Report and EIP-Style Factsheets on Characteristics of Successful VCN

Deliverable D5.2 - v.4

20/09/2022

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement 862993.

Deliverable 5.2	**Report and EIP-Style Factsheets on Characteristics of Successful VCN**
Related Work Package	WP5
Deliverable lead	ORC
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Reviewer	Daniele Vergamini
Grant Agreement Number	862993
Instrument	Horizon 2020 Framework Programme
Start date	1st November 2020
Duration	48 months
Type of Delivery (R, DEM, DEC, Other)[1]	R
Dissemination Level (PU, CO, CI)[2]	PU
Date last update	20/09/2022
Website	https://AGROMIXproject.eu/

Revision n° X	Date	Description	Author(s)
0.1	**29/04/2022**	**First Draft**	**Rowan Dumper-Pollard, Abel Villa**
0.2	**27/05/2022**	**Review**	**Victoria Schoen**
0.3	**26/08/2022**	**Review**	**Daniele Vergamini**
0.4	**20/09/2022**	**Revised Version**	**Rowan Dumper-Pollard, Abel Villa, Chiara Tuoni, Daniele Vergamini, Victoria Schoen, Fabio Bartolini, Robert Borek, Alma Thiesmeier, Zaira Ambu, Arthur Follebout , Kira Miskulnig, Marilena Reinhardkolempas, Valerio Bondesan**

Please cite this deliverable as: Dumper-Pollard, R., Villa, A., Tuoni, C., Vergamini, D., Schoen, V., Bartolini, F., Borek, R., Thiesmeier, A., Ambu, Z., Follebout, A., Miskulnig, K., Reinhardkolempas, M. and Bondesan, V. (2022) Report and EIP-Style Factsheets on Characteristics of Successful VCN. D5.2 of the AGROMIX project funded under the Grant Agreement 862993 of the H2020 EU programme.
Document available at: **https://agromixproject.eu/project/#how-we-work**

[1] **R**=Document, report; **DEM**=Demonstrator, pilot, prototype; **DEC**=website, patent fillings, videos, etc.; **OTHER**=other
[2] **PU**=Public, **CO**=Confidential, only for members of the consortium (including the Commission Services), **CI**=Classified

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1 Executive Summary

This document represents deliverable D5.2 “Report and EIP-style factsheets on the characteristics of successful VCN” within work package 5 (WP5) “Socio-economic, value chain and network assessment” of the EU Horizon 2020 project AGROMIX.

Agroforestry and mixed farm systems have increasingly been shown to offer a more resilient and efficient use of land while providing multifunctional landscape benefits relating to the aesthetic and recreational value, social interactions, cultural value and environmental public services. As part of the socioeconomic analysis carried out in the AGROMIX project, this report adopts a qualitative approach, drawing from the personal experiences of agroforestry and mixed farm value chain stakeholders, to identify key bottlenecks and challenges in agroforestry and mixed farm VCN as well as opportunities that could unlock the wider adoption of agroforestry and mixed farm systems to counter existing trends of farm specialisation.

Task T5.2 deals with the data collection and qualitative analysis of a broad number of agroforestry and mixed farm case study farms and related VCNs in Europe. Data analysis was divided into two levels of diagnosis, which have been defined in the DoA as “first-level analysis” and “second-level analysis”.

The first-level analysis aimed at providing a broad catalogue of successful agroforestry and mixed farm business models and related VCNs throughout Europe in the form of EIP-style factsheets. The aim, process and results of the first-level analysis have been reported in the current Deliverable and will be further disseminated through the project website and through planned and targeted activities within WP7. Included in this document are 13 EIP-Style factsheets, that clearly present agroforestry and mixed farm VCN case studies across Europe, the challenges they face, key success factors, and wider system benefits.

The second-level analysis is devoted to the in-depth assessment of the case study farms and related VCNs selected for this task, which specifically aims at illustrating key VCN characteristics and their potential innovation and market opportunities. Also, the results of the second-level analysis are reported in this document.

