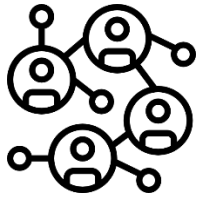


FAIRCHAIN

- **Objective** : Test, pilot and demonstrate **technological innovations** that have the potential to support the scaling up and expansion of small and mid-sized farmers and food producers
- **Methodology**

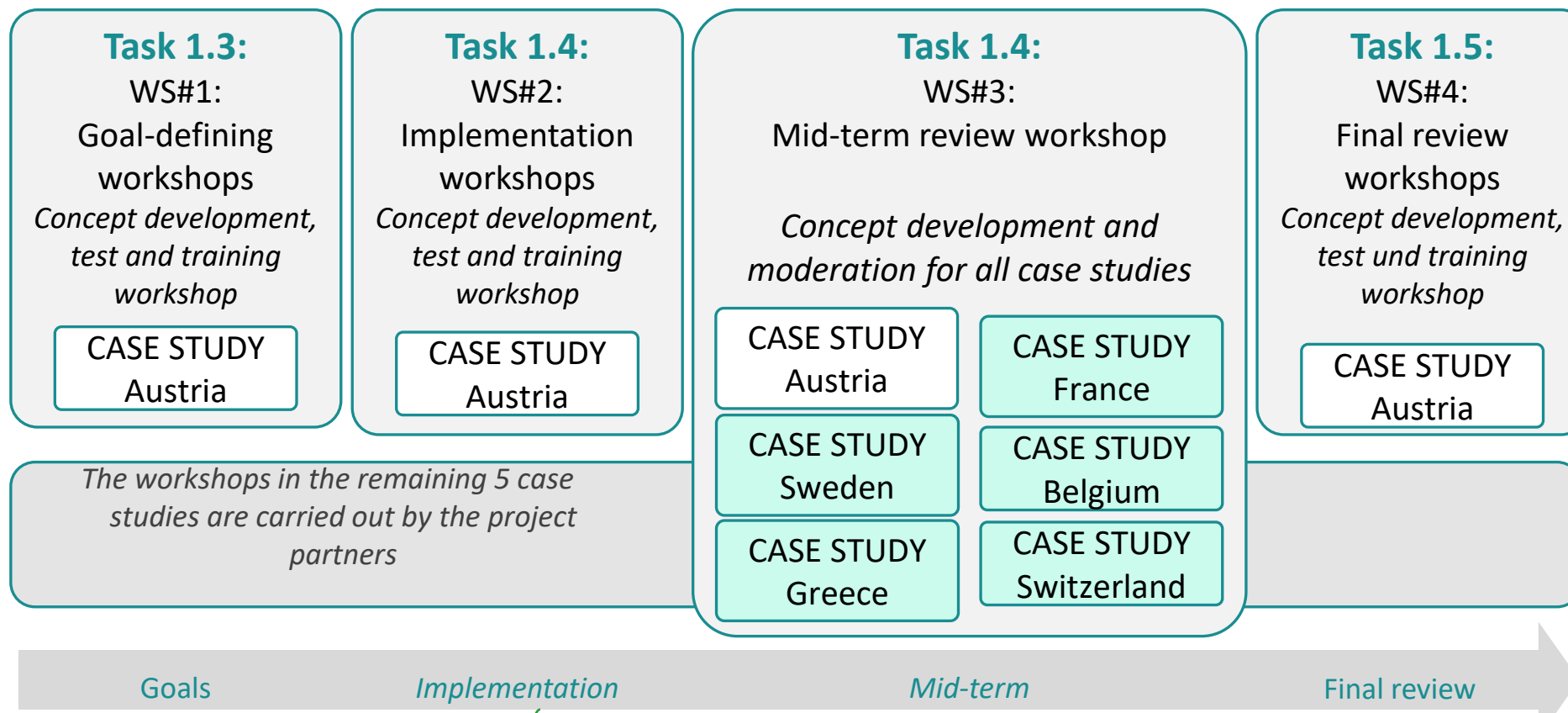


Multi-actor Co-Creation Approach: Goals



- Integrate **expertise** from different stakeholders
- Include and address stakeholders and actors across the **entire value chain**
- Generate **new perspectives** on each of the case studies
- Ensure **fair(er) distribution** of benefits and risks along the VC
- Design the new/reconfigured value chains in each case study
- Foster **exchange between** the different FAIRCHAIN **case studies** to provide new insights from other areas of expertise and can lead to spill-overs.
- Foster **collaboration** and partnerships among stakeholders that can thrive and grow **beyond the duration of the project**.

The FAIRCHAIN Co-creation process



Which steps, actions and competencies are required by which actor to achieve the goals and implement the innovation?

What do you want the case study to achieve?
What are the most pressing concerns for the respective case study?

Key aspects/challenges for a successful co-creation

- **No default co-creation process**; must be tailored specifically to case study setting and stakeholder resources
- **Representativity**: Stakeholder identification and involvement according to PESTEL, affectedness and influence, covering all stages of the value chain
- **Early involvement**, influence: give stakeholders the opportunity to shape (parts of) the case study
- Openness for **different kinds of innovation** (technical, social, organisational)
- Task definition, influence, transparency: very **clear communication** of co-creation workshop goals, what is negotiable, what not
- **Fair and transparent** decision-making and conflict-solving processes

Specific effort
to involve
SMEs or small
producers

Important steps: identify stakeholder, facilitate dialogue and knowledge sharing, incentivise stakeholders, build long-lasting cooperations

