PRUDENT

WP1: GREEN NUDGES LANDSCAPE ANALYSIS

D1.2: Insights on green nudging from ongoing projects v1

Funded by
the European Union

Document Information

Grant Agreement Number		101134051	**Acronym**	PRUDENT
Full Title	Promoting Green Nudging for Sustainable Agriculture and Forestry			
Start Date	1st March 2024	**Duration**	48 months	
Project URL	www.prudent-project.eu			
Milestone	N/A			
Work Package	WP1			
Date of Delivery	**Contractual**	28/02/2025	**Actual**	27/02/2025
Nature	R — Document, report	**Dissemination Level**	PU - Public	
Lead Beneficiary	UNITN			
Responsible Author	Simone Cerroni			
Contributions From	Ruggiero Rippo (UNITN), Marilena Gemtou (AUA), Erwin Wauters (EV-ILVO)			

Document History

Version	Issue Date	Stage	Description	Contributors
v0.1	9/2/2025	Draft	Draft of the report	Simone Cerroni, Ruggiero Rippo
V0.2	26/02/2025	Final	Final version of the report	Simone Cerroni, Ruggiero Rippo, Marilena Gemtou, Erwin Wauters
V1.0	27/02/2025	Proofreading	Final version of the report used as deliverable	Simone Cerroni, Ruggiero Rippo, Marilena Gemtou, Erwin Wauters

Disclaimer

Copyright message

Funded by the European Union

Table of Contents

Funded by the European Union

List of Figure

List of Tables

Funded by the European Union

List of abbreviations

BM: Business model

CAP: Common Agricultural Policy

CSA: Climate Smart Agriculture

CF: Conceptual Framework

EAFRD: European Agricultural Fund for Rural Development

LTR: Light Touch Review

MLP: Multi Level Perspective

PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses

SFS: Sustainable Food Systems

SME: Small and medium enterprises

SPI: Scientific Policy Interface

Funded by
the European Union

List of consulted deliverables and milestones

BEATLES Project

D1.1: Integrated framework of decision-making factors

D1.2: Use Case Co-Creation Workshops – First Round 2023

D2.1: Lab experiments v1

D4.1: Portfolio of fair value proposition v1

ENFASYS Project

D1.1: Conceptual Framework

D1.2: Mapping lock-ins, interventions and transition pathways to SFS

VISIONARY Project

M2.1: Initial Conceptual Framework

D2.1: Literature-based mapping of drivers for behaviour change in the food system

D6.1: Transdisciplinary policy mapping of barriers and interventions for food system sustainability

Funded by
the European Union

1 Executive summary

PRUDENT aims to transform the agricultural, food and forestry systems, speeding up the shift toward sustainable practices and smart farming technologies thanks to the integration of green nudges in public policies and private initiatives. The project builds on knowledge and expertise generated within three EU-funded projects under the call HORIZON-CL6- 2021-FARM2FORK-01-08 — BEATLES (G.A. ID: 101060645), ENFASYS (G.A. ID: 101059589), and VISIONARY (G.A. ID 101060538).

Given these premises, this report systematically maps, organizes and synthetizes findings from three sister projects mentioned above up to the end of November 2024 using publicly available milestones and deliverables as well as additional documentation that was made available by the principal investigators of the three sister projects.

While the three sister projects broadly address the complex challenges of transitioning towards more Sustainable Farming Systems (SFS), BEATLES has a specific focus on the adoption of Climate-Smart Agriculture (CSA) to foster sustainability in agri-food systems. All projects aim to enhance understanding of the behavioural aspects of farmers' decision-making and integrate behavioural insights into a systemic perspective, enabling a comprehensive view of the complex relationships among all actors operating in food systems. Empirical evidence from these projects supports the design and implementation of innovative public policies and business models that effectively promote a large-scale and long-term behavioural change among the farming community towards more sustainable and climate-neutral production systems.

These projects build on sound conceptual frameworks and robust empirical evidence collected using case studies (or use cases) that are representative of different farming systems across Europe. The research agenda of the three projects is based on participatory approaches such as co-creation activities and science-policy interfaces that imply a collaborative co-designing procedure that involves multiple stakeholders and considers different and possibly divergent perspectives. Using a diverse set of methodologies ranging from systematic literature review to semi-structured qualitative interviews, and from behavioural surveys and experiments to large-scale randomized control trials, the three sister projects aim to develop innovative policy and business strategies to overcome systemic barriers and foster sustainable transitions.

This report's final goal is to synthesize and consolidate the main findings stemming from the three sister projects up to November 2024. It is important to underline two aspects that characterize the report. First, while it is given for granted that the transition towards CSA and SFS is a process that includes not only farmers but all stakeholders involved in agri-food systems, this report mainly focuses on findings from the three sister projects regarding farmers' behaviour as a response to public policies and private initiatives geared to foster more sustainable farming and food systems. Second, this report builds on milestones, deliverables and additional material related to research conducted in the first few months of activity of these projects. Therefore, the report mainly focuses on results from foundational research activities such as the definition of conceptual frameworks, development of case studies (or use cases), literature reviews and mapping exercises.

The report is structured in five core thematic areas: conceptual framework (Section 2), decision-making factors (Section 3), policy tools (Section 4), green nudges (Section 5), and business models (Section 6). Hence, the report is structured in 7 sections. Section 1 presents the executive summary. Section 2 outlines the theoretical and conceptual foundation of the three sister projects, serving as a guide for past, present, and future empirical research conducted within them. Section

3 reports findings regarding the behavioural and systemic factors that were mapped as drivers, barriers and lock-ins to the transition towards sustainable agricultural and food systems. Section 4 describes the mapping of policy tools and interventions carried out within the three projects, while Section 5 specifically focuses on whether and how green nudges are considered within these projects as policy interventions. Section 6 provides a mapping of key business models and strategies that can contribute to the transition towards more sustainable farming systems. Section 7 offers the conclusions where we summarize evidence and main lessons learnt from these projects, and we describe how these finding may be beneficial for PRUDENT and future similar initiatives.

This report provides a useful resource for policymakers, practitioners, and researchers aiming to achieve resilient food systems aligned with the EU Green Deal and Farm to Fork Strategy.

Funded by the European Union

2 Conceptual frameworks of the three sister projects

1.1 BEATLES

BEATLES aims to facilitate the transformation of agri-food systems by promoting a systemic and systematic behavioural change towards CSA and smart farming technologies. This shift is aligned with the goals outlined in the European Farm to Fork and Biodiversity Strategies, as well as the new CAP. By adopting a food system approach, BEATLES views the agri-food value chain as a series of interconnected components, where interactions among components can lead to systemic innovations.

The project has a strong empirical focus and explores the adoption of CSA in diverse food systems across Europe, including the most important farming sectors such as cereals (wheat), vegetables (onions and potatoes), stone fruits (apples), livestock (pig), and dairy, represented in various EU countries: Lithuania, Germany, Spain, Denmark, and the Netherlands. To this end, the project builds on 6 use cases (one per each country and farming system), where the empirical research is conducted within the lifespan of the project itself. This diversity helps account for the differing conditions and challenges faced by different agricultural contexts.

A core element of BEATLES is the creation of an integrated framework that identifies and analyses individual (behavioural), systemic, and policy factors as well as existing climate-smart practices and technologies that drive behavioural change for the transition to CSA and more SFS. Another essential element of the project is represented by the ongoing co-creation activities involving value chain stakeholders throughout the project's lifespan at use-case level. These two elements ensure a robust empirical foundation for the experimental research that will be conducted within the project in the next months (see deliverable 1.2 for an example). This research aims to develop transformative pathways, including business strategies and policy recommendations, to accelerate the transition to fair, healthy, and environmentally friendly food systems.

In contrast to ENFASYS and VISIONARY, this project does not develop a theoretically grounded Conceptual Framework (CF) but, as it will be evident in the next section, the research conducted in BEATLES is mainly grounded on empirical evidence collected from the integrated framework and co-creation activities in the different use cases.

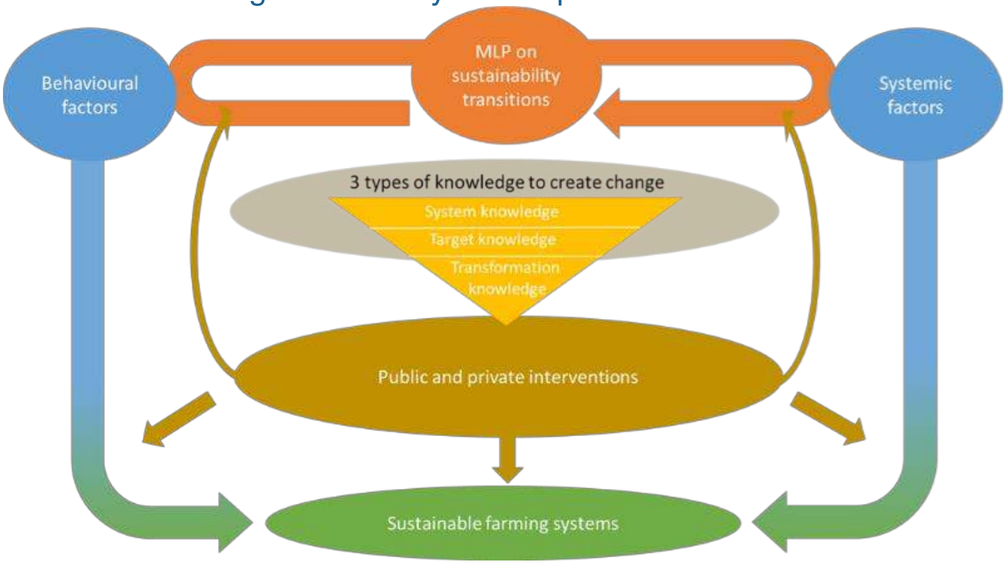
1.2 ENFASYS

The ENFASYS project aims to stimulate a just and robust transition to sustainable, productive, climate-neutral, biodiversity-friendly and resilient farming systems by improved policies and business strategies that encourage farmers' behavioural change. The theoretical underpinning of the activities within the project is contained in the CF that is developed in Task 1.1 within WP1). Deliverable 1.1. describes in detail the CF that describes how the transition towards more sustainable food systems (SFS) is investigated in the project (see Figure 1). The CF describes the key elements to be considered and their potential interlinkages. These elements are the following: i) systemic lock-ins and levers in farming and food systems that prevent or enable transition to more sustainable farming systems (more details in Section 2 of this report); ii) behavioural factors affecting farmers' adoption of more SFS (more details in Section 2 of this report); iii) public intervention such as policies in the CAP or in the member states (Section 3 of

Funded by
the European Union

this report) and iv) private intervention such as business strategies and social innovation (Section 5 of this report).

Figure 1 Enfasys conceptual framework



Source: ENFASYS Deliverable 1.1

The CF highlights the need to identify and map the behavioural and systemic factors that can be considered as key elements enabling or hindering change toward SFS. Behavioural factors refer to elements that relate to the capacity and motivations of individuals, such as farmers, buyers, citizens, and investors to make decisions. They pertain to the sphere of individual decision-making processes. Systemic factors are those constraining and motivating effects on individuals' actions of social dynamics of the systems or social structures in which actors are positioned. Systemic factors pertain to underlying structures and institutional frameworks (more details in Section 2 of this report).

Drawing on Karen O'Brien's "three spheres of transformation" –practical, political, and personal – ENFASYS underscores the necessity of integrating these dimensions. The practical sphere refers to specific practices and behaviours, the political sphere "represents the systems and structures that facilitate or constrain practical responses", while the personal sphere concerns the beliefs and values that are used to construct the two former spheres (O'Brien, 2018). Despite advancements in both behavioural science and food systems research, the integration of these domains remains limited. To achieve this integration, ENFASYS plans to enrich the classic Multi-Level Perspective (MLP) framework that is widely used to study transitions in socio-technical systems (Geels 2002, 2011), including SFS, with behavioural insights. In a nutshell, the MLP conceptualizes systems as being structured across three interconnected levels: landscapes (i.e., the broader socio-technical, cultural and institutional context), regimes (i.e., the dominant structures, practices and institutional arrangements) and niches (i.e., protected spaces where innovations emerge). Transitions are results of the dynamic interactions between these levels. For example, radical innovations developed in niches can scale up and disrupt entrenched regimes when landscape pressures (e.g., climate change or market shifts) destabilize existing systems. A richer description of the classic MLP framework alongside its strengths and limitations can be found in D1.1.

Funded by the European Union

PRUDENT

The ENFASYS's CF proposes the integration of insights from social practice theory into the MLP with the final goal of enriching the MLP with the analysis of agency, habits, and cultural norms (Sovacool & Hess, 2017). The ability of the MLP to explain the transition towards SFS could be improved by integrating other elements in its classic formulation. For example, the role of material and economic constraints on transitions, such as resource availability and market dynamics (Geels, 2019) or greater attention to the geographic and scalar dimensions of lock-ins and opportunities (Bui, 2021).

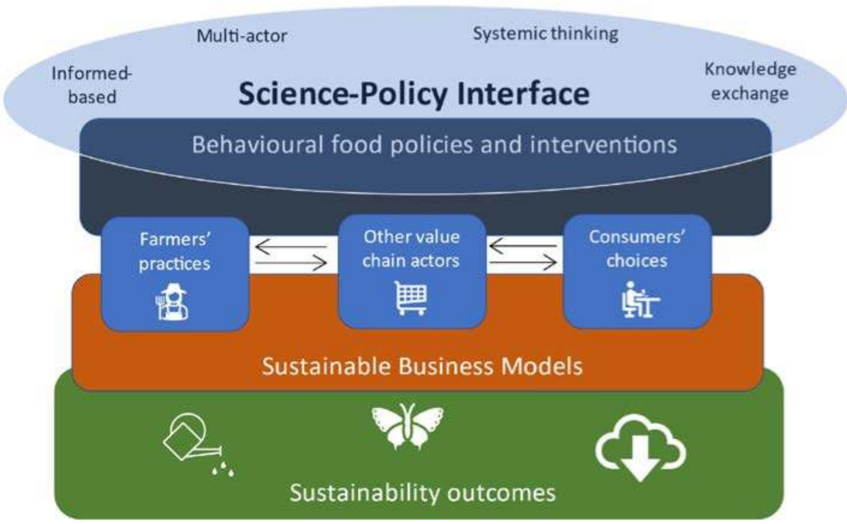
Interestingly, the CF was critically assessed and scrutinized by the same project partners and a selected set of key stakeholders involved in farming systems. Task 1.2. and 1.3 aims to generate a better understanding of possible transition pathways towards SFS by all partners involved in the consortium and find a shared vision that can reconcile different perspectives within the consortium. Building on Personal Construct Theory as proposed by Kelly (1995) and eliciting personal construct from 10 consortium partners using Repertory Grid Technique (Jankowicz, 2005), 7 main clusters of constructs were identified that are important to explain the transformation potential of initiatives geared to facilitate the transition towards SFS. These clusters indicate that the transformation potential of an initiative depends on the degree of stakeholder inclusion in the system, the factors that enable farmers to participate in the initiative (workload for example), the degree of independence of such initiatives from systemic factors (government support for example), the degree of ambition of the transformative initiative, the scope of the initiative (geographical area for example), orientation of the initiative in the market and supply chain, and the clarity and transparency of the transformative initiative's objective. Task 1.3 provides a mapping of the transformative initiatives towards SFS that were developed in previous and ongoing EU and national research projects via a light touch review (LTR). These were used to elicit the personal constructs in Task 1.2 and draw additional conclusions about enablers, barriers, and transformative potential of existing transformative initiatives. Key enablers include institutional and technological innovation, social collaboration, knowledge exchange, supportive policies, and market demand for sustainable products. The main barriers are economic challenges, knowledge gaps, institutional inertia, and market constraints, among others. Results from Tasks 1.2 and 1.3 are reported in Deliverable D.1.2.

Ultimately, the CF provides the theoretical basis for the project's empirical research that is currently conducted across 10-difference case studies involving diverse farming systems and EU countries (Belgium, Italy, Germany, Switzerland, Ireland, Greece, France, Slovenia and Serbia). In some of these countries, the case-study involves a specific production system, such as pig production, open-air vegetables, dairy production, wheat production, on other various production systems are involved. The empirical research in each case study is co-designed in cooperation with key stakeholders who participate in co-creation activities throughout the lifespan of the project.

1.3 VISIONARY

VISIONARY aims at facilitating the transition of food systems towards more sustainable pathways. The project's CF is developed in Task 2.2 within WP2 and is presented in Milestone 2.1. It provides the theoretical and conceptual foundations necessary to investigate this transition. The CF identifies the systemic elements that characterize food systems and their potential transitions toward sustainability. First and foremost, it emphasizes the importance of mapping key actors within food systems, as well as identifying the main barriers and levers that can either facilitate or hinder behavioural change. It highlights the need to design more effective behavioural sustainable business models (BM) along food value chains and public policies using a holistic systems-thinking approach. The CF calls for a stronger interaction between research, policy-making and private initiatives. This interaction is essential for accelerating the transition towards more SFS and it is achieved through science-policy interfaces that promote a policy design process rooted in a multi-actor co-creation approach (e.g. Cvitanovic et al., 2015; Bednarek et al., 2018) (see Deliverable 6.1 as an example). This approach ensures the continuous exchange of information among all stakeholders involved. Furthermore, the CF underscores the necessity of designing behavioural food policies using a holistic systems-thinking approach. This approach should encompass all activities from food production to consumption, consider the interactions between bio-geophysical and human environments, assess the outcomes of these activities, and account for all determinants of food security. Ultimately, the CF establishes the theoretical foundation for the project's empirical work, which will be conducted across various food systems (cereals, dairy, stone fruits, livestock, vegetables) and 8 EU countries (Germany, Poland, Hungary, Romania, Italy, Spain, Denmark and the UK).

Figure 2 Scheme of VISIONARY Conceptual Framework



Source: VISIONARY Deliverable 1.1

The CF emphasizes the need for behavioural change among all actors involved in food systems, with a particular focus on farmers and consumers. This report primarily concentrates on farmers, as PRUDENT is mainly concerned with farmers' and foresters' behavioural change. A key priority of the CF is identifying and mapping the factors that influence farmers' behavioural change, including behavioural determinants. Special emphasis is placed on the role of these factors in the transition process. To support this, a taxonomy is proposed, building on the mapping presented in Dessart et al.'s (2019) review of behavioural factors affecting the adoption of sustainable farming practices. This taxonomy is further enriched with insights from the work of Bargushen et al. (2021) and Barnes et al. (2022). Further details on these taxonomies can be found in Milestone 2.1.

The CF represents the theoretical basis for all experimental investigations that will be conducted in the near future across the 10 case studies developed within the project. These case studies

Funded by the European Union

involve diverse food systems (cereal, dairy, etc.) and diverse countries (Denmark, England, Germany, Spain, Poland, and Romania)

1.4 CONCLUSIONS

The three sister projects—BEATLES, ENFASYS and VISIONARY—share a common goal: studying and facilitating the transition of food systems toward sustainability. A key similarity across these projects is their holistic approach, integrating behavioural and systemic perspectives to drive sustainable change. This is particularly evident in the CFs of ENFASYS and VISIONARY that highlight the importance of a comprehensive approach that combines internal (behavioural) factors with external (systemic) factors.

Important levers for this transition are strengthening knowledge exchange and social learning networks, empowering stakeholders, and encouraging the widespread adoption of sustainable practices. Addressing systemic barriers requires streamlined regulatory frameworks, effective financial incentives, and participatory governance structures. Additionally, interventions must facilitate behavioural change by addressing normative and habitual processes while bridging the gap between intention and action through tailored support mechanisms. Ultimately, fostering collaboration among farmers, consumers, policymakers, and industry stakeholders is essential for driving collective action and accelerating systemic change.

While VISIONARY, ENFASYS, and BEATLES share a common objective, they employ distinct approaches, each reflecting a different underlying rationale. This section highlights the key differences in their CFs. First, ENFASYS and VISIONARY adopt a broad perspective, focusing on the overall transition toward more sustainable food and farming systems, whereas BEATLES has a more specific focus on CSA within the same transition. Second, ENFASYS and VISIONARY have developed theoretical CFs to guide their research, whereas BEATLES takes a more empirical approach, without implementing a theory-based CF. The ENFASYS' CF can be seen as an expanded and enriched version of the MLP, incorporating elements from other theories such as Social Practice Theory to integrate in the same theoretical framework systemic and behavioural factors influencing sustainable farming systems, shedding light on systemic lock-ins and levers that either hinder or facilitate transitions. This approach should facilitate the development of BM and public policies fostering transformative change. VISIONARY's CF, on the other hand, integrates behavioural science, systems thinking, and a multi-actor approach putting a strong emphasis on the role of science-policy interfaces. By integrating insights from behavioural science within a systems-thinking approach, VISIONARY aims to study and develop behaviourally grounded agricultural and food policies, private-sector-led interventions, and innovative BM.

The CFs produced in ENFASYS and VISIONARY, and the Integrated Framework generated in BEATLES collectively highlight the need for integrated strategies that align behavioural and systemic perspectives. These strategies will be instrumental in achieving meaningful progress toward sustainable agriculture and food systems while promoting environmental, social, and economic resilience. Future initiatives should continue to build on these foundations, leveraging interdisciplinary research and stakeholder engagement to drive transformative outcomes.

The project PRUDENT has benefited from the CFs developed in ENFASYS and VISIONARY and the more empirical Integrated Framework developed in BEATLES in the design phase of the proposal and in the research activities that are currently conducted in WP1 about mapping the behavioural underlying mechanisms (behavioural factors) behind the functioning of green nudges geared to facilitate the transition towards more SFS. Future projects could benefit from the work conducted in three sister projects as well.

Funded by
the European Union

3 Decision-making factors affecting farmers' behaviour

3.1 BEATLES

BEATLES maps factors influencing farmers' transition to CSA in agri-food systems by conducting a literature review and administering a survey to farmers. Results from these activities contribute to the development of the integrated framework of decision-making factors that is developed within WP 1 and presented in Deliverable D1.1. In addition, empirical evidence from these two activities is integrated with information from the co-creation activities conducted at use-case level in WP1.

3.1.1 The literature review

The integrated framework of decision-making factors is based on results from five systematic reviews focusing on: (i) the CSA practices and technologies adopted by farmers, (ii) the decision-making factors that drive farmers' behavioural change towards CSA, (iii) the business strategies that impact the transition to CSA, (iv) the decision-making factors influencing consumers' purchasing choices regarding environmentally-friendly products at the farm level, and (v) the existing policy and regulatory frameworks affecting the transition to CSA. In this section, we focus on the literature review on the decision-making factors that drive farmers' behavioural shifts towards CSA (ii).

The systematic review is carried out following a Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) approach. More details are available in deliverable D1.1. The factors identified are categorized into seven categories: socio-demographic, psychological, farm characteristics, geographical, technology-related, systemic, and policy factors. The most studied CSA practices were smart farming technologies, digital tools, artificial intelligence, and organic farming. Below, we report the main findings for each decision-making factor category (see also Table 1 below). Deliverable 1.1 reports for each decision-making factor the number of studies that find a positive or negative relationship with adoption and the number of papers that find a significant correlation.

<u>Socio-demographic factors</u>

The most researched factors are age, gender and education level. The main results are that:

- Younger farmers are more likely to adopt CSA practices than older ones.
- Higher education levels are positively correlated with CSA adoption.
- Gender presents mixed results, and it has no significant effect on adoption overall.

<u>Psychological factors</u>

Factors that receive attention are awareness of environmental challenges and climate change, environmental consciousness, knowledge of CSA's benefits, perceived behavioural control, motivational and attitudinal factors. Results suggest that:

- Farmers' awareness of environmental challenges and climate change is positively correlated with adoption.
- Perceived behavioural control, which refers to farmers' confidence, skills, and sense of control over adopting CSA, also has a significant positive correlation with adoption.

Funded by
the European Union

In addition, motivational and attitudinal factors such as economic, environmental, social, and moral considerations influence the adoption process.

- Farmers who perceive potential environmental and economic benefits related to the adoption of CSA are more likely to adopt.
- Environmental consciousness and a sense of responsibility for future generations also motivate adoption.
- Farmers are often influenced by subjective norms, meaning they are likely to adopt CSA practices if they believe it will align with social expectations.
- Farmers' degree of innovativeness has a positive relationship with CSA adoption.

Farm characteristics

The most investigated farm-related factors are farm size, size of the arable land, farm ownership and labour availability. Results indicate that:

- Farm size is positively correlated with CSA adoption, with larger farms more likely to adopt these practices.
- Farm ownership is another important factor. Tenants, who do not own the land they farm, tend to be less likely to adopt CSA practices.
- The larger the size of arable land the higher is the probability of adoption.
- Labour availability and the use of shared machinery were not found to have a strong influence on CSA adoption.

Characteristics of the practice/technology

A lot of attention has been devoted to farmer's perception of the characteristics of the CSA.

Farmers' perceptions of CSA practices and technologies play a crucial role in the decision to adopt them.

- Perceived usefulness (the ability of the technology or practice to enhance productivity, reduce workload, and simplify farm operations), perceived ease of use (how user-friendly the practice or technology is), and perceived compatibility (how well the new practice or technology fits with current farm operations and the individual's social, economic, and personal circumstances) positively correlate with CSA adoption.
- Perceived costs, such as investment, training requirements, increased workload, and long payback periods, are negatively associated with adoption rates.
- Perceived benefits, including economic gains, environmental benefits, and improved societal outcomes like food safety, quality, and higher yields, positively drive adoption.
- Concerns over the trustworthiness of technologies, including data ownership, privacy protection, and security have also been identified as barriers to adoption.

Systemic factors

Systemic factors were widely investigated in the literature. The factors that received most attention were access to information and extension services as well as collaboration in the value chain.

Funded by
the European Union

- Access to information is a key positive factor, as it helps farmers understand the benefits of CSA. Extension and advisory services, particularly those that offer ongoing training and technical support tailored to individual farm needs significantly promote adoption.
- Participatory approaches, where multiple actors from the value chain are involved in the decision-making process, have been found to increase farmers' engagement in CSA. Membership in cooperatives also supports CSA adoption by providing access to technical support, information, and market opportunities.

Policy factors

Policy factors were widely studied in the literature. Evidence suggests that:

- A supportive legal and political environment can enable adoption, while overly strict or inconsistent regulations that limit flexibility often act as barriers to CSA implementation.
- Governmental financial support, such as subsidies, tax reductions, and schemes, is positively associated with CSA uptake, as it helps offset income loss and investment risks.
- Bureaucratic regulations, particularly those related to subsidies and certifications, are seen as obstacles to CSA adoption due to the time, effort, skills, and knowledge required to navigate the paperwork.

Geographical factors have not been extensively explored in the literature and existing evidence does not allow to draw robust conclusions.

Table 1 Decision-making factors affecting adoption of CSA

Factors	Positive effect	Negative effect	Insignificant	% Significant
Demographics				
Age	3	26	11	72.5
Education level	19	0	15	55.9
Gender (male)	2	3	8	38.5
Farming experience	3	1	0	100
On-farm income	4	1	3	62.5
Off-farm income	5	0	3	62.5
Full-time farmers	4	1	1	83.3
Household size	1	0	2	33.3
Psychological factors				
Awareness	15	0	2	88.2
Knowledge	14	0	1	93.3
Farmer skills	7	0	3	70
Perceived behavioural control	22	0	1	95.7
Motives	17	7	0	100
Attitudes	17	1	4	81.8
Trust	3	0	0	100
Subjective norms	9	1	1	90.9
Risk aversion	8	0	0	100
Resistance to change	5	0	0	100
Innovativeness	8	1	2	81.8
Environmental consciousness	12	0	0	100
Responsibility for future generations	2	0	0	100

Funded by the European Union

Farm characteristics				
Farm size	18	6	6	80
Size of arable land	8	1	1	90
Farm outputs (yield, profitability)	5	2	1	87.5
Farm ownership	5	3	2	80
Farm successor	4	0	2	66.7
Labour availability	5	1	8	42.9
Shared machinery	0	0	2	0
Characteristics of practice/technology				
Perceived usefulness	17	0	1	94.4
Perceived ease of use	13	0	3	81.3
Perceived compatibility	11	0	0	100
Perceived costs	37	5	0	100
Perceived benefits	43	0	3	93.5
Perceived trustworthiness	16	0	0	100
Perceived lack of verified impact	0	8	1	88.9
Availability of certification	4	0	0	100
Systemic factors				
Social norms	5	4	2	81.8
Social learning	11	0	2	84.6
Social networks	6	0	4	60
Information sources	13	1	3	82.4
Extension and advisory services	35	0	2	94.6
Marketing and communication campaigns	9	0	1	90
Lack of research, education, and knowledge	0	7	0	100
Access to market	7	0	0	100
Direct marketing	5	0	0	100
Short supply chains	3	0	0	100
Access to credit	4	0	0	100
Market demand	11	0	0	100
Lack of infrastructure	13	0	0	100
Collective decisions and participatory approach	23	0	0	100
Membership in a cooperative	6	0	4	60
Policy factors				
Legal framework	14	10	0	100
Financial support	29	0	2	93.5
Bureaucracy	0	8	0	100
Geography factors				
Weeds	0	3	1	75
Pests	1	0	1	50
Crop diseases	1	0	0	100
Soil quality	0	5	1	83.3
Temperature	0	0	1	0
Precipitation	1	0	2	100
Drought	0	0	1	0
Extreme weather conditions	1	0	3	25

Funded by the European Union

Source: Extracted from BEATLES Deliverable 1.1

3.1.2 Survey - Decision-Making Factors and Intention to Adopt CSA

WP1 complements findings from this literature review with results from an online survey administered to EU farmers to understand their perspective about decision-making factors that affect farmers' behavioural change towards CSA practices. The final goal of the survey is the investigation of the correlation between individual, systemic, and policy-related factors with farmers' intention to adopt CSA in the future measured on a seven-point Likert scale. Individual factors are further categorized into: socio-demographic, psychological, farm characteristics, geographical, and technology-related. Results show that farmers show a moderate intention to adopt. The correlation was measured using the Spearman's correlation coefficient. The survey was conducted across six European countries: Denmark, Germany, Lithuania, the Netherlands, Spain, and Slovenia. The final sample consists of around 720 farmers. More details on the survey and results are available in deliverable D1.1.

Socio-demographic factors:

- Age and gender of farm household heads showed significant but very weak negative correlations with adoption intentions, with younger farmers displaying a higher propensity to adopt and female-headed households being less inclined.
- Higher education and income levels are positively and weakly correlated with intention to adopt.
- Farm size and private ownership of farmland were positively correlated with intention to adopt.
- Farming experience did not demonstrate a significant relationship with adoption intention.

Psychological factors:

- Perceptions of self-responsibility, farm motives, and financial risk tolerance were weakly but significantly correlated with adoption intentions.
- Preference for certainty over uncertainty did not significantly influence adoption.
- Farmers' perceptions of financial sufficiency and household income were positively linked to adoption.

Technology-related variables:

- Technologies that are perceived to enhance productivity, reduce workload, and simplify farm operations meet higher adoption rate.
- Technologies that align with existing farming goals are positively correlated with intention to adopt.
- Technologies that are easy to understand and implement were particularly influential in shaping adoption intentions.

Systemic decision-making factors

- Social norms, encompassing both observed practices of peers (descriptive norms) and the perceived approval of important others (injunctive norms), positively influence adoption intentions.
- Perceived equity within the food value chain also play a role. Farmers are more inclined to adopt CSA when they believe all stakeholders contribute fairly to environmental, ethical, and fair-trade goals.

- Trust in other stakeholders' honesty regarding climate and ethical commitments also positively correlates with the intention to adopt.
- Availability of certification processes and the market willingness to pay premium prices for CSA products positively influence adoption intentions, as do perceptions of access to market.
- Access to information and advisory services is another critical determinant. Farmers who rely on agricultural training, advisory services, and trusted information sources are more likely to adopt CSA.

Policy and institutional framework on CSA

- Positive and significant correlations were observed between adoption intentions and perceptions about access to credit and governmental financial support

Table 2 Decision-making factors and intention correlation

Variables	N	Correlation coefficient	Significance
Socioeconomic characteristics			
Age	713	-0.0669	0.0.741
Gender	713	-0.1078	0.0040
Education level	713	0.1362	0.0003
Household size	713	0.1444	0.0001
Farm income level	713	0.1354	0.0003
Farming experience	713	-0.0191	0.6112
Farm characteristics			
Farm size	715	0.2235	0.0000
Farm ownership	715	0.1019	0.0064
Farm production type	715	-0.0176	0.6381
Farm cooperative membership	715	-0.0488	0.1922
CSA technologies related variables			
Perceived ease to use	721	0.209	0.000
Perceived compatibility	721	0.365	0.000
Perceived technological usefulness	721	0.180	0.000
Psychological variables			
Perception of self-responsibility	689	0.2221	0.000
Farm motives	689	0.2336	0.000
Risk tolerance-prefer certainty over uncertainty	689	0.058	0.129
Risk tolerance - avoid risks in my investments	689	-0.003	0.941
Risk tolerance- like to take financial risks	689	0.110	0.004
Perception of the financial resources' sufficiency	633	0.154	0.000
Perception on sufficiency of household's income	632	0.169	0.000
Systemic factors			
Perceived equity	650	0.1356	0.0005
Perceived contributions	650	0.1013	0.0098
Perceived honesty	650	0.1405	0.0003
Subjective norm	650	0.3867	0.0000
Availability of CSA certification	673	0.1190	0.0027
Perception on market access	673	0.1354	0.0006

Funded by the European Union

Perception on WTP for CSA products by buyers	672	0.0829	0.0368
Information use	636	0.2170	0.0000
Extension and advisory serves	636	0.1966	0.0000
Policy and institutional factors			
Perception on governmental support on CSA	673	0.117	0.002
Perception on credit access for CSA	673	0.166	0.000

Source: Extracted from BEATLES Deliverable 1.1

Using data from the same survey, Deliverable 4.1 (Task 4.1, WP 4) presents results from a segmentation analysis of European farmers, aiming to profile them based on their unique characteristics and needs, which will help tailor policies and interventions. Market segmentation analysis identifies homogeneous segments with similar traits, enabling more targeted policymaking that can foster transformative change towards sustainability. Results suggest that farmers can be categorized into four distinct segments based on their expectations and intentions regarding the adoption of CSA initiatives.

- **Segment 1:** Farmers with modest expectations (34%). This segment has Low Experience, Medium Expectations, and Medium Intention to use CSA.
- **Segment 2:** Farmers with high expectations (28%). This segment has Low Experience, High Expectations, and Medium Intention to use CSA.
- **Segment 3:** Farmers using CSA (24%). This segment has Medium Experience, High Expectations, and High Intention to use CSA.
- **Segment 4**: Farmers not using CSA (13%). This segment has Low Experience, Medium Expectations, and Low Intention to use CSA.

Overall, three out of the four segments, which make up 76% of the sample, show low experience with CSA practices and a low to medium intention to adopt them in the future, indicating a potential lock-in effect due to lack of experience. The only segment with a majority of experienced farmers (24% of the sample) has the highest intention to use CSA practices. Potential key barriers, or lock-ins, identified include:

- **Personal barriers**: Farmers not using CSA face constraints such as time, resources, or willingness to adopt new practices.
- **Social barriers**: A lack of trust among farmers towards other actors in the food supply chain, as well as the belief that others (business partners and consumers) are not willing to pay fair prices for climate-smart products, hampers collective action. Additionally, some farmers are unaware of others in their peer group adopting CSA practices, which can deter them from making changes.
- **Economic barriers**: Many farmers report difficulties accessing financial resources, markets for inputs/outputs, and institutional support like certifications or credit facilities, along with a generally unfavourable policy framework which further contribute to the lock-in.

Based on results from the three different activities described above (literature review, correlation analysis and segmentation analysis), a few robust conclusions can be drawn about farmers' willingness to adopt CSA and decision-making factors influencing observed adoption and intention to adopt.

Data collected in the survey indicate that, on average, farmers tend to be moderately inclined towards the adoption of CSA. However, the segmentation analysis shows a high degree of heterogeneity in farmers' intention to adopt due to different expectations about the potential benefits of adoption and different levels of familiarity with CSA. The vast majority of farmers have a low or moderate intention to adopt CSA, while only a quarter of farmers are likely to adopt.

Findings from the literature review and the correlation analysis based on primary data show are consistent, overall. Results indicate that age and education are important drivers of adoption. Therefore, the ageing of the farmer population in Europe and the moderate level of education of the farming community could represent the main barriers to adoption. A more systemic circulation of information as well as support from extension services are crucial to enhance farmers' perception of the potential benefits and costs of adoption. Farmers, on average, have little knowledge and familiarity with CSA and, in the survey, they clearly express the need to better understand the complementarity of CSA with their current farming activity and whether they would be able to implement and efficiently use new technologies. Perceived behavioural control becomes an important enabler in this sense. Results also show that farmers who are more aware and conscious about environmental challenges that threaten their activities and about the contribution that farming itself has on environmental degradation are more responsive. Therefore, initiatives that aim at increasing awareness of environmental challenges, including climate change could improve farmers' environmental consciousness and, consequently, adoption rates. A more systemic knowledge about CSA could also be achieved thanks to the creation capacity-building networks generated at supply-chain level and involving different types of stakeholders. Results also suggest that social norms can positively affect adoption and the establishment of collaborative farmer initiatives that foster mutual support, risk sharing, peer effects and social comparisons could facilitate adoption of CSA. Finally, an improvement in the legal framework, larger financial support, easier access to credit, and a lower bureaucratic burden related to the adoption of CSA could increase the rate of adoption. Governance reforms that enhance cross-sector coordination and inclusive decision-making could further strengthen the effectiveness of policy interventions. In summary, a better understanding of how decision-making factors influence intended and observed farmers' behaviour as well as their interlinkages allows for the design of more effective interventions that can enhance CSA adoption and contribute to sustainable agricultural practices.

BEATLES project will use these findings as a foundation to examine effective behavioural interventions, through experimental designs, in WP2 as well as fair business strategies in WP4.

3.2 ENFASYS

The ENFASYS's CF highlights the importance of integrating behavioural and systemic perspectives as anticipated in Section 1.2. Behavioural economics explains decision-making as influenced by behavioural and situational factors, while food systems research views these factors as products of systemic structures that define actors' social and cultural environments. These perspectives are complementary, as behavioural science examines proximate causes of actions, while systemic perspectives explore underlying mechanisms.

To better understand interlinkages between these two domains, Task 1.1. in WP 1 provides a literature review of the systemic and behavioural factors affecting this transition of farmers and consumers towards SFS. This review used an approach similar to PRISMA even though it does not explicitly follow this approach. Deliverable D1.1. presents the results of this exercise. However, in this section, only the main findings from the literature review about farmers are provided given the focus of the PRUDENT'S project.

Funded by the European Union

Among system factors, main enablers, deterrents and lock-ins were identified. Here, we summarize that in Table 3.

Table 3 Enablers, deterrent and lock-ins of SFS

Enablers	Deterrents	Lock-ins
Institutional innovation: Institutional innovation emerges as a pivotal driver, focusing on the development and reconfiguration of rules, norms, and governance structures within agri-food systems. Research underscores its critical role in overcoming systemic barriers and entrenched practices that hinder sustainability (e.g. Garrett et al., 2020; Akimowicz et al., 2022).	**Economic challenges**: Economic challenges emerge as a significant hindrance to sustainability. Financial constraints, such as insufficient compensation for environmental investments and the inequitable distribution of costs and benefits, create disincentives for farmers to adopt sustainable practices (e.g. Gomes & Reidsma, 2021; Ada et al., 2021).	**System lock-ins:** "Food system lock-in" or "regimes" are defined as mechanisms that encapsulates the irreversible self-perpetuating dynamics of the global food system (e.g. Kuokkanen et al., 2017; Klerkx & Begemann, 2020).
Technological innovation: Technological innovation complements institutional advancements by introducing tools and methodologies that optimize resource use and minimize environmental impact. Precision farming technologies, renewable energy integration, and digital applications exemplify such innovations (e.g. Linares et al., 2022; Rohe et al., 2022).	**Knowledge gaps:** Knowledge gaps, particularly at the systemic level, are another critical barrier. These gaps do not reflect a lack of individual expertise but rather inadequate circulation and integration of knowledge within the agri-food system (e.g. Verburg et al., 2022; Rohe et al.2022).	**Knowledge and cultural lock-ins:** Knowledge and cultural lock-ins operate on a more cognitive and normative level, influencing decision-making and sustaining established paradigms. Sutherland et al. (2012) highlight how formal training and practical farming experience can embed specific approaches, limiting farmers' openness to sustainable innovations. Huttunen (2021) delves into the socio-cultural dimensions of farming, proposing ways to break such lock-ins through targeted sustainability research and interventions. The study underscores how socio-cultural norms and deeply rooted traditions act as barriers to transformation.
Social Innovation: Social innovation introduces the human dimension into the idea of	**Institutional inertia:** Institutional inertia further compounds these	**Technology and practice lock-ins:** Technological and practice lock-ins further

Funded by the European Union

transitioning, fostering new ideas and collaborative models to address social challenges. It is instrumental in creating inclusive and equitable food systems (e.g. Anderson and Leach, 2019; Pereira et al., 2020). Examples are social movements advocating for agroecology and equitable land access.	challenges by reinforcing resistance to change within existing structures and policies. For example, Dumont et al. (2020) discuss the rigidity of institutional arrangements that obstruct transitions to more sustainable systems. Overcoming this inertia requires systemic analysis and structural reforms (e.g., Engelberts et al., 2021; De Lauwere et al., 2022)	complicate transitions by reinforcing the dominance of specific tools, processes, or methods over time. Sutherland et al. (2012) study technological lock-ins in the context of intensive agriculture, where significant investments in specialized machinery deter farmers from adopting sustainable alternatives, such as organic farming. Kuokkanen et al. (2017) explore practice lock-ins, exemplified by the widespread adoption of chemical fertilizers, which has entrenched intensive production methods and heightened expectations of continuous growth, impeding the shift toward alternative, sustainable farming practices.
Knowledge exchange and learning: Knowledge exchange and learning are identified as enablers of innovation and collaboration, driving the dissemination and adoption of sustainable practices. An example is the exploitation of stakeholder engagement and capacity-building networks in fostering continuous learning and innovation (De Herde et al., 2022; Akimowicz et al., 2022).	**Market dynamics:** Market dynamics also play a pivotal role in shaping the trajectory of sustainable farming. The lack of consumer demand for sustainable products, coupled with the dominance of conventional agriculture, creates market conditions unfavourable to sustainability. These market-related barriers highlight the need for consumer education, demand creation, and supportive market policies (e.g. Young et al., 2022; Verburg et al., 2022).	
Policy and governance mechanisms: Policy and governance mechanisms are critical in providing the regulatory and financial frameworks needed to incentivize sustainable practices. It is important to develop	**Complex realities and interactions:** The complexity of the agri-food system itself presents a formidable barrier. El Bilali (2019) highlights how the interactions among	

Funded by the European Union

targeted policies, including subsidies, public procurement programs, and agroecological incentives, in removing systemic barriers. Governance reforms that promote cross-sectoral coordination and participatory decision-making further amplify the impact of policy interventions (e.g. Klerkx and Begemann, 2020; Linares et al., 2022**).**	ecological, economic, and social processes create a heterogeneous landscape, making the implementation of uniform sustainable practices challenging. Addressing these multifaceted challenges requires a nuanced understanding of the interconnected dynamics at play.	
Market and consumers preferences: Market dynamics and consumer preferences play an increasingly influential role in driving transitions. Growing consumer demand for sustainable and locally produced food creates market pressures that incentivize producers to adopt sustainable practices. The interplay between market forces and policy measures is key to create sustainable value chains that respond to consumer expectations while supporting producers (e.g. Kuokkanen et al., 2017; Linares et al., 2022).		

To review the literature on the behavioural factors, it was used the same approach that was implemented for the systemic factors. ENFASYS builds on different theories of human behaviour to theoretically map possible behavioural factors that may drive the transitions towards SFS. Particular attention is paid to the review of behavioural theories proposed by Known and Silva (2020) that identified 17 factors that affect the intention or motivation for behaviour. Here, the key behavioural factors and processes are presented in Table 4.

Table 4 Key behavioural factors for SFS

Factor	Description
Normative processes	Social norms are key factors influencing economic agents, including farmers. A dominant social norm in agriculture is productivism, characterized by a focus on intensive, industrialized farming supported by government policies aimed at maximizing productivity (e.g. Kaiser & Burger, 2022; Busse et al., 2021). However, shifts in values are emerging, with some farmers moving away from the productivity paradigm in favour of more sustainable and value-driven practices (Bouttes et al., 2019; Barnes et al., 2022). Farmers behavioural change towards SFS is inevitably related to whether sustainable farming is seen as socially acceptable (e.g. Hübel & Schaltegger, 2022; Murphy et al., 2022). However agricultural

Funded by the European Union

	traditions—such as land ownership, inheritance patterns, and knowledge transfer—play a significant role in defining these norms, with conservative practices often dominating (e.g. Bouttes et al., 2019; Kaiser & Burger, 2022). Agri-environmental policies are sometimes perceived as threats to these traditions, creating anxiety-driven resistance to change (e.g. Murphy et al., 2022; Puupponen et al., 2022).
Intentional processes	Decisions to adopt sustainable practices often reflect the recognition of generating environmental benefits, and the desire to create socially just and economically viable food systems (e.g. Bouttes et al., 2019; Kaiser & Burger, 2022). Many farmers are motivated by intrinsic values, such as a connection to nature, animal welfare, and the fulfilment derived from working with the land in harmony (de Lauwere et al., 2022; Konzett & Grüner, 2022).
Risk assessment	Farmers are more likely to adopt sustainable practices if they perceive minimal risks and clear benefits. Those with low risk aversion (e.g., pioneers) are more willing to experiment with uncertain but potentially transformative practices (e.g. Bakker et al., 2021; Möhring & Finger, 2022). Younger farmers, who are often better educated and more aware of sustainability issues, tend to be more open to adopting sustainable practices (e.g. Burton, 2014; García-Arias et al., 2015). However, resilience, adaptive capacity, and financial independence also play critical roles in motivating sustainable behaviours (e.g. Bouttes et al., 2020; Sutherland, 2011).
Situational Influences	The pressures of the conventional food system, including low prices, competition, and limited autonomy, hinder farmers' perceived control over adopting sustainable practices (e.g. Busse et al., 2021; Murphy et al., 2022). Economic viability remains a crucial factor. When financial incentives or stability is not guaranteed, sustainability efforts are unlikely to gain traction (e.g. Bartulovic & Kozorog, 2014; Sutherland, 2011). Farmers with supplementary off-farm income are more financially independent and thus more likely to engage in sustainable practices (e.g. Unay-Gailhard & Bojnec, 2016).
Social interaction	Community ties, trust, and collaboration within farming communities or short supply chains can positively influence the adoption of sustainable practices. These networks foster mutual support, knowledge-sharing, and collective action (Carson et al., 2016; Hvitsand, 2016). The relationships between farmers, consumers, and other stakeholders in localized value chains further enhance engagement and sustainability efforts (Borsellino et al., 2020; Guerrero et al., 2019).
Interest and satisfaction	Farmers often experience mistrust and disconnection within conventional food value chains, which can lead to frustration and undervaluation of their sustainability efforts (Hübel & Schaltegger, 2022). The desire for greater autonomy, self-realization, and a questioning of prevailing power structures motivates some farmers to transition to alternative practices, even at the risk of reduced income (Hvitsand, 2016; Vaderna et al., 2022).

Overall, the literature review on systemic and behavioural factors affecting farmers' behavioural change towards SFS highlights the need to integrate systemic and behavioural factors into the same CF. Behavioural factors should not be studied in isolation, but they should be embedded in more dynamic models of decision-making, recognizing that behaviour is shaped by recursive processes, where past decisions and their outcomes influence future actions. This evolving perspective opens the door for closer integration of behavioural science and food systems research. A key question is whether one-to-one relationships can be established between behavioural science concepts (e.g., social norms, habits, values, motivations) and food systems research concepts (e.g., systems, cultural norms, institutions, power, and agency). Further theoretical exploration is needed to determine whether these conceptual overlaps represent true bridges between disciplines or merely reflect distinct perspectives on social behaviours. ENFASYS seeks to advance this integration and enrich the understanding of sustainability transitions in agri-food systems.

Consistent with the approach used in the other two sister projects, co-creation activities conducted at the case-study level within different work packages integrate the literature review presented in this section. In WP 3, a co-creation workshop was held in all case-studies with the goal to propose existing and novel behavioural interventions targeted at the individual micro-level. The co-creation activity started from barriers and levers identified through the literature review and through the qualitative analysis in WP 2. In WP 6 (Policy instruments) and WP 7 (business models), a series of 2-3 co-creation workshops were held in all case studies to identify possible policy mixes and business models that could overcome some of the identified barriers. In WP 4, a co-creation workshop was held to develop theories of change.

At the moment of writing this PRUDENT deliverable, ENFASYS has mostly finalized its activities to map the systems, identify systemic lock-ins, and investigate behavioural factors that act as barriers or levers. ENFASYS has entered its experimental stage, in which ex-ante analysis of the effectiveness of policy instruments, business models and overall changes to the farming systems will be performed. In WP 5, behavioural experiments will be conducted using randomized trials, discrete choice experiments and lab-in-the-field experiments. Further, a number of stylized system dynamic models will be developed allowing to assess more systemic changes to the farming system. In WP 6 (Policy mixes) and WP 7 (Business models), further activities will be executed to produce insight regarding the feasibility of implementing policy mixes and regarding the scalability of identified business models.

3.3 VISIONARY

The VISIONARY's CF highlights the importance of mapping decision-making factors (or drivers) when investigating levers and lock-ins that may facilitate or hinder behavioural change across actors operating in food systems. To identify factors that may influence behavioural change, VISIONARY carried out a literature-based mapping in Task 2.1 in WP2. Deliverable D2.1. presents the approach used and the findings from this exercise. The literature review employed the PRISMA approach to identify 70 literature reviews. In essence, is a second-order literature review, meaning that is a literature review of existing literature reviews. In the process, two main domains of interest were identified: sustainable farming and sustainable food consumption. Here, we mainly focus on the decision-making factors affecting sustainable farming as PRUDENT is mainly interested in farmers' behavioural change. The main questions the literature review tried to address are: i) What can we conclude about the behavioural dimension of the transition to SFS from existing structured literature reviews? ii) What factors hinder (barriers) or facilitate (enablers) the behavioural change of food system actors towards sustainable food provision? iii) What

Funded by the European Union

recommendations can be made for future research on sustainability transitions in agri-food systems (what remains unknown or under-studied in the discourse)?

The review regarding sustainable farming produced a final list of factors grouped into 10 main categories, 53 parent subcategories and 20 child subcategories (i.e. subcategories of subcategories). Regarding factors influencing the adoption of sustainable farming, these can be grouped into 10 main categories:

- Concerns
- Norms
- Experiences
- Exogenous Factors
- Perceptions
- Farm Characteristics
- Attitudes
- Social Relations
- Personal Attributes
- Knowledge/Awareness
- Socio-demographic Factors
- Intervention/Tools

The complete list of categories, sub-categories and factors are presented in Figure 4. Notably, the findings demonstrated that many factors exist on a "motivation-barrier continuum," meaning that the same determinant can act as either a motivator or a barrier depending on context. For instance, economic incentives can enable adoption when subsidies are well-structured, yet they may also create dependency and resistance to voluntary adoption in other cases. The review does not provide a detailed description of such categories, subcategories and child subcategories, and it does not aim to provide a detailed summary of results about the correlation between identified behavioural factors and sustainable farming practices. Instead, it aims at identifying potential gaps in the literature that could be filled by future research.

Funded by
the European Union

Figure 3 360° Review of factors influencing the adoption of sustainable farming.

Source: VISIONARY Deliverable 2.1

Overall, the key categories of factors identified in the literature review include sociodemographic variables, sociopsychological influences, economic and institutional factors, and farm characteristics.

Sociodemographic factors, such as farmers' age, education, and experience, emerged as significant predictors of sustainable practice adoption. However, Burton (2014) highlights that these relationships are often treated descriptively, with limited investigation into causal mechanisms. Addressing this gap could provide deeper insights into how demographic variables shape farming behaviours over time.

Sociopsychological factors such as risk perception, cultural norms, and identity also significantly influence behaviour. Rosario et al. (2022) underscores the need for further research into these dimensions, particularly the role of personal identity in fostering or hindering sustainable practices. Farmers' perceptions of risk and uncertainty were found to be critical in shaping their willingness to adopt new technologies or conservation methods. Additionally, cultural norms often mediate the acceptance of practices, creating variation across regions and farming systems.

Funded by the European Union

Economic and institutional factors are also pivotal. The provision of subsidies, the credibility of advisory services, and the structure of regulatory frameworks strongly affect adoption. Bartkowski and Bartke (2018) highlight the importance of co-creating partnerships and advisory systems that foster trust and knowledge-sharing.

Finally, the review emphasizes the need for future research to adopt holistic approaches that account for internal factors (e.g., perceptions, norms, and habits) and external factors (e.g., financial circumstances, cultural context, and environmental conditions) influencing decision-making processes. Such frameworks could generate insights that better reflect real-world complexities. Furthermore, exploring the interconnections between value chain actors—such as the influence of consumers' preferences, retailers' logistics, and production capacities—presents an important avenue for future inquiry.

Results from this literature review and additional evidence generated thanks to co-creation activities conducted at the case study level in the VISIONARY's science-policy interfaces informed the agri-environmental policy and the value-chain experimentation that are currently conducted in WP3 and WP4, respectively.

3.4 CONCLUSION

The theoretical foundations and the mapping of drivers influencing farmers' behaviour towards more SFS and food systems explored in BEATLES, ENFASYS, and VISIONARY, highlight the multifaceted and intricate nature of transitioning towards sustainable agriculture, forestry, and food systems. Starting from different conceptualizing frameworks, all these projects converge to the idea that it is crucial to understand better the critical interplay between behavioural and systemic factors that influence the decision-making processes of key stakeholders, including farmers. Given these premises, the first step taken from the three sister projects is the same: a mapping of the drivers influencing farmers' behaviour towards the transition towards more sustainable agriculture and food systems. However, it is evident that the three sister projects implemented a different rationale and different approaches to conduct this mapping.

First, the final goal of these mapping exercises is also different across projects. ENFAYS provides a macro mapping of systemic and behavioural factors that identifies broad categories of phenomena and processes that could act as enablers, deterrents and lock-ins in the transition process towards SFS. This is perfectly consistent with the more systemic approach that ENFASYS has in addressing the challenges and opportunities related to this transition. The VISIONARY's goal is more granular in the sense that the mapping exercise aims to identify all possible decision-making factors influencing behavioural change towards more SFS. However, VISIONARY does not necessarily aim to review the specific correlations that have been observed in the literature between decision-making factors and actual farmers' decisions. This gap is filled by BEATLES which first identifies the full set of decision-making factors affecting farmers' adoption of CSA and then it explores the correlation between such factors and adoption in terms of directional and size effects. The work conducted in BEATLES could lead to the future structuring of a meta-analysis. Some additional considerations can be made. The mapping activities conducted in ENFASYS and VISIONARY are more qualitative, while the one conducted in BEATLES is more quantitative. The three approaches complement each other, in fact the granular work conducted in VISIONARY and BEATLES could be easily integrated into the more systemic approach used by ENFASYS. While BEATLES and VISIONARY are more behaviourally driven, ENFASYS's perspective is more systemic.

Funded by
the European Union

Second, while the three sister projects all map these drivers conducting literature reviews, BEATLES integrate the literature review with a survey that aims at studying the correlation between identified drivers and intention to adopt CSA as well as at developing a segmentation analysis of the EU farming population in relation to their intention to adopt CSA. One of the aims of the survey is to test whether findings from previous literature are systematically replicable at a large scale, using a cross-country survey including six different EU countries.

Three, the number of literature reviews varies across projects. ENFASYS, taking inspiration from its CF, conducts two parallel literature reviews on drivers of farmers' behavioural change towards SFS. One relates to systemic drivers, the other to behavioural drivers. BEATLES and VISIONARY conduct one literature on decision-making factors and distinguish between behavioural and systemic factors later.

Fourth, VISIONARY proposes a "second-order" literature review, in the sense that a literature review of existing literature reviews exploring drivers of farmers' behavioural change towards more sustainable agriculture. Differently, BEATLES and ENFASYS conduct a "first-order" literature review, meaning that they focus on original studies and not on literature review.

Fifth, there exists also differences in the methodological approaches used to conduct the literature reviews across projects. VISIONARY and BEATLES followed the PRISMA approach, while ENFASYS conducted systematic literature reviews without explicitly following one specific approach.

Overall, the findings regarding key drivers influencing farmers' adoption of sustainable and CSA are consistent across the three sister projects. All three projects highlight that systemic and behavioural factors can be critical enablers or barriers to the transition towards SFS. At the systemic level, technological innovation as CSA technologies are certainly enablers. Also, social innovations like stakeholders' collaborative actions promoting agroecology and organic farming or institutional innovations like new governance models that promote participatory decision-making processes can facilitate the transition. These unconventional types of innovations can improve stakeholder engagement, and the natural creation of capacity-building networks, overcoming some of the barriers that exist at the systemic level like financial constraints, knowledge gaps, institutional inertia, and market-related barriers due to a limited demand for more sustainable products. Some of these systemic barriers are inextricably related to behavioural barriers and could be overcome thanks to behavioural levers. For example, the literature indicate that social norms, social comparison and peer effects are positive drivers of behavioural change towards adoption of CSA and transition to SFS, more generally. Another behavioural factor affecting farmers' ability to embrace changes and innovations is risk tolerance. Farmers who are more risk tolerant are more willing to adopt CSA for example. However, it is also true that risk tolerance is correlated by farmers' sociodemographic characteristics such as age, gender and education as well as by situational influences, for example, farmers' financial independence or self-sufficiency. These examples highlight the complexity of the food system where farmers operate, which is an important lock-ins for behavioural change.

PRUDENT will tremendously benefit from the decision-making factors mapping exercise conducted in BEATLES, ENFASYS and VISIONARY for the development of the empirical behavioural research to be conducted in each use case within the projects. After all, green nudges build on economic agents' deviation from rationality that are intrinsically related to the behavioural but also systemic factors mapped in the three sister projects. Any other projects aiming at facilitating behavioural change in food systems will benefit from the decision-making factors' mapping as much as PRUDENT will.

Funded by the European Union

4 Policy tools for sustainable agriculture and food system

4.1 BEATLES

In WP1, BEATLES conducts a literature review regarding the existing policy and regulatory frameworks affecting the transition to CSA. Results from this literature review, provided in Deliverable D1.1 provides a systematic mapping of policy interventions related to the CAP at EU and national level, and it studies the impact that such policy interventions can generate on farmers' adoption of CSA.

The literature review is conducted following the PRISMA approach, and it considers 100 peer-reviewed studies related to CSA and the Common Agricultural Policy (CAP) published between 2012 – 2022. The literature review examined categorizing these studies based on their geographical and thematic focus.

Geographically, the studies were classified as either EU-wide (54 studies) or national/regional (46 studies) depending on their geographical focus. Thematically, the studies were divided into those that primarily focused on CAP governance and incentives (56 studies) and those that investigated specific aspects of CSA, where CAP served as a contributing factor or explanatory variable (44 studies). More generally, it was observed that a substantial portion of the research prioritized sustainability over the adoption of CSA, reflecting the emphasis placed by CAP on promoting sustainable practices within the agricultural sector.

Based on this review, Deliverable D1.1. identifies the following governance and policy challenges in the relationship between the CAP and farmers' adoption of CSA

Governance-related challenges are presented in Table 5.

Table 5 Key governance challenges

Factor	Description
Contribution of the CAP as a driver for CSA	Existing measures promoting CSA within the CAP are not sufficient to generate a significant behavioural change among farmers that has the potential to contribute to meeting broader EU policy objectives related to climate, sustainability, and biodiversity indicated in the Green Deal, Farm to Fork, and Biodiversity strategies. Given its size and funding scope, CAP has far greater potential leverage to drive the adoption of smart and sustainable farming practices than specialized environmental and climate-focused policies. However, this potential is not sufficiently unlocked (e.g., Glowinkel et al.,2020, Pe'er et al., 2020).
Alignment of the CAP with other Policy Tools	More coherent integration of the CAP within the Green Deal framework could significantly enhance environmental outcomes (e.g., Díaz et al. 2021). Better alignment of the CAP with global sustainability frameworks, including the Sustainable Development Goals (SDGs) and the Convention on Biological Diversity (CBD) is also essential (e.g. Pe'er et al., 2020).
Policy interventions within the CAP should be	The literature review highlights the importance of a whole-food-system approach that integrates agricultural, environmental, and public health policies by using a more systemic approach that considers the complexity of food systems (Lampkin et al., 2020).

Funded by the European Union

designed according whole-food-system approach	
Participatory approach of policy interventions within the CAP	CAP instruments—while promising—are hindered by a lack of specificity and inconsistent application, particularly in supporting small and medium-sized farms. Participatory policy tools that account for the diverse needs of farmers and consumers, improve the distribution of value along food chains, and build trust among stakeholders are key to overcoming these barriers. Narrative scenario design, farmer-centered approaches, and integrated assessments have demonstrated successful in improving CAP schemes (e.g. Delmotte et al., 2017; Hočevar, 2018)
Decentralization of responsibility within the CAP	The increased decentralization of responsibilities within the CAP has not fully delivered the expected sustainability outcomes, and more specifically the adoption of CSA (Grzelak et al. 2019). The CAP often fails to adequately address the diverse needs of regions and sectors. Participatory approaches that involve all interested stakeholders in the development of sustainability measures could improve CAP's impact on sustainable farming.

Policy-related challenges are mainly related the structure of farmers incentives within the CAP and are presented in Table 6.

Table 6 Key policy challenges

Factor	Description
Restructuring of the subsidization framework	Direct payments should be restructured into payments for public goods, rewarding farmers for reducing greenhouse gas emissions, enhancing biodiversity, and adopting sustainable farming practices. This will expand expanded funding for Agro-Environmental Climate Measures (AECMs) and eco-schemes (e.g. Pe'er et al., 2020). Strengthening these measures through coordinated landscape-level actions, targeted incentives, and collective contracts for farmers could further improve biodiversity outcomes. (e.g., Batáry et al. 2018, Lefebvre et al. 2015).
Restructuring of the subsidization mechanisms	Introduce innovative payment mechanism such as result-based payment systems that remunerate farmers based on tangible ecological outcomes (e.g. Pe'er et al., 2020). Spatial planning and coordination are seen as essential to address environmental challenges at the landscape level. Coordinated actions, such as longer-term farmer contracts to support practices like peatland restoration and habitat maintenance, should be promoted under the CAP.
Strengthened monitoring tools	Strengthening of monitoring systems, including annual assessments of land use and biodiversity indicators, are also emphasized to ensure policy effectiveness and accountability (e.g. Pe'er et al., 2020). Scholars propose the adoption of evaluation tools and frameworks to better integrate productivity and resource conservation in policy assessments, especially for newer EU Member States (e.g., Passeri et al. 2016, Baur et al. 2018).

Funded by the European Union

Deliverable 1.1. discuss then specific measures for specific key agricultural issues:

Synthetic input management and CAP

CAP incentives have driven the adoption of organic farming, but several barriers remain, including bureaucracy, weak market connections, and low profitability. Some regions struggle to achieve both economic and environmental benefits from organic farming. Authors like Konstantinidis (2018) warn that organic farming in Europe is becoming more industrialized, emphasizing mechanization and monoculture rather than transitioning toward a fully agroecological model.

Biodiversity and CAP

CAP measures remain insufficient in terms of biodiversity conservation (Palacín et al. 2018). The dichotomy between land-sparing and land-sharing approaches does not reflect the complex reality of agricultural landscapes. Greater involvement of farmers and local stakeholders in designing biodiversity schemes is essential for better outcomes.

Soil protection and CAP

CAP efforts to address soil degradation and improve soil organic carbon content are still lacking in coherence and tailored incentives. Effective measures require localized strategies, such as precision farming and rotational cropping. Innovative policies to manage critical resources like phosphorus, reducing current path dependencies in soil conservation practices. (e.g., Garske et al. 2020).

Results from the literature review gathering information on the public policy tools affecting the transitions towards CSA are enriched with evidence generated by the co-creation activities conducted at the use-case level in WP1.

In conclusion, these activities emphasize that the CAP holds significant potential to drive behavioural change across Europe's agricultural sector, but its effectiveness is limited by key limitations about its governance design and the structure of the farmer subsidization schemes. Key reforms of the CAP governance and policy mechanisms should be introduced to enhance its ability to facilitate the transition towards CSA. These reforms should create a more resilient, equitable, and sustainable agricultural system while addressing critical environmental and social challenges. By better aligning CAP with sustainability goals and tailoring approaches to the needs of different farming segments, policymakers can foster greater adoption of climate-smart practices across Europe.

At later stages of the project, policy analysis in WP5 will be expanded to include other policy instruments that affect the policy framework of the sectors and countries of the five case studies investigated in the BEATLES project. These policies will be evaluated with respect to their effectiveness in promoting CSA outcomes (mitigation, adaptation, productivity). Barriers and drivers in policy implementation will be investigated along with the concept of fairness in policy design to propose fair policies and tools.

4.2 ENFASYS

ENFASYS' CF, proposed in D1.1., highlights the distinction between public and private interventions and the key role that such interventions play in transitioning towards more SFS.

ENFASYS does not aim to systematically map the public and private policies and interventions that are currently available to foster the transition towards SFS. Rather, the project provides a general overview of such policies, focusing on the key challenges that characterize them.

Given the broad nature of the notion of food systems, public and private initiatives do not only focus on agriculture but they have strong interlinkages with policy areas, including agriculture, the environment, trade, market regulation, fiscal and social policies, food safety, public health, education, and research (e.g. De Schutter, 2019; EEA, 2023). The complexity of food systems, with a wide range of actors and interrelations, necessitates multifaceted policy approaches that address diverse societal and environmental goals.

The focus of this section is on public initiatives, while private initiatives are summarized in Section 6 which focuses on BM. D.1.1 specifies that the public policies with a potential high impact on sustainability include agro-environmental schemes (AES) (Giomi et al., 2018), public food procurement strategies (Schleiffer et al., 2022), and support for local food production (Reina-Usuga et al., 2022), organic farming (Acs et al., 2005; Kaiser & Burger, 2022), and labelling schemes aimed at promoting "consumer responsibility" (EEA, 2023).

However, the current sets of identified public policies present several shortcomings. These are described in Table 7.

Table 7 Key policy challenges

Factor	Description
Lack of integration between agricultural and environmental goals	There are not public policies that coherently integrate agricultural and environmental goals. This is often due to the dominance of economic interests, trade concerns, and institutional power relations. This results in the dilution of environmental measures in policies like the CAP (e.g. Alons, 2017).
Lack of coordination across policies	Policy coordination is crucial, especially when various administrations must collaborate across multiple policy areas. Disjointed administrative processes and a lack of timely responses to social demands hinder effective implementation (e.g. Reina-Usuga et al., 2022).
Legitimacy of public policies	The legitimacy of public policies is a key concern. Despite increasing recognition of the environmental and social externalities of current agricultural systems, policy development remains contested. Conflicting interests between stakeholders and the social justice implications of policy impacts make the transition to sustainable food systems complex. Farmers, in particular, may feel alienated by rapidly changing and seemingly arbitrary policies, which can undermine their motivation to adopt new practices (de Boon et al., 2022). The legitimacy of policies can be enhanced through participatory approaches, involving a broad range of stakeholders in the design process, to ensure that policies reflect societal goals and values more comprehensively (Dwyer, 2021). This approach aligns with the principles of food sovereignty, which emphasize local and regional ownership of food system decisions (De Schutter, 2017).
Effectiveness of participatory policy design	Participatory approaches for policy design are often advocated. However, the effectiveness of participatory policy design is contingent upon overcoming the challenges of watered-down participation during implementation (Pretty et al., 2020). Ensuring meaningful stakeholder engagement requires a clear and shared understanding of policy problems, which can be facilitated through collaborative frameworks for agroecological transitions (Duru et al., 2015). A just and inclusive participation process is vital for the legitimacy and success of public

Funded by the European Union

	interventions, as demonstrated by the need for careful planning in transdisciplinary research projects (Delzeit et al., 2021).

The findings from the literature review on public policy tools influencing the transition to SFS are complemented by evidence gathered through co-creation activities conducted at the case-study level in WP 6. In this work package, a first series of co-creation activities will identify possible policy mixes at the case-study level. In a second series of co-creation activities, insights will be produced regarding the suitability of the 'policy design space' (the ability and willingness of a government to propose and implement this most suitable mix of policy instruments).

Co-creation activities at the case study level complement the literature review presented in this section.

In conclusion, ENFASYS highlights that public interventions in agricultural and food systems play a critical role in advancing sustainability. However, for these interventions to be effective, they must address the complexities of policy integration, stakeholder coordination, and the legitimacy of policy pathways. Participatory and inclusive policy design processes are key to overcoming the challenges associated with implementing sustainable agricultural and food policies.

4.3 VISIONARY

The VISIONARY projects carried out a policy mapping exercise within task 2.3, in WP2. This exercise mapped 96 policy tools grouped in sustainability thematic and policy thematic clusters. Deliverable 6.1 describes the main findings from the policy mapping exercise. The mapping exercise has been undertaken to screen and analyse regulatory, and policy tools considered relevant to enabling or hindering initiatives that can deliver SFS outcomes. However, there was no critical assessment of the main strengths and limitations of such policy tools.

Each project partner was asked to identify and describe the policy tools deemed to be most relevant in their empirical application within VISIONARY.

Six sustainability thematic clusters were identified: i) biodiversity delivery; ii) organic farming; iii) climate; iv) value chain; v) plant-based protein; and vi) water resources management. (see Table 8).

Table 8 Clustering of the policy tools by sustainability thematic cluster

Thematic Cluster	Number of Tools	Participating Countries
Organic Farming	19	UK, Germany, Poland, Hungary, Spain
Biodiversity	19	UK, Germany, Poland, Spain
Climate	4	Italy, Denmark, Spain
Water	6	Denmark, Hungary, Spain
Plant-Based Protein	11	Denmark, Germany, Poland, Spain
Value Chain	35	Germany, Poland, Hungary, Spain, Romania, UK

Source: Extracted from VISIONARY Deliverable 6.1

Here, we provide a discussion about the distribution of policy tools across sustainability thematic clusters. Most of the tools related to the categories "Plant-Based Protein" and "Value Chain" address policy initiatives that do not directly involve farmers but other stakeholders along the value chains, including consumers. Most of the remaining policy pools are related to organic farming and biodiversity-related policy initiatives, while only a few relate to climate and water. This is not a surprise as the CAP has devoted a lot of attention to organic farming as means to rationalize the use of synthetic inputs. Also, most agri-environmental schemes and eco-schemes aim primarily at biodiversity.

Six policy thematic clusters were identified (see also Table 9):

i) Direct regulation refers to the imposition of restrictions or the establishment of rules that enforce compliance or limit certain actions. This category encompasses bans, obligations, and standards, with associated penalties ranging from fines to legal convictions. Its primary objective is to ensure compliance through mandatory constraints.
ii) Economic incentives are designed to encourage voluntary behaviour by offering various benefits, such as monetary rewards, time savings, or other resources. These incentives rely on a cost-benefit analysis undertaken by the policy subjects and include mechanisms like tax reliefs and environmental payments. Public agencies may also centralize transaction costs to facilitate certain decisions, such as through public certification schemes or the opportunity to sell tradable environmental permits.
iii) Economic disincentives aim to discourage specific voluntary behaviours by imposing penalties or costs. These disincentives are based on a similar cost-benefit analysis and can include taxation, charges, and the requirement to purchase environmental permits. The goal of this approach is to make undesirable behaviours less appealing by making them costlier.
iv) Public infrastructure focuses on providing the means and opportunities necessary for individuals or groups to engage in desirable behaviours. This category includes the creation of physical assets, such as roads, facilities, or buildings, that support the intended outcomes by offering accessible resources.
v) Capacity tools or boosts involve providing individuals or groups with the information, training, education, and knowledge required to make informed decisions or take effective action. These tools aim to empower people by equipping them with the necessary skills and understanding to address challenges or make better choices.
vi) Moral suasion seeks to persuade individuals to comply with policies by appealing to their internal motivations, such as beliefs and values. This approach assumes that individuals make decisions based on their ethics and the compelling reasons presented for compliance. Nudges are subtle interventions designed to steer individuals' behaviour in predictable ways by leveraging cognitive biases and limitations in human decision-making, without forbidding any options or significantly changing economic incentives.

Table 9 Clustering of the policy tools by policy tool thematic cluster

Policy Tools	Number of Tools
Economic Incentives	57
Economic disincentives	1
Direct regulation	15
Public infrastructure	2
Capacity tool/boost	9
Moral suasion and nudges	4

Source: Extracted from VISIONARY Deliverable 6.1

Funded by the European Union

Here, a discussion is proposed on the distribution of policy tools across policy thematic clusters. Overall, a significant portion of the selected policy tools fall under the category “economic incentives”. This trend suggests that more environmentally sustainable practices are often seen as going beyond mandatory standards, requiring voluntary uptake through compensation for income lost and incentivizing specific actions. This approach also reflects the perception that sustainable food and farming practices can incur an economic burden, necessitating compensation to maintain market competitiveness. In most countries analysed, these economic incentives are framed within the CAP framework, particularly under Pillar I (direct payments and market interventions) and Pillar II (rural development), which are funded by the European Agricultural Guarantee Fund and the European Agricultural Fund for Rural Development (EAFRD), respectively. Some countries have also included interventions funded by the EU Next Generation framework. In the UK, economic incentives are structured in national policies but remain closely aligned with CAP mechanisms.

In contrast, the use of behavioural interventions (e.g., moral suasion and nudges) appears to be very limited indicating that governments face challenges in integrating more innovative approaches into their policy frameworks.

Some policy tools are hybrid, blending traditional categories such as direct regulation, economic, or informational tools. These hybrid tools, such as some interventions in the CAP (e.g., direct payments tied to good agri-environmental practices or eco-schemes), occupy a middle ground between obligatory regulations and voluntary agri-environmental or climate schemes. This intermediate position is noteworthy, as it represents a gradient of intervention modalities, with varying perceptions among farmers and policymakers regarding the voluntary or obligatory nature of the tools. Over time, certain environmental standards or requirements evolve from voluntary to mandatory, as green payment modalities become obligatory to access CAP payments.

In alignment with the other sister projects, also VISIONARY enriches findings from the policy mapping exercise with information collected during the co-creation activities conducted in each case study via the science-policy interfaces.

4.4 Conclusion

The BEATLES, ENFASYS and VISIONARY projects present distinct but complementary approaches to map existing policy tools, discuss their shortcomings and describe possible reforms. Given the focus of this report on policy initiatives that are directly related to farmers and farming, it is no surprise that most policy tools discussed here fall within the CAP.

BEATLES, given the nature of the project, focuses on how the CAP and related policy interventions can influence the adoption of CSA. The main take-home message is that the budget allocated to policy interventions that can facilitate the adoption of CSA is limited given the important potential contribution that CSA can have on climate, sustainability, and biodiversity objectives outlined in the Green Deal, Farm to Fork, and Biodiversity strategies. In contrast, ENFASYS and VISIONARY focus on public interventions within the CAP that generally promote more SFS.

All projects conduct a policy mapping exercise, however the scope and the methods used differ. Both BEATLES and ENFASYS conducted literature reviews to map the existing policy tools, identify shortcomings in the CAP and suggest policy reforms that could enhance the CAP. While BEATLES provides a PRISMA-based literature review, ENFASYS implements a less systematic

Funded by
the European Union

approach. The main outcome is the policy mapping per se but an in-depth discussion of the current limitations of the overall governance and specific policy tools promoting sustainable farming practices within the CAP.

Findings converge across projects. The CAP lacks a holistic food-system approach that can provide effective solutions to complex and multi-faceted challenges. The CAP is not integrated with the broader policy environments. A better alignment of the CAP with global sustainability frameworks, including the Sustainable Development Goals (SDGs) and the Biodiversity Strategy is essential to achieve acceptable results in terms of sustainability (e.g. Pe'er et al., 2020). The CAP lacks a proper participatory approach that involves all interested parties in the system. More inclusive participation processes will enhance the legitimacy and success of the policy interventions. In addition, the literature review highlights the need of a restructuring of the farmers' subsidization mechanisms. BEATLES calls for a redefinition of direct payments to incentivize the provision of public goods, the use of result-based payments and the implementation of improved monitoring and verification systems.

VISIONARY conducts a mapping of the most relevant public policies that are strictly relevant to the food systems included in the projects and the main environmental challenges that these systems currently face. The mapping is narrower in its scope but provides some interesting findings. For example, the vast majority of mapped policy tools are directly related to economic incentives for farmers, while the use of behavioural policy intervention is very limited. This highlights the importance of projects like BEATLES, ENFASYS, VISIONARY and PRUDENT that will provide insights and best practices to better design behavioural interventions to facilitate the transition to SFS within the CAP.

Funded by
the European Union

5 Green nudges for sustainable agriculture and food system

5.1 BEATLES

BEATLES plans to use nudges as a behavioural intervention to facilitate farmers' transitions towards CSA. To date, BEATLES has only tested the impact of nudges on consumers' behaviour towards more sustainable food using three survey experiments within task 2.2. in WP2. These studies test the impact that different behavioural interventions have on consumers' willingness to pay (WTP) a price premium for climate-friendly food products like carrots, beef, and bread in different countries (Denmark, Germany Lithuania, Slovenia. Spain, and the Netherlands).

Below, the main features and results of these experiments are described as economic agents' responses to nudges may be similar in different contexts given that behavioural mechanisms underlying nudges do not really change.

The first survey experiment, using a 2x2 design, tested the effects of two interventions: information about CSA production methods and social norm information (indicating growing interest in climate-friendly food). It was carried out with 1,568 respondents from Denmark, Spain, and Lithuania. Results suggest that CSA information has a mixed impact on WTP (contingent on the food product), while the social norm intervention did not have a statistically significant impact on the WTP for any of the products.

The second investigated the individual and combined effects of information about CSA production methods and fairness in the supply chain on WTP using a 2x2 design. The fairness information described a scenario where major supermarkets collaborate to enhance the accessibility of climate-friendly food by ensuring that farmers receive additional compensation for producing these products, without supermarkets capitalizing on the higher prices. The study involved 1,084 respondents from Germany and the Netherlands. There is some effect of the CSA and fairness information but, again, it is contingent on the type of products.

The third explored the effects of three interventions (triple-nudge: CSA information, social norm information, and fairness information) and their combined impact on WTP using a 3x3 design. The sample consists of 954 respondents from Slovenia. Again, there is some effect of the CSA, social norms and fairness information but it is dependent on the good under investigation.

In the next steps of the project, BEATLES will examine nudges and other behavioural interventions in farmer both in lab conditions and more natural contexts.

5.2 ENFASYS

While the ENFASYS CF does not explicitly highlight the role of nudges in farmers' behavioural change, the project recognizes the importance of nudges as a type of behavioural intervention that could facilitate the transitions towards SFS. For example, task 5.1 in WP 5 will provide evidence from randomized trials on nudging farmers toward the adoption of SFS. A sample of farmers will be exposed to nudges to test the impact of informational, educational, and group pressure-based (descriptive norms) intervention on farmers' participation to voluntary schemes. The nudges will be co-selected with EU-level policymakers, relevant stakeholders, and JRC.

Funded by
the European Union

5.3 VISIONARY

VISIONARY emphasizes the role of nudges in the initial CF (WP2, Task 2.1, Milestone 2.1). A nudge is defined as an element/aspect of the choice architecture that predictably steers individuals' behaviour by exploiting cognitive shortcomings in human deliberation and choice, without changing the financial (dis)incentives. A nudge does not affect those features over which people have explicit preferences (e.g., money, convenience, taste, status, etc.), but rather those features that people would typically claim not to care about (e.g., position in a list, default options, framing). Nudges should shift individuals' behaviour in a predictable direction by taking advantage of cognitive limitations in human decision-making. This approach does not alter financial incentives but instead relies on subtle changes in the presentation or structure of choices.

The policy mapping exercise and the scientific policy interface (SPI) activities conducted so far and described in Section 3 show that the use of nudges to change farmers' behaviour is limited and stakeholders have little awareness and knowledge of this type of behavioural intervention. The few examples that were reported primarily targeted consumers, highlighting the need to broaden the application of behavioural tools to include other target populations. A noticeable exception is the mentioning of moral suasion and nudges to help the transition to organic farming in the "Scottish Biodiversity Strategy to 2045". VISIONARY will conduct randomized control trials with retailers to test nudging interventions for sustainable food in the context of consumers' real purchase behaviour in Task 4.3 in WP4 but it does not plan to explore the role of nudging to change farmers' behaviour.

5.4 CONCLUSION

BEATLES, ENFASYS, and VISIONARY acknowledge the potential role of behavioural interventions and nudges in facilitating behavioural change and they will test the effectiveness of nudging in some of their future empirical applications. However, it is evident from the policy mapping exercises (reported in Section 3) that, at the moment, nudging is not widely used to promote the adoption of CSA or a more general shift towards sustainable farming. The literature on testing the effectiveness of nudging interventions in changing farmers behaviour towards more sustainable farming practices is growing but it is still limited (Čop & Mario Njavro, 2024). The recent funding of EU-Horizon projects such as PRUDENT and ForestAgriGreenNudge (Grant agreement ID: 101133987) will certainly shed light on the strengths and limitations of using nudging techniques in agri-food systems.

Funded by the European Union

6 Business model for sustainable agriculture and food system

6.1 BEATLES

BEATLES investigates the interplay between the adoption of more sustainable BM and strategies and the adoption of CSA by conducting a systematic literature review. The literature review is conducted in WP1 using a PRISMA approach and considering 142 studies. Deliverable D1.1 presents results from this exercise.

The content analysis of selected articles has two objectives: i) categorizing and mapping CSA strategies and innovations, ii) mapping CSA innovations that can be functional to the adoption of CSA strategies.

The literature identifies three primary CSA strategies:

- **Mitigation** aims to reduce the negative environmental impacts of agri-food production. Practices under this strategy include agroforestry, conservation agriculture, improved crop and livestock management, renewable energy use, organic farming, regenerative agriculture, agroecology, and smart farming technologies.
- **Adaptation** addresses the challenges posed by climate change, particularly its effects on food production. Since agri-food systems are vulnerable to climate variability, adaptation strategies such as conservation agriculture, crop diversification, and water management practices help producers cope with these uncertainties.
- **Resilience** focuses on maintaining sustainable agricultural practices by building the capacity to withstand and recover from climate-related shocks. Strategies to enhance resilience involve cooperatives, ecosystem management, social networks, and gender equality, all contributing to long-term climate-smart agri-food actions.

Moreover, the literature categorizes CSA innovations into three main types:

- **Innovation in Production Methods**: This involves developing new agricultural production methods that integrate climate change challenges with agricultural productivity. For instance, on-farm diversification and sustainability-oriented practices suggest a move from purely efficiency-driven production to one that balances multiple sustainability goals.

- **Innovation in Products, Services, or Techniques**: This type focuses on the introduction of new products, services, and techniques, often incorporating precision agriculture through smart devices and IoT systems. The development of climate-resilient crop varieties is another example, offering innovative solutions to enhance sustainability.

- **Innovation in Business Strategies**: This category pertains to innovative BM that support local small and medium-sized producers. Examples include "eco-system networks," "civic agriculture," "community-supported agriculture," and "market-garden" models, which emphasize localized, community-driven food production for local markets.

Results suggest that different CSA innovation types can be applied across the various CSA strategies. By combining multiple strategies and innovations, agri-food producers can create more robust and climate-smart systems. The review highlights that the successful adoption of CSA practices necessitates collaboration across multiple actors, including farmers and various stakeholders. These collaborative efforts are crucial for pooling resources, aligning strategic

Funded by the European Union

goals, and implementing innovative, sustainability-driven actions within agri-food systems. The review emphasizes that fairness in value propositions—both at the individual BM and network level—plays a critical role in the adoption of CSA. Ultimately, inter-organizational networks and multi-stakeholder collaboration platforms are central to driving systemic changes that facilitate the transition to CSA practices.

D.1.1 then focus on the relationships between innovations in business strategies and the adoption of two specific CSA mitigation strategies, namely agroecology and organic farming. Successful implementation of agroecology and organic farming as CSA practices relies on the creation of interconnected networks that facilitate knowledge exchange, alignment of goals, financial support mechanisms, and the fostering of trust and fairness among stakeholders.

Agroecology

Business strategies that can facilitate the adoption of an agroecology-driven production approach generally involve interconnected models promoting stakeholder cooperation and the alignment of agricultural production with sustainability.

A collaborative approach that is based on multi-stakeholder networks including farmers, policymakers, consumers, and technology developers is needed to stimulate the adoption of CSA in a broader agroecology perspective (e.g. Eastwood et al., 2021). These networks should involve also local associations, research institutions, experimental farms, and training centres to generate agroecology-based hubs (e.g. Guareschi et al., 2020; Polge & Pagès, 2022). The role of knowledge exchange and education is pivotal in shifting farming practices toward an agroecology-driven farming approach.

Organic farming

Similar business strategies can be used to promote organic farming as a CSA approach. The creation of solid and long-term innovation networks can generate environments where actors in food supply chains trust each other, collaborate, share knowledge, and align organizational structures to achieve sustainability goals that balance agricultural productivity objectives and environmental conservation aspirations (e.g. Favilli et al., 2015; Mantino & Forcina, 2018). These networks can foster the adoption of smart farming technologies designed to reduce environmental impact, with external collaborations playing a crucial role in digital innovation (Bentivoglio et al., 2022).

Another related business strategy is the establishment of community-supported agriculture (CSA) models, based on membership subscriptions that can act as a risk-sharing enabler. Risk-sharing can overcome some barriers related to the adoption of organic farming, for example, initial significant investments and high production risk (Medici, 2021).

The creation of formal or informal producer platforms, groups or associations can facilitate the adoption of organic farming as well by fostering interaction among various stakeholders and overcoming social barriers to innovation. These networks enable farmers to diversify production and improve collaboration with external actors. For example, Navarrete et al. (2015) suggest the creation of common markets to encourage farm diversification, while Osman et al. (2016) argue that forming new socio-economic partnerships can overcome legal and economic barriers to CSA practices. These platforms can also create a sense of group membership and stimulate peer effects that stimulate virtuous behaviour and cycles. The establishment of more formal producer groups with transparent conditions, including long-term contracts, fixed prices, and quantities, can improve perceived fairness and trust among network members. Such approaches can enhance collaboration and promote the adoption of organic farming as a CSA strategy.

Again, the evidence gathered during the co-creation activities at the use-case level complements the findings from the PRISMA-based literature review and it will help designing behavioural experimentation aiming at developing innovative and more sustainable BM that promote the transition towards CSA.

This systematic mapping of business strategies will be used in WP4 to identify fair value propositions and BM for the transition to CSA. A key aspect here is the notion of fairness in the value chain. Farmers interact with other value chain stakeholders, such as industry and consumers, with conflicting interests, creating various trade-offs, feedback loops, information asymmetries and unequal value distribution that affect their business strategies. In the next steps of the project, the notion of fairness will be explored to identify fair value propositions which will feed into fair BMs. These will be co-designed and validated with the participation of multiple stakeholders in co-creation activities.

6.2 ENFASYS

The ENFASYS CF presented in Section 1, highlights the role of public and private interventions to achieve a transition towards SFS. Public initiatives were presented in Section 3 of this report, while, here, the research conducted on private initiatives by the project ENFASYS is reported. This research is part of task 1.1. in WP1. As outlined in section 3.2 regarding public interventions, ENFASYS does not aim at systematically mapping the public and private policies that are currently available to promote SFS but it aims at delivering a general overview of such interventions. Results are provided in Deliverable 1.1.

In this deliverable, ENFASYS highlights that the private sector's engagement in sustainability practices is often motivated by the perception of competitive advantage, particularly when sustainability strategies align with business profitability and innovation opportunities. Adoption of such practices at the business level often requires a shift in vision and operation as well as access to reliable data and sustainability assessment tools (Muñoz Torres et al., 2022). These tools help decision-makers identify opportunities and challenges, especially in complex food supply chains where information asymmetry and poor stakeholder cooperation hinder progress (Pakseresht et al., 2023).

The most prominent private interventions identified by ENFASYS are reported below:

<u>New governance models</u>

New governance models such as voluntary standards, certification schemes, and procurement guidelines can incentivize businesses to innovate and differentiate themselves in the market by aligning with societal and environmental goals e.g. (Del Vecchio et al., 2021; Kinderman, 2016). Corporate motivations to adopt voluntary environmental management stem from two complementary frameworks: utility maximization, which seeks to reduce costs and increase revenues through market mechanisms, and institutional theory, which emphasizes external pressures from markets and NGOs to drive environmental performance (Ervin et al., 2013).

<u>Social innovations</u>

Social innovation involves creating and implementing effective solutions to complex and systemic social and environmental challenges to drive social progress. Successful solutions often emerge through active collaboration among government, businesses, and non-profit organizations. Social innovation can be an approach to create or reach new emerging markets. ENFASYS underlines that consumer behaviour plays a crucial role in driving sustainable transitions in agri-food systems, as evidenced by the demand for transparency and traceability in food products. Examples of social innovation can alternative food networks (e.g., farmers' markets, food cooperatives) and digital marketing (e.g., web stores) that enhance coordination and efficiency while directly communicating sustainability information to consumers (Vercher, 2022; Csordás et al., 2022).

Innovative business models

Innovative BM such as short supply chains, cooperative business strategies, and circular production processes can help the private sector to align with sustainability goals while responding to evolving consumer demand by creating new markets and increasing operational efficiency and resource optimization. One risk is the rise of unethical practices like the use of misleading or false claims about the environmental benefits of their products or operations to gain market credibility without making substantive changes. Greater transparency, stronger accountability measures, and the development of more reliable sustainability standards are needed to ensure that businesses genuinely contribute to environmental and social goals and do not engage in greenwashing activities (Möllers et al., 2022; Taufique et al., 2022).

Short supply chains, cooperative business strategies, and circular production processes can also be interpreted as efficiency-focused strategies that are directed at increasing efficiency aligning sustainability goals with competitiveness objectives.

Short supply chains enhance efficiency by allowing producers to respond quickly to market needs through direct producer-consumer relationships (Stanciu et al., 2022). These agile systems enable businesses to tailor production to sustainability-oriented demands (Möllers et al., 2022). While shortening supply chains can improve ecological outcomes, Muñoz Torres et al. (2022) caution that proximity alone should not be viewed as a proxy for sustainability, as this may obscure underlying social or environmental inefficiencies.

Cooperative BM also play a role in circular systems by fostering resource sharing and industrial symbiosis, where waste and by-products are reused within a region to create added value (Haller et al., 2022). Some research advocates hybrid urban-rural cooperation models that link producers and consumers, fostering market responsiveness and new market creation.

Circular BM are gaining traction as a means to enhance sustainability by increasing efficiency and reducing waste. These models emphasize reusing resources, reducing by-products, and leveraging local assets (Del Vecchio et al., 2021). Critical barriers to the adoption of circular BM include insufficient research on implementation strategies, stakeholder coordination, and performance measurement systems. Digital platforms and technologies, such as blockchain, offer the potential to enhance data management and transparency, improving the tracking of product provenance and resource flows (Pakseresht et al., 2023).

To conclude, ENFASYS highlights that both public and private interventions are crucial for transitioning to SFS. Public policies must overcome challenges related to policy integration, coordination, and legitimacy, emphasizing participatory and context-sensitive approaches. Meanwhile, private sector strategies should leverage data-driven tools, governance models, and social innovation to create competitive advantages while genuinely contributing to sustainability.

Funded by the European Union

Addressing gaps in both sectors through targeted interventions and collaborative frameworks can foster systemic change in agriculture and food systems.

The evidence gathered during the co-creation activities at the case-study level enriches the findings from the work conducted by ENFASYS so far about innovative and more sustainable BM. ENFASYS' research on innovative business strategies, BM and social innovation BMs that is currently conducted within WP7 builds on this evidence. The main objective of WP 7 is to engage with multiple stakeholders (farmers, consumers and other food system actors) to co-design innovative ways that can enable food systems to transition towards sustainability. Further, in WP 7, activities will be undertaken to produce insights on how to increase the potential for upscaling or outscaling (replicating) business models and social innovations.

6.3 VISIONARY

VISIONARY defines the notion of business and sustainable BMs in its CF, but it does not aim to provide a literature review or an overview of sustainable BMs currently adopted in the private sector.

The VISIONARY's CF presented in Milestone 2.1 of task 2.1 of WP 2 argues that sustainable BMs can be considered as meeting points of different streams of knowledge about farmers', consumers' and other food actors' sustainable behaviour. Therefore, the study of sustainable BMs can be viewed as an approach to explore the transition of food systems towards sustainability adopting a more holistic and systemic perspective.

In the CF, a BM is defined as the framework through which an organization creates, delivers, and captures value for its customers and stakeholders (e.g. Fielt, 2013, Chesbrough, 2010). A BM framework typically consists of two primary pillars: the infrastructure/management pillar and the customer interface pillar. The infrastructure/management pillar refers to the internal resources, activities, and external partnerships necessary for value creation, while the customer interface pillar connects the value proposition to customer segments through communication, distribution channels, and relationships. The goal of these elements is to generate a steady revenue stream that sustains the business. In essence, a BM must facilitate the capture of customer value by the organization, allowing it to convert this value into sustainable profit (Lüdeke-Freund, 2010).

Sustainable BMs take a step forward. They not only create value for customers but also contribute positively to societal and environmental goals. In other words, BMs must strike a balance between creating economic value and addressing broader social and environmental challenges. This balance is often referred to as shared value creation (Dyllick and Muff, 2015). By integrating sustainability into the core of their operations, companies can unlock new business opportunities while also addressing pressing global issues. Eco-innovation, or sustainability-oriented innovation, is central to the evolution of sustainable BMs. It involves the development of new products, processes, or organizational practices that not only create value for customers but also contribute to environmental sustainability. For small-medium enterprises (SMEs), sustainable BMs can be crucial to attract new market markets, differentiate themselves from large enterprises and pursue a more sustainable business pathway.

There are some key factors that determine SMEs willingness and ability to adopt sustainable BMs.

First, SMEs with higher sustainability ambitions tend to adopt sustainable BMs and pursue more radical innovations, which are characterized by significant changes to products, processes, or business structures, often in response to environmental or societal challenges.

Second, SMEs are more likely to adopt sustainability-oriented innovations when they engage in proactive collaboration with external actors, such as local communities, policy-makers, and other businesses. This relational perspective on BMs views businesses as part of a broader system of stakeholders, rather than isolated entities. According to Burch and Di Bella (2021), transformative BMs that address sustainability challenges must emphasize collaboration and co-production. These BMs rely on a dynamic interaction with the local context, where businesses work together with local communities to create shared value.

Third, experimentation and an openness to failure are critical components of innovative BMs. By testing new ideas with community partners, businesses can expand their capabilities and identity. This iterative process enables businesses to discover new ways to address sustainability challenges while fostering innovation. Establishing new hierarchies within organizations, where employees are given more opportunities to lead and influence sustainability initiatives, also contributes to a more inclusive and collaborative BM.

Fourth, imagination and creativity play a significant role in accelerating the transition towards more sustainable business practices. This can involve developing new BMs that incorporate environmental and social considerations, enabling businesses to thrive while supporting the global transition towards sustainability.

In summary, the BM is a vital framework for driving sustainability, particularly within SMEs. By integrating sustainability into the core of their operations, SMEs can create shared value that benefits both their business and society. Through eco-innovation, collaborative relationships, and a focus on experimentation and creativity, SMEs can develop BMs that contribute to sustainable development while remaining economically viable.

Most of the research related to BMs is conducted in WP4 where innovative business strategies introduced by private initiatives within agri-food value chains to create markets for sustainably produced food will be explored and investigated. This research builds on the VISIONARY's perspective on innovative and more sustainable BMs developed in CF and on more specific information gathered during the co-creation activities conducted at case-study levels thanks to the science-policy interfaces.

6.4 CONCLUSION

The preliminary work conducted on BMs in BEATLES, ENFASYS, and VISIONARY reveals that the transition of the private sectors, especially SMEs, towards innovative and sustainable BMs is key to producing a systemic behavioural change towards the adoption of CSA and more SFS. This behavioural change should involve all actors operating in the food supply chains including farmers.

Using different perspectives and methods the three sister projects converge on some broad conclusions. Sustainable BMs are particularly crucial for SMEs that want to pursue more sustainable business strategies for economic reasons and intrinsic pro-environmental reasons. Sustainable BMs are more likely to succeed only if they have multi-stakeholder perspectives that facilitate capacity building and learning processes, imply fair and transparent relationships across the food supply chain, guarantee risk-sharing among the farming community and across actors operating in the value chain, and foster the creation of a market for more sustainable goods and services.

BEATLES reaches these conclusions by conducting a PRISMA-based literature review that mainly aims at understanding the interplay of innovations promoted by different categories of CSA

Funded by
the European Union

and innovative business strategies that aspire to mitigate environmental externalities produced by agriculture. Sustainable BMs help SMEs adapting to climatic, environmental, and market changes, and improving the resilience of broader agri-food systems. Particular attention is devoted to agroecology and organic farming.

ENFASYS do not carry out a systematic literature review, but it provides an overview or mapping of all private policy interventions that could play a role in facilitating the transition towards more SFS. Innovative governance models, social innovation, innovative BMs and efficiency-focus strategies are considered, with particular attention to short-supply chain as well as to circular and sustainable BMs.

VISIONARY does not conduct any literature review or mapping exercise but its CF carefully defines how sustainable BMs are interpreted in the project and discusses some general factors that can facilitate the adoption of such innovative models. In particular, VISIONARY stress the role of SMEs in the adoption of sustainable BMs and the transition towards more SFS. The adaptability of SMEs makes them key actors in implementing sustainable BMs.

All projects highlight that the adoption of sustainable BMs or other business-related initiatives requires supportive policy environments that provide long-term stability, financial incentives, and regulatory frameworks that enable the scaling of sustainable practices.

Funded by
the European Union

7 Conclusions

This report aims to map, organize and synthesize findings from three EU-funded sister projects under the call HORIZON-CL6- 2021-FARM2FORK-01-08 — BEATLES (G.A. ID: 101060645), ENFASYS (G.A. ID: 101059589), and VISIONARY (G.A. ID 101060538). In a nutshell, these projects aim to deepen the understanding of farmers' decision-making processes by incorporating behavioural insights into a systemic perspective to facilitate the transition towards more sustainable farming systems and CSA.

The need for this report stems from the fact that PRUDENT is the natural extension of the three sister projects as it is explicitly mentioned in the call HORIZON-CL6-2023-GOVERNANCE-01-3 which provided funding for PRUDENT. The report makes use of all publicly available milestones and deliverables from BEATLES, ENFASYS and VISONARY up to the end of November 2024 as well as additional documentation that was made available by the principal investigators of the three sister projects.

It is important to underline that this report builds on research conducted in the first few months of activity of these projects. Therefore, the report mainly focuses on results from foundational research activities such as the definition of CFs, development of case studies (or use cases), literature reviews and mapping exercises.

As an extension to three sister projects, PRUDENT addresses the specific challenges and opportunities related to the use of green nudges to support the development of public policies and BMs that effectively drive large-scale and long-term behavioural shifts within the farming and forestry communities toward more sustainable and climate-neutral production systems.

The report focuses on five core thematic areas: CFs, decision-making factors, policy mapping, green nudges, and BM mapping. It is structured in 7 sections, where Section 1 is the executive summary and Section 7 offers conclusions.

Section 2 outlines the theoretical and conceptual foundations of the three sister projects, serving as a guide for past, present, and future empirical research conducted within them. All projects converge on the idea that only an integrated approach that combines behavioural insights into a systemic perspective can achieve meaningful change. The aim of ENFASYS and VISIONARY is a broader transition towards more sustainable farming and food systems, while the goal of BEATLES is more specific and it consists of a shift towards CSA. While BEATLES and VISIONARY's integrated approach appear to be more behaviourally driven, ENFASYS's approach seems to lean towards a more systemic perspective. The process that has produced the conceptual foundations is heterogeneous across projects. ENFASYS and VISIONARY have developed theory-based CFs to guide their empirical research, whereas BEATLES has a more evidence-based approach that builds since the beginning on facts (data) and it does not necessarily rely on a theory-based CF. An aspect that characterizes all projects is the emphasis on co-creation activities that should allow translating theory into practice in all use cases or case studies that were identified within each project. Co-creation activities bring together all stakeholders involved in the behavioural change process with the final aim to co-design behaviourally grounded agricultural and food policies, private-sector-led interventions, and innovative BMs that could foster the transition towards more SFS and CSA.

Section 3 reports findings regarding the mapping of decision-making factors that could influence farmers' behaviour and guide the transition to SFS and CSA. The mapping is crucial to understanding interlinkages between behavioural factors and systemic factors. Despite the scope

Funded by the European Union

of the mapping and the methods used to map decision-making factors being diverse across projects, conclusions from the projects are similar and they can be easily integrated. At the systemic level, technological innovation, social innovation, and institutional innovation can facilitate the transition towards SFS and CSA. While the importance of technological innovation is well-established in the literature, the positive effects generated by social and institutional innovations are often underestimated. For example, social and institutional innovations that promote participatory decision-making processes and collaborative actions among stakeholders can generate noticeable positive externalities such as the establishment of capacity-building networks that can counterbalance the negative influence of systemic barriers such as knowledge gaps and institutional inertia. The mapping exercises conducted at the project-level also highlight those behavioural factors are inevitably interconnected with systemic factors. For example, participatory decision-making processes and collaborative actions (systemic elements) can activate social norms and peer effects that contribute to individual behavioural change towards the transition to SFS. These examples highlight the complexity of the food system where farmers operate and the need to have integrated models that improve the understanding of the relationships between behavioural and systematic components of food and farming systems.

Section 4 summarizes insights from the policy mapping exercises carried out within the three sister projects. Again, while the scope and the methods used to map public policy tools and interventions differ across projects, findings are consistent. Given that the projects' focus on SFS and CSA, it is not surprising that the majority of policy tools taken into consideration are related to the CAP. The policy mapping exercises lead to a critical assessment of the CAP and its ability to facilitate the transition towards more sustainable agri-food systems in all projects. A shared conclusion is that the CAP lacks a holistic food-system approach that is capable of providing effective solutions to complex and multi-faceted challenges. In addition, the CAP is not well integrated with EU environmental policy agenda and it does not support enough participatory approaches that are pivotal to activate behavioural change. All projects conclude that a restructuring of the farmer subsidization system is needed, in particular a revision of direct payments, a shift towards results-based payments and more transparent monitoring and verification systems would be necessary. Interestingly, the policy mapping exercises indicate that the use of behavioural policy interventions to change farmers' behaviour towards SFS, including nudges, is very limited within the CAP.

Section 5 confirms the latter evidence. The investigations of the effectiveness of nudging interventions in influencing farmers' behaviour toward more sustainable practices is still limited. (Čop & Mario Njavro, 2024). The three sister projects alongside more recent EU Horizon-funded projects, such as PRUDENT and ForestAgriGreenNudge are pioneers in this area of research and they will provide in the near future insights on how to design behavioural interventions that maximize intended behavioural change in farmer and forester communities (Dupoux et al., 2025).

Section 6 summarizes the main findings on the role of sustainable BMs and strategies in the transition towards more SFS and CSA. Approaching the problem from different perspectives and using different methodologies, the three projects converge on the idea that sustainable BMs are vital for SMEs seeking to diversify by adopting more sustainable strategies. In addition, the three projects highlight that sustainable BMs are more likely to succeed when they incorporate a multi-stakeholder approach that supports capacity building and learning and fosters fair and transparent relationships across the food supply chain. Based on this evidence and premises, the three sister projects design behavioural-based interventions that could facilitate the adoption of more

Funded by the European Union

sustainable BMs. As noted above, recent EU Horizon-funded projects, such as PRUDENT and ForestAgriGreenNudge will contribute to this research in the near future.

A yearly report summarizing and synthesizing main developments and findings from the three sister projects will be generated throughout the life-span of PRUDENT. The main focus of future reports will be the experimental research exploring to what extent and how behavioural public policies and private initiatives can shift farmers' behaviour towards more suitable farming practices including CSA. In the future, the scope of the report will be extended to considering other EU-funded projects that look at the application of behavioural research in agri-food and forestry systems. An example is the ForestAgriGreenNudge projects. This will ensure that the yearly report serves as a valuable resource for policymakers, practitioners, and researchers striving to build resilient food systems in line with the EU Green Deal and Farm to Fork Strategy.

8 References

Acs, S., Berentsen, P. B. M., & Huirne, R. B. M. (2005). Modelling conventional and organic farming: A literature review. *NJAS - Wageningen Journal of Life Sciences*, *53*, 1–18. https://doi.org/10.1016/S1573- 5214(05)80007-7

Ada, E., Sagnak, M., Uzel, R., & Balcioglu, İ. (2022). Analysis of barriers to circularity for agricultural cooperatives in the digitalization era. *International Journal of Productivity and Performance Management*, *71*, 932–951. https://doi.org/10.1108/IJPPM-12-2020-0689

Ada, N., Kazancoglu, Y., Sezer, M. D., Ede-Senturk, C., Ozer, I., & Ram, M. (2021). Analyzing Barriers of Circular Food Supply Chains and Proposing Industry 4.0 Solutions. *SUSTAINABILITY*, *13*(12). https://doi.org/10.3390/su13126812

Akimowicz, M., Del Corso, J.-P., Gallai, N., & Képhaliacos, C. (2022). The leader, the keeper, and the follower? A legitimacy perspective on the governance of varietal innovation systems for climate changes adaptation. The case of sunflower hybrids in France. *Agricultural Systems*, *203*, 103498. https://doi.org/10.1016/j.agsy.2022.103498

Alons, G. (2017). Environmental policy integration in the EU's common agricultural policy: Greening or greenwashing? *Journal of European Public Policy*, *24*(11), Article 11. https://doi.org/10.1080/13501763.2017.1334085

Anderson, M., & Leach, M. (2019). Transforming Food Systems: The Potential of Engaged Political Economy. *IDS Bulletin*, *50*. https://doi.org/10.19088/1968-2019.123

Bager, S., Persson, M., & Reis, T. (2020). Reducing commodity-driven tropical deforestation: Political feasibility and 'theories of change'for EU policy options. *Reducing Commodity-Driven Deforestation–Bager et al.(2020)*.

Bair, J., Anner, M., & Blasi, J. (2020). The Political Economy of Private and Public Regulation in Post-Rana Plaza Bangladesh. *ILR Review*, *73*(4), 969–994. https://doi.org/10.1177/0019793920925424

Bakker, L., Sok, J., van der Werf, W., & Bianchi, F. J. J. A. (2021). Kicking the Habit: What Makes and Breaks Farmers' Intentions to Reduce Pesticide Use? *Ecological Economics*, *180*, 106868. https://doi.org/10.1016/j.ecolecon.2020.106868

Bakker, T., Dugué, P., & de Tourdonnet, S. (2022). How do farmers change their practices at the farm level after co design processes in Farmer Field Schools? *Agricultural Systems*, *201*. https://doi.org/10.1016/j.agsy.2022.103457

Banovic, M., Barone, A. M., Asioli, D., & Grasso, S. (2022). Enabling sustainable plant-forward transition: European consumer attitudes and intention to buy hybrid products. *Food Quality and Preference*, *96*. https://doi.org/10.1016/j.foodqual.2021.104440

Barnes, A. P., Thompson, B., & Toma, L. (2022). Finding the ecological farmer: A farmer typology to understand ecological practice adoption within Europe. *Current Research in Environmental Sustainability*, *4*. https://doi.org/10.1016/j.crsust.2022.100125

Bartley, T. (2014). Transnational governance and the re-centered state: Sustainability or legality?: Re-centered state. *Regulation & Governance*, *8*(1), 93–109. https://doi.org/10.1111/rego.12051

Funded by the European Union

Bartulovic, A., & Kozorog, M. (2014). Taking up organic farming in (pre-)Alpine Slovenia: Contrasting motivations of dairy farmers from less-favoured agricultural areas. *Anthropological Notebooks*, *20*, 83–102.

Bastounis, A., Buckell, J., Hartmann-Boyce, J., Cook, B., King, S., Potter, C., Bianchi, F., Rayner, M., & Jebb, S. (2021). The Impact of Environmental Sustainability Labels on Willingness-To-Pay for Foods: A Systematic Review and Meta-Analysis of Discrete Choice Experiments. *Nutrients*, *13*, 2677. https://doi.org/10.3390/nu13082677

Bauer, J. M., Aarestrup, S. C., Hansen, P. G., & Reisch, L. A. (2022). Nudging more sustainable grocery purchases: Behavioural innovations in a supermarket setting. *Technological Forecasting & Social Change*, *179*. https://doi.org/10.1016/j.techfore.2022.121605

Bednarek, A.T., Wyborn, C., Cvitanovic, C., Meyer, R., Colvin, R.M., Addison, P.F.E., Close, S. L., Curran, K., Farooque, M., Goldman, E., Hart, D., Mannix, H., McGreavy, B., Parris, A., Posner, S., Robinson, C., Ryans, M., Leith, P., (2018). Boundary spanning at the science-policy interface: the practitioners' perspectives. Sustainability Science 13 (4), 1175–1183, https://doi.org/10.1007/s11625-018-0550-9

Bentivoglio D., G. Bucci, M. Belletti, A. Finco, A theoretical framework on network's dynamics for precision agriculture technologies adoption. Rev. Econ. Sociol. Rural 60, 1-21 (2022).

Berger, V., & Burkhalter, L. (2022). Beyond one size fits all? An experimental study of the effects of stage-specific interventions to promote ecological online food shopping. *Journal of Consumer Behaviour*, *21*(5), Article 5. https://doi.org/10.1002/cb.2054

Borsellino, V., Kaliji, S. A., & Schimmenti, E. (2020). COVID-19 Drives Consumer Behaviour and Agro-Food Markets towards Healthier and More Sustainable Patterns. *Sustainability*, *12*(20), Article 20. https://doi.org/10.3390/su12208366

Bouttes, M., Bancarel, A., Doumayzel, S., Viguié, S., Cristobal, M., & Martin, G. (2020). Conversion to organic farming increases dairy farmers' satisfaction independently of the strategies implemented. *Agronomy for Sustainable Development*, *40*. https://doi.org/10.1007/s13593-020-00616-5

Bouttes, M., Darnhofer, I., & Martin, G. (2019). Converting to organic farming as a way to enhance adaptive capacity. *Organic Agriculture*, *9*, 235–247. https://doi.org/10.1007/s13165-018-0225-y

Bui, S. (2021). Enacting Transitions—The Combined Effect of Multiple Niches in Whole System Reconfiguration. *Sustainability*, *13*, 6135. https://doi.org/10.3390/su13116135

Bui, S., Cardona, A., Lamine, C., & Cerf, M. (2016). Sustainability transitions: Insights on processes of niche-regime interaction and regime reconfiguration in agri-food systems. *Journal of Rural Studies*, *48*, 92–103. https://doi.org/10.1016/j.jrurstud.2016.10.003

Burch, S. and Di Bella, J. (2021). Business models for the Anthropocene: acceleratingsustainability transformations in the private sector. Sustainability Science, 16: 1963–1976.

Burton, R. J. F. (2014). The influence of farmer demographic characteristics on environmental behaviour: A review. *Journal of Environmental Management*, *135*, 19–26. https://doi.org/10.1016/j.jenvman.2013.12.005

Funded by the European Union

PRUDENT

Busse, M., Kernecker, M., Zscheischler, J., Zoll, F., & Siebert, R. (2019). Ethical Concerns in Poultry Production: A German Consumer Survey About Dual Purpose Chickens. *Journal of Agricultural and Environmental Ethics*, *32*. https://doi.org/10.1007/s10806-019-09806-y

Busse, M., Zoll, F., Siebert, R., Bartels, A., Bokelmann, A., & Scharschmidt, P. (2021). How farmers think about insects: Perceptions of biodiversity, biodiversity loss and attitudes towards insect-friendly farming practices. *Biodiversity and Conservation*, *30*, 1–22. https://doi.org/10.1007/s10531-021-02235-2

Carson, R., Hamel, Z., Giarrocco, K., Baylor, R., & Mathews, L. (2016). Buying in: The influence of interactions at farmers' markets. *Agriculture and Human Values*, *33*. https://doi.org/10.1007/s10460-015-9675-y Cayre, P. (1), Michaud, A. (2), Theau, J.-P. (3), & Rigolot, C. (4). (2018). The coexistence of multipleworldviews in livestock farming drives agroecological transition. A case study in French Protected Designation of Origin (PDO) cheese mountain areas. *Sustainability (Switzerland)*, *10*(4), Article 4. https://doi.org/10.3390/su10041097

Cash, D.W., Clark, W.C., Alcock, F., Dickson, N.M., Eckley, N., Guston, D.H., Jager, J., Mitchell, R.B. (2003). Knowledge systems for sustainable development. PNAS, 100 (14), https://doi.org/10.1073/pnas.1231332100

Chambers, R., & Ghildyal, B. (1985). Agricultural research for resource-poor farmers: The farmer-first-and-last model. *Agricultural Administration*, *20*(1), 1–30.

Chan, D. Y.-T., & Yang, C. (2022). Institutional Escape and Embeddedness in the Cross-border Production Networks: Relocation of Chinese Electronics Small and Medium-sized Enterprises to Vietnam. *Journal of Contemporary China*, *31*(137), 675–692. https://doi.org/10.1080/10670564.2021.2010859

Connolly, R., Bogue, J., & Repar, L. (2022). Farmers' Markets as Resilient Alternative Market Structures in a Sustainable Global Food System: A Small Firm Growth Perspective. *Sustainability (Switzerland)*, *14*(18), Article 18. https://doi.org/10.3390/su141811626

Čop, T. & Njavro, M. (2024). Nudge research in agricultural economics: two-decade retrospective of empirical evidence. China Agricultural Economic Review, 16(4), https://doi.org/10.1108/CAER-10-2023-0277

Csordás, A., Pancsira, J., Lengyel, P., Füzesi, I., & Felföldi, J. (2022). The Potential of Digital Marketing Tools to Develop the Innovative SFSC Players' Business Models. Journal of Open Innovation: Technology, Market,and Complexity, 8(3), Article 3. https://doi.org/10.3390/joitmc8030122

Cvitanovic, C., Hobday, A. J., van Kerkhoff, L., Wilson, S. K., Dobbs, K., and Marshall, N. A. (2015).Improving knowledge exchange among scientists and decision-makers to facilitate the adaptivegovernance of marine resources: a review of knowledge and research needs. Ocean & Coastal Management, 112, 25-35.

De Bernardi, P., Bertello, A., & Forliano, C. (2022). Circularity of food systems: A review and research agenda. *BRITISH FOOD JOURNAL*. https://doi.org/10.1108/BFJ-05-2021-0576

de Boer, J., & Aiking, H. (2018). Prospects for pro-environmental protein consumption in Europe: Cultural, culinary, economic and psychological factors. *Appetite*, *121*, 29–40. https://doi.org/10.1016/j.appet.2017.10.042

de Boer, J., Schösler, H., & Aiking, H. (2017). Towards a reduced meat diet: Mindset and motivation of young vegetarians, low, medium and high meat-eaters. *Appetite*, *113*, 387–397. https://doi.org/10.1016/j.appet.2017.03.007

de Boon, A., Sandström, C., & Rose, D. C. (2022). Perceived legitimacy of agricultural transitions and implications for governance. Lessons learned from England's post-Brexit agricultural transition. *Land Use Policy*, *116*, 106067. https://doi.org/10.1016/j.landusepol.2022.106067

De Herde, V., Segers, Y., Maréchal, K., & Baret, P. V. (2022). Lock-ins to transition pathways anchored in contextualized cooperative dynamics: Insights from the historical trajectories of the Walloon dairy cooperatives. *Journal of Rural Studies*, *94*, 161–176. https://doi.org/10.1016/j.jrurstud.2022.04.003

de Lauwere, C., Slegers, M., & Meeusen, M. (2022). The influence of behavioural factors and external conditions on Dutch farmers' decision making in the transition towards circular agriculture. *Land Use Policy*, *120*, 106253. https://doi.org/10.1016/j.landusepol.2022.106253

De Schutter, O. (2017). The political economy of food systems reform. *European Review of Agricultural Economics*, *44*(4), 705–731.

De Schutter, O. (2019). *Towards a Common Food Policy for the European Union. The policy reform and realignment that is required to build sustainable food systems in Europe*. IPES Food Panel.

Del Vecchio, P., Secundo, G., Mele, G., & Passiante, G. (2021). Sustainable entrepreneurship education for circular economy: Emerging perspectives in Europe. *International Journal of Entrepreneurial Behavior & Research*, *27*(8), Article 8. https://doi.org/10.1108/IJEBR-03-2021-0210

Dessart, F. J., Barreiro-Hurlé, J., & Van Bavel, R. (2019). Behavioural factors affecting the adoption of sustainable farming practices: A policy-oriented review. *European Review of Agricultural Economics*, *46*(3), Article 3. https://doi.org/10.1093/erae/jbz019

Dupoux, M., Gaudeul, A., Baggio, M., Bruns, H. et al. (2025) Unlocking the full potential of behavioural insights for policy – From influencing the individual to shaping the system, Publications Office of the European Union. https://data.europa.eu/doi/10.2760/7367599

Dumont, A. M., Gasselin, P., & Baret, P. V. (2020). Transitions in agriculture: Three frameworks highlighting coexistence between a new agroecological configuration and an old, organic and conventional configuration of vegetable production in Wallonia (Belgium). *Geoforum*, *108*, 98–109. https://doi.org/10.1016/j.geoforum.2019.11.018

Duru, M., Therond, O., & Fares, M. (2015). Designing agroecological transitions; A review. *AGRONOMY FOR SUSTAINABLE DEVELOPMENT*, *35*(4), Article 4. https://doi.org/10.1007/s13593-015-0318-x

Eastwood C. R, J. P. Edwards, J. A. Turner, Review: Anticipating alternative trajectories for responsible Agriculture 4.0 innovation in livestock systems. Animal 15, (2021).

EEA,(2023). *Transforming Europe's food system. Assessing the EU policy mix*. European Environment Agency.

Funded by
the European Union

El Bilali, H. (2019). The Multi-Level Perspective in Research on Sustainability Transitions in Agriculture and Food Systems: A Systematic Review. *Agriculture*, *9*, 74. https://doi.org/10.3390/agriculture9040074

Elzerman, J. E., van Dijk, P. E. M., & Luning, P. A. (2022). Substituting meat and the role of a situational context: Exploring associations and motives of Dutch meat substitute-users. *British Food Journal*, *124*(13), Article 13. https://doi.org/10.1108/BFJ-09-2021-1051

Engelberts, L., Rheede, A., Kievit, H., & Nijhof, A. (2021). Appreciating Multiple Realities in the Transformation towards a Sustainable Dairy Sector: An Explorative Study from the Inside-Out Perspective. *Agronomy*, *11*, 2116. https://doi.org/10.3390/agronomy11112116

Ervin, D., Wu, J., Khanna, M., Jones, C., & Wirkkala, T. (2013). Motivations and Barriers to Corporate Environmental Management: Motivations and Barriers to Corporate Environmental Management. *Business Strategy and the Environment*, *22*(6), 390–409. https://doi.org/10.1002/bse.1752

Favilli E., A. Rossi, G. Brunori, Food networks: collective action and local development. The role of organic farming as boundary object. Organic Agriculture 5, 235-243 (2015).

Fielt, E. (2013). Conceptualising business models: Definitions, frameworks and classifications. Journal of Business Models, 1(1): 85-105.

Garrett, R. d. (1, 2), Cortner, O. (1, 2), Garik, A. v. n. (2), Ryschawy, J. (3), Bell, L. w. (4), Ferreira, J. (5), Gil, J. d. b. (6), Klerkx, L. (7), Moraine, M. (8), Peterson, C. a. (9), Dos Reis, J. c. (10), & Valentim, J. f. (11). (2020). Drivers of decoupling and recoupling of crop and livestock systems at farm and territorial scales. *Ecology and Society*, *25*(1). https://doi.org/10.5751/ES-11412-250124

Geels, F. W. (2002). Technological transitions as evolutionary reconfiguration processes: A multi-level perspective and a case-study. *Research Policy*, *31*(8–9), 1257–1274. https://doi.org/10.1016/S0048-7333(02)00062-8

Geels, F. W. (2011). The multi-level perspective on sustainability transitions: Responses to seven criticisms. *Environmental Innovation and Societal Transitions*, *1*(1), Article 1. https://doi.org/10.1016/j.eist.2011.02.002

Geels, F. W. (2019). Socio-technical transitions to sustainability: A review of criticisms and elaborations of the Multi Level Perspective. *Current Opinion in Environmental Sustainability*, *39*, 187–201. https://doi.org/10.1016/j.cosust.2019.06.009

Geels, F. W. (2020). Micro-foundations of the multi-level perspective on socio-technical transitions: Developing a multi-dimensional model of agency through crossovers between social constructivism, evolutionary economics and neo-institutional theory. *Technological Forecasting and Social Change*, *152*, 119894. https://doi.org/10.1016/j.techfore.2019.119894

Geels, F. W., & Schot, J. (2007). Typology of sociotechnical transition pathways. *Research Policy*, *36*(3), 399–417. https://doi.org/10.1016/j.respol.2007.01.003

Giomi, T., Runhaar, P., & Runhaar, H. (2018). Reducing agrochemical use for nature conservation by Italian olive farmers: An evaluation of public and private governance strategies. *International Journal of Agricultural Sustainability*, *16*(1), Article 1. https://doi.org/10.1080/14735903.2018.1424066

Funded by the European Union

Glowinkel, M., Mocan, M., Külkens, M., (2021), “Survey of German farmers towards the impact of the common agricultural policy on their businesses”, Bulgarian Journal of Agricultural Science, 27, 4, 646-655. https://www.ordid.org/10.1016/j.biocon.2014.08.005

Gomes, A., & Reidsma, P. (2021). Time to Transition: Barriers and Opportunities to Farmer Adoption of Soil GHG Mitigation Practices in Dutch Agriculture. *Frontiers in Sustainable Food Systems*, *5*, 706113. https://doi.org/10.3389/fsufs.2021.706113

Guareschi M., M. Maccari, J. P. Sciurano, F. Arfini, A. Pronti, A methodological approach to upscale toward an agroecology system in EU-LAFSs: The case of the parma bio-district. Sustainability (Switzerland) 12, (2020).

Guerrero, L., Pereira, L., Ravera, F., & Jiménez-Aceituno, A. (2019). Flipping the Tortilla: Social-Ecological Innovations and Traditional Ecological Knowledge for More Sustainable Agri-Food Systems in Spain. *Sustainability*, *11*, 1222. https://doi.org/10.3390/su11051222

Haller, H., Fagerholm, A.-S., Carlsson, P., Skoglund, W., van den Brink, P., Danielski, I., Brink, K., Mirata, M., & Englund, O. (2022). Towards a Resilient and Resource-Efficient Local Food System Based on Industrial Symbiosis in Härnosand: A Swedish Case Study. *Sustainability*, *14*(4), Article 4. https://doi.org/10.3390/su14042197

Hočevar, D.K., (2018), “We are sustainable - they are not!' Farmers' understandings of sustainable agriculture in Slovenia”, Anthropological Notebooks, 24, 2, 25-46. https://www.ordid.org/10.1504/IJGE.2015.075199

Hübel, C., & Schaltegger, S. (2022). Barriers to a sustainability transformation of meat production practices—An industry actor perspective. *Sustainable Production and Consumption*, *29*, 128–140. https://doi.org/10.1016/j.spc.2021.10.004

Huttunen, S. (2021). Socio-cultural lock-ins and the difficulty of sustainability transition in fertilization – Response to Struckman. *Nordia Geographical Publications*, *49*, 102–106. https://doi.org/10.30671/nordia.100204

Huttunen, S., Kaljonen, M., Lonkila, A., Rantala, S., Rekola, A., & Paloniemi, R. (2021a). Pluralising agency to understand behaviour change in sustainability transitions. *Energy Research & Social Science*, *76*, 102067. https://doi.org/10.1016/j.erss.2021.102067

Huttunen, S., Kaljonen, M., Lonkila, A., Rantala, S., Rekola, A., & Paloniemi, R. (2021b). Pluralising agency to understand behaviour change in sustainability transitions. *Energy Research & Social Science*, *76*, 102067. https://doi.org/10.1016/j.erss.2021.102067

Huttunen, S., Turunen, A., & Kaljonen, M. (2022). Participation for just governance of food-system transition. *Sustainability: Science, Practice and Policy*, *18*, 500–514. https://doi.org/10.1080/15487733.2022.2088187

Hvitsand, C. (2016). Community Supported Agriculture (CSA) as a Transformational Act—Distinct Values and Multiple Motivations among Farmers and Consumers. *Agroecology and Sustainable Food Systems*, *40*. https://doi.org/10.1080/21683565.2015.1136720

Kaiser, A., & Burger, P. (2022). Understanding diversity in farmers’ routinized crop protection practices. *Journal of Rural Studies*, *89*, 149–160. https://doi.org/10.1016/j.jrurstud.2021.12.002

Funded by
the European Union

Kaljonen, M., Ott, A., Huttunen, S., Kuusela, A.-J., & Lonkela, A. (2021). Policy mixes for more vital legume value chains: Evaluation across competing policy frames. *The International Journal of Sociology of Agriculture and Food*, *27*(2), Article 2. https://doi.org/10.48416/ijsaf.v27i2.455

Kaljonen, M., Salo, M., Lyytimäki, J., & Furman, E. (2020). From isolated labels and nudges to sustained tinkering: Assessing long-term changes in sustainable eating at a lunch restaurant. *British Food Journal*, *ahead-of print*. https://doi.org/10.1108/BFJ-10-2019-0816

Kelemen, E., Pataki, G., Konstantinou, Z., Varumo, L., Paloniemi, R., Pereira, T.R., SousaPinto, I., Vandewalle, M., Young, J. (2021). Networks at the science-policy-interface: challenges, opportunities and the viability of the 'network-of-networks' approach. Environmental Science and Policy, 123, 91–98.

Kinderman, D. (2016). Time for a reality check: Is business willing to support a smart mix of complementary regulation in private governance? Policy and Society, 35(1), 29–42. https://doi.org/10.1016/j.polsoc.2016.01.001

Kings, D., & Ilbery, B. (2010). The environmental belief systems of organic and conventional farmers: Evidence from central-southern England. *Journal of Rural Studies*, *26*(4), Article 4. https://doi.org/10.1016/j.jrurstud.2010.05.003

Klerkx, L., & Begemann, S. (2020). Supporting food systems transformation: The what, why, who, where and how of mission-oriented agricultural innovation systems. *Agricultural Systems*, *184*, 102901. https://doi.org/10.1016/j.agsy.2020.102901

Konzett, S., & Grüner, B. (2022). New Players on a Tough Field Identifying New Entrants to Mountain Farming inthe Austrian Alps. *European Countryside*, *14*(2), Article 2. https://doi.org/10.2478/euco-2022-0015

Konstantinidis, C., (2018), "Capitalism in Green Disguise: The Political Economy of Organic Farming in the European Union", Review of Radical Political Economics, 50, 4, 830-852. https://www.orcid.org/10.3390/su11102753)

Kuokkanen, A., Mikkilä, M., Kuisma, M., Kahiluoto, H., & Linnanen, L. (2017). The need for policy to address the food system lock-in: A case study of the Finnish context. *Journal of Cleaner Production*, *140*, 933–944. https://doi.org/10.1016/j.jclepro.2016.06.171

Kwon, H. R., & Silva, E. A. (2020). Mapping the Landscape of Behavioral Theories: Systematic Literature Review. *Journal of Planning Literature*, *35*(2), Article 2. https://doi.org/10.1177/0885412219881135

L. Scherer, P. H. Verburg, Mapping and linking supply- and demand-side measures in climate-smart agriculture. A review. Agronomy for Sustainable Development 37, (2017).

Lamine, C., Darnhofer, I., & Marsden, T. K. (2019). What enables just sustainability transitions in agrifood

systems? An exploration of conceptual approaches using international comparative case studies. *Journal of Rural Studies*, *68*, 144–146. https://doi.org/10.1016/j.jrurstud.2019.03.010

Lampkin, N., Schwarz, G., Bellon, S., (2020), "Policies for agroecology in Europe, building on experiences in France, Germany and the United Kingdom", Landbauforschung, 70, 2, 103-112. https://www.ordid.org/10.1093/erae/jbz019Delmotte et al., 2017

Funded by the European Union

Lehikoinen, E., & Salonen, A. (2019). Food Preferences in Finland: Sustainable Diets and their Differences between Groups. *Sustainability*, *11*. https://doi.org/10.3390/su11051259

Lefebvre, M., Espinosa, M., Gomez y Paloma, S., Paracchini, M.L., Piorr, A., Zasada, I., (2015), "Agricultural landscapes as multi-scale public good and the role of the Common Agricultural Policy", Journal of Environmental Planning and Management, 58, 12, 2088-2112.