From the factsheets and the in-depth analysis, it is possible to conclude that even though most farmers who participated in this task found an enjoyment of their work as agroforestry and mixed farming practitioners and saw a value in what they are doing, there remain numerous challenges in terms of workload, required expertise, labour shortages, and the divergence from more commonplace agricultural production lines, that could present significant barriers to the wider adoption of agroforestry and mixed farming. Concern over a lack of consumer awareness and supermarkets setting the bottom line for food prices were the most prominent concerns felt by practitioners. The deliverable also considers a number of opportunities for agroforestry and mixed farming. Some are context specific innovations on-site that could alleviate challenges faced by practitioners and are captured in the EIP-style factsheets. The systems can reduce dependence on external inputs, allow the development of new lines of vegetable seed production, allow for diversifying feed production for livestock and an increased production of firewood from the agroforestry enterprise makes a farm more resilient in times of energy crisis. While other opportunities, identified in the in-depth analysis, relate more to the agroforestry and mixed farming sector as a whole. Those opportunities were considered from a range of perspectives, and it was found that the strongest consensus across VCN stakeholders was for

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opportunities for agroforestry and mixed farming practitioners to be supported in the delivery of the different public goods by both public and private financing to improve the profitability of those systems.

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2 Expected impact

The D5.2 Report and EIP-style factsheets on characteristics of successful VCN aims at generating a number of impacts that can be summarised in the following points:

Experiential knowledge of agroforestry and mixed farming practitioners has been collected to yield insights that can **better inform policy strategies, and discussions about the performance of those systems** that are grounded in the everyday experiences of practitioners. The report and EIP-style factsheets are expected to be used as tools to provide **context of the wider socioeconomic dimensions of agroforestry and mixed farming to complement ecological and policy research** both within this project and in subsequent projects. This is realised by the provision within this text of a **clear list of challenges faced by agroforestry and mixed farm system stakeholders**. Such a list can better inform policy and further research of the breadth of challenges faced by practitioners by situating agroforestry and mixed farm systems within the wider context of the socio-technical system. Further, more in-depth analysis using a range of research methods and analytical techniques has provided evidence of a number of **opportunities for agroforestry and mixed farming that relate to the farm site-level, the wider value chain and farm business environment.** Q-Methodology as a research technique was implemented to identify which **opportunities for agroforestry and mixed farming were valued by stakeholders across the VCN to identify convergent viewpoints. Such data could be used to better steer supportive measures for agroforestry and mixed farming for a wider, system impact.**

Finally, the outputs of this task are presented in a manner that is useful to multiple stakeholder groups (researchers, policymakers, practitioners and other interest groups) involved in the discussion around food and farming systems. The **EIP-Style Factsheets are written in a more engaging and communicable way, to better tell the story of practitioners participating in this task and provide easy access to practical information regarding different agroforestry VCNs**, while the report offers additional detail and analysis for further consideration.

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3 Introduction

3.1 Objective

The overall objective of D5.2 is to report the results of the qualitative analysis of data collected on successful agroforestry and mixed farm business models and related value chain networks (VCNs). These results inform successful value chain (VC) characteristics that deliver resilient and efficient land uses, as well as potential bottlenecks and challenges for their implementation. Specific attention through the in-depth analysis of selected VCNs, has been posed to the identification of innovation and market opportunities. The selection of the specific VCN depended on the available data and we aimed for 'depth of study' and insight into the innovation opportunities. The results inform subsequent tasks of WP5, serving as a basis for the further development of the T5.3 "Behavioural aspects of supply chain functionality for different VCN approaches" and T5.4 "Model-based scenario evaluation". The catalogue of descriptive EIP-style factsheets of all European case study farms and related VCNs contributes to feeding communication activities in WP7 and improving the overall project impacts among farmers and VC actors.
In order to achieve these objectives, D5.2 will give an insight into the two levels of diagnosis developed: a) a structured overview of agroforestry and mixed farm case study farms and related VCNs based on interviews with farmers and MF/AF practitioners, b) in-depth analysis of selected VCNs by means of focus groups and Q-methodology to rank the solutions envisaged by different agroforestry and mixed farm site-level actors (farmers, farm managers, practitioners) and downstream value chain stakeholders (including consumers) and identify convergent and divergent interests between stakeholder groups.