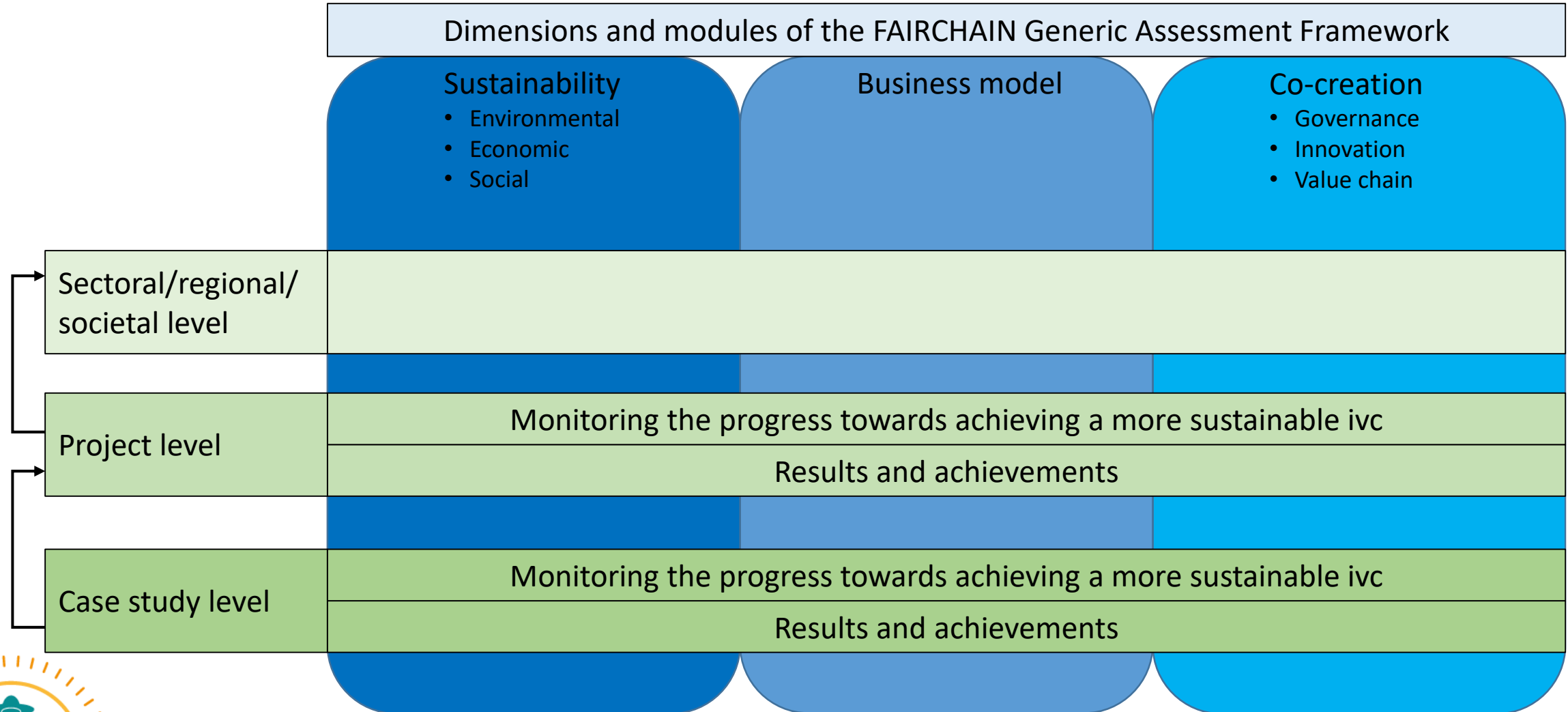


FAIRCHAIN-specific assessment framework

- High-quality case study execution
 - integrate stakeholder perspectives, sustainability and business model development right from the start of the innovation process
 - ensure that sustainability hot spots are addressed
 - ensure that suitable business models are developed
 - provide guidance between different options
 - Compare before – after and monitor progress towards goals
- Project achievements must be more than the sum of the case study achievements
 - unifying function of the methodology
 - allows cross-case study analysis
- Team-building function in the consortium
 - close interactions between project partners when elaborating and applying the methodology
 - inducing mutual learning processes



Structure of the FAIRCHAIN Assessment Framework





Innovative fermented whey-based drinks



Current situation versus aim

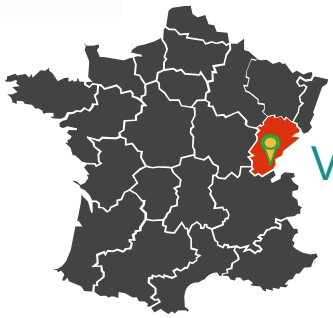


Whey

Curd
(Cheese)



The Vevy cheese dairy



Vevy

Comté

PDO (Protected Designation of Origin) cheeses



Processing 1

Pressing

Slightly acidified whey

Sweet whey

Preconcentrator plant

Drying plant



Long dominant value chain

Processing 2

Molding & maturing

Slightly acidified whey

Wastewater treatment plant



Tomme



Raclette



Morbier

Current situation versus aim

- Find a new route adapted to small and mid-sized actors at a regional level for upgrading value of whey by developing innovative fermented whey-based drink



Comté

PDO (Protected Designation of Origin) cheeses



The Vevy cheese dairy

Processing 1

Pressing

Slightly acidified whey

Sweet whey

Preconcentrator plant

Drying plant



Sweet whey

Processing 2

Molding & maturing

Slightly acidified whey

Wastewater treatment plant



Tomme



Raclette



Morbier

Fermentation
+ « zero waste » distribution mode
(Reusable bottles / Bulk distribution)

Development of the fermented whey-based drinks

- Determine heat-treatment conditions to stabilize wheys (lab-scale)
Obj: Remove native cheese whey micro-organisms with minimal impairment of whey organoleptic properties
- Screen and select the micro-organisms on wheys alone
 - Screening of > 125 lactic acid bacteria (or consortia of yeasts + lactic acid bacteria) on ≠ wheys to identify the strains with the best acidification and sensorial properties
 - Selection of 20 promising strains on Comté acid whey and 32 strains on Morbier sweet whey
- Carry out fermentation assays on wheys mixed with fruits/vegetables/herbs
 - Over 15 flavours (fruit juice or herb) were tested,
 - Selection of **4 bacteria strains (/ whey type)** working well in association with (at least) one flavour
 - Some of the best prototypes were tasted and validated by CS-Fra team

Poster P4.1.32



→ Many options / degrees of freedom (flavours, texture, ... conditions of storage, type of packaging ...)

Main learnings from the co-creation process

- **Lack of market studies and definition of consumer expectations / innovative drinks**
 - Need to identify the targeted consumers to define the drink features
 - Emphasis of the 'story-telling' of the innovative drinks
 - Need to co-develop the drink with the consumer at an early stage
- **Re-organisation of activities, planning, budget**
 - **Consumer studies** → 3 concepts that best suit consumers **were identified and validated by stakeholders** :
"Whey-based Kefir"; "Fruit whey-based drink"; "Whey-based concentrate to dilute"
 - **Priorization of technological development**
- **Emergence of new ideas and / or barriers that need to be investigated**
 - Constraints in the development of the new business models : low volume of whey to be collected, high cost of collection, storage, and production/distribution; constraints imposed by the protected designations of origin (PDO) regulation of cheeses, ...
 - Weak know-how of the cheese makers as regards fermentation; lack of equipment in the current cheese dairies;
 - Definition of a specific brand for the drink;
- **New stakeholders** are prone to actively participate
(ex: The Franche-Comté region, J'aime Mes bouteilles)



Main learnings from the assessment baseline

From an environmental perspective

- The management of whey is not a hotspot (milk production and whey drying);
- Transport of whey from cheese dairies to valorization sites is not negligible → The innovative drinks should be produced as close as possible to the cheese dairy

From a social point of view

- Generation of more jobs and reinforcement of the regional workforce.
- More stability and independence on the costs of current markets. → Reinforcement of the independence of the regional players facing international market (whey) prices, which fluctuate according to world market demand (infant milk with Asia) or political situations (like the war in Ukraine)

From an economical point of view

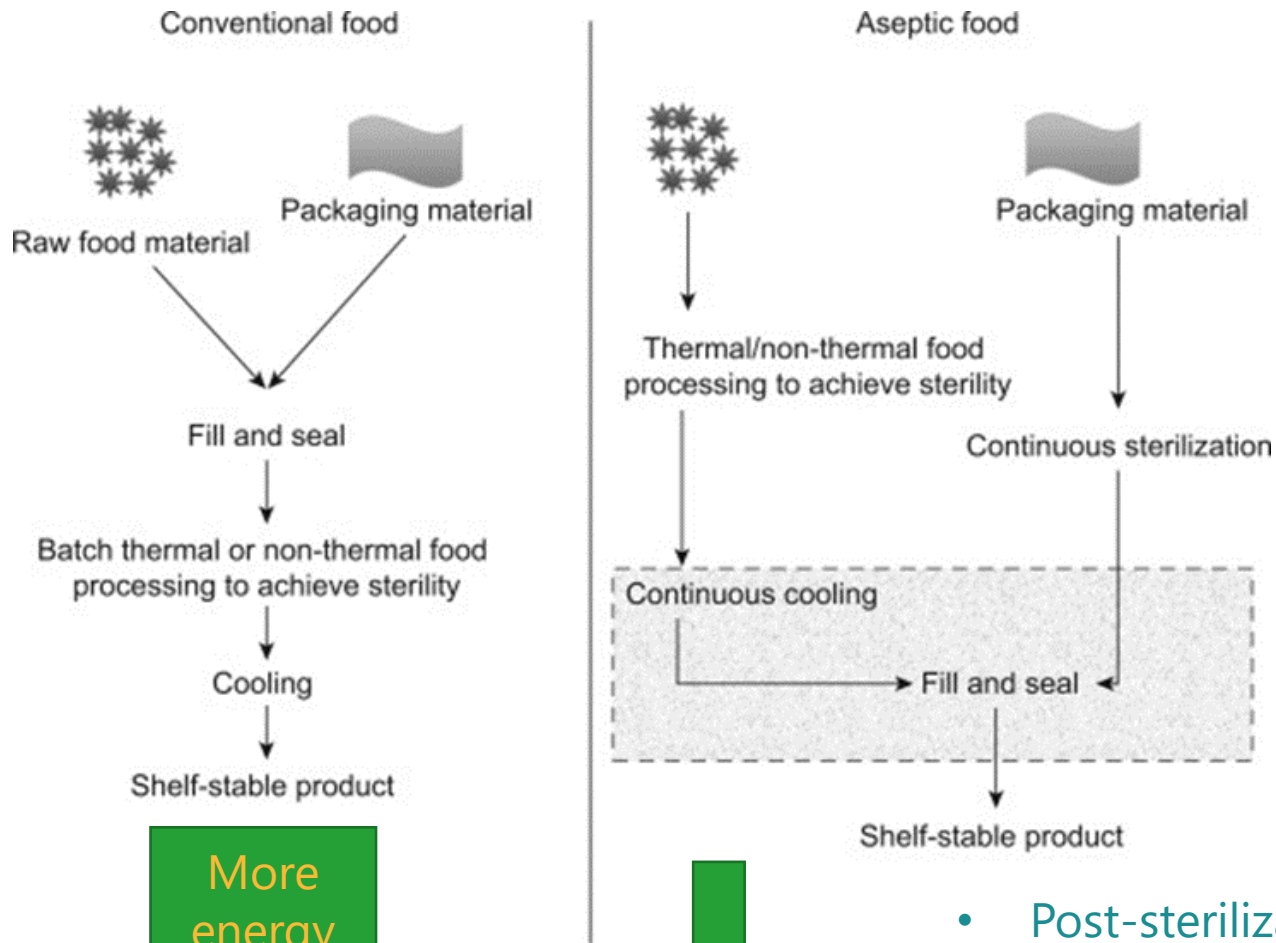
- Producers and processors, being part of the SODIAAL cooperative, would benefit directly from the margin profit.
- The business models needs to consider the constraints imposed by PDO regulation and be defined by considering the volume, the cost of collected whey, storage conditions, and production/distribution modes and the different implementation schemes of the distribution reuse loop, including cleaning and packaging machine.



The main challenges of this technological innovation are related to the economic sustainability of the innovative drink, including its acceptability by the consumers/citizens and the business models including the “zero waste”,



Current situation versus aim



Fruit juice



Vegetable juice/soupe



Whey based drink

- Up-scaling: Access; design and/or business models needed for small scale producers/farmers
- Down-scaling (process steps) big producers

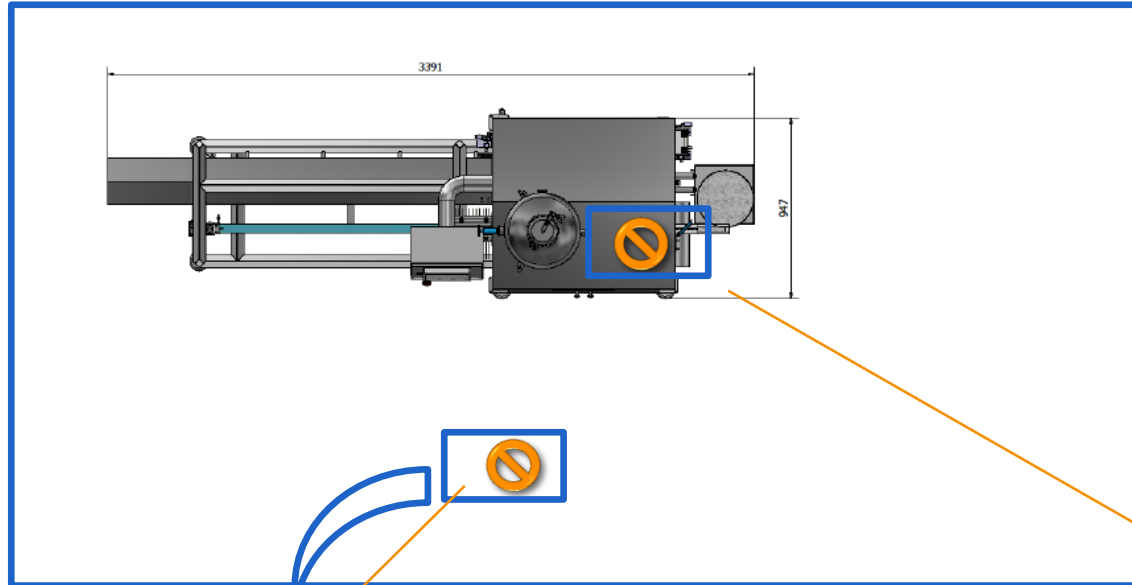
More energy and water use

- Post-sterilization is not needed resulting in less dropout
- Less energy may be expected
- Packaging material could also be less resistant allowing the use of different (biobased) materials

• Effoast Dublin, the 9th November 2022

Hygienic design: e.g. air quality toward new guidelines

Measure air where packaging enters the machine following the method of Pasquerella, 2000 (1 meter from the machine, 1 meter height, for 1 hour).

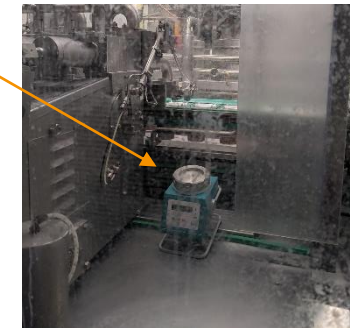
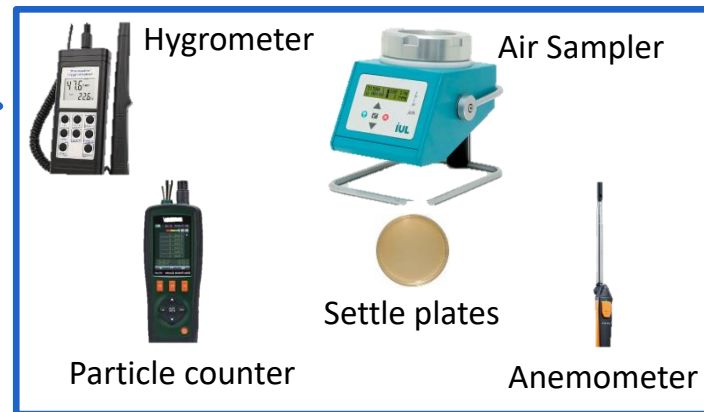


Air Sample Point

- Passive (Settle plates)
- Active (Air Sampler)
- Temperature (Hygrometer)
- Relative humidity (Hygrometer)
- Air Velocity (Anemometer)
- Particles/diameter (Particle counter)



Outside Machine



Inside Machine

Sampling campaign in Food Industry (Belgium)

Factory	Total Viable Count (Active)		
	n	\bar{x} (CFU/m ³)	std
Dairy 1	36	14	10
Dairy 2	6	1447	220
Dairy 3	15	356	518
Sauces 1	12	1050	1082
Sauces 2	6	406	46
Sauces 3	6	198	50
Margarines 1	18	44	42
RTE 1	12	208	118
RTE 2	27	112	82
RTE 3	12	204	126
Fruit puree	15	366	138

*n – number of samples, \bar{x} - mean in CFU/m³, std - standard deviation

- Significant differences between factories for airborne contamination of TVC and Yeast/Mould ($p < 0.01$) for active and passive measurements
- No correlation between relative humidity and active/passive counts
- No correlation between temperature and active/passive counts
- Weak positive correlation between high water pressure cleaning (r equals 0.305) and moulds/yeasts in the air (passive measurement)
→ See next slide

E.g. Results winter/spring active air samples at food producer (Belgium)

Weak negative correlation when doors are closed (r equals -0.396) and TVC (active measurements)

→ Data collection summer/autumn still needs to be processed

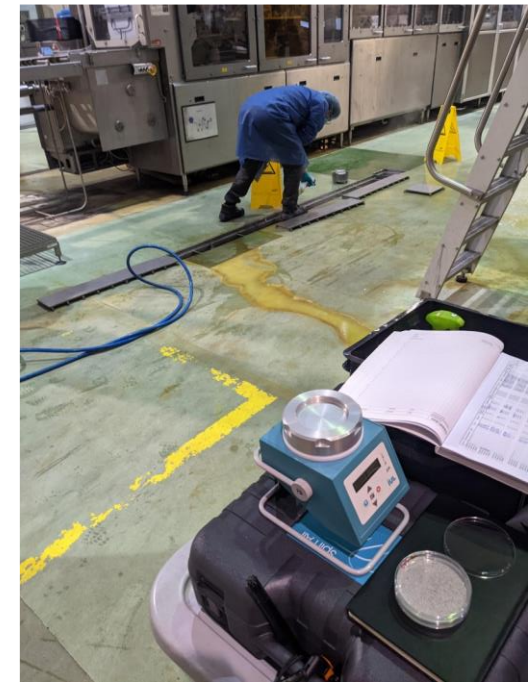
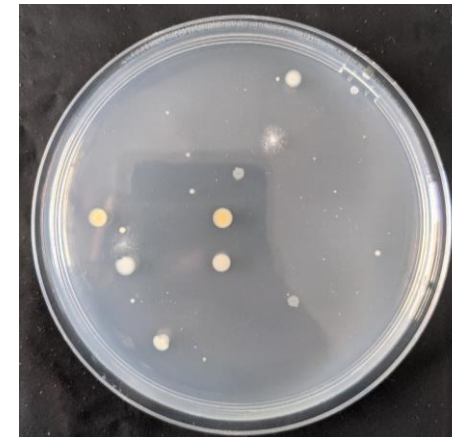


Air Sampling @ Dairy Producer 1

E.g. results Moulds/Yeasts (mean) at dairy producer (Belgium)

	Morning (09:00 – 10:00)	Afternoon (13:00 – 14:00)	Evening (17:00 – 18:00)
Active	23 CFU/m ³	293 CFU/m ³ *	15 CFU/m ³
Passive	0 CFU/m ² .h	0 CFU/m ² .h	0 CFU/m ² .h
Outdoor (Active)	105 CFU/m ³	135 CFU/m ³	160 CFU/m ³
Outdoor (Passive)	1 CFU/m ³	0 CFU/m ³	0 CFU/m ³
Temperature	21,1°C	20,8°C	20,8°C
Relative humidity	66,9%	64,6%	64,3%
Airflow	0,03 m/s	0,02 m/s	0,01 m/s

*** Higher CFU/m³ counted when drains are cleaned with a high pressure hose during production near packaging line**



Integration of technological, organisational and social innovations into **business models**

General perceptions of the solutions

Machines and pouches



- Both machines are a great asset for users to reduce human labour and errors and save time for actors already engaged in a processing activity. But considered as a less priority investment for actors not already engaged in a processing activity.
- Packaging should not be considered in isolation but as one tool among others, in the whole process.
- High interest for the aseptic process of filling.
- Interest for a high versatility of the machine regarding the products to be packed and packaging (types and content). Few recommendations in terms of technical improvements.
- Capacity and purchase price of the light-version machine seems more appropriate to small and mid-sized actors, using or owning the machine.
- Plastic pouches not well accepted for some small and mid-sized actors, for convenience & environmental reasons. Seems more appropriate for B2B market & collective catering → Need for information & education on environmental impact of packaging solutions.



General perceptions of the solutions for users

Business models

Two common aspects to the 3 Business Models (BM):

- The question of the cross-contamination (allergen, plant-based vs. animal products, organic vs. conventional)
- The need for associating the packaging machine to other processing machines to consider the whole process

BM1 Mobile packaging machine

- + Save time in transportation
- + No need to consider maintenance
- Cost of the service for users and place needed

**Users with
seasonal/punctual
productions**

BM2 Individual ownership with open access

- + Areas already complying hygienic norms
- + No need for considering maintenance
- Cost of the service, potential variability

**Users starting a new
processing activity or
with non-regular
production**

BM3 Sharing in cooperative

- + Shared investment AND skills, workforce, and other resources
- + Being part of the governance
- Higher administrative charge

**Users with similar
needs and more
regular productions**

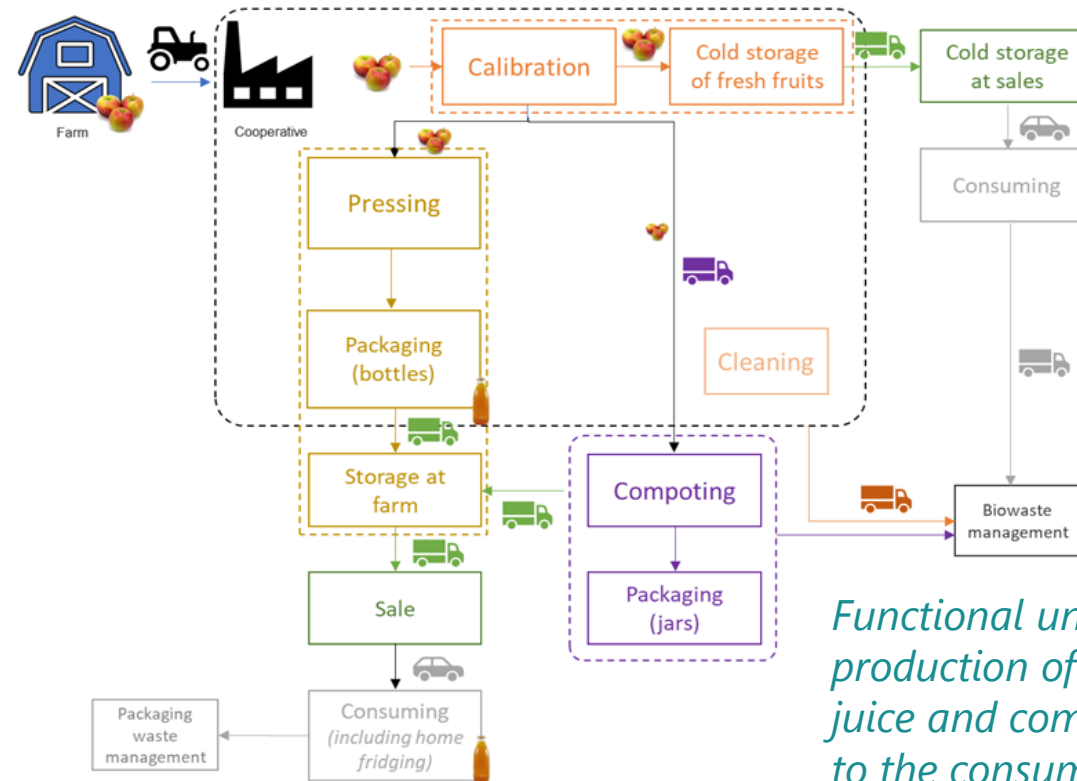
Business models in the form of “shared workshops” or “food hubs” seems appropriate to small and mid-sized actors (compatible with BM2 and BM3).