Leresche, J.-P. (2018). *Consumers: Considered and consulted more, but not yet influential*.
Linares, A., Yoldi, U., Gava, O., Schwarz, G., Povellato, A., & Carlos, A. (2022). Assessment of the Common Agricultural Policy 2014–2020 in Supporting Agroecological Transitions: A Comparative Study of 15 Cases across Europe. *Sustainability*, *14*, 9261. https://doi.org/10.3390/su14159261

Lingnau, V., Fuchs, F., & Beham, F. (2019). The impact of sustainability in coffee production on consumers' willingness to pay–new evidence from the field of ethical consumption. *Journal of Management Control*, *30*(1), 65–93. https://doi.org/10.1007/s00187-019-00276-x

Lioutas, E. D., & Charatsari, C. (2018). Green Innovativeness in Farm Enterprises: What Makes Farmers Think Green? *Sustainable Development*, *26*(4), Article 4. https://doi.org/10.1002/sd.1709

Loera, B., Murphy, B., Fedi, A., Martini, M., Tecco, N., & Dean, M. (2022). Understanding the purchase intentions for organic vegetables across EU: A proposal to extend the TPB model. *British Food Journal*, *124*(12), Article 12. https://doi.org/10.1108/BFJ-08-2021-0875

Lonkila, A., & Kaljonen, M. (2021). Promises of meat and milk alternatives: An integrative literature review on emergent research themes. *Agriculture and Human Values*, *38*. https://doi.org/10.1007/s10460-020-10184-9

Loorbach, D., Wittmayer, J., Avelino, F., von Wirth, T., & Frantzeskaki, N. (2020). Transformative innovation and translocal diffusion. *Environmental Innovation and Societal Transitions*, *35*, 251–260. https://doi.org/10.1016/j.eist.2020.01.009

Łuczka, W. (2019). Changes in the Behavior of Organic Food Consumers. *Ekonomia i Środowisko*, *nr 3 (70)*, Article nr 3 (70). https://doi.org/10.34659/2019/3/40

Lutz, J., Smetschka, B., & Grima, N. (2017). Farmer cooperation as a means for creating local food systems Potentials and challenges. *Sustainability (Switzerland)*, *9*(6), Article 6. https://doi.org/10.3390/su9060925

Lüdeke-Freund, F. (2010). Towards a conceptual framework of business models for sustainability. Knowledge Collaboration & Learning for Sustainable Innovation ERSCP-EMSU Conference, Delft, The Netherlands, October 25-29.

M. Guareschi, M. Maccari, J. P. Sciurano, F. Arfini, A. Pronti, A methodological approach to upscale toward an agroecology system in EU-LAFSs: The case of the parma bio-district. Sustainability (Switzerland) 12, (2020).

M. Medici, M. Canavari, A. Castellini, Exploring the economic, social, and environmental dimensions of community-supported agriculture in Italy. Journal of Cleaner Production 316, (2021).

M. Navarrete, L. Dupré, C. Lamine, Crop management, labour organization, and marketing: three key issues for improving sustainability

F. Mantino, B. Forcina, Market, policies and local governance as drivers of environmental public benefits: The case of the localised processed tomato in northern Italy. Agric. 8, (2018).

Magrini, M.-B., Béfort, N., & Nieddu, M. (2019). Chapter 24—Technological Lock-In and Pathways for Crop Diversification in the Bio-Economy. In G. Lemaire, P. C. D. F. Carvalho, S. Kronberg, & S. Recous (Eds.), *Agroecosystem Diversity* (pp. 375–388). Academic Press. https://doi.org/10.1016/B978-0-12-811050- 8.00024-8

M. Kröger, M. Schäfer, Between Ideals and Reality: Development and Implementation of Fairness Standards in the Organic Food Sector. Journal of Agricultural and Environmental Ethics 27, 43-63 (2014).

Magrini, M.-B., Martin, G., Magne, M.-A., Duru, M., Nathalie, C., Hazard, L., & Plumecocq, G. (2019). *Agroecological Transition from Farms to Territorialised Agri-Food Systems: Issues and Drivers* (pp. 69– 98). https://doi.org/10.1007/978-3-030-01953-2_5

Malik, M., & Abdallah, S. (2019). Sustainability Initiatives in Emerging Economies: A Socio-Cultural Perspective. *Sustainability*, *11*(18), 4893. https://doi.org/10.3390/su11184893

Manlosa, A. O., Schultner, J., Dorresteijn, I., & Fischer, J. (2019). Leverage points for improving gender equality and human well-being in a smallholder farming context. *Sustainability Science*, *14*, 529–541.

Markard, J., & Truffer, B. (2008). Technological innovation systems and the multi-level perspective: Towards an integrated framework. *Research Policy*, *37*(4), Article 4. https://doi.org/10.1016/j.respol.2008.01.004

Martens, K. (1), Rogga, S. (1), Zscheischler, J. (1, 2), Piorr, A. (1), Pölling, B. (3), & Obersteg, A. (4). (2022). Classifying New Hybrid Cooperation Models for Short Food-Supply Chains—Providing a Concept for Assessing Sustainability Transformation in the Urban-Rural Nexus. *Land*, *11*(4), Article 4. https://doi.org/10.3390/land11040582

Martinelli, F., Vollheyde, A.-L., Cebrián-Piqueras, M., Haaren, C., Lorenzetti, E., Bàrberi, P., Loreto, F., Piergiovanni, A., Valkov, V., Bedini, A., Morelli, R., Noureddine, Y., Rezki, M., Ouslim, S., fatima-zohra, fyad-lamèche, Abdelkader, B., Sikora, S., Rodríguez-Navarro, D., Camacho, M., & Yousefi, S. (2022). LEGU-MED: Developing Biodiversity-Based Agriculture with Legume Cropping Systems in the Mediterranean Basin. *Agronomy*, *12*, 132. https://doi.org/10.3390/agronomy12010132

Massari, S. (2021). Chapter Nineteen - Transforming research and innovation for sustainability: Transdisciplinary design for future pathways in agri-food sector. *Transdisciplinary Case Studies on Design for Food and Sustainability*, 315–326. https://doi.org/10.1016/B978-0-12-817821-8.00027-8

Mastronardi, L., Romagnoli, L., Mazzocchi, G., Giaccio, V., & Marino, D. (2019). Understanding consumer's motivations and behaviour in alternative food networks. *British Food Journal*, *ahead-of-print*. https://doi.org/10.1108/BFJ-01-2019-0032

Mattioni, D., Milbourne, P., & Sonnino, R. (2022). Destabilizing the food regime "from within": Tools and strategies used by urban food policy actors. *Environmental Innovation and Societal Transitions*, *44*, 48–59. https://doi.org/10.1016/j.eist.2022.05.007

Funded by the European Union

Matysik-Pejas, R., Szafrańska, M., & Lato, E. (2017). Determinants of Leading of Organic Farms in Małopolska Region. *Proceedings of the International Scientific Conference: Rural Development*, 75–79. https://doi.org/10.15544/RD.2017.033

Mayer, R. C., Davis, J. H., & Schoorman, F. D. (2006). An integrative model of organizational trust. *Organizational Trust: A Reader*, 82–108.

Mazzucchelli, A., Gurioli, M., Graziano, D., Quacquarelli, B., & Aouina-Mejri, C. (2021). How to fight against food waste in the digital era: Key factors for a successful food sharing platform. *Journal of Business Research*, *124*, 47–58. https://doi.org/10.1016/j.jbusres.2020.11.055

McDonald, R., Macken-Walsh, Á., Pierce, K., & Horan, B. (2014). Farmers in a deregulated dairy regime: Insights from Ireland's New Entrants Scheme. *Land Use Policy*, *41*, 21–30. https://doi.org/10.1016/j.landusepol.2014.04.018

Melchior, I. C., & Newig, J. (2021). Governing Transitions towards Sustainable Agriculture-Taking Stock of an Emerging Field of Research. *SUSTAINABILITY*, *13*(2), 528. https://doi.org/10.3390/su13020528 Melovic, B., Dabic, M., Rogic, S., Djurisic, V., & Prorok, V. (2020). Food for thought: Identifying the influential factors that affect consumption of organic produce in today's youth. *British Food Journal*, *ahead-of-print*. https://doi.org/10.1108/BFJ-10-2019-0761

Messean, A., Viguier, L., Paresys, L., AUBERTOT, J.-N., CANALI, S., Iannetta, P., Justes, E., KARLEY, A., Keillor, B., KEMPER, L., Muel, F., PANCINO, B., Stilmant, D., Watson, C., Willer, H., & ZORNOZA, R. (2021). ENABLING CROP DIVERSIFICATION TO SUPPORT TRANSITIONS TOWARD MORE SUSTAINABLE EUROPEAN AGRIFOOD SYSTEMS. *Frontiers of Agricultural Science and Engineering*. https://doi.org/10.15302/J-FASE-2021406

Meynard, J.-M., Jeuffroy, M.-H., Le Bail, M., Lefèvre, A., Magrini, M.-B., & Michon, C. (2017). Designing coupled innovations for the sustainability transition of agrifood systems. *Agricultural Systems*, *157*, 330–339. https://doi.org/10.1016/j.agsy.2016.08.002

Möhring, N., & Finger, R. (2022). Pesticide-free but not organic: Adoption of a large-scale wheat production standard in Switzerland. *Food Policy*, *106*. https://doi.org/10.1016/j.foodpol.2021.102188

Möllers, J., Bäuml, T., & Dufhues, T. (2022). Understanding the market potential of products from alternative food networks in a transition economy—A discrete choice experiment. *British Food Journal*, *124*(13), Article 13. https://doi.org/10.1108/BFJ-08-2021-0925

Muñoz Torres, M. j., Fernández-Izquierdo, M. á., Ferrero-Ferrero, I., Escrig-Olmedo, E., & Rivera-Lirio, J. m. (2022). Transitioning the agri-food system. Does closeness mean sustainability? How production and shipping strategies impact socially and environmentally. Comparing Spain, South Africa and U.S. citrus fruit productions. *Agroecology and Sustainable Food Systems*, *46*(4), Article 4. https://doi.org/10.1080/21683565.2022.2039835

Murphy, S. P., Cannon, S. M., & Walsh, L. (2022). Just transition frames: Recognition, representation, and distribution in Irish beef farming. *Journal of Rural Studies*, *94*, 150–160. https://doi.org/10.1016/j.jrurstud.2022.06.009

Naab, F., Coles, D., Goddard, E., & Frewer, L. (2021). Public Perceptions Regarding Genomic Technologies Applied to Breeding Farm Animals: A Qualitative Study. *BioTech*, *10*, 28. https://doi.org/10.3390/biotech10040028

O'Brien, K. (2018). Is the 1.5°C target possible? Exploring the three spheres of transformation. *Current Opinion in Environmental Sustainability*, *31*, 153–160. https://doi.org/10.1016/j.cosust.2018.04.010

O. J. Rover, P. S. Ramos, D. L. R. Miranda, in Agroecology: Insights, Experiences and Perspectives. (Nova Science Publishers, Inc., 2020), pp. 119-139.

Osman A. M., C. J. M. Almekinders, P. C. Struik, E. T. Lammerts van Bueren, Adapting spring wheat breeding to the needs of the organic sector. NJAS - Wageningen Journal of Life Sciences 76, 55-63 (2016).

Pakseresht, A., Yavari, A., Kaliji, S. A., & Hakelius, K. (2023). The intersection of blockchain technology and circular economy in the agri-food sector. *Sustainable Production and Consumption*, *35*, 260–274. Scopus. https://doi.org/10.1016/j.spc.2022.11.002

Palacín, C., Alonso, J.C., (2018), "Failure of EU Biodiversity Strategy in Mediterranean farmland protected areas, Journal for Nature Conservation, 42, 62-66. https://www.orcid.org/10.3390/agriculture12050705

Pawlewicz, A. (2020). Change of Price Premiums Trend for Organic Food Products: The Example of the Polish Egg Market. Agriculture, 10(2), 35. https://doi.org/10.3390/agriculture10020035

Pe'er, G, Bonn, A, Bruelheide, H, et al.2020. Action needed for the EU Common Agricultural Policy to address sustainability challenges. People Nat. 2: 305– 316. https://doi.org/10.1002/pan3.10080Passeri et al. 2016,

Pereira, L., Drimie, S., Maciejewski, K., Tonissen, P., & Biggs, R. (2020). Food System Transformation: Integrating a Political–Economy and Social–Ecological Approach to Regime Shifts. *International Journal of Environmental Research and Public Health*, *17*, 1313. https://doi.org/10.3390/ijerph17041313

Polge, E., & Pagès, H. (2022). Relational drivers of the agroecological transition: An analysis of farmer trajectories in the Limagne plain, France. *Agricultural Systems*, *200*, 103430. https://doi.org/10.1016/j.agsy.2022.103430

Puupponen, A., Lonkila, A., Savikurki, A., Karttunen, K., Huttunen, S., & Ott, A. (2022). Finnish dairy farmers' perceptions of justice in the transition to carbon-neutral farming. *Journal of Rural Studies*, *90*, 104–112. https://doi.org/10.1016/j.jrurstud.2022.01.014

Purnhagen, K.P., Clemens, S., Eriksson, D., Fresco, L.O., Tosun, J., Qaim, M., Visser, R.G.F., Weber, A.P.M., Wesseler, J.H.H., Zilberman, D., (2021), "Europe's Farm to Fork Strategy and Its Commitment to Biotechnology and Organic Farming: Conflicting or Complementary Goals?", Trends in Plant Science, 26, 6, 600-606. https://www.orcid.org/10.32725/det.2021.018Díaz et al. 2021

Reina-Usuga, L., Parra-López, C., & de Haro-Giménez, T. (2022). Urban food policies and their influence on the development of Territorial Short Food Supply Chains: The case of cities in Colombia and Spain. *Land Use Policy*, *112*, 105825. https://doi.org/10.1016/j.landusepol.2021.105825

Sarkki, S., Tinch, R., Niemela, ¨ J., Heink, U., Waylen, K., Timaeus, J., Young, J., Watt, A., Neßhöver, C., van den Hove, S. (2015). Adding 'iterativity' to the credibility, relevance, legitimacy:

a novel scheme to highlight dynamic aspects of science–policy interfaces. Environmental Science & Policy, 54, 505–512. https://doi.org/10.1016/j.envsci.2015.02.016

Schäufele, I., & Janssen, M. (2021). How and Why Does the Attitude-Behavior Gap Differ Between Product Categories of Sustainable Food? Analysis of Organic Food Purchases Based on Household Panel Data. *Frontiers in Psychology*, *12*. https://doi.org/10.3389/fpsyg.2021.595636

Schleiffer, M., Landert, J., & Moschitz, H. (2022). Assessing public organic food procurement: The case of Zurich (CH). *Organic Agriculture*, *12*. https://doi.org/10.1007/s13165-022-00402-5

Schösler, H., Boer, J., & Boersema, J. (2013). The Organic Food Philosophy: A Qualitative Exploration of the Practices, Values, and Beliefs of Dutch Organic Consumers Within a Cultural-Historical Frame. *Journal of Agricultural and Environmental Ethics*, *26*, 439–460. https://doi.org/10.1007/s10806-012-9392-0

Schut, M., van Paassen, A., Leeuwis, C. (2013). Beyond the research–policy interface. Boundary arrangements at research–stakeholder interfaces in the policy debate on biofuel sustainability in Mozambique. Environmental Science

Sepide Mehrabi, Juan Carlos Perez-Mesa, & Cynthia Giagnocavo. (2022). The Role of Consumer-Citizens and Connectedness to Nature in the Sustainable Transition to Agroecological Food Systems: The Mediation of Innovative Business Models and a Multi-Level Perspective. *Agriculture*, *12*(203), Article 203. https://doi.org/10.3390/agriculture12020203

Stanciu, M., Popescu, A., & Răsvan, R.-I. (2022). Short Food Supply Chains and Young People's Attitude Towards Healthy Eating. *Scientific Papers: Management, Economic Engineering in Agriculture & Rural Development*, *22*(1), Article 1.

Sutherland, L.-A. (2011). "Effectively organic": Environmental gains on conventional farms through the market? *Land Use Policy*, *28*, 815–824. https://doi.org/10.1016/j.landusepol.2011.01.009

Sutherland, L.-A., Burton, R. J. F., Ingram, J., Blackstock, K., Slee, B., & Gotts, N. (2012). Triggering change: Towards a conceptualisation of major change processes in farm decision-making. *Journal of Environmental Management*, *104*, 142–151. https://doi.org/10.1016/j.jenvman.2012.03.013

Sutherland, L.-A., Mills, J., Ingram, J., Burton, R. J. F., Dwyer, J., & Blackstock, K. (2013). Considering the source: Commercialisation and trust in agri-environmental information and advisory services in England. *Journal of Environmental Management*, *118*, 96–105. https://doi.org/10.1016/j.jenvman.2012.12.020

Sutherland, L.-A., Toma, L., Barnes, A. P., Matthews, K. B., & Hopkins, J. (2016). Agri-environmental diversification: Linking environmental, forestry and renewable energy engagement on Scottish farms. *Journal of Rural Studies*, *47*, 10–20. https://doi.org/10.1016/j.jrurstud.2016.07.011

Taufique, K. m. r., Nielsen, K. s., Dietz, T., Shwom, R., Stern, P. c., & Vandenbergh, M. p. (2022). Revisiting the promise of carbon labelling. *Nature Climate Change*, *12*(2), Article 2. https://doi.org/10.1038/s41558-021- 01271-8

Funded by the European Union

Unay-Gailhard, İ., & Bojnec, Š. (2016). Sustainable participation behaviour in agri-environmental measures. *Journal of Cleaner Production*, *138*(Part 1), Article Part 1. https://doi.org/10.1016/j.jclepro.2015.09.003

Vaderna, C. (1, 2, 3), Home, R. (2), Roep, D. (3), & Migliorini, P. (4). (2022). Overcoming divergence: Managing expectations from organisers and members in community supported agriculture in Switzerland. *Humanities and Social Sciences Communications*, *9*(1), Article 1. https://doi.org/10.1057/s41599-022-01115-6

Van den Hove, S. (2007). A rationale for science-policy interfaces. Futures, 39 (7), 807–826. https://doi.org/10.1016/j.futures.2006.12.004.

Vecchio, P. d., Urbinati, A., & Kirchherr, J. (2022). Enablers of Managerial Practices for Circular Business Model Design: An Empirical Investigation of an Agro-Energy Company in a Rural Area. *IEEE Transactions on Engineering Management*. https://doi.org/10.1109/TEM.2021.3138327

Vercher, N. (2022). Territorial Social Innovation and Alternative Food Networks: The Case of a New Farmers' Cooperative on the Island of Ibiza (Spain). Agriculture (Switzerland), 12(6), Article 6. https://doi.org/10.3390/agriculture12060748

Y. Boulestreau, M. Casagrande, M. Navarrete, Analyzing barriers and levers for practice change: a new framework applied to vegetables' soil pest management. Agronomy for Sustainable Development 41, (2021).

Young, J. C., Calla, S., Lécuyer, L., & Skrimizea, E. (2022). Understanding the social enablers and disablers of pesticide reduction and agricultural transformation. Journal of Rural Studies, 95, 67–76. https://doi.org/10.1016/j.jrurstud.2022.07.023

End of Document

Funded by
the European Union