Tasks Addressed

Deliverable 5.2 reflects activities carried out in task 5.2 of the project:

Task 5.2. Diagnostic of MF/AF Value Chain Networks (VCNs) (M4-M18)
Leader: ORC; **Participants:** CU, WR, AEEU, UNIPI, AEEU, CRAN, ORC, VENAG, IfaS, NRDS, ZALF
Task T5.2 deals with the data collection and qualitative analysis of a broad number of agroforestry and mixed farm case study farms and related VCNs in Europe. Data analysis was divided into two levels of diagnosis, which have been defined in the DoA as “first-level analysis” and “second-level analysis”.
The first-level analysis aimed at providing a broad catalogue of successful agroforestry and mixed farm business models and related VCNs throughout Europe in the form of EIP-style factsheets. The aim, process and results of the first-level analysis have been reported in the current Deliverable and will be further disseminated through the project website and through planned and targeted activities within WP7.
The second-level analysis was devoted to the in-depth assessment of the case study farms and related VCNs selected for this task, which specifically aims at illustrating key VCN characteristics and their potential innovation and market opportunities. Also, the results of the second-level analysis are reported in the current Deliverable.

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Outline

Deliverable D5.2 is structured as follows:

Section 4 presents the conceptual framework and methodological approach adopted for the completion of T5.2 research tasks and objectives. This section includes the protocol for data collection and explains how information is filtered to the two main outputs of this task – diagnostic level one (EIP-Style Factsheets) and diagnostic level two (in-depth analysis).

Section 5 provides a catalogue of EIP-Style factsheets of different case study agroforestry and mixed farm VCNs.

Section 6 presents the results of the in-depth analysis. This section also includes a discussion of findings as well as a summary of the main bottlenecks and challenges as well as the main opportunities for agroforestry and mixed farming identified in this deliverable. This section ends with a brief conclusion and summary of findings.

Section 7 includes a list of sources referred to throughout this document.

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4 Methods for Value Chain Analysis

4.1 Introduction

Factors influencing MF/AF VCNs extend beyond the supply chain configurations that make up a normal production network. Firstly, they are **agroproduction networks**. Agroproduction networks are part of a much larger trend in food systems - characterised by a decreasing number of suppliers and manufacturers (Hassler et al., 2018). The shape and distribution of a network in the agriculture/agroforestry sector differs significantly from other global production networks. Unlike other production networks, agroproduction networks are highly locally embedded at the production stage (Hassler et al., 2018).

Agroforestry and mixed farm VCNs are knowledge-intensive and complex farming systems. In agroforestry and mixed farm systems, technology interacts with production processes and natural resource use as well as other ecological and cultural elements and according to D5.1 forming complex socio-technical-ecological systems. It will be important for this task to take into consideration processes that have helped enable agroforestry and mixed farms at the farm level - specifically regarding access to experiential knowledge, knowledge networks, the dissemination of data to practitioners, and educational opportunities.

Such elements are best captured in **value chain analysis**. Porter (1985) provides a definition of value chain as a series of value-adding activities. These could include primary activities, related directly to manufacture, sales and distribution, and secondary activities which support primary activities, such as planning, finance, R&D and human resources (Porter, 1985). In essence a series of interlinked processes that contribute to the flow of value (knowledge, capital, goods etc.) up and down a chain of actors and organisations. Value chain analysis is a tool for examining the current state of such processes and identifying areas for improvement (Fearne, Garcia and Dent, 2012).

Building on the definition provided by D5.1, we refer and consequently analyse the VC for a different degree of combination (transformation) of the most relevant characteristics, such as the actors (organization), the operations (steps), as well as the links between them (input-outputs flows, information and values), and for the impact on the socio-technical and ecological system in which they operate (performances). This combination forms a new object, the VCN, whose ultimate purpose is to add (extract) value from exchanges that can take place in both directions from downstream to upstream or vice versa. Environmental value is considered in addition to the economic value, when the VCN is developed toward more efficient and environmentally friendly land use models through sustainable agricultural practices characterised by the provision of positive

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externalities on biodiversity, water, soil, landscape and climate change, in addition to the positive contribution to the income stability of the farms involved.