Life Cycle Assessment of current situation: example of the upscaling scenario

Apple production in French Flandres

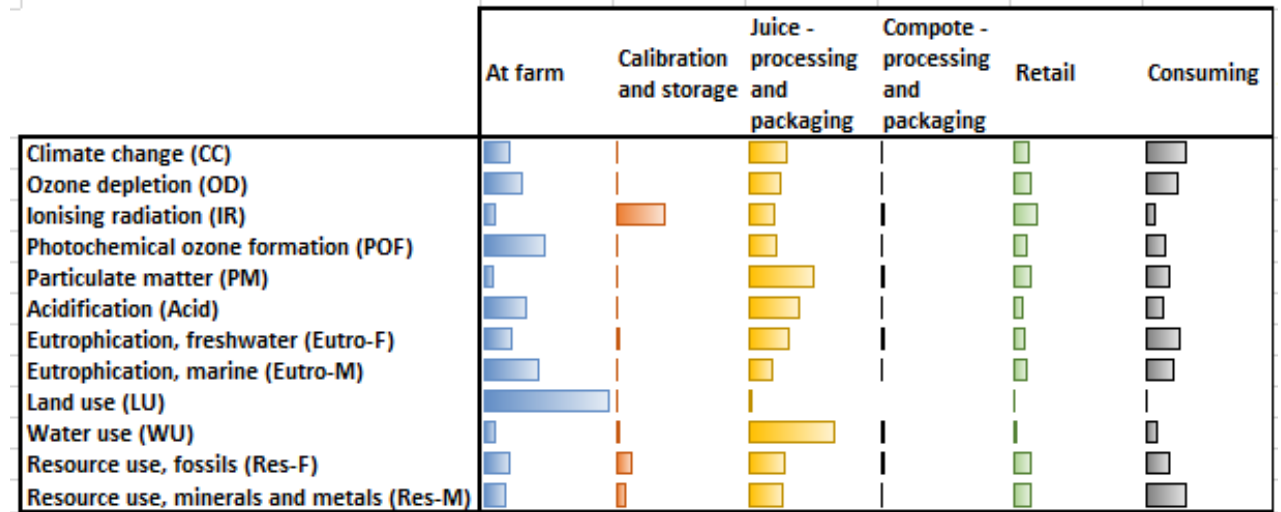
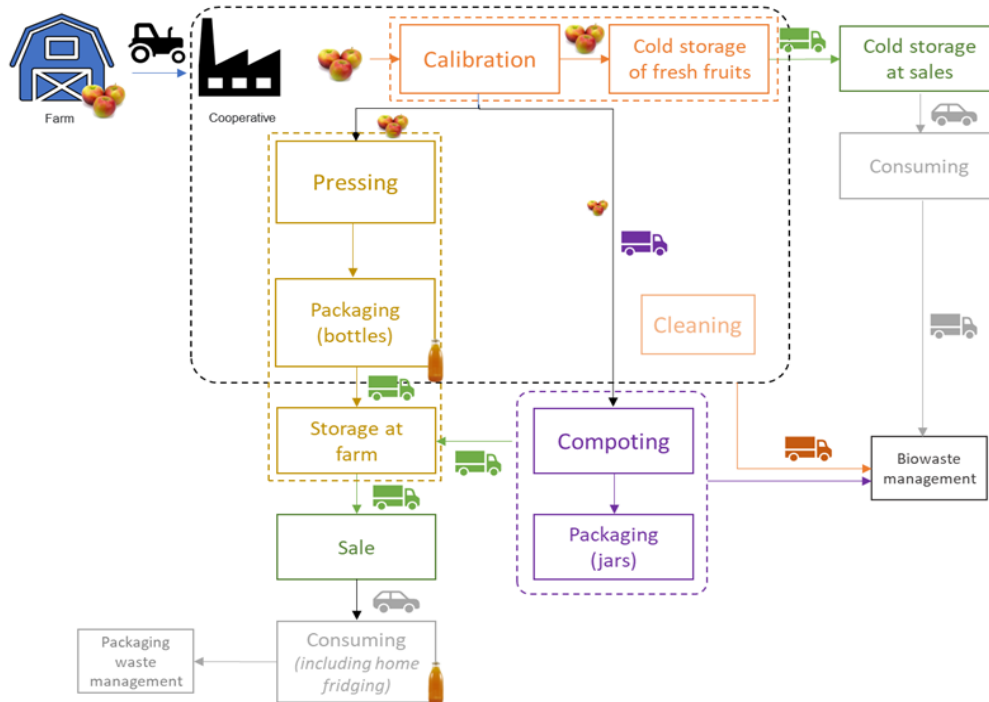
- Small producer: 3 ha
- Transformations: juice and compote (made off-farm)
- Packaging: glass bottles and jars
- Limited finance and workforce



Functional unit: « one year production of fresh apples, juice and compote delivered to the consumer »

LCA is applied to the whole value chain to evaluate the potentialities to reduce environmental impacts with the innovation

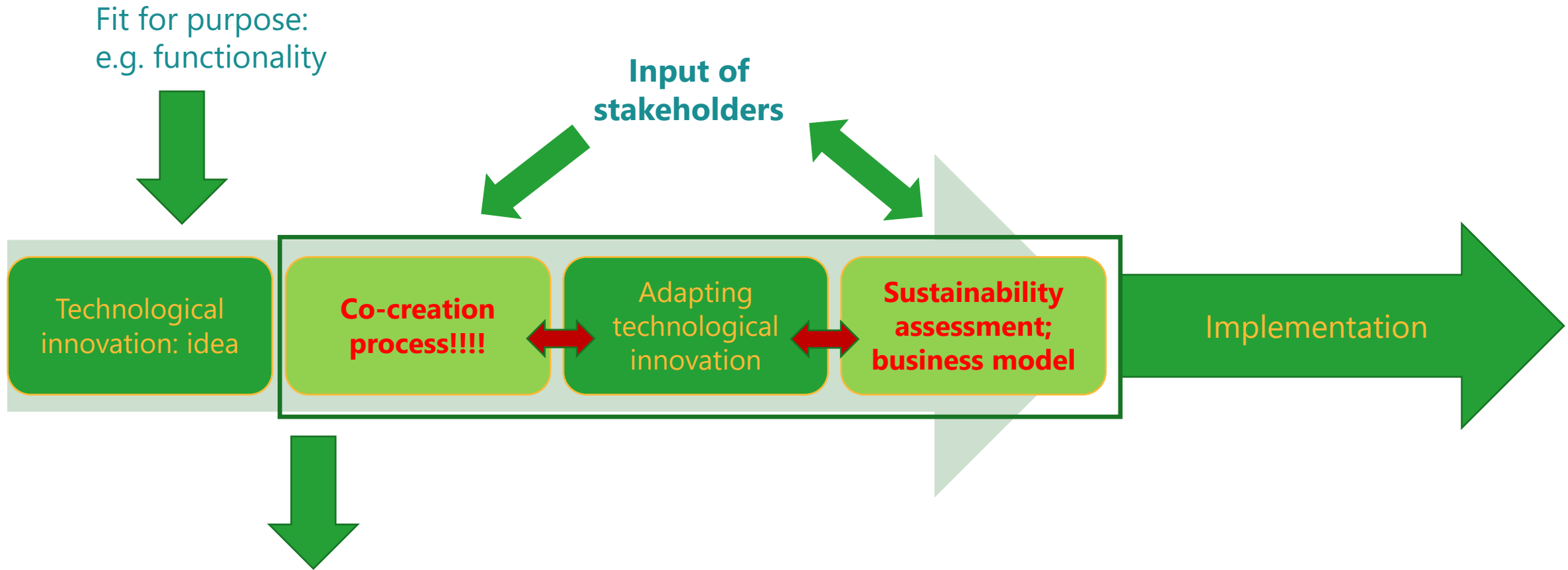
Life Cycle Assessment of current situation: example of the upscaling scenario



From 3% to 73% of the total impacts related to the processing and packaging of juice and compote

=> The innovation can potentially significantly improve the environmental performance of the farmer

Take home messages



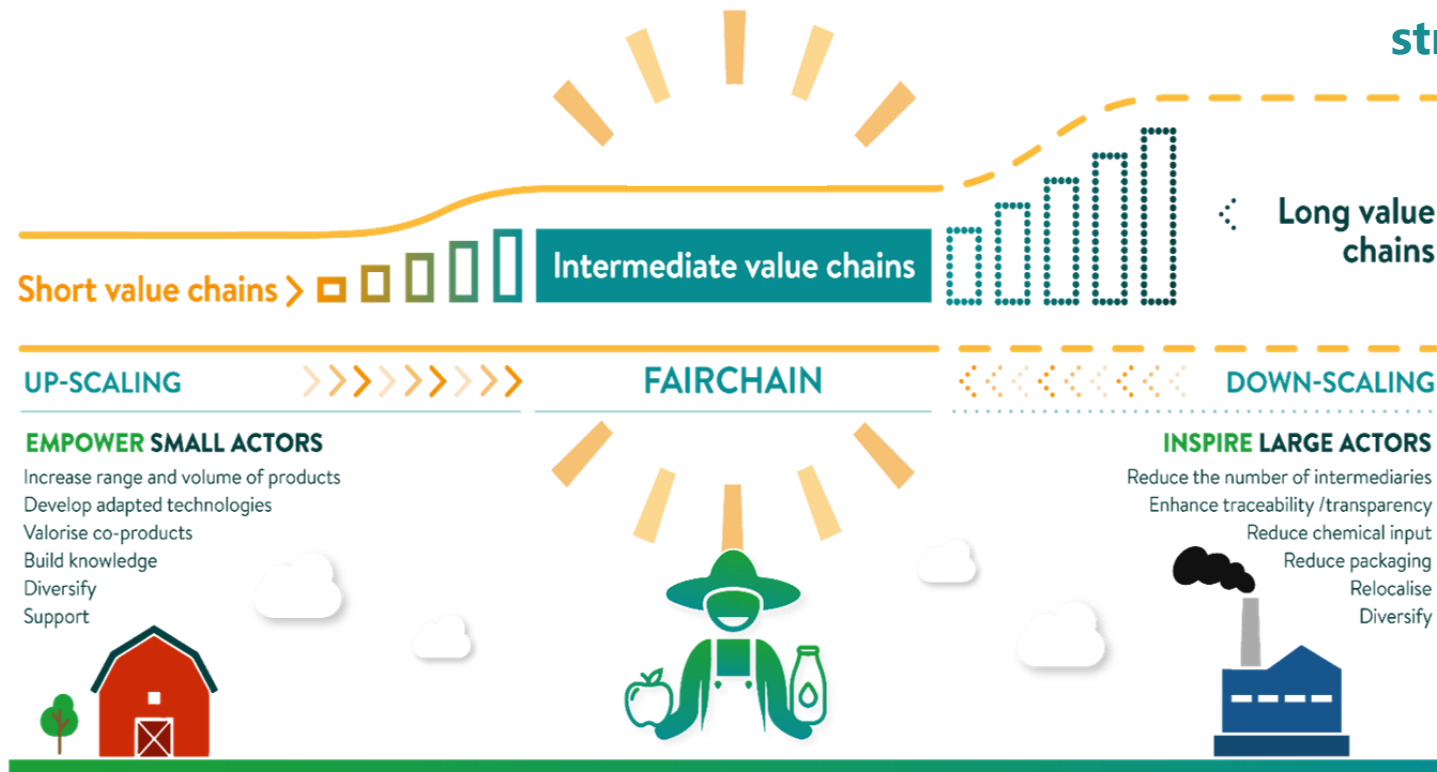


FAIRCHAIN

Innovative technological, organisational and social solutions
for FAIRer dairy and fruit and vegetable value CHAINS



Goal : Enable small and mid-sized farmers and food producers to scale up and expand production of nutritious food through **competitive intermediate value chains** at the regional level



Intermediate value chains combine the strengths of both short and long chains while avoiding their weaknesses

They are characterized by

- **cooperation of mainly small and mid-sized actors on a network or strategic alliance;**
- **trusted and transparent relationships** and a **fair distribution** of value created among the involved actors (win-win situations)
- implementation of **common values** through **collective organisation**.

They supply **sustainable and high-quality food products** to consumers beyond the local market **in greater quantities** - often on a regional level- with facilitated access for consumers.

Focus on postharvest steps in dairy and fruits & vegetables sectors

Objectives

Main Objective



Test, pilot and demonstrate **technological, organisational, social innovations** that have the potential to support intermediate value chains and address some of their issues

Specific Objectives



Deliver a **set of innovations** at technology readiness level (TRL) 7, fostering the emergence of competitive intermediate value chains

Develop **business models** associated to these innovations and carry out environmental, social and economic impact assessment

Formulate **recommendations, create tools and guidance documents**, promote the results to ensure uptake and replicability of value chains developed within FAIRCHAIN

Case studies and innovations at the start of FAIRCHAIN



CS-Aut

Food Innovation Incubator

Food Innovation Incubator



CS-Bel

Innovative packaging machine for small and mid-sized actors

Flexible filling machine

Sharing of processing equipment and/or infrastructure

Funding system based on philanthropic income streams



CS-Fra

Production and distribution of innovative dairy drinks based on co-products of cheese

Fermented whey-based drink

Distribution with reduction of packaging consumption



CS-Gre

Traceability and reliable information sharing in local dairy production

Blockchain



CS-Swi

Fruit co-product valorisation for SMEs and regional stakeholders

Alternative cleaning agent

Sharing of processing equipment and/or infrastructure



CS-Swe

Developing wild berry business to boost local economy and social cohesion

ICT tool for berry picking

Technological

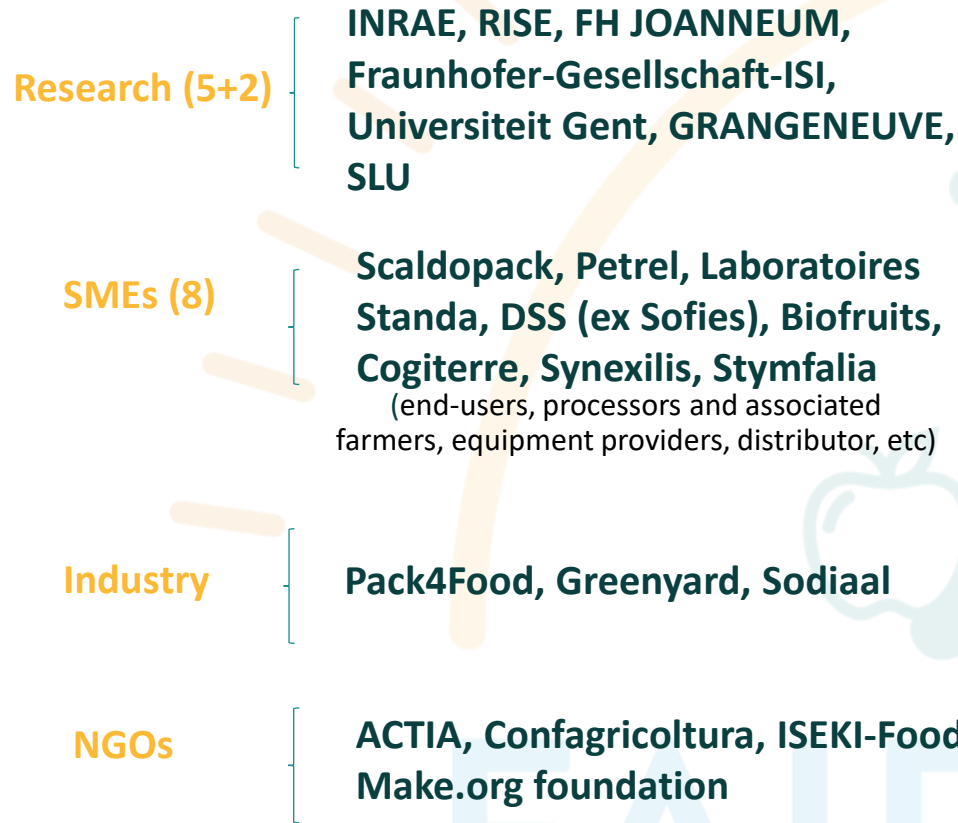
Organisational

Social

Consortium

A multidisciplinary partnership including **22 organisations in 8 countries**

(process engineering, environmental science, supply chain management, logistics, economy, marketing, social science, sensory and consumer science, information and communication technology, technology transfer...)



PARTNERS

- INRAE, PETREL, STANDA, SODIAAL, ACTIA, MAKE.ORG
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- CONFAGRICOLTURA
- U GENT, SCALDOPACK, PACK4FOOD, GREENYARD
- RISE, SLU
- SOFIES, BIOFRUITS, COGITERRE, GRANGENEUVE
- JOANNEUM
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ACTALIA

MONTs & TERROIRS
De merveilleux fromages



29/09/2022

2nd GENERAL ASSEMBLY MEETING

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