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Literature review of resources and knowledge on organic farming

Literature review

Deliverable 2.6

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DEM	Demonstrator, pilot, prototype, plan designs	
DEC	Websites, patents filing, press & media actions, videos, etc.	
DATA	Data sets, microdata, etc.	
OTHER	Software, technical diagram, algorithms, models, etc.	

Dissemination level

PU	Public, fully open, e.g. web (Deliverables flagged as public will be automatically published in CORDIS project's page))	X
SEN	Sensitive, limited under the conditions of the Grant Agreement	

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Executive Summary

Deliverable 2.6 provides a structured, practice-oriented knowledge baseline to support the OH-FINE Organic Farming Learning Community (OFC) and subsequent Work Packages. It collates and synthesises key peer-reviewed and grey literature, policy resources, and outputs from relevant EU-funded research and innovation projects, organised around six thematic domains derived from the WP2 farm profiling and technical knowledge needs analysis (Deliverables D2.2–D2.5). In tandem with the literature review, this deliverable also compiles an OH-FINE database of the reviewed resources in excel format, categorised as projects that are directly related to OH-FINE, a broader suite of organic research projects and the wider organic research literature (Annex C).

The review is intentionally scoped as an applied literature review rather than a comprehensive systematic review. Its objectives are to:

(i) identify and map the most relevant existing knowledge resources for farmers, advisors and project partners across the five OH-FINE regions
(ii) highlight areas where knowledge is well developed but remains difficult to access, contextualise or operationalise at farm level
(iii) provide a coherent thematic structure to guide the curation and deployment of knowledge resources within the OH-FINE digital platform and
(iv) provide the OH-FINE knowledge database that will be publicly accessible on the OH-FINE Knowledge Hub. This database will be built-on and added-to over the course of the OH-FINE project.

Evidence from WP2 case study farm profiling and the competitiveness analysis indicates that, while regulatory and compliance-related knowledge represents a universal requirement across systems, the primary drivers of farm performance differ by system orientation. Cropping and mixed systems most prevalent in Spain, Poland and Lithuania face particular challenges related to yield stability, soil fertility management and crop diversification. In contrast, livestock-dominated systems in Ireland and Bulgaria rely heavily on effective pasture management, feed planning and labour-efficient technologies, while remaining exposed to input cost volatility and emissions-related policy pressures.

Across all systems, the literature demonstrates that productivity gaps in organic farming are strongly mediated by management practices, crop rotation design and system integration, rather than being intrinsic to organic production. In addition, value-chain coordination, market access and risk-sharing mechanisms emerge as critical determinants of economic viability alongside on-farm technical performance.

Accordingly, the review extends beyond technical practices to explicitly address the role of Agricultural Knowledge and Innovation Systems (AKIS). Advisory capacity, peer-to-peer learning mechanisms and institutional coordination are shown to play a decisive role in shaping innovation uptake and farm-level decision-making. In this context, Deliverable 2.6 not only establishes an evidence-informed knowledge base but also provides the structured foundation for knowledge mobilisation within the OH-FINE

platform, informing subsequent advisory, demonstration and learning interventions.

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1. Introduction

The expansion of organic farming is a central objective of the European Green Deal, the Farm to Fork Strategy and the EU Organic Action Plan, which collectively target 25% of EU agricultural land under organic management by 2030. These policy frameworks position organic farming as a key mechanism for environmental sustainability, biodiversity protection, climate mitigation and rural development. Achieving these ambitions, however, requires more than financial incentives alone. It depends critically on the availability of relevant knowledge, adequate advisory capacity and innovation systems that can support farmers through both conversion and post-conversion stages.

Within this context, Agricultural Knowledge and Innovation Systems (AKIS) play a pivotal role by mediating access to information, translating research into practice and enabling peer learning. Recent EU research highlights the existence of persistent constraints that are related to fragmented advisory provision, uneven access to organic-specific expertise and weak coordination between research, advisory services, value-chain actors and policy implementation.

The OH-FINE project responds by establishing a pan-European Organic Farming Learning Community (OFC) and developing Organic Hubs for Innovation and Farmer Network Empowerment. Deliverable 2.6 contributes by collating and synthesising existing research and practice resources to provide a structured knowledge baseline that informs the design and delivery of later Work Packages that implement farmer advisory and training interventions along with farm-based trials of innovative practices.

1.1 Purpose of the Review

Deliverable 2.6 identifies and synthesises key resources relevant to organic farming in a structured, thematic format aligned with OH-FINE delivery needs. The scope includes peer-reviewed academic literature, EU and international policy documents, grey literature (technical manuals, advisory guidelines) and outputs from relevant EU-funded research and innovation projects. Emphasis is placed on resources that (i) offer actionable guidance, (ii) are adaptable across multiple European contexts and (iii) address the technical themes prioritised through WP2.

The review and database support the WP2 objective of clarifying knowledge transfer challenges, barriers to conversion and priority knowledge needs. It therefore covers both farm-level practice resources and evidence relating to the operation and effectiveness of the AKIS supporting organic farming development in the EU.

The review and database support the OH-FINE baseline establishment phase. Its focus is informed by earlier WP2 outputs (D2.2 and D2.5), including the case study farm selection and the knowledge needs survey. Accordingly, it does not aim to replicate previous systematic reviews; rather, it provides an applied synthesis of the most relevant and transferable knowledge to inform subsequent project delivery. The primary audience is the OH-FINE consortium partners involved in designing and implementing later Work Packages.

2. Methodological Approach

Given the applied objectives of OH-FINE and the requirement for timely delivery, this deliverable adopts a rapid scoping review approach. Scoping methods are suited to mapping evidence, clarifying knowledge landscapes and identifying key concepts where the objective is knowledge mobilisation rather than hypothesis testing or formal meta-analysis.

Targeted keyword searches were undertaken across academic databases including Scopus, Web of Science and Google Scholar. Search terms were aligned with the technical themes identified through Deliverable 2.2 (case study farm selection guidance) and Deliverable 2.5 (technical knowledge needs domains). Priority was given to review and synthesis papers, EU-relevant empirical studies and and outputs with clear implications for practice, advisory design and policy.

In parallel, structured screening of outputs from relevant EU-funded projects was undertaken, including projects informing OH-FINE's approach. Policy and advisory resources from recognised organisations (e.g., European Commission, FAO, OECD, IFOAM Organics Europe) were included to ensure alignment with EU strategies and to capture established advisory and practice guidance.

The intent is to provide an evidence-informed resource base that is suitable for platform curation and knowledge exchange design, rather than a complete inventory of all available literature.

3. Thematic Framework for Knowledge Synthesis

To ensure coherence and usability, all resources are organised under six thematic areas aligned with Deliverable 2.2 and the priority knowledge domains identified in Deliverable 2.5. This framework reflects farm-level technical needs, system-level enabling conditions and the structure of the OH-FINE case study sample.

The six thematic areas are:

1. EU agricultural support policies for organic farming
2. Crop Management and Diversity
3. Livestock Systems and Animal Health
4. Mechanisation and Labour Efficiency
5. On-Farm Processing and Adding Value to Products
6. Reflections on Knowledge and Innovation Systems for Organic Agriculture.

This thematic structure underpins the organisation of both the written review and the resource architecture within the OH-FINE knowledge platform. The technical domains in Deliverable 2.5 were derived from detailed farm profiling and the identification of thematic research needs (Annex A & Annex B). A central finding of D2.5 is that EU Agricultural Support Policies, Standards and Compliance are universally important across partner countries and farm types, reflecting the centrality of regulatory knowledge, certification and documentation demands. As such, Theme 1 is treated as a cross-cutting priority and a major component of the subsequent review.

In addition, given OH-FINE's explicit focus on supporting organic farming and sectoral development through networked knowledge exchange interventions, and the emphasis within WP2 on understanding the dynamics of the underlying support environment, a sixth cross-cutting thematic area "Reflections on Knowledge and Innovation Systems for Organic Agriculture" is developed in this review.

Evidence from the WP2 farm profiling and knowledge needs analysis indicates that many of the constraints faced by organic and in-conversion farmers are not solely technical in nature, but are shaped by the organisation, accessibility and effectiveness of advisory services, peer networks, research linkages and policy implementation structures. These systemic factors strongly influence how knowledge is accessed, interpreted and applied at farm level, and help to explain observed differences in innovation uptake across countries, farm types and stages of conversion.

This additional thematic area therefore provides a necessary analytical lens through which to interpret the technical knowledge domains reviewed above. It situates crop, livestock, mechanisation and value-chain challenges within the broader Agricultural Knowledge and Innovation Systems (AKIS) context, highlighting the role of social learning, advisory capacity, farmer-to-farmer exchange and institutional coordination in enabling successful organic transitions. By explicitly addressing these systemic dimensions, the review aligns more closely with the objectives of OH-FINE, which seeks not only to curate technical knowledge, but to strengthen the pathways through which that knowledge is mobilised, adapted and embedded within diverse organic farming contexts.

3.1 EU agricultural support policies for organic farming

The results from the OH-FINE Knowledge Needs survey and subsequent Deliverable 2.5 showed that across all surveyed farms (conventional, in-conversion and post-conversion), the top ranked knowledge need was 'EU Policy/Subsidies' (average score of 4.6/5 in terms of importance to the 100+ farms surveyed). This is especially important for in-conversion farmers who expressed a high need for information on organic compliance supports (4.51) and EU policy/subsidies (4.72). This section of the literature review provides an overview of EU agricultural policy and support for organic farming. It also includes a specific section on organic standards and compliance. Together, these elucidate the background to the survey questions and farm responses.

Organic farming has received policy support at national level since the 1980s, with coordinated measures at EU level emerging in the early 1990s. Support instruments have included an EU-wide regulatory framework, agri-environment payments for conversion and ongoing organic management, rural development funding for marketing and processing, financial support for promotion, public procurement initiatives and investments in research, knowledge exchange and information activities (Lampkin, 2023). Over time, this policy portfolio has expanded to incorporate further rural development measures, enhanced promotion and research efforts, CAP Pillar I interventions and the adoption of organic action plans at regional, national and EU scales.

During the 2014–2020 CAP programming period, organic farming was formally recognised within the Rural Development framework. Its environmental performance was acknowledged through automatic eligibility for ‘Greening’ payments under CAP Pillar I. The publication of the European Green Deal in 2019 established a new overarching policy context for climate and environmental action, subsequently giving rise to the Farm to Fork and Biodiversity Strategies. These strategies introduced ambitious objectives, including the target that 25% of EU agricultural land should be farmed organically by 2030, alongside a substantial expansion of organic aquaculture (Lampkin et al., 2024). Building on this momentum, the EU Organic Action Plan adopted in 2021 called on Member States (MS), to develop national organic strategies aligned with the forthcoming CAP reform. Consequently, the policy framework supporting organic production has been further consolidated and reinforced under the CAP for the 2023–2027 period.

Broadly speaking, the EU policy framework for supporting organic sector development covers four main areas (Meredith et al., 2018):

1. Legally defined production and labelling rules: Based on the EU organic regulations and a widely recognised common (leaf) logo (Regulation (EU) 2018/848)
2. Supporting farmers financially (compensation for organic farm management, environment & animal welfare)
3. Production and supply chain development
4. Recognition of the contribution of organic farming to wider policy goals (e.g. biodiversity, soil health).

There are four main types of support available to farmers through EU policies and strategies (Red PAC, 2023):

1. Financial (e.g. subsidies for converting to organic and maintaining organic practices),
2. Technical and Knowledge exchange (e.g. farm advisory services and skills building),
3. Promotional (funding for marketing, promoting organic products and developing markets),
4. Research and Innovation (directing agri-research budgets to organic-related topics).

The principal source of CAP financing is the European Agricultural Fund for Rural Development (EAFRD). In addition, substantial earmarked resources from both the European Agricultural Guarantee Fund (EAGF) and the EAFRD are allocated to support the conversion to organic farming and the continued management of organic land (European Commission, 2022). Within the first pillar of the CAP, eco-schemes constitute a new form of direct payment designed to deliver benefits for the environment, climate mitigation and animal welfare and they represent a central component of the reformed CAP architecture. For the 2023–2027 programming period, at least 25 % of direct payments must be devoted to eco-schemes (European Commission, 2023).

Under the CAP regulatory framework for 2023–2027, Member States have the option to support organic conversion and maintenance either through a Pillar I eco-scheme (Article 31), which is entirely financed by the EAGF, or through Pillar II agri-environment-climate measures within Rural Development Programmes (Article 70), which combine EAFRD funding with national co-financing. As a result, the structure of financial support for organic farming differs across Member States. In some cases, conversion to organic production is incentivised through 'eco-schemes' under Pillar I, while payments for existing organic farms continue to be delivered through Pillar II measures, reflecting arrangements from earlier programming periods (European Commission, 2023). In other countries, support for organic conversion is provided through EAFRD-funded measures under Pillar II, with maintenance payments channelled through eco-schemes. A further group of Member States relies exclusively on either Pillar I or Pillar II instruments to finance both conversion and ongoing organic management.

Each Member State is required to define a set of eco-schemes aligned with its national environmental and climate priorities and farmer participation in these schemes remains voluntary. Compared with the Greening requirements applied under the 2014–2022 CAP, eco-schemes allow greater flexibility in both design and implementation (European Commission, 2023). This flexibility arises from the discretion granted to Member States to determine the content and budgetary allocation of individual schemes, provided they contribute to at least two of the environmental, climate or animal welfare objectives specified in the CAP Strategic Plan Regulation. Farmers may therefore choose the measures that best correspond to the characteristics and management objectives of their holdings.

By 2023, the majority of Member States had established national or regional Organic Action Plans (OAPs), which facilitate the coordination of supply-side instruments, such as area-based support payments, with demand-oriented measures focused on markets, information and awareness-raising. These plans support a more balanced alignment between the delivery of environmental public goods and the economic performance of the organic sector, as illustrated in Table 1 (Lampkin, 2022). Many relevant policy measures (including investment support for production and processing, producer organisations, advisory services, training initiatives and EIP operational groups) are financed through sectoral or rural development instruments, while others, such as public procurement, promotion and research, draw on separate EU or national funding programmes.

Table 1. Typical measures in national OAPs, by type and focus (Lampkin, 2022)

Focus	Supply push	Demand pull
Public Good	• Area support • Information, advice • Training, education • Professional events • Research, data	• Tax incentives (e.g. VAT) • Public events • School initiatives (farm visits, gardens, cooking)
Market	• Capital investments • Producer groups • Meet the buyer events • Supply hubs	• Organic regulations • Consumer promotion • Public procurement

Ongoing analysis (Lampkin & Rehburg, 2023) suggests the following in terms of organic farming support in the national CAP Strategic Plans (CSPs) for the 2023-2027 period, agreed between the European Commission and MS in 2022:

- All Member States have implemented policies to support conversion to and maintenance of organic farming
- All MS included detailed sections on organic farming in their CSPs, with details of planned payment rates, eligibility conditions, estimated uptake and expenditure
- All Member States have set targets for organic land area to be achieved by 2027 or 2030, in either their CAP Strategic Plans (CSPs) or national organic action plans (OAPs), or in a few cases separately
- MS have planned to double the land area supported from 5% to 10% of EU utilised agricultural area and to nearly double the expenditure on organic area support by 2027/8 compared with 2018.

It should be noted that although all MS have created CSPs and/or OAPs, some countries have not set ambitious enough targets to continue the further development of organic farming and may be insufficient to fairly contribute to the EU's overall 25% target for 2030 (IFOAM, 2022).

Table 2. Overview of key EU level and national level organic farming support policies

Key EU policies for organic farming	Description
CAP 2023- 2027	The Common Agricultural Policy (CAP) is the key EU policy that has contributed the most to supporting the development of organic farming in the EU. The CAP largely offers support for direct payments to farmers and measures regulating or supporting agricultural markets (Meredith et al., 2018). Under CAP, farm advisory services are strengthened, notably as part of Agricultural Knowledge and Innovation Systems (AKIS), to promote relevant knowledge exchange.
The Green Deal (2019)	The primary objective of the EU Green Deal is a sustainable, climate-neutral Europe by 2050. It emphasises the transition towards a more sustainable food system. In particular, it emphasises the strengthening of farmers' efforts to tackle climate change, protect the environment and preserve biodiversity.
Farm to Fork (2020)	A series of targets to enhance the sustainability of food production in the EU, including a 50% reduction in pesticide use, a 20% reduction in fertiliser use and a 25% target for the share of agricultural land to be managed organically.
Biodiversity Strategy 2030[1]	The EU's biodiversity strategy for 2030 is a comprehensive, ambitious and long-term plan to protect nature and reverse the degradation of ecosystems. The strategy aims to put Europe's biodiversity on a path to recovery by 2030 and contains specific actions and commitments. One of the key commitments in the plan is "at least 25% of agricultural land is under organic farming management and the uptake of agro-ecological practices is significantly increased" (European Commission, 2020) in line with other key EU agricultural policies.

[1] https://environment.ec.europa.eu/strategy/biodiversity-strategy-2030_en

Organic Action Plan (2021)[2]	The action plan aims to encourage a marked increase of the share of organic farming in the EU, through encouraging farmers to convert to organic farming and to expand the accessibility of organic food to close the gap between a business-as-usual growth curve and the "extra effort" necessary to reach a 25% target by 2030. It is broken into three interlinked axes that reflect the structure of the food supply chain and the Green Deal's sustainability objectives: 1. Demand and consumer trust 2. Stimulate conversion and refine the entire value chain 3. improve the contribution of organic farming to environmental sustainability. The EU action plans are focused on actions that can be taken by the European Commission. Regional /national plans should reflect local development needs and priorities.
Country-level policies	
CAP Strategic Plans	Alongside the EU's 25% share of agricultural land area by 2030 target, all MS have set national targets for share of land area to be managed organically. The European Commission set up the EU CAP Network in line with the Regulation of the European Parliament and of the Council to support CAP strategic plans. This includes a catalogue of CAP interventions extracted from Member States's CAP Strategic Plans[3]
National Organic Action Plans	Organic action plans (OAPs) are commonly used in Europe for coordinating public policies and private or voluntary-led initiatives in a framework, at different governance levels, local, national or European, to support the development of the organic sector. They are usually based on a partnership approach between the organic sector, policy makers and other stakeholders, with common objectives and actions for development, set out over a defined period of time (Meredith et al., 2018).

[2] https://agriculture.ec.europa.eu/farming/organic-farming/organic-action-plan_en

[3] https://eu-cap-network.ec.europa.eu/publications/catalogue-cap-interventions_en

3.1.1 Beyond financial support - other policy support for organic farming

ddd Although support for organic conversion and maintenance is the most visible and readily traceable element within CAP Strategic Plans (CSPs), organic producers may also access a wider range of policy instruments. Under Pillar I of the CAP, financed by the European Agricultural Guarantee Fund (EAGF), organic farmers are generally eligible for basic income support, coupled payments and specific schemes targeting young farmers or particular agricultural sectors. Pillar II, supported through the European Agricultural Fund for Rural Development (EAFRD), offers several additional measures that are relevant to organic production and may be adapted to reflect its specific characteristics, including payments for areas facing natural constraints (ANC) (Article 71), investment support (Articles 73 and 74) and risk management tools (Article 76).

CAP expenditure is therefore not limited to measures directly linked to organic conversion or ongoing organic management (Lampkin et al., 2024); a range of other interventions can influence organic farming either directly or indirectly. These include actions supporting knowledge exchange and innovation, sectoral programmes, farm advisory services, quality schemes for agricultural products and food (including information and promotion activities), investment aid, farm and business development measures, support for the establishment of producer groups and organisations, agri-environment-climate measures (AECMs), Natura 2000 and Water Framework Directive payments, ANC compensatory payments, animal welfare schemes and LEADER initiatives (European Commission, 2023).

In addition, organic farmers make extensive use of cooperation- and knowledge-based instruments, such as advisory services, European Innovation Partnership (EIP) operational groups, training activities and collaborative initiatives aimed at improving supply-chain coordination and strengthening sector capacity. These measures are widely recognised as critical for the advancement of organic food and farming systems and are prominently featured in many Member State OAPs. However, systematic data on historical uptake and explicit references to these instruments within CSPs remain limited (Lampkin et al., 2024).

Beyond the CAP framework, EU-level funding for organic farming is also provided through programmes dedicated to consumer promotion and research. According to the European Commission, more than €50 million was allocated to organic-specific research projects under the Horizon 2020 programme during the 2014 - 2020 period (DG AGRI, 2023b). Furthermore, within Horizon Europe, 30% of the budget for Cluster 6 - Intervention Area 3 (Agriculture, Forestry and Rural Areas) is earmarked for research that is either specifically focused on or highly relevant to organic farming systems (EU, 2021).

In 2025, the European Commission released the 'Strategy for Generational Renewal in Agriculture', which aims to double the share of young farmers in the EU by 2040, so that young and new farmers constitute about 24% of European farmers. While there is no specific focus on organic farming, it aims to “equip every new farmer with the skills needed to manage a modern, sustainable business” . In most countries, farms fully converted to organic farming or under conversion attracted younger farm managers compared to conventional farms. At EU level, around 21% of organic farms in 2020 had a manager aged under 40, while this proportion was only 12% in conventional farms (Eurostat, 2020).

3.1.2 Organic Standards and Compliance

As previously discussed, one of the core tenets of EU policy in relation to organic farming is the legally defined production and labelling rules (i.e. Regulation (EU) 2018/848). EU-level regulation of organic production and labelling was first established in 1991, marking the beginning of a harmonised framework for organic products across Member States. In 2023, the regulatory framework was updated with the implementation of revised provisions replacing Regulations (EC) No 834/2007 and 889/2008, alongside the full entry into force of Regulation (EU) 2018/848 of 30 May 2018. Together, these instruments set out the core standards governing organic production methods and the labelling of organic food within the European Union (Kononets et al., 2023). Regulation (EU) 2018/848 defines organic farming as a form of sustainable management (Article 5) and expands upon the objectives and principles previously outlined in Regulation (EC) No 834/2007 by providing greater clarity and specificity (Article 4). The revised framework also places stronger emphasis on animal welfare, introducing more detailed and stringent requirements in this area.

The organic certification system within the EU is founded on the verification of compliance with these regulatory standards, both at the point of initial certification and through mandatory annual inspections to maintain certification status (Kononets et al., 2023). Certification and control activities are carried out by accredited bodies, which may operate as independent third-party organisations or as public authorities designated by Member States. These control bodies are authorised to certify specific sectors of organic production, including crop and livestock farming, beekeeping, aquaculture and seaweed production, processing activities and the marketing of organic products. For example, in Poland, twelve certification bodies are currently authorised to operate within defined areas of organic production (Miśniakiewicz et al., 2021).

While third-party certification provides regulatory assurance, it also poses significant challenges, particularly for small-scale organic producers. Existing research highlights the financial burden and administrative complexity associated with certification requirements as major barriers to participation (Saachi et al., 2024), a concern that was also reflected in responses to the OH-FINE Knowledge Needs survey. In addition, the certification system has been criticised for contributing to the standardisation of organic practices, potentially leading to a process of “conventionalisation” within the organic sector (Iannucci & Sacchi, 2021). One notable innovation introduced under Regulation (EU) 2018/848 is the option of group certification through an Internal Control System (ICS), which allows groups of small operators to be certified collectively rather than individually (Saachi et al., 2024).

The introduction of group certification has the potential to lower entry barriers for smallholders by reducing costs and administrative demands that currently discourage participation in organic schemes. Moreover, ICS arrangements may strengthen cooperation among small-scale producers by simplifying procedures, enhancing transparency and fostering greater trust in organic systems, including among farmers who are initially sceptical in relation to organic conversion (Pinto et al., 2014). However, the effectiveness of group certification may be constrained by practical challenges such as ambiguity surrounding implementation rules, difficulties in establishing and managing producer groups, continued administrative burdens and limited farmer engagement with participatory governance approaches, all of which may affect the successful uptake of ICS schemes (Saachi et al., 2024).

3.1.3 Challenges facing agricultural support policies in the EU

European agricultural policy has been the subject of growing discontent among farmers, culminating in widespread protests across several Member States from 2023 onwards. In response, EU institutions moved rapidly to propose and adopt measures aimed at “simplifying” the Common Agricultural Policy (CAP), with the stated objective of reducing the administrative burden faced by farmers. Concerns regarding the complexity of organic regulation and certification and its influence on farmers’ decisions to convert to organic production, were also highlighted by respondents to the OH-FINE Knowledge Needs Survey conducted as part of Work Package (WP) 2.

However, critics contend that the practical outcome of this simplification agenda has been a dilution of environmental conditionality within the CAP, without offering meaningful new incentives for the uptake of more sustainable farming practices (IFOAM, 2024). While administrative complexity is widely acknowledged as a genuine problem, this approach has been criticised for lacking a coherent long-term vision for European agriculture, failing to address farmers’ underlying economic challenges and overlooking the structural drivers of the recent protests. Moreover, weakening the environmental ambition of the CAP may ultimately undermine farmers’ resilience by reducing incentives to adapt to the climatic and environmental pressures expected to intensify over the coming decades.

A number of challenges also arise from the current design of EU organic policy. In principle, payments supporting conversion to organic farming, which are calculated on an income-foregone basis, should exceed those for ongoing organic management, reflecting the higher costs and risks associated with the transition period. Although these additional conversion costs have been well documented in the literature (Lampkin & Padel, 1994), many Member States do not provide higher payments during conversion. As a result, conversion support often covers only a portion of the associated costs and income losses, functioning more as a mechanism for sharing risk rather than offering full compensation. Furthermore, while policy targets may not directly drive farm-level conversion decisions - since producers also respond to market conditions and other external factors - they nonetheless serve as important indicators of political commitment and play a key role in ensuring that sufficient resources are allocated to the sector, as reflected in Member State responses to EU organic targets (Lampkin, 2023).

In certain contexts, interactions between alternative support instruments - such as Pillar I eco-schemes and agri-environment-climate-animal welfare measures - may create competitive dynamics. For example, payments offered to non-organic farmers for measures such as reduced pesticide or fertiliser use can exceed those available to organic farmers, partly because organic price premiums are factored into income-foregone calculations. Similarly, non-organic producers may be able to combine several eco-schemes, such as restrictions on inputs and extensive grassland management, resulting in total payments that surpass those available under organic farming schemes, despite organic systems delivering comparable or greater environmental outcomes.

Conversely, there is concern that strong incentives for conversion to organic farming could lead to supply expanding more rapidly than market demand, potentially placing downward pressure on organic price premiums and threatening the economic viability of established organic producers (Lampkin, 2023). Additional concerns relate to substantial variations in support rates between and within Member States, particularly where highly differentiated payments are applied across crop and livestock categories, which may distort competition within the internal market.

Finally, in most Member States, payments for organic maintenance are applied as flat-rate schemes that do not reflect differences in environmental performance at the farm level. Empirical evidence indicates that, while organic farming generally delivers superior environmental outcomes on average, performance varies considerably among individual farms (Sanders & Heß, 2019). Introducing more targeted and differentiated payment structures could therefore allow higher-performing farms to be rewarded more appropriately, in line with the principle of providing public funding in return for demonstrable public goods.

3.2 Crop Management and Diversity

The topics of crop management and diversity represent a core technical knowledge domain for the development and long-term sustainability of organic farming systems in Europe. Within the OH-FINE case study sample, cropping and mixed farming systems are particularly prevalent in Spain, Poland and Lithuania, while livestock-dominated systems in Ireland and Bulgaria also rely critically on effective crop and forage management to maintain soil fertility and system resilience. Even in contexts where on-farm cropping is limited, as is the case for many livestock-oriented farms, there is a direct dependence on imported organic supplementary feed (particularly concentrate feeds used alongside grass and forage crops). This creates an indirect but significant reliance on crop production systems, crop management knowledge and associated technologies beyond the farm gate.

As such, crop-related knowledge needs intersect strongly with economic viability, environmental performance and system integration objectives across all partner countries. Results from the OH-FINE baseline analyses (Deliverables 2.2 and 2.5) and the complementary economic competitiveness analysis (Deliverable 2.4) indicate tha, beyond policy and compliance-related information, farmers within the OH-FINE project consistently prioritise practical knowledge on soil management, crop rotation, organic weed control and diversification strategies. These needs are most pronounced among in-conversion and post-conversion organic farmers as yield stability, input substitution and market performance become increasingly important once regulatory compliance has been achieved.

3.2.1 Crop Management Knowledge Needs Across Farm Types

Findings from Deliverable 2.5 show that soil and pest management constitute the most widely shared technological knowledge needs across all farm categories (conventional, in-conversion and post-conversion). Conventional farms participating in OH-FINE, many of which are actively exploring organic conversion, expressed particularly strong interest in soil health management, pest control strategies, market information and reduced tillage systems. This suggests a readiness to adopt organic-compatible technologies under supportive advisory and policy frameworks (reflection of the profile of producers selected to participate in OH-FINE and their willingness to engage in the project and organic subject areas – Deliverable 2.2).

In-conversion organic farms reported heightened demand for training related to soil fertility management, compost and manure use and integrated crop livestock systems. These farms also identified crop rotation design and weed management as critical challenges during the transition phase, reflecting the need to replace synthetic inputs with biologically based fertility and control strategies while striving to maintain productivity (Lampkin et al., 2015; Peigné et al., 2016).

Post-conversion organic farms, while continuing to rank compliance and policy support highly, showed increased concern with economic performance, market access and crop diversity. This shift highlights a transition from regulatory learning towards optimisation of production systems and value creation once organic certification has been secured (Padel, 2008).

3.2.2 Crop Diversity, Rotation and Soil Fertility

Evidence from the producer profile analysis presented in Annex A, together with findings from the OH-FINE economic competitiveness analysis (Deliverable 2.4), confirms that cereals (C) and protein crops (P) constitute the core of cropping systems across the OH-FINE case study farms in all partner countries. However, substantial between-country variation is evident in the diversity, balance and functional role of crops within farm systems.

Case-study farms in Poland and Lithuania exhibit the highest levels of crop diversity, characterised by a more balanced mix of cereals, protein crops, forage crops and cover crops. This reflects the greater prevalence of arable and mixed farming systems in the case study farm profiles for both regsions (not nationally representative) (Annex A). The Spanish farms also display relatively diversified cropping systems, frequently combining arable cropping with horticultural enterprises or mixed production models. In contrast, farms in Ireland and Bulgaria show lower cropping diversity, a pattern closely associated with the dominance of livestock-based systems, higher reliance on permanent grassland and, in some cases, smaller effective cropped areas.

Although horticultural production remains limited across the overall sample, it is most evident on the Polish farms, where it contributes to greater system diversification and market orientation. These structural differences in crop systems are directly relevant to the identification of crop management knowledge needs, as more diverse systems typically require more complex rotation planning, nutrient management strategies and agronomic decision-making (Watson et al., 2002).

Nutrient balance analyses further underline the importance of crop management and diversity as foundational elements of organic system performance. Research presented in Deliverable 2.4 indicates that organic farms particularly mixed and livestock-oriented systems generally maintain positive organic matter balances, supporting long-term soil health and system resilience. At the same time, organic systems may face phosphorus and potassium deficits over time, especially in stockless arable systems, while conventional farms more frequently exhibit nitrogen and potassium surpluses, posing risks to soil and water quality (Feledyn-Szewczyk & Kopiński, 2024).

These findings highlight the central role of rotation design, legume integration and access to appropriate organic nutrient sources in sustaining productivity within organic cropping systems.

Insights from the OK-Net Arable project reinforce these conclusions, highlighting how well-designed crop rotations particularly those incorporating both annual and perennial legumes can enhance nitrogen supply, improve soil structure and stabilise yields (Melander et al., 2016). However, despite the availability of robust scientific evidence, the uptake of best practices remains uneven. Economic constraints, operational challenges and knowledge gaps continue to limit adoption, underscoring the need for targeted advisory support, farmer-friendly decision tools and peer-to-peer learning mechanisms.

Taken together, the producer profile analysis (Annex A), the competitiveness assessment (D2.4) and findings from OK-Net Arable provide a coherent evidence base demonstrating that crop management and diversity are central leverage points for improving the productivity, resilience and sustainability of organic farming systems, particularly in countries where cropping and mixed systems play a dominant role.

3.2.3 Yield gaps and productivity challenges in organic crop systems

A consistent concern across the literature and strongly reflected in OH-FINE survey responses, particularly among the Polish cohort of case study farms is the perceived yield gap between organic and conventional cropping systems. Findings from Deliverable 2.4 indicate that yield stability and competitiveness remain a central constraint for organic arable and mixed farms, especially in regions where conventional systems achieve relatively high baseline yields and where organic conversion is associated with short-term productivity risks.

Meta-analytical evidence provides important context for interpreting these perceptions. A comprehensive synthesis by de Ponti et al. (2012), drawing on over 360 organic conventional yield comparisons, estimates that organic crop yields average approximately 80% of conventional yields, implying a mean yield gap of around 20%, though with substantial variation by crop type, region and management intensity.

Similarly, Ponisio et al. (2015), using a larger and more robust hierarchical meta-dataset, report an average yield gap of 19.2%, but demonstrate that this gap can be substantially reduced - to below 10% when diversification practices such as crop rotations and multi-cropping are implemented within organic systems.

Crucially, both studies highlight that yield gaps are not inherent to organic farming per se, but are strongly mediated by management practices, system design and nutrient availability. Evidence suggests that under favourable soil and climatic conditions, yield gaps may widen if best organic practices particularly those related to rotation design, legume integration and soil fertility management are not fully applied. This aligns with findings from the OH-FINE competitiveness analysis (D2.4), which shows that case-study farms with more diversified rotations and access to organic nutrient sources tend to achieve stronger yield performance and more favourable organic matter balances, while dedicated arable systems (stockless) are more vulnerable to phosphorus and potassium deficits over time. The EU OK-Net Arable project further reinforces these insights, highlighting that well-designed rotations incorporating annual and perennial legumes can significantly enhance nitrogen supply, improve soil structure and stabilise yields.

From an OH-FINE perspective, these findings underscore the importance of closely monitoring and integrating results from ongoing EU research initiatives aimed at narrowing organic yield gaps, while simultaneously strengthening advisory capacity and farmer-to-farmer knowledge exchange. Addressing yield concerns is important not only to improving farm-level competitiveness but also to supporting wider organic sector expansion in line with emerging (and re-emerging) EU Common Agricultural Policy (CAP) and broader agri-food strategy priorities including food security.

3.2.4 Tillage, Weed, Pest and Disease Management

Across the OH-FINE partner countries, conventional tillage systems, typically involving mouldboard ploughing followed by disc harrowing and secondary cultivation remain the dominant approaches used in organic production. While reduced tillage and direct seeding systems are emerging on case-study farms in some regions, particularly Spain and Poland, their uptake within organic systems remains limited. This is consistent with findings within the literature, which highlight weed pressure and yield stability as persistent constraints for reduced tillage, especially in the absence of well-adapted system re-design including reduced tillage methods (e.g. Peigné et al., 2016).

Precision agriculture and robotic technologies are increasingly cited as offering significant potential to improve weed control efficiency in organic systems, particularly through site-specific interventions and reduced labour requirements (Lati et al., 2021). However, a persistent technology gap remains, reflecting the historical focus of agricultural engineering innovation on conventional farming systems. As a result, many emerging tools remain poorly adapted to the agronomic, operational and economic realities of organic production.

Disease and pest management in organic arable systems remains predominantly preventive in nature. Core strategies include the use of resistant or tolerant crop varieties, diversified rotations, soil health management and habitat-based approaches to pest regulation. While these strategies are effective across a wide range of crops, persistent challenges remain for specific systems, such as late blight in potatoes and pest pressures in oilseed rape. The literature highlights these as areas where existing organic compliant solutions are either limited or highly context-dependent (Finckh et al., 2021). Overall, continued applied research and strengthened farmer–researcher collaborations are identified as critical to translating scientific advances into practical, system-adapted innovation.

3.2.5 Implications for Knowledge Exchange and Advisory Support

Taken together, the evidence from OH-FINE Deliverables 2.4 and 2.5, alongside synthesis outputs from the EUOK-Net Arable project, underscores that crop management and diversity in organic and low-input systems are highly knowledge intensive domains, requiring continuous learning, local adaptation and sustained advisory support. While the scientific evidence base is extensive, its translation into farmer-friendly decision-support tools, practice abstracts and advisory materials remains uneven across regions and production contexts (Ingram, 2018).

The literature consistently indicates that key knowledge gaps relate less to the absence of research than to challenges surrounding the accessibility, contextualisation and practical application of existing knowledge at farm level (Klerkx et al., 2012; Rose et al., 2016). In organic systems, where management outcomes are strongly shaped by local soil, climate and rotation design, generic recommendations often have limited applicability without adaptive interpretation by farmers and advisors.

This reinforces the importance of interactive knowledge exchange mechanisms, including farmer-to-farmer learning, on farm experimentation and participatory innovation approaches. Such mechanisms are widely recognised as effective in supporting complex system transitions and are central to the design of the OH-FINE project. These approaches support experiential learning, peer validation and the co-creation of solutions that are more readily adopted in practice (EU SCAR AKIS, 2019).

Accordingly, crop management and diversity represent priority domains for knowledge synthesis and dissemination within the OH-FINE platform. This is particularly relevant for arable-dominant regions such as Spain, Poland and Lithuania, while also offering significant relevance for mixed and livestock-based systems seeking to enhance crop integration, soil health and overall system resilience through improved rotational design and agronomic decision making.

3.3 Livestock Systems and Animal Health

Analysis of the OH-FINE case study farm profiles (Annex A) indicates that livestock production systems represent a substantial share of the sample, with clear between-country differentiation in system types. Livestock-only systems dominate the sample of case-study farms in Ireland and Bulgaria, reflecting the prevalence of grass-based production in Ireland and more extensive livestock systems in Bulgaria. In contrast, mixed (crops and livestock) systems are most common in Poland and Spain, supporting a greater degree of on farm integration between cropping and livestock enterprises. A significant proportion of farms in Lithuania and Spain report no livestock activity, aligning with predominantly cropping based production systems.

Across those farms that operate livestock enterprises, ruminant production systems clearly dominate, with bovine systems particularly beef and dairy being the most prevalent. Beef production is the most widespread enterprise across the farms in all partner countries, while dairy systems are concentrated primarily in Ireland, Bulgaria and Poland. While sheep enterprises are present across all countries (except Lithuania), they are fewer in number, while horse, poultry and goat enterprises are limited to a small number of cases.

This concentration of ruminant systems and bovine systems in particular, justifies a targeted focus within OH-FINE on grass-based beef and dairy production systems. These systems are central not only to farm income and rural livelihoods in several partner countries, but also to wider policy debates related to greenhouse gas emissions, nutrient management and crop livestock integration as well as climate mitigation (Gerber et al., 2013; Herrero et al., 2016). Ruminant livestock systems account for a substantial share of agricultural greenhouse gas emissions globally, while simultaneously playing a key role in land use, nutrient cycling and the utilisation of grassland resources that are unsuitable for cropping (FAO, 2018).

Evidence from the farm-level modelling literature further confirms that pasture-based ruminant systems are among the most intensively studied livestock systems in terms of both economic and environmental performance, reflecting their scale, heterogeneity and policy relevance (Reidsma et al., 2018; O’Donoghue et al., 2024). These characteristics make grass-based beef and dairy systems a critical focus for research examining sustainability trade-offs, management innovation and the effectiveness of policy interventions in organic and low-input farming contexts.

3.3.1 Dominance of Grass Based Ruminant Systems

The prevalence of grass based ruminant systems in the OH-FINE sample mirrors national production patterns, particularly in Ireland, where beef and dairy systems are strongly pasture oriented. Grass based systems are also prominent in Bulgaria and Poland, albeit with greater heterogeneity in management intensity and integration with cropping activities. These systems rely heavily on effective pasture management, forage quality and seasonal grazing strategies to sustain productivity while maintaining compliance with organic standards (Shalloo et al., 2018; Reganold & Wachter, 2016).

From a sustainability perspective, grass based ruminant systems represent both an opportunity and a challenge. On the one hand, they offer potential advantages in terms of feed self-sufficiency, reduced reliance on purchased in concentrate and enhanced soil carbon sequestration through permanent grassland and well managed forage systems (Gattinger et al., 2012; Lal, 2016). On the other hand, their contribution to agricultural greenhouse gas emissions, particularly methane emissions from enteric fermentation, places ruminant agriculture at the centre of climate policy debates. This is especially the case in countries such as Ireland, where livestock production dominates the agricultural sector, output is export-oriented and ruminant systems account for a large share of the national emissions profile (Gerber et al., 2013; Herrero et al., 2016).

These characteristics underline why grass-based ruminant systems constitute a critical focal point for sustainability-oriented research and policy within the OH-FINE project. Understanding how management practices, feeding strategies and system design (including potential for great crop livestock integration) influence both economic performance and environmental outcomes. These are essential to informing effective mitigation pathways that are compatible with organic and low input farming principles.

3.3.2 Grazing Management and Pasture Utilisation

Statistical analysis of survey data from casestudy farms collected in Deliverable 2.4 indicates that rotational grazing is the dominant grazing system in Ireland and Poland and is also widely used in Bulgaria. In contrast, Lithuania relies more heavily on continuous grazing systems, reflecting differences in farm structure, herd size and advisory traditions. Regenerative grazing practices are considerably less widespread and are reported primarily in Spain, where a subset of livestock farmers haveadopted more experimental or adaptive grazing approaches.

Across the literature, grazing management is consistently identified as a critical determinant of both economic and environmental performance in organic ruminant systems. Effective rotational grazing improves pasture utilisation, supports animal nutrition and contributes to improved nutrient cycling and soil structure particularly in grass-based systems (Teague et al., 2011; Murphy et al., 2019). Evidence from organic beef and dairy benchmarking research in Ireland suggests that well managed grass-based systems can achieve competitive economic performance relative to conventional systems, particularly where feed costs are controlled and pasture utilisation is optimised (Shalloo et al., 2018; Buckley et al., 2018; Chase et al., 2024).

Despite this, Deliverable 2.5 indicates that pasture management knowledge remains a priority innovation need among farmers, particularly those undergoing conversion. This reflects the technical complexity of matching grazing intensity, stocking rates and forage availability under organic constraints, as well as the labour and management demands associated with rotational systems. The literature highlights that without adequate advisory support and practical learning opportunities, the adoption and effective implementation of improved grazing strategies can remain limited, even where their benefits are well established (Klerkx et al., 2012; Ingram, 2018).

3.3.3 Animal Health, Veterinary Care and Antibiotic Use

Animal health and organic-compliant veterinary care emerge as central knowledge needs across the livestock-based OH FINE case study farms. Organic farming regulations prohibit the preventative use of antibiotics, allowing their use only when necessary, under veterinary supervision and subject to strict limitations on treatment frequency and drug withdrawal periods. This regulatory framework places a strong emphasis on preventative animal health strategies, including nutrition, housing, hygiene, grazing management and breeding for positive health traits (Sanders & Hess, 2019; Finckh et al., 2021).

OH-FINE survey results (D2.4) indicate marked between-country differences in antibiotic use. The majority of case-study farmers in Spain and Ireland report having used antibiotics, while most farmers in Bulgaria, Lithuania and Poland report no antibiotic use. Among those who use antibiotics, therapeutic use is universal across all countries, while metaphylactic and prophylactic use is limited and reported only in Spain, Ireland and Poland, involving a small share of users. These findings are consistent with wider European evidence indicating that antibiotic use in organic livestock systems is generally lower than in conventional systems but varies significantly by enterprise type and management intensity (Vaarst et al., 2006; Spoolder et al., 2017).

Observed differences in antibiotic use reflect differences in herd size, system intensity, veterinary access and disease pressure across countries and production systems. In more intensive dairy systems, particularly those with higher metabolic demands, maintaining animal health under reduced veterinary intervention presents additional challenges. The organic livestock literature emphasises that effective disease prevention under such conditions requires high levels of stockmanship, early disease detection, robust nutritional management and close alignment between grazing strategy and animal physiological needs (Vaarst & Alrøe, 2012; Rutherford et al., 2013).

Taken together, these findings highlight animal health management as a knowledge intensive domain within organic livestock systems, where outcomes depend less on reactive intervention and more on whole system management and farmer skills. Strengthening advisory support and peer-to-peer learning around preventative health strategies is therefore critical to maintaining animal welfare, reducing reliance on antibiotics and supporting the long-term sustainability of organic beef and dairy systems

3.3.4 Livestock Nutrition and Crop–Livestock Integration

Livestock nutrition and feed planning are repeatedly highlighted in Deliverable 2.5 as priority knowledge needs, particularly for in-conversion farmers. While pasture-based feeding systems form the backbone of organic ruminant production across participating OH-FINE farms, reliance on supplementary organic concentrates feed is important in many systems, creating both economic and logistical challenges. This reliance creates both economic pressures—given higher organic feed costs and logistical challenges related to availability and supply chain reliability (Haas et al., 2001; Sanders & Hess, 2019; Wilkinson & Lee, 2018).

Crop livestock integration, pasture establishment and low tillage methods appear as medium level priorities in the technological needs survey results (D2.5). Their positioning reflects the fact that while these practices are recognised as important, they are often constrained by farm structure, land availability and existing system design. In mixed systems, particularly those prevalent in Poland and Spain, greater integration between cropping and livestock enterprises offers clear potential to enhance internal nutrient flows, reduce dependency on external feed and fertiliser inputs and improve overall system efficiency (Wilkins, 2008; Bell et al., 2014

In contrast, livestock-only systems, such as those dominating in Ireland and Bulgaria, face greater challenges in closing nutrient loops due to limited access to on-farm cropping. In these systems, maintaining nutrient balance and feed self-sufficiency relies more heavily on effective pasture management, manure handling and strategic feed planning, increasing the importance of advisory support and system-level coordination (Lemaire et al., 2014).

Evidence from organic dairy and beef studies suggests that improved integration between forage production, grazing management and manure utilisation can enhance both economic resilience and environmental performance. However, the successful implementation of such integrated approaches typically requires coordinated advisory input, long-term system planning and farmer learning to align biological processes with economic objectives (Vaarst & Alrøe, 2012; Reganold & Wachter, 2016).

3.3.5 Technology Adoption and Labour Efficiency

The attractiveness and long-term viability of organic livestock systems are increasingly shaped by labour requirements and workload management, particularly in dairy based ruminant systems where daily management intensity can be high. Findings from Deliverable 2.5 highlight strong farmer interest in labour-saving technologies, including GPS collars, virtual fencing and other digital decision-support tools. These technologies are increasingly viewed as potential enablers of more flexible grazing management, reduced labour input and improved work–life balance (Eastwood et al., 2017; Beeken et al., 2021).

Digital and precision technologies have the potential to support more adaptive pasture utilisation by facilitating real-time monitoring of animal location, grazing pressure and forage availability. In organic systems, where management flexibility rather than input substitution is central to performance, such tools may offer particular value by supporting management intensity without proportional increases in labour demand (Rose et al., 2016).

Ireland, as an example, benefits from relatively strong institutional support structures, including advisory and research capacity and state support for capital investment in precision and organic-specific technologies, notably through schemes such as the Targeted Agricultural Modernisation Scheme (TAMS). These supports position Ireland well to test, adapt and disseminate emerging technologies within organic and grass-based livestock systems. However, adoption remains uneven across partner countries, reflecting differences in capital availability, farm scale, infrastructure and levels of digital readiness (D2.4). The literature consistently highlights that technology uptake in livestock systems is mediated not only by economic feasibility, but also by farmer skills, advisory support and perceived compatibility with existing production systems (Klerkx et al., 2012; Ingram, 2018).

Taken together, these findings suggest that while digital technologies offer promising opportunities to improve labour efficiency and management flexibility in organic livestock systems, their effective deployment depends on targeted advisory support, appropriate financial incentives and system-specific adaptation to ensure alignment with organic production principles

3.3.6 Implications for Knowledge Exchange and Advisory Support with OH FINE

The dominance of grass-based ruminant systems across the OH-FINE sample, combined with the complexity of animal health, nutrition and grazing management under organic constraints, underscores the need for targeted, system specific advisory support. Livestock related knowledge needs are particularly pronounced in Ireland, Bulgaria and Poland, where beef and dairy systems play a central role in farm income and environmental performance.

The evidence indicates that effective advisory support must extend beyond regulatory compliance to address whole-system management challenges. This includes the integration of pasture utilisation, animal health and welfare, nutrition and labour efficiency within a coherent system design. Such an approach aligns with the broader literature on agricultural innovation systems, which emphasises that complex production systems require interactive, adaptive forms of knowledge exchange rather than linear transfer of technical information (Sutherland et al., 2017; EU SCAR AKIS, 2019)

Strengthening farmer-to-farmer learning, demonstration farms and applied research focused on organic ruminant systems is therefore critical to supporting both farm-level resilience and wider organic sector expansion. Participatory approaches that enable farmers, advisors and researchers to co-develop and test solutions under real-world conditions are particularly effective in addressing context-specific challenges and accelerating the uptake of best practices (Vaarst & Alrøe, 2012; Sutherland et al., 2017).

Within the OH-FINE framework, these findings reinforce the importance of investing in knowledge synthesis, practical decision-support tools and peer-based learning mechanisms that are tailored to grass-based beef and dairy systems. Such targeted support will be essential to enabling sustainable system transitions and ensuring that organic livestock systems can meet economic, environmental and animal welfare objectives simultaneously.

3.4 Technology, Mechanisation and Digitalisation in Organic Farming Systems

Mechanisation and digitalisation are increasingly central to the competitiveness and resilience of European agriculture. However, in organic systems, the role of technology differs in important ways from conventional farming contexts. Organic farming is often more labour and management intensive because synthetic inputs are restricted and replaced by practices such as mechanical weed control, more complex rotations, enhanced monitoring and preventive animal health strategies. As a result, technologies that reduce labour demand, improve timeliness of operations and support decision-making and compliance can have high value in organic systems (Padel & Lampkin, 1994; Sørensen et al., 2005).

Findings from Deliverable 2.5 confirm strong farmer interest across the OH-FINE partner countries in machinery, technology and agricultural digitalisation, while also highlighting persistent constraints. In all partner countries, high machinery and equipment costs represent the dominant barrier to mechanisation. Limited knowledge and training is reported as a secondary barrier (more pronounced in Bulgaria and Lithuania), while difficulties adapting available machinery to the type of farm or crop are especially relevant in Bulgaria and Spain. These barriers are highly consistent with wider evidence on precision agriculture and smart farming adoption, where investment costs, skills, inter-operability and uncertainty about economic returns remain central constraints (Kutter et al., 2011; Tey & Brindal, 2012; Lowenberg-DeBoer, 2019; Balafoutis et al., 2020).

A key implication emerging from the synthesis of D2.5 findings and supporting literature is that mechanisation and digitalisation within OH-FINE should be framed not as a generic modernisation agenda, but as an organic-specific innovation domain focused on technologies that enable organic agronomy and livestock management under input constraints, improve labour efficiency and support cost-effective adoption.

3.4.1 Organic-Specific Mechanisation Needs: Timeliness, Weed Control and Labour Substitution

Deliverable 2.5 shows that farmers prioritise practical agronomic knowledge gaps that are directly linked to mechanisation choices in organic systems, particularly pest and disease management, soil fertility without synthetic inputs and designing efficient crop rotations and mixed systems adapted to local agroecological conditions. In organic arable and mixed systems, machinery plays a central role in enabling timely field operations (e.g., stale seedbeds, inter-row cultivation, mechanical weeding) and managing the labour burden associated with weed pressure.

This aligns with evidence that conversion to organic farming is frequently associated with increased labour and machinery requirements due to additional monitoring, more diverse rotations and mechanical weed control (MacRae et al., 1990; Sørensen et al., 2005; Melander et al., 2016).

Sørensen et al. (2005) further highlight that farm-level labour and machinery demand during transition is highly system-specific and depends on crop mix, specialisation and mechanisation levels reinforcing the need for advisory tools that quantify technology and labour implications for different organic farm types and cropping systems.

3.4.2 Investment, Cost–Benefit and Access - The Main Constraint to Organic Mechanisation

Across the partner countries, Deliverable 2.5 identifies initial capital investment as the primary barrier to mechanisation, particularly on Lithuanian and Polish farms. While investment costs are also a major constraint on Bulgarian and Spanish farms, machinery maintenance costs emerge as a more prominent concern in these countries. These findings mirror broader EU evidence that adoption of precision and advanced machinery is strongly mediated by farm size, access to finance, support cycles and perceived cost to benefit ratios and relative contribution to profitability (Kutter et al., 2011; Tey & Brindal, 2012; Lowenberg-DeBoer, 2019).

For organic farms, the cost–benefit challenges associated with increased mechanisation can be more acute. Many relevant technologies such as specialist mechanical weeders, inter-row cultivation tools, camera-guided hoes and emerging robotic weeders - are highly system- or crop-specific, often exhibit lower annual utilisation rates on smaller or more diverse farms and require substantial operator skill to realise their potential benefits. Empirical studies of organic and low-input systems show that these characteristics can significantly affect both the economic viability and adoption likelihood of such technologies, particularly where learning costs and operational risks are high (Sørensen et al., 2005; Finger et al., 2019).

This research evidence reinforces the D2.5 recommendation that advisors and producers require clearer guidance on available mechanisation options, funding routes and transparent, system-specific cost–benefit assessments. Demonstrations, peer-to-peer learning and advisory support that explicitly address utilisation rates, learning requirements and economic risk are therefore critical to supporting informed investment decisions in organic farming contexts.

3.4.3 Digital Tools in Organic Systems - Compliance, Decision Support and Input Efficiency

Deliverable 2.5 indicates that the use of digital tools in farm management is most widespread on farms in Ireland and Spain, moderate in Bulgaria and less frequent in Lithuania and Poland. Across all countries, however, a sizeable minority of farms report little or no use of digital tools in day-to-day management. This pattern is consistent with broader EU evidence showing uneven adoption of digital and precision agriculture technologies across Member States (European Commission, 2023; Balafoutis et al., 2020). Where digitalisation is present, commonly used applications include farm management software, GPS guidance systems and digital record-keeping tools (Rose et al., 2016; Pierpaoli et al., 2013). These technologies are particularly valuable in organic systems, where certification, traceability and inspection requirements increase administrative and information-management demands (Padel & Lampkin, 1994; Sanders & Hess, 2019).

Beyond these commonly adopted applications, the findings of Deliverable 2.5 highlight clear national differences in the uptake of more specialised digital tools. Irish farmers frequently report the use of weather forecasting and pest or disease alert applications, Spanish farmers make greater use of digital irrigation control, GIS-based tools and e-commerce platforms, while Bulgarian farmers reference soil moisture sensors, drones and livestock tracking technologies. This pattern reflects differences in production systems, climatic conditions, infrastructure and advisory traditions across countries.

The wider ‘smart farming’ literature conceptualises digitalisation not as a single technology, but as a combination of farm management information systems (FMIS), precision technologies (such as GPS guidance and sensors) and automation or robotics. Adoption of these tools is consistently shown to be constrained by factors including digital skills, inter-operability between systems, uncertainty regarding economic returns and the availability of advisory support (Rose et al., 2016; Balafoutis et al., 2020; Lowenberg-DeBoer, 2019).

In organic farming contexts, these constraints can be more pronounced. Decision-support tools must be compatible with organic agronomic practices, capable of handling diverse rotations and mixed systems and sufficiently flexible to operate at smaller scales. Deliverable 2.5 highlights that, in Spain in particular, case-study farmers perceive a mismatch between available digital tools and the specific characteristics of their farms or crops. This underscores the need for better adaptation of digital solutions to organic systems and for advisory support that helps farmers assess the practical relevance and cost-effectiveness of digital tools under organic production conditions.

3.4.4 Digitalisation and Mechanisation in Organic Livestock Systems - Monitoring and Labour Efficiency

For livestock-oriented organic farms (notably Ireland, Bulgaria and Poland), D2.5 highlights interest in labour-saving tools such as GPS tracking collars and related technologies. In grass-based systems, these tools can complement grazing management by improving monitoring efficiency and enabling more adaptive pasture use. However, the benefits depend on connectivity, farmer digital readiness and system fit - echoing wider findings that digital uptake requires advisory support and confidence in practical value (Rose et al., 2016; Lowenberg-DeBoer, 2019).

3.4.5 Links to Efficiency and System Performance in Organic Transition

A recurring theme across Deliverable 2.5 is that technology adoption in organic systems is not solely a mechanisation issue, but a pathway to improving overall system performance under organic constraints. This interpretation aligns with empirical evidence showing that conversion to organic farming can affect technical efficiency and productivity, with outcomes varying significantly by farm type, management capacity and technology choice (Latruffe & Nauges, 2014). More recent research on intensive and extensive technology pathways in European dairy systems further reinforces the importance of aligning technology choice and system intensity with farm objectives and resource constraints when assessing performance outcomes (Latruffe et al., 2023).

From an OH-FINE perspective, these findings support a knowledge transfer framework in which mechanisation and digitalisation are positioned as management enablers improving timeliness of operations, reducing labour bottlenecks and supporting monitoring and decision-making - rather than as simple indicators of increased machinery intensity.

3.4.6 Implications for OH-FINE Knowledge Exchange and Innovation Support

Deliverable 2.5 indicates that accelerating the adoption of organic-appropriate mechanisation and digital technologies requires more than awareness-raising alone. Instead, it highlights the need for:

- clear technology option maps (what exists, what fits which organic systems and why)
- credible cost–benefit evidence, including organic-specific labour substitution impacts
- training in digital literacy and data interpretation and
- demonstration and peer-learning formats that build farmer confidence and practical capability.

These requirements align closely with D2.5 recommendations for field demonstrations, producer experience-sharing sessions (notably in Ireland and Spain) and targeted capacity-building programmes. They also point to an applied innovation role for OH-FINE in facilitating dialogue between farmers, advisors, researchers and agri-technology providers to improve the fit of machinery and digital tools to organic and small-scale farming contexts.

In this regard, there is clear value in linking OH-FINE knowledge-exchange activities with existing applied innovation initiatives, such as European Innovation Partnership (EIP) operational groups that are actively addressing mechanisation barriers in organic systems. For example, the Organic Tillage & Vegetables Integrated Weed Management (OTV-IWM) EIP in Ireland focuses on the collective testing and demonstration of innovative mechanical and thermal weed-control technologies across groups of organic farms. Strengthening communication and exploring complementarities with such initiatives would allow OH-FINE to amplify practical learning, avoid duplication of effort and support wider dissemination of proven, fit-for-purpose technologies.

3.5 On-Farm Processing and Adding Value to Products

The analysis undertaken in OH-FINE Deliverables 2.4 and 2.5 indicates that value chain integration including on-farm processing, direct marketing, cooperative action and premium branding remain a persistent bottleneck for the economic viability of organic farms across the case study regions. While many farms have successfully achieved organic compliance at the production stage, their capacity to retain value beyond the farm gate is uneven and frequently constrained by structural factors. These include market power imbalances, limited access to processing infrastructure, weak collective organisation and high regulatory and administrative burdens associated with small-scale food processing. Similar constraints have been widely documented in the organic and agri-food economics literature, which highlights that value capture is often determined more by downstream coordination and governance than by on-farm productivity alone (Barrett et al., 2022; Renting et al., 2012).

These challenges are increasingly recognised in wider EU synthesis work, which emphasises that achieving the Farm-to-Fork and organic expansion targets requires a balanced upscaling of both production and consumption, supported by coordinated value chain development rather than production-focused measures alone. In this context, processors, retailers, public procurement mechanisms and value-chain-capable Agricultural Knowledge and Innovation Systems (AKIS) are identified as essential enablers of organic sector growth, alongside primary producers (Daugbjerg & Schvartzman, 2022; Darnhofer et al., 2019).

A cross-cutting insight from Delphi expert interviews undertaken as part of the EU OrganicTargets4EU project shows that downstream actors consistently highlight the need for stronger upstream - downstream linkages. Secure market outlets, fair trading relations and coordinated value chain strategies are viewed as critical for encouraging organic expansion and stabilising producer incomes. Experts point to a portfolio of complementary mechanisms - including longer-term contracts, stronger producer inclusion in value chains, the development of short supply chains and targeted public and private funding as levers to support investment in value-added activities. These findings align with broader evidence that coordinated value-chain governance is central to reducing risk and enabling investment in differentiated agri-food products (Jahrl et al., 2016; Lučzka et al., 2021).

3.5.1 Structural Constraints to Value Capture - Market Power, Scale and Governance

Deliverable 2.4 highlights that access to markets is frequently constrained by the growing dominance of large retail chains and by the difficulty facing small farms in meeting standardisation, consistency and volume requirements. These conditions often push organic producers towards selling raw materials with limited bargaining power, thereby capturing only a small share of final consumer value. Such asymmetries in market power and coordination are well documented in agri-food supply chain research, particularly in relation to small-scale and differentiated producers (Swinnen & Vandeplas, 2014; Bijman et al., 2012).

In Bulgaria, these challenges are compounded by long-standing weaknesses in cooperative governance and trust, including hierarchical management structures, low member participation and limited accountability (Sarov, 2021; Nikolova, 2020). In such contexts, farmers face limited opportunities to coordinate supply, invest jointly in processing infrastructure, or negotiate stable contractual arrangements, reinforcing dependence on intermediaries.

OrganicTargets4EU similarly underscores that cooperation and coordination across value chains are frequently missing in countries where organic sectors are less mature. Power imbalances particularly between retailers or large processors and upstream suppliers can weaken producer organisations and constrain farmers' ability to capture added value. Conversely, evidence from more developed organic markets illustrates how institutionalised collaboration (e.g. organic councils or inter-professional bodies) can support market development through coordinated planning, capacity building and clearer value chain strategies (Michelsen, 2001; Daugbjerg & Schvartzman, 2022).

3.5.2 On-Farm Processing and Diversification - Opportunity Under High Transaction Costs

Deliverable 2.5 identifies on-farm milk and meat processing, post-harvest processing for direct selling (e.g. grain cleaning, drying and treatment) and support for short local supply chains (farm shops, online sales) as recurring knowledge and innovation needs. However in the technological needs survey (D2.5) these activities score only modestly overall, suggesting that their relevance is often conditional on the stage of farm business development, local market access, processing capacity, regulatory feasibility and farmer skills.

This pattern reflects a broader finding that while value-adding is attractive in principle, it may not be prioritised where immediate production, labour, or compliance constraints dominate farm decision-making. The literature on farm diversification and multifunctionality similarly shows that engagement in processing and direct marketing tends to increase with managerial capacity, access to advisory support and proximity to demand centres (Ilbery et al., 2013; Meert et al., 2005). Evidence from organic dairy stakeholder perspectives further highlights a scale–investment coordination problem; processors may be reluctant to invest in higher value-added organic product lines without reliable volumes, while farmers face uncertainty regarding price stability and market access that would justify on-farm or cooperative investment in processing capacity.

3.5.3 Short Supply Chains and Direct Marketing - Value Retention and Enabling Policy Instruments

The literature on short value chains hihglight farmers' markets, direct sales and online platforms as means of enabling producers to retain a greater share of the final price. For Polish farmers, for example, Deliverable 2.4 highlights the importance of enabling legal frameworks such as Rolniczy Handel Detaliczny (RHD), which simplifies administrative procedures for direct sales and on-farm processing. Such instruments align closely with direct marketing strategies and are associated with improved economic efficiency and farm resilience (Balanovska et al., 2021; Sobocińska et al., 2021).

More broadly, short food supply chains have been shown to strengthen producer consumer relationships, increase price transparency and improve income stability for small and organic farms, particularly where collective organisation supports logistics and marketing (Renting et al., 2012; Kneafsey et al., 2013). Despite this, cross-country survey evidence (D2.4) indicates that even when farmers report awareness of policies aimed at shortening the value chain, they often struggle to identify concrete instruments or programmes. This points to a persistent information and translation gap between policy frameworks and farm-level decision-making.

From the OrganicTargets4EU Delphi evidence, the development of short supply chains emerges as a point of broad consensus. Experts explicitly link reduced intermediation to improved producer incomes and highlight the potential role of local logistics platforms and matchmaking mechanisms in connecting producers with consumers, retailers and food service actors.

3.5.4 Contracts and Risk-Sharing to Unlock Investment in Value-Added Pathways

A central barrier to on-farm processing and value-adding is investment risk. Processing facilities, compliance systems and marketing activities require substantial upfront capital, while revenues depend on access to stable premium outlets. OrganicTargets4EU repeatedly highlights the role of longer-term contracts between producers and processors or retailers as a mechanism to stabilise prices and volumes and to provide the security needed for upstream investment.

The role of contractualisation in reducing income volatility and facilitating investment is well established in agri-food economics, particularly in high-quality and differentiated supply chains (Giraud-Héraud et al., 2019; Fischer et al., 2021). Although there is no consensus on optimal price-indexation mechanisms, there is broad agreement that contractualization combined with improved public funding instruments and reduced payment delays can lower income volatility and support conversion, reinvestment and innovation. For OH-FINE, this underscores the importance of addressing value-adding not only as a technical or marketing issue, but as one that is fundamentally shaped by risk-sharing and governance arrangements across the value chain.

3.5.5 Demand Creation via Public Procurement and Out-of-Home Channels

OrganicTargets4EU highlights that expanding organic markets requires demand-side development alongside supply-side growth. Out-of-home catering, both public and private, is framed as a particularly powerful lever because it represents a substantial share of food consumption, can generate additional demand rather than displacing retail sales and can normalise organic products through routine consumption.

Empirical studies on public food procurement show that minimum organic thresholds, combined with training and supply coordination, can significantly increase organic demand while providing stable outlets for producers (Mikkelsen et al., 2016; Morgan & Sonnino, 2008).

Experts identify a range of enabling mechanisms, including transparency and labelling requirements, training for catering actors and monitoring systems that verify organic shares. These approaches provide a concrete rationale for linking ‘adding value’ not only to on-farm processing, but also to route-to-market innovation through public procurement, food service and local logistics platforms, where coordinated supply and credible verification are essential.

3.5.6 Implications for OH-FINE Knowledge Exchange and Innovation Support

Taken together, Deliverables 2.4 and 2.5 and the synthesis of OrganicTargets4EU deliverables suggest that on-farm processing and adding value should be treated as a whole value-chain capability challenge, rather than a simple marketing add-on. Several interlinked knowledge needs emerge.

First, farmers require practical capability-building in branding, market analysis, negotiation and compliance pathways for processing and direct sales particularly where awareness of concrete policy instruments and viable market routes remains low.

Second, the feasibility of on-farm processing depends on effective risk-sharing mechanisms, including longer-term contracting and credible demand signals, in order to justify investment in facilities, skills and compliance systems.

Third, stronger collective action through cooperatives, producer groups, or shared logistics platforms is essential to overcome scale constraints and improve bargaining power, especially in contexts where governance weaknesses and trust deficits persist.

Fourth, demand-side levers, notably public procurement and out-of-home consumption, represent actionable pathways to expand organic markets, but require coordination, training and administrative simplification to function effectively.

Territorial coordination models such as organic bio-districts provide a concrete illustration of how collective governance, market coordination and public procurement can be integrated to support on-farm processing, short supply chains and value retention at regional level. The literature highlights that bio-districts can facilitate cooperation between farmers, processors, local authorities and consumers, helping to align supply development with demand creation while strengthening institutional capacity and trust across the value chain (Renting et al., 2012; Sonnino, 2016; IFOAM Organics Europe, 2020).

Within the OH-FINE framework, these findings support prioritising knowledge-exchange formats that connect farmers with processors, retailers, advisors and policy actors, rather than focusing on farmers alone. They also highlight the importance of translating abstract ‘short supply chain’ concepts into implementable models such as compliant processing options, cooperative governance templates, contracting examples and buyer supplier matchmaking tailored to the distinct institutional and market conditions across partner countries.

3.6 Reflections on Knowledge and Innovation Systems for Organic Agriculture

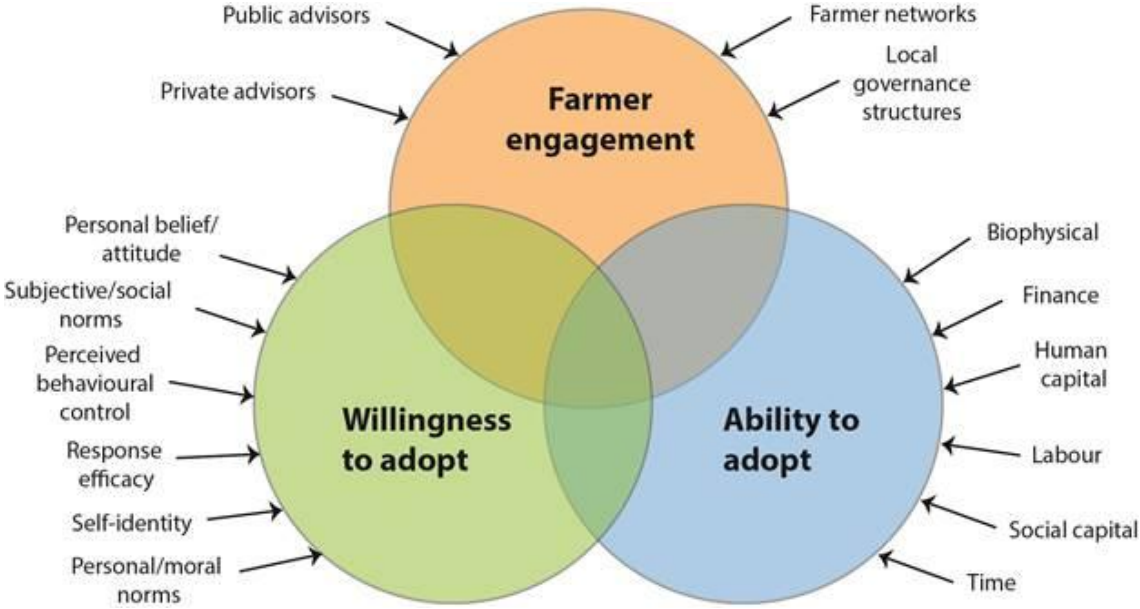
3.6.1 Factors impacting the organic conversion process

For most farms, the shift from conventional to organic production represents a phase of profound transformation. This transition is shaped by a combination of physical, economic and social factors, the relative importance of which varies across farms, regions, production systems and countries and is strongly influenced by individual farmer circumstances. The scale and complexity of change experienced at both farm and farmer level, as well as the time required to complete the transition, depend on several interrelated factors. These include the intensity of conventional practices prior to conversion, the baseline condition of the holding, the degree to which new production activities or marketing channels are introduced and the yield reductions and financial pressures that may arise during the conversion period (Lampkin et al., 2023).

Empirical research on organic conversion consistently identifies the availability of financial support, environmental motivations, comparative profitability between organic and conventional systems and uncertainty regarding the long-term stability of organic markets as key determinants influencing farmers’ conversion decisions (Home et al., 2019). Although less frequently emphasised, social factors (such as peer networks, advisory support and community norms) also play an important role in shaping farmers’ willingness and capacity to transition to organic production (Mills, 2023).

Mills et al. presented a framework considering farmer engagement, willingness and ability to adopt environmentally friendly practices (Mills et al., 2017):

Figure 1. Factors influencing farmer environmental decisions (Mills et al., 2017)



From the framework above, farmers may be a combination of willing, able and engaged. Farmers who fall into the intersection between willing, able and engaged are those who are committed to long-term environmental management on their farms and have the ability (time and resources) to undertake the work and to engage with environmental advice. How long the period of conversion takes (if it happens) depends on the farmer, farm staff and the farm. Empirical research indicates that pathways into organic farming are diverse and highly context dependent, with no single model of transition applying across all farms (Padel et al., 2020; Weinberg, 2023). As a result, farmers encounter different barriers and challenges at various stages of the conversion process, implying that a uniform policy approach is unlikely to be effective. Support measures therefore need to be sufficiently flexible to address stage-specific needs when designing policies to encourage organic uptake.

In this context, advisory services must be capable of recognising and responding to this heterogeneity by tailoring their communication strategies and interventions accordingly (Blackstock et al., 2010). Effective advisory approaches also require sensitivity to the varying combinations of farmers' willingness, capacity and engagement, which may differ not only between contrasting farm situations but also among farms operating under similar conditions (Mills et al., 2017). Developing such nuanced understanding and situating advice within the specific context of individual farms necessitates a degree of direct, personalised interaction. Research by Mills (2017) shows that farms resistant to change often have weak social connections and limited participation in formal or informal networks, resulting in reduced access to information and a lower exposure to peer influence. These circumstances make it more difficult for advisory and support programmes to influence norms, attitudes and farmer identities. In other cases, disengagement from advisory services may stem from previous negative experiences.

A supportive social environment is frequently identified as a key enabling factor in successful organic conversion (Lindemann, 2021). One mechanism through which such support can be fostered is the development of Communities of Practice, which bring together groups of individuals who share common concerns and strengthen their knowledge and skills through ongoing interaction and collective learning.

A comprehensive review by Möhring et al. (2024), encompassing 120 empirical studies on organic farming adoption and 183 associated policy recommendations, assessed these findings in relation to broader indicators of national development. The authors categorised influencing factors across multiple stages of the food system, including farm system choice, on-farm production, processing and transport and market engagement with consumers. Based on this analysis, they proposed a set of evidence-based recommendations highlighting actionable leverage points for policymakers and other actors seeking to support the transition towards organic and sustainable food systems (Möhring et al, 2024).

Table 3. Outline of factors impacting on decisions related to organic conversion across countries in the EU (Stephenson et al., 2022; Möhring et al., 2024; Padel et al., 2023)

Factors impacting organic conversion	
Farm-level obstacles and barriers	Technical aspects of crop production (weed & pest management / crop rotation) *and* accompanying information & advice
	Livestock production (organic feed, animal housing)
	Farm-level economic issues (profitability, feasibility, risk aversion)
	Personal & social issues (experience / knowledge; peer networks)
Marketplace	Uncertainty: future demand and market stability
	Market access and organic premiums
	Long-term commitment of downstream actors
	Access to market information
Local / regional infrastructure	Access to inputs and equipment
	Labour availability
	Land availability
	Investment in research
Administration & policy	Organic certification costs
	Recordkeeping /bureaucracy, rule changes over time
	Knowledge of regional & national administration / legislation
	Long-term policy stability

Padel et al (2023) highlight that influences extending beyond purely technical considerations play a critical role in shaping organic adoption, including market conditions, the availability of regional infrastructure and the broader administrative and policy environment. These factors lie largely outside the direct control of individual farmers. This perspective aligns with the findings of Stephenson et al. (2022), who argue that increasing the number of farms converting to organic production requires more than farm-level research, farmer training and improved advisory services. Instead, it also depends on investment in regional supply-chain infrastructure and the introduction of supportive national policy incentives. Accordingly, an emphasis on technical solutions alone is unlikely to be sufficient to stimulate widespread behavioural change in farming systems (Day & Cramer, 2021).

3.6.2 Strengthening organic advisory services

In the current Programming Period (2023–2027), important reforms have been implemented in the field of agricultural advisers. The New CAP encourages farmers to step up their efforts to accelerate the necessary transition to a fair, healthy and environmentally friendly agri-food system by 2030. Each member state has developed a strategic plan focusing on knowledge sharing and supporting innovation practices, thus incorporating AKIS into their national planning (Labarthe & Beck, 2022).

Advisory services play a vital role in supporting the expansion of organic farming by facilitating knowledge exchange, providing technical guidance and strengthening decision-making processes for farmers, processors and other key stakeholders. However, the effectiveness of these services varies across countries, influenced by differences in institutional frameworks, financial resources and advisory expertise.

Interestingly, the extensive review of research carried out by Kountios et al (2024) in 28 EU countries on the effectiveness of the AKIS in each country suggests that Ireland is the country with the strongest AKIS. It is estimated that more than 75% of Irish farmers have access to advisory services (Kountios et al., 2024). Also, the high level of training of Irish farmers has effectively changed the role of agricultural advisers from “teachers” to “facilitators” of agricultural knowledge exchange (Kountios et al., 2024). Given that Ireland is one of the partner countries for the OH-FINE project, there should be interesting learnings which can be cross-shared with the other partner countries.

Based on national level workshops or surveys conducted by OMKI in eight focus countries (Austria, Denmark, Germany, Greece, Hungary, Italy, France and Romania) for the OrganicTarget4EU project, Padel et al (2023) provide a robust analysis of the characteristics of advisory services for organics.

Firstly, the workshops and surveys revealed the following ten categories of advisory actors:

- Public bodies
- Research institutes
- Education and training (vocational/higher educational institutions)
- Cooperations (operational groups and consortia)

- Private sector (private consultancy providers, input suppliers and independent advisors)
- Farmer organisations, cooperatives or producer groups, organic associations
- Certification and control bodies
- Government regulatory agencies
- (Social) media and digital platforms
- Organic regional communities (e.g. bio-districts or regional level collaborations).

These categories largely overlap with the AKIS actors identified in the OH-FINE Knowledge Needs baseline survey (Question 2 in the survey). One exception is media and digital platforms (which were included in Question 3 as a method of receiving knowledge).

The findings also revealed patterns in terms of the influence and effectiveness of different advisory actors across the focus countries (Padel et al., 2023):

- Public and institutional advisory services are generally regarded as the most credible sources of expertise; however, their affordability and ease of access vary considerably across regions.
- Peer-to-peer learning among farmers represents one of the most accessible and cost-effective channels for knowledge exchange. Although levels of technical expertise may differ, farmers often place greater trust in the experiences and advice of fellow producers than in guidance from external advisors.
- Private or independent consultants tend to be less widely available and involve higher costs, though they may provide more tailored and specialised advisory services.
- Digital advisory platforms have expanded access to information, but they frequently lack the depth and personalisation required to address farm-specific challenges. Moreover, farmers' willingness and ability to engage with digital tools differ between countries and are also likely influenced by age and levels of digital literacy.
- Cooperative organisations offer a hybrid model that combines peer learning with professional expertise, but access to their advisory services is typically restricted to members.
- Certification and control bodies play a more limited advisory role, as their primary function is to ensure compliance with regulatory standards rather than to deliver practical farm-level guidance, although they remain an important component of the organic system.
- Research institutions possess high levels of technical competence, yet their advisory services are often less accessible or affordable for individual farmers. Their impact tends to be strongest in contexts where close links exist between research organisations and the wider AKIS.

The OMKI survey also reveals the key thematic areas addressed by current advisory actors:

- Production and technical practices
- Compliance/administrative support (certification processes, regulation requirements)
- Financial planning and subsidy access
- Market and economic aspects (financial planning, commercialisation channels)
- Knowledge exchange and peer learning
- Climate change adaptation
- Digitalisation (new technologies, digital tools, supply chain digitalisation).

In terms of advisory methods and tools, individual face-to-face consultations, facilitated group activities and short training events such as one-day seminars are viewed by surveyed AKIS actors as the most effective means of supporting farmers. For farmers who are already certified organic, however, peer-to-peer learning and knowledge exchange are considered even more valuable than personalised in-person advice. The results of the OMKI survey further indicate that farmers undergoing conversion place particular importance on opportunities for networking with other farmers, followed by support related to regulatory compliance and the provision of technical and legal guidance.

These results are consistent with the initial results from the OH-FINE Knowledge Needs baseline survey. Across all farmer groups (conventional, in-conversion and post-conversion farmers), in-person and peer-to-peer formats (e.g., farm walks, demos, discussion groups) remain central to farmer learning. One outlier is Lithuania where there is a greater use of farm apps, YouTube and live webinars and greater scope to use digital tools to support scalable engagement.

Finally, the OMKI survey identifies the main barriers to a well-functioning organic advisory system (Padel et al., 2023):

- Training deficiencies, advisor shortages and retention challenges
- Knowledge gaps are further reinforced by the absence of a centralised coordination platform, limited uptake of existing advisory tools, weak cooperation at regional level, restricted access to the outcomes of advisory innovation and a lack of strategic collaboration between advisors and other actors within the agricultural knowledge system. In addition, the commercial priorities of many input suppliers may constrain the neutrality and scope of advice provided.
- There is a mismatch between advisory systems and farmer needs - more specialised expertise is needed. Farmers require different forms of training and innovate at different levels.
- Financial and structural barriers also reduce access to advisory services, particularly for small-scale producers. Limited availability of demonstration farms and opportunities for on-farm experimentation restrict experiential

learning, while time constraints and travel distances further reduce participation in training activities.

- Governance and efficiency issues continue to undermine the effectiveness of advisory services. Excessive administrative requirements, complex certification and legal frameworks and frequent regulatory changes increase the burden on both advisors and farmers.

Adding to these identified challenges, Kountios et al (2024) also identify that generally speaking, private agricultural advisory providers have prevailed in the general AKIS (i.e. both conventional and organic farming) over time. This dominance of private providers has led to a fragmentation of advice rather than a plurality of decision support channels.

3.6.3 AKIS assessment

A well-functioning AKIS is widely recognised as a prerequisite for achieving the objectives set out in key EU policy frameworks, including the European Green Deal, the Farm to Fork Strategy and the Biodiversity Strategy. The CAP for the 2023–2027 period places greater emphasis on strengthening AKIS as an integrated concept, building on existing advisory and knowledge-exchange structures at both national and transnational levels within the CAP's financial and policy architecture. Although the Farm to Fork targets offer an overarching policy context for reinforcing AKIS, there remains limited empirical evidence on how these provisions are implemented in practice.

Drawing on case studies from eight countries (Austria, Denmark, Germany, France, Italy, Hungary and Romania), Nagy et al. (2023) identify the principal centres of knowledge creation and innovation relevant to organic farming. Across all countries examined, public and private research organisations, along with educational institutions, are consistently recognised as key knowledge hubs. With the exception of Germany, on-farm research networks and demonstration farms are also regarded as important sources of knowledge, while organic farming associations fulfil this role in six of the eight countries. The study further underscores the value of practice-oriented and participatory research approaches, as well as the growing relevance of e-learning platforms.

The importance of practice-oriented and participatory research was identified by farmers in the OH-FINE Knowledge Needs survey and the Social Network Analysis (SNA) mapping workshops where farmers asked for more demonstration farms and short-term, practical research which included learning from other successful farmers in their regions. Moreover, OH-FINE participants suggested locally coordinated platforms (e.g. WhatsApp groups) which include not only farmers but also other AKIS stakeholders. The Nagy et al (2023) research highlights how there are limited centralised or national e-infrastructures available for knowledge exchange, with the majority focusing on specific audiences / scopes. Additionally, platforms could be better connected to one another and need to improve their user-friendliness.

Overall, the Nagy et al (2023) study suggests the following key reflections on the development of the AKIS for organic farming in the EU:

- A well-functioning AKIS for organic is dependent on conventional AKIS actors and their willingness to support organic farming: The strengths of an AKIS system largely depends on the received institutional support and the presence and influence of significant institutions that are often specialised or at least committed to the development of the organic sector. The involvement of conventional stakeholders can substantially increase the importance and outreach of AKIS for organic and more farmers interested in organic farming.
- In countries with less developed ecological AKIS, a very important role is played by private market actors: In countries with poorly developed AKIS, private market actors often take over AKIS functions. In this case, the development of advisory services for organic farmers is mainly market driven (e.g., by processors, input suppliers, seed suppliers, etc.) in contrast to countries where advisory services are respondent to the needs of farmers.
- EU programmes (e.g. EIP AGRI) play a crucial role in shaping the development of AKIS for organic (especially where public sector initiatives are lacking): they promote pilot adaption of best practices, international exchanges and the development of training materials
- Local networks are important for knowledge exchange and support between farmers and farmers' organisations, but these networks remain partly closed and do not manage an upscaling at a supra-regional level because of a lack of systematic support and funding
- The conversion to organic agriculture requires support in many areas of the farming system but topics on organic in AKIS are mainly related to production and technical issues. Also, there are often knowledge gaps in learning materials for organic courses and training. Hence, trainers and farmers often need to rely on the same information available for conventional farming.

Moschitz et al. (2021) further observe that current EU policy tends to prioritise nature-based and technological responses, while placing comparatively less emphasis on the social dimensions of innovation. Given the inherent complexity of agricultural systems and the multidimensional character of sustainability, social innovations are likely to be as important as technological advances, with policy choices inevitably involving trade-offs that require broader societal deliberation. For sustainability measures to be effective, farmers must develop a deeper understanding of ecosystem processes and how these can be integrated into everyday farm management. Such systemic transformations differ fundamentally from the adoption of individual technologies or crops. Consequently, evaluations of organic AKIS should extend beyond linear models of technology transfer and explicitly account for informal institutions (e.g. norms, values and beliefs) as well as the social processes that underpin innovation.

Additionally, Nagy et al (2023) provide recommendations for the future development of the organic AKIS:

- Foster capacity building, participatory approaches, networking and cross-regional specialised advisory services

- Support sound (long-term) funding and financial resources linked to policy commitment
- Foster knowledge transfer and exchange (including strengthening and centralising platforms for sharing knowledge)
- Create long-term vision and support in organic farming research
- Implement organic curriculums in knowledge creation and innovation, advisory services, training and education.

The Kountios et al (2024) literature review of the AKIS of 28 different EU countries also provides recommendations for improving the AKIS. While this review is not solely focused on the organic AKIS, it is worthwhile to include these recommendations as organic farming falls under the wider AKIS.

- An effective AKIS depends on strong links between actors, which cannot operate in isolation and specifically the need to strengthen cooperation with the private sector. Furthermore, coordinating mechanisms (including institutional co-ordinating bodies) could be improved
- The dissemination of agricultural knowledge and research from academics and research agents to farmers is a key factor in improving an AKIS
- Agricultural advisory services play a pivotal intermediary role, acting as the primary interface between farmers and education and research organisations. To fulfil this function effectively, advisory providers must be adequately resourced, accessible and capable of delivering high-quality, relevant support.

4. Development and Integration of the OH-FINE Knowledge Database into the ICT Platform

Building directly on the thematic synthesis presented in Sections 3.1 to 3.6, this section outlines how the identified literature, project outputs and technical resources are integrated into the OH-FINE Knowledge Platform and in particular, how Deliverable 2.6 feeds into Work Package 4, the OH-FINE Platform ICT Tool (WP4).

WP4 aims to develop a digital platform that centralises resources for organic farming, facilitates data-driven decision-making, enhances knowledge exchange, supports informed farming choices, and promotes the uptake of digital technologies within the organic sector. In this context, Deliverable 2.6 provides the foundation upon which the OH-FINE ICT platform is built.

All resources identified through the literature review and project screening process have been structured into a database-ready format, presented in Annex C, and designed for inclusion into the OH-FINE ICT platform developed under WP4. Annex C thus represents the operational knowledge database required under Task 2.6 and provides the baseline dataset for integration into WP4, the OH-FINE Platform ICT Tool. This database will be expanded and updated throughout the project lifecycle as new resources, project outputs and practice-oriented materials become available. Each entry includes standardised metadata (resource type, thematic domain, relevance, geographic scope, year and origin), enabling efficient search, filtering and thematic navigation within the platform.

The knowledge database established under Deliverable 2.6 represents the initial population of the OH-FINE platform. It brings together:

- peer-reviewed scientific publications and syntheses,
- technical and advisory materials,
- policy and regulatory resources, and
- concrete outputs from EU-funded projects (e.g. technical deliverables, platforms, tools and practice abstracts), selected on the basis of their relevance to the six thematic domains and the needs identified in WP2.

In line with the objectives of WP4, the platform is conceived as a dynamic and evolving resource. While Deliverable 2.6 establishes the baseline database at the end of WP2, additional resources will be continuously added as new EU projects deliver results, as collaborations under later Work Packages mature, and as emerging innovations in organic farming are identified. This ensures that the platform remains current, relevant and responsive to user needs throughout and beyond the lifetime of the project.

The database structure and content developed under Deliverable 2.6 are fully aligned with the coordination and duplication-prevention framework established in Deliverable 2.7. While D2.7 focuses on identifying complementary initiatives and avoiding overlap with parallel projects, Deliverable 2.6 operationalises this approach by translating relevant literature, project outputs and technical resources into a structured and reusable knowledge database. Together, these deliverables ensure that the OH-FINE platform is populated with high-quality, non-duplicative content that directly supports knowledge exchange, advisory activities and innovation uptake across subsequent Work Packages.

5. Limitations and Future Updates

The scope of Deliverable 2.6 is intentionally defined to align with the objectives of Work Package 2, where the primary purpose is to establish a structured knowledge baseline to inform the design and implementation of subsequent Work Packages. Accordingly, the review focuses on technical farming practices, enabling conditions and thematic areas directly relevant to the WP2 case study sample and the knowledge needs identified in earlier deliverables.

The limitation in the scope of deliverable 2.6 which establishes the initial population of the OH-FINE knowledge database, will be addressed by expanding, refining and updating the database throughout the project lifecycle via the OH-FINE platform. Ongoing contributions from project partners, stakeholders and emerging EU project outputs will progressively broaden coverage, including additional national, regional and language-specific resources.

6. Conclusions and Implications for OH-FINE

This deliverable has established a structured and practice-oriented knowledge baseline to support the objectives of the OH-FINE project. By synthesising peer-reviewed literature, policy analysis, advisory resources and outputs from relevant EU-funded projects, it provides an evidence-informed overview of the technical, economic and institutional dimensions shaping organic farming systems across Europe.

The review confirms that while substantial knowledge exists across key technical domains including crop management and diversity, livestock systems and animal health, mechanisation and labour efficiency, and on-farm processing and value addition the effective use of this knowledge is highly context-dependent. Differences in farm system orientation, scale, market integration and stages of organic conversion mean that knowledge needs vary significantly across countries and farm types. As such, accessibility, relevance and practical framing of knowledge are as important as the underlying technical content.

A central cross-cutting insight is that many constraints faced by organic and in-conversion farmers are not solely technical but are strongly mediated by the functioning of Agricultural Knowledge and Innovation Systems (AKIS). Advisory capacity, peer-to-peer learning mechanisms, institutional coordination and the translation of research outputs into farmer-relevant formats all play a decisive role in shaping innovation uptake and system performance.

Importantly, Deliverable 2.6 goes beyond narrative synthesis by operationalising the reviewed evidence into a structured, database-ready format. Annex C constitutes the operational knowledge database required under Task 2.6 and provides the initial content layer for integration into the OH-FINE Platform ICT Tool (WP4). This database is designed as a living resource, to be expanded and updated throughout the project lifecycle as new research outputs, project deliverables and practice-oriented materials emerge.

Overall, this deliverable provides both an analytical foundation and a practical infrastructure for subsequent OH-FINE activities. By linking empirical farm-level insights from WP2 with a curated and structured knowledge base, OH-FINE is well positioned to support targeted advisory interventions, demonstration activities and peer-to-peer learning, while contributing to broader EU objectives for organic farming expansion and sustainability.

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Annex A – Profile of OH-FINE Case Study Farms

Summary of findings

Annex A summarises cross-country findings from the analysis of over 100 case study farms across Ireland, Bulgaria, Poland, Lithuania and Spain. The analysis uses harmonised farm-level data covering structural and demographic variables, including gender, age, farm size, farm system type, crop and livestock enterprises and work time. Descriptive statistics and figures illustrate patterns across countries, with supporting tables provided in the appendix.

These results inform the identification of likely technical knowledge needs across the OH-FINE sample and underpin the development of the five core technical knowledge domains used to structure Deliverable 2.6. The analysis also supports the design of the technical knowledge needs questionnaire (D2.5) and the interpretation of heterogeneity across partner regions.

Key Results

Across the full sample, farmers are predominantly male, with relatively higher female participation in Bulgaria and Ireland than in Spain and Poland. Most farmers fall within the 40–60 age group, with younger profiles more evident in Spain and Lithuania and older profiles in Bulgaria and Ireland. Farm sizes vary widely, with Bulgaria and Spain exhibiting higher median and average sizes and Poland characterised by smaller holdings.

System orientation differs markedly across countries. Livestock-only systems dominate in Ireland and Bulgaria, consistent with grassland-based and extensive production structures, while mixed systems are most common in Poland and Spain. A substantial share of farms in Lithuania and Spain report no livestock enterprises, aligning with cropping-based systems.

Crop systems are centred on cereals and protein crops across the sample, while crop diversity is highest in Poland and Lithuania, reflecting the prevalence of arable and mixed systems. Horticulture is limited overall but most apparent in Poland.

Average work units (AWU) are relatively consistent across countries, indicating most farms are managed close to one full-time equivalent, with slightly higher labour input indicated in Poland and lower in Lithuania.

Insights for Technical Knowledge Needs of Organic Farms

Based on the farm profiles and the WP2 synthesis, five core technical knowledge domains are identified as most relevant across the OH-FINE sample. These domains reflect both production challenges and system-level support requirements, grounded in observed differences in farm structure, enterprise mix and conversion context.

1. EU Agricultural Support Policies, Standards and Compliance

This domain captures the knowledge required to navigate certification processes, traceability, documentation and evolving EU/national policy frameworks, including CAP Strategic Plans and organic support measures. It is consistently important across all countries and farm types.

2. Crop Management and Diversity

This domain reflects the prominence of cropping and mixed systems, particularly in Spain, Poland and Lithuania. It includes rotation planning, soil fertility management without synthetic inputs, diversification strategies (including cover crops and legumes) and integration pathways for livestock-dominant farms seeking stronger crop/forage links.

3. Livestock Systems and Animal Health

This domain is shaped by the dominance of ruminant systems in Ireland, Bulgaria and Poland. It includes organic-compliant veterinary care, disease prevention, grazing management, forage utilisation and nutrition/feed planning.

4. Mechanisation and Labour Efficiency

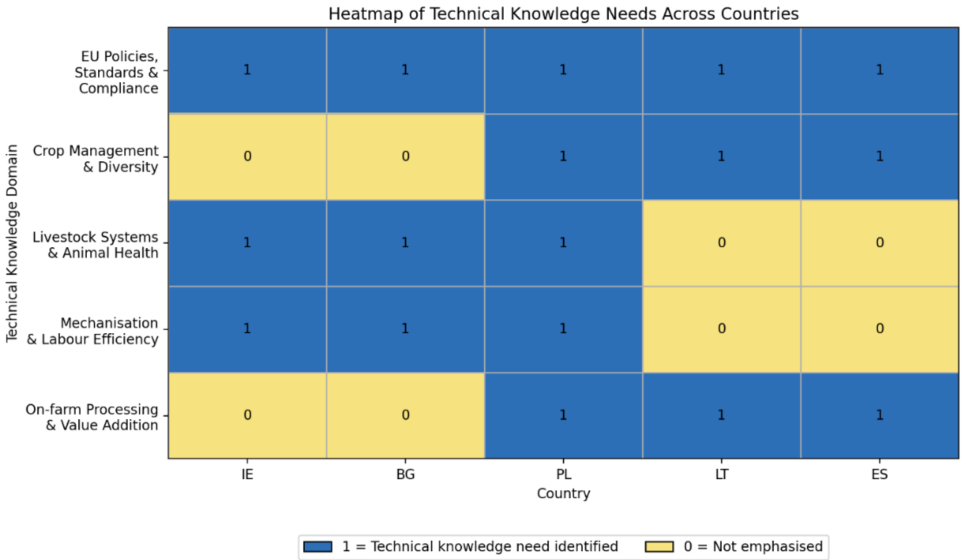
This domain reflects labour constraints, ageing farmer profiles in parts of the sample and the operational demands of organic systems. It includes labour-saving technologies (including mechanical weed control), scale-appropriate machinery and tools adapted to mixed and low-input systems.

5. On-Farm Processing and Adding Value to Products

This domain reflects the growing importance of diversification and market orientation, including post-harvest handling, processing, product differentiation, direct selling and short supply chains. It is particularly relevant in Spain and Poland but is emerging across the wider sample.

Heatmap of Technical Knowledge Needs

A heatmap is used to summarise where technical support needs are potentially most pronounced across partner countries, based on farm system distributions, enterprise diversity, demographic characteristics and observed variation in system integration and practice adoption. Cells indicate whether a domain represents a heightened support need in a given country context, recognising that the heatmap is an indicative tool intended to support targeting rather than a definitive ranking.



Domain	IE	BG	PL	LT	ES
EU Policies, Standards & Compliance	1	1	1	1	1
Crop Management & Diversity	0	0	1	1	1
Livestock Systems & Animal Health	1	1	1	0	0
Mechanisation & Labour Efficiency	1	1	1	0	0
On-farm Processing & Value Addition	0	0	1	1	1

Annex B – Case study Producer Selection Criteria

Essential criteria

- Minium 5 years of farming experience
- High community regard for farmer
- Must be willing to cooperate/interest in project
- Farmers of average size and with typical regional soils will be prioritised

Farm Specific Factors

In conversion criteria	Gender balance	Farm systems	Farm Size (area)	Farm Size (AWU)	Intensity of production
Organic application submitted Jan 2023 Jan 2025	Aim to achieve national average female representation (Min 1 each cohort)	Livestock, Arable, Mixed (min 20% farms with livestock in each cohort)	Min 10ha, Max 180ha	Min 1 AWU, Max 5 AWU	achieve balance of intensive and extensive systems

Annex C – OH-FINE Operational Knowledge Database

Annex C1- Directly Related EU Organic Farming and Food Research Projects

Summary table of key EU-funded research and innovation projects that directly informed the design, methodological approach, and knowledge exchange framework adopted within the OH-FINE project The table of projects are formatted here as a database (table), indicating the following fields: Project Name, Thematic Funding Instrument, Project Partners, Topic/ Thematic Domain, Specific Topic/Relevance to OH-FINE, Project Link. This table is also available as a downloadable spreadsheet file (excel) as part of Deliverable 2.6.

Project Name	Thematic Funding	Partners	Thematic Domain	Key Inputs to OH-FINE	Project Link
ECOPIONET	EU (EIP-Agri OG)	CSIC, SEAE, OFI	AKIS / Knowledge exchange methodology	Innovative multi-actor knowledge exchange methodology (MITTCon), particularly relevant for participatory learning and advisory engagement.	https://ecopionet.eu
OK-Net Arable	EU(H2020)	BIOSEL, F-CH, FiBL-AT	Crop Management & Diversity	Development of an Organic Farm Knowledge Platform; best practice in digital knowledge exchange and farmer-led innovation.	https://www.ok-net-arable.eu
LIFT	EU(H2020)	TEAG	EU Policy Framework / socio-economic drivers	Socio-economic and policy analysis of ecological farming approaches, informing OH-FINE's treatment of policy drivers and barriers.	https://www.lift-h2020.eu
Best4Soils (H2020)	EU(H2020)	FiBL-AT, BIOSEL, TEAG, LAMMC	Crop Management & Diversity	Approaches to multi-stakeholder engagement and farmer-oriented information materials.	https://www.best4soil.eu

i2connect (H2020)	EU(H2020)	TEAG, EV-ILVO, F-CH	AKIS / Advisory systems	Empowerment of advisors and advisory organisations; informed OH-FINE's AKIS and advisory system framing.	https://www.i2connect-h2020.eu
AGRISPIN (H2020)	EU(H2020)	TEAG	AKIS / Knowledge exchange	Cross-Visit methodology and experiential learning approaches.	https://www.agrispin.eu
NEFERTITI (H2020)	EU(H2020)	TEAG, EV-ILVO, F-CH	AKIS / Demonstration networks	Peer-to-peer on-farm demonstration networks and multi-actor innovation pathways.	https://nefertiti-h2020.eu
TRUE (H2020)	EU(H2020)	TEAG	Crop Management & Diversity	Transition pathways for legume-supported production systems.	https://www.true-project.eu
FLINT	EU (FP7)	TEAG	Monitoring / Metrics	Development of farm-level sustainability metrics, contributing to baseline and monitoring approaches.	https://cordis.europa.eu/project/id/613800

Annex C2 - Related EU Organic Farming and Food Research Projects

Summary Table of EU-funded research and innovation projects related to organic farming, agroecology, soil health, livestock systems, advisory services, and food systems. These projects are not direct methodological precursors to OH-FINE but represent the wider research and innovation ecosystem within which OH-FINE is embedded. The table of projects are formatted here as a database (table), indicating the following fields: Project Name, Thematic Funding Instrument, Project Partners, Topic/ Thematic Domain, Specific Topic/Relevance to OH-FINE, Project Link. This table is also available as a downloadable spreadsheet file (excel) as part of Deliverable 2.6.

Project Name	Thematic Funding	Partners	Thematic Domain	Key Inputs to OH-FINE	Project Link
Horizon Europe – Organic, Agroecology & AKIS					
OrganicAdviceNetwork	Horizon Europe	FiBL, IFOAM OE, national advisory bodies	AKIS & Advisory Services	Strengthening organic advisory capacity; peer-to-peer advisor networks; advisory tools and training materials	https://organicadvicenetwork.eu
OrganicTargets4EU	Horizon Europe	FiBL, Teagasc, IFOAM OE, universities	Policy, AKIS & Sector Development	Analysis of barriers to conversion; policy pathways to 25% organic target; AKIS assessments and advisory recommendations	https://organictargets.eu
OH-FINE	Horizon Europe	Multi-actor EU consortium	AKIS, Innovation & Knowledge Exchange	Organic hubs, learning communities, needs assessments, platform-based knowledge exchange	https://ohfine.eu
AGROECOLOGY	Horizon Europe Partnership	EU research institutes, networks	Agroecology & Living Labs	Living labs, agroecology transition pathways, systems innovation relevant to organic farming	https://agroecology.eu
FarmBioNet	Horizon Europe	Advisory & biodiversity networks	Biodiversity & AKIS	Biodiversity-focused advisory knowledge, farm-level biodiversity practices and peer learning	https://farmbionet.eu

OrganicClimateNET	Horizon Europe	Organic farmer networks, research bodies	Climate & Organic Farming	Climate-smart organic practices, mitigation/adaptation knowledge, farmer demonstration networks	https://organicclimatenet.eu
Soil Health, Nutrient Management & Circularity					
Project Name	**Thematic Funding**	**Partners**	**Thematic Domain**	**Key Inputs to OH-FINE**	**Project Link**
TRAILS4SOIL	Horizon Europe	Research institutes, living labs	Soil Health & Living Labs	Living lab approaches for soil health; regenerative and conservation practices	https://trails4soil.eu
DeepHorizon	Horizon Europe	Universities, soil scientists	Soil Functions & Subsoil	Understanding subsoil functions; long-term soil fertility and resilience	https://deephorizon.eu
NBSOIL	Horizon Europe	Research & practice partners	Nature-Based Solutions	Soil NBS for sustainable management and climate resilience	https://nbsoil.eu
ReLeaf	Horizon Europe	Circular economy actors	Nutrient Recycling	Bio-waste recycling into fertilisers; circular nutrient solutions	https://releaf-project.eu
DeliSoil	Horizon Europe	Research institutes, industry	Soil Improvers	Safe, circular soil improvers from food-system residues	https://delisoil.eu
Waste4Soil	Horizon Europe	Research & innovation partners	Circularity & Soil Health	Food waste valorisation for soil improvement	https://waste4soil.eu
BIOservicES	Horizon Europe	Universities, ecology institutes	Soil Biodiversity & ES	Linking soil biodiversity to ecosystem services and resilience	https://bioservices.eu
Crop Systems, Diversity & Breeding					
Project Name	**Thematic Funding**	**Partners**	**Thematic Domain**	**Key Inputs to OH-FINE**	**Project Link**
IntercropValuES	Horizon Europe	Research & value-chain actors	Intercropping & Value Chains	Intercropping systems, value chain integration, farmer guidance	https://intercropvalues.eu

LIVESEED	Horizon 2020	FiBL, breeders, research-ers	Organic Seed & Breeding	Organic seed sys-tems, participatory breeding, seed availability	https://liveseed.eu
ReMIX	Horizon 2020	Universi-ties, farm-ers	Species Mixtures	Crop mixtures for productivity and resilience	https://www.remix-intercrops.eu
DiverIMPACTS	Horizon 2020	Multi-actor consortium	Crop Diversi-fication	Diversified rota-tions, intercropping, innovation path-ways	https://www.diverimpacts.net
BRESOV	Horizon 2020	Breeding institutes	Organic Vegetable Breeding	Breeding for resili-ent organic vegeta-ble systems	https://bresov.eu
LegValue	Horizon 2020	Research & industry partners	Legume Systems	Legume-based cropping systems and value chains	https://www.legvalue.eu
Markets, Value Chains & Consumer Trust					
Project Name	**Thematic Funding**	**Partners**	**Thematic Domain**	**Key Inputs to OH-FINE**	**Project Link**
ATTESTED	Horizon Eu-rope	SMEs, tech developers	Traceability & Trust	Digital traceability systems for short supply chains	https://attested.eu
SALSA	Horizon 2020	Universi-ties, SMEs	Food Sys-tems & SMEs	Role of SMEs in sustainable food systems	https://www.salsa-project.eu
OrganicData-Network	Horizon 2020	Market analysts, research-ers	Organic Markets	EU organic market data and transpar-ency	https://organicdatanetwork.net
DIVINFOOD	Horizon 2020	Multi-actor consortium	Short Food Chains	Value chains for agrobiodiversity and healthy diets	https://www.divinfood.eu

Annex C3 – Organic Farming Research Literature

Summary Table of EU organic farming research literature identified and discussed in the review in section 3. The description of publications is formatted here as a database (table), indicating the following fields: Names of Authors; Type of Publication; Thematic Domain; Relevance to OH-FINE; Journal Title; Region; Year; Link or Source. This table is also available as a downloadable spreadsheet file (excel) as part of Deliverable 2.6.

Authors	Type of Pub	Thematic Domain	Relevance to OH-FINE	Journal	Region	Year	Link or Source
Balafoutis et al. (2020)	Journal article	Mechanisation & digitalisation	Smart farming technologies taxonomy and impacts	Computers and Electronics in Agriculture	EU/Global	2020	https://doi.org/10.1016/j.compag.2020.105244
Balanovska et al. (2021)	Journal article	On-farm processing & marketing	Direct marketing strategies and farm efficiency	Agricultural and Resource Economics	EU	2021	https://doi.org/10.51599/are.2021.07.02.05
Barrett et al. (2022)	Journal article	AKIS & innovation systems	Socio-technical innovation bundles	Nature Sustainability	Global	2022	https://doi.org/10.1038/s41893-022-00940-1
Beeken et al. (2021)	Journal article	Livestock systems	Digital adoption in grazing systems	Animal	EU	2021	https://doi.org/10.1016/j.animal.2021.100260
Bell et al. (2014)	Journal article	Crop–livestock integration	Integrated systems productivity and environment	European Journal of Agronomy	EU	2014	https://doi.org/10.1016/j.eja.2013.04.007
Bijman et al.	EC report	Value chains	Support for farmers’	European Com-	EU	2012	https://op.europa.eu/en/publication-detail/-/publication/4e66c9d5-8d0f-4b42-9f5b-

(2012)		& cooperation	cooperatives	mission			4fd0d07b0b8f
Blackstock et al. (2010)	Journal article	AKIS & behaviour	Farmer behaviour change and water quality	Science of the Total Environment	EU	2010	https://doi.org/10.1016/j.scitotenv.2009.04.029
Buckley et al. (2018)	Journal article	Livestock systems	Resilience of pasture-based dairy systems	Journal of Dairy Science	Ireland	2018	https://doi.org/10.3168/jds.2017-13614
Chase (2024)	MSc thesis	Farm economics	Benchmarking organic pasture-based farms	University of Galway	Ireland	2024	University repository / thesis submission
Darnhofer et al. (2019)	Journal article	Systems resilience	Adaptiveness in farming systems	Agronomy for Sustainable Development	EU	2019	https://doi.org/10.1007/s13593-019-0575-3
Daugbjerg & Schvartzman (2022)	Journal article	Policy & markets	Policy feedback in organic markets	Journal of Public Policy	EU	2022	https://doi.org/10.1017/S0143814X21000168
Day & Cramer (2022)	Journal article	Policy & transition	Regenerative agriculture policy	Sustainability Science	Global	2022	https://doi.org/10.1007/s11625-021-01024-5
de Ponti et al. (2012)	Journal article	Crop productivity	Organic–conventional yield gap	Agricultural Systems	Global	2012	https://doi.org/10.1016/j.agsy.2011.12.004
Eastwood et al. (2017)	Journal article	AKIS	Public/private advisory roles	Journal of Rural Studies	EU	2017	https://doi.org/10.1016/j.jrurstud.2016.11.008

EU SCAR AKIS (2019)	Policy report	AKIS	Future AKIS frameworks	European Commission	EU	2019	https://op.europa.eu/en/publication-detail/-/publication/0f8a91e2-21b7-11ea-95ab-01aa75ed71a1
EC (2020) Biodiversity Strategy	Policy	Policy	EU Biodiversity Strategy	European Commission	EU	2020	https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2020:380:FIN
EC (2021) Organic Action Plan	Policy	Policy	EU Organic Action Plan	European Commission	EU	2021	https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2021:141:FIN
EC (2023) Organic Brief	Market report	Markets	Organic sector trends	European Commission	EU	2023	https://agriculture.ec.europa.eu
Feledyn-Szewczyk & Kopiński (2024)	Journal article	Soil fertility	Nutrient balances organic vs conventional	JPNSS	EU	2024	https://doi.org/10.1002/jpln.202300221
Finger et al. (2019)	Review article	Precision farming	Precision farming impacts	Annual Review	Global	2019	https://doi.org/10.1146/annurev-resource-100518-093929
Finckh et al. (2021)	Review article	Plant health	Disease management in organic	ARP	Global	2021	https://doi.org/10.1146/annurev-phyto-020620-093619
Gattinger et al. (2012)	Journal article	Soil carbon	Carbon stocks under organic farming	PNAS	EU/Global	2012	https://doi.org/10.1073/pnas.1209429109
Giraud-Héraud et al. (2019)	Journal article	Value chains	Risk sharing and coordination	ERAE	EU	2019	https://doi.org/10.1093/erae/jby033

Home et al. (2019)	Journal article	Conversion	Farmer conversion decisions	RAFS	Switzerland	2019	https://doi.org/10.1017/S1742170518000358
IFOAM (2020) Organic districts	Policy guide	Territorial development	Organic districts concept	IFOAM	EU	2020	https://www.ifoam.bio
Ilbery et al. (2013)	Journal article	Supply chains	Rural food chain development	Journal of Rural Studies	EU	2013	https://doi.org/10.1016/j.jrurstud.2012.10.001
Ingram (2018)	Journal article	Transition theory	Knowledge systems dynamics	EIST	EU	2018	https://doi.org/10.1016/j.eist.2017.12.002
Jahrl et al. (2016)	Journal article	Governance	Institutional change in value chains	Journal of Rural Studies	EU	2016	https://doi.org/10.1016/j.jrurstud.2016.09.012
Klerkx et al. (2012)	Journal article	Innovation systems	Systems approaches to innovation	FSR	EU	2012	https://doi.org/10.1016/j.fsr.2012.02.001
Kneafsey et al. (2013)	EC report	Short supply chains	Local food systems	JRC	EU	2013	https://publications.jrc.ec.europa.eu
Kononets et al. (2023)	Journal article	Certification	Evolution of organic certification	Frontiers	EU	2023	https://doi.org/10.3389/fsufs.2023.1167017
Kountios et al. (2024)	Journal article	AKIS	Strengthening AKIS	Sustainability	EU	2024	https://doi.org/10.3390/su16167068

Labarthe & Beck (2022)	Journal article	Advisory services	CAP and advisory evolution	EuroChoices	EU	2022	https://doi.org/10.1002/euch.202200008
Lampkin (2023)	Conference paper	Policy	Policy support for organics	AES	EU	2023	Conference proceedings
Lampkin et al. (2024)	EU deliver-able	Policy	Policy re-sponses to F2F	OrganicTargets4EU	EU	2024	https://organictargets.eu
Latruffe & Nauges (2014)	Journal article	Efficiency	Efficiency & conversion	ERAE	EU	2014	https://doi.org/10.1093/erae/jbt033
Latruffe et al. (2023)	Journal article	Livestock systems	Dairy intensi-fication	ERAE	EU	2023	https://doi.org/10.1093/erae/jbad013
Lindemann (2021)	PhD thesis	Conversion	Drivers of conversion	Aarhus University	EU	2021	Aarhus University repository
MacRae et al. (1990)	Journal article	Conversion impacts	Farm-scale conversion impacts	Advances in Agronomy	Global	1990	https://doi.org/10.1016/S0065-2113(08)60260-2
Melander et al. (2016)	Journal article	Weed man-agement	Weed control in organic	Crop Protection	EU	2016	https://doi.org/10.1016/j.cropro.2015.10.018
Michelsen (2001)	Journal article	Policy	Political ac-ceptance of organic	Sociologia Ruralis	EU	2001	https://doi.org/10.1111/1467-9523.00169
Mills et al. (2017)	Journal article	Engagement	Farmer en-gagement in environment	AHV	EU	2017	https://doi.org/10.1007/s10460-016-9735-2

Möhring et al. (2024)	Journal article	Adoption	Adoption of organic	ERAE	EU	2024	https://doi.org/10.1093/erae/jbad044
Nagy et al. (2023)	EU deliver-able	AKIS	Assessment of organic AKIS	OrganicTargets4EU	EU	2023	https://organictargets.eu
Padel (2008)	Journal article	Values	Values of organic pro-ducers	IJAS	EU	2008	https://doi.org/10.3763/ijas.2007.0295
Padel et al. (2023)	EU deliver-able	Advisory	Barriers to conversion	OrganicTargets4EU	EU	2023	https://organictargets.eu
Peigné et al. (2016)	Journal article	Conservation ag	Organic conservation ag	RAFS	EU	2016	https://doi.org/10.1017/S1742170514000305
Ponisio et al. (2015)	Journal article	Crop diversifi-cation	Diversification reduces yield gap	Proc. B	Global	2015	https://doi.org/10.1098/rspb.2014.1396
Renting et al. (2003)	Journal article	Alt food net-works	Alternative food networks	EPA	EU	2003	https://doi.org/10.1068/a3510
Renting et al. (2012)	Journal article	Food democ-racy	Food democ-racy	IJSAAF	EU	2012	https://www.ijsaf.org
Rose et al. (2016)	Journal article	Decision support	Decision support tools	Agricultural Sys-tems	EU	2016	https://doi.org/10.1016/j.agsy.2016.06.007
Sanders & Heß (2019)	Policy report	Impacts	Benefits of organic farm-ing	Thünen	EU	2019	https://www.thuenen.de

Stephenson & Damerell (2022)	Journal article	Bioeconomy	Circular bioe-conomy	Sustainability	EU	2022	https://doi.org/10.3390/su141710643
Sutherland et al. (2017)	Journal article	Transitions	Transition pathways	Sustainability	EU	2017	https://doi.org/10.3390/su9122210
Weinberg (2023)	MSc thesis	Transition	Farmer transi-tion pathways	WUR	EU	2023	Wageningen University repository