Agroforestry and mixed-farm systems entail complex production processes and routes to market (EIP-AGRI., 2017; Garcia de Jalon et al., 2018). As such, a range of socio-economic and environmental factors enable and restrain agroforestry and mixed farm practitioners who must implement strategies to negate challenges and capitalise on farm management and marketing opportunities in order to maintain competitiveness. Such factors should also be considered in the analysis of VCN alongside the flow of products, information, finances, payments, contracts, and social capital that influence the organisation of a production process and a product's value. According to Grando et al., (2020) we can group key internal and external conditions to the farm business environment that affect the farm decision making process and consequently their performances (Figure 1).

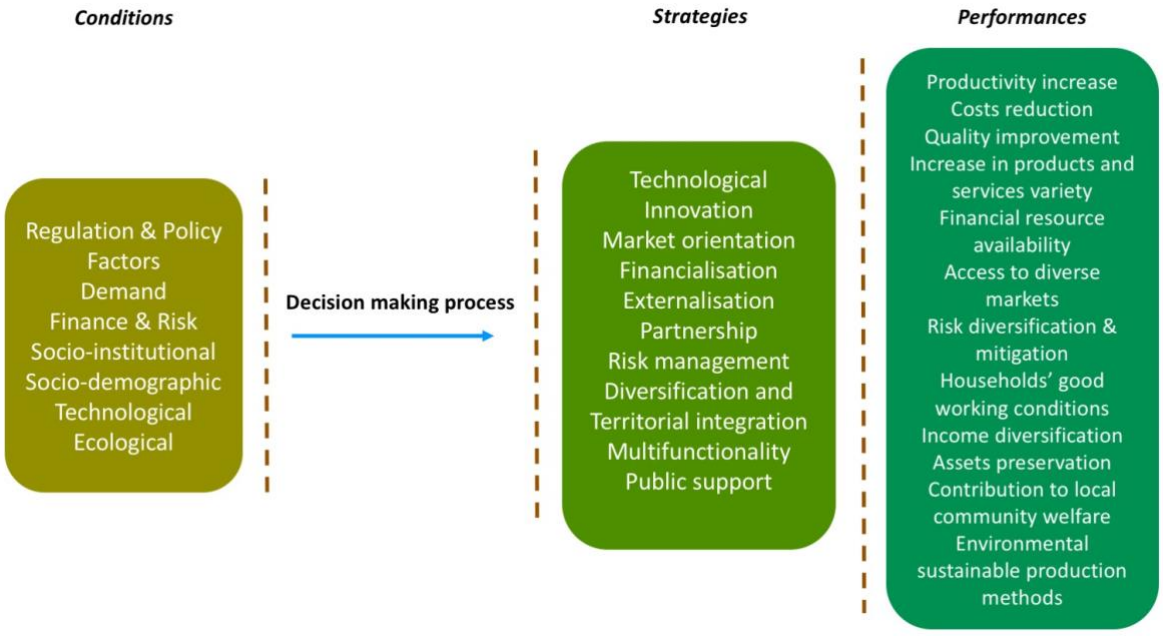

Figure 1: CSP approach for MF/AF business models and related VCNs (authors adaptation from Grando et al., 2020)

The Condition-Strategies-Performance approach (CSP) combined with VC analysis is useful for describing the key conditions in which selected farms and related VCNs operate and the strategies through which they deal with the evolution of these conditions in order to pursue their objectives. Understanding the influence of certain elements of the CSP model is critical to understanding possible bottlenecks and challenges for implementing successful VCN.

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First level analysis captures the processes that make up agroforestry and mixed farm networks, and considers the environmental conditions as well as social, economic and political structures in which agroforestry and mixed farm value chain networks (VCN) are embedded and the key challenges and enablers these pose for different agroforestry and mixed farm systems. Fearne, Garcia and Dent (2012) in their review of value chain analysis methodologies find that not enough attention is given to the analysis of social and environmental factors influencing value chains. While second level analysis provides practical solutions and opportunities for agroforestry and mixed farms learned from the experiences of value chain stakeholders in their interaction with value chains to achieve individual and institutional goals. At the second level, we consider how stakeholders act on or create opportunities from value chains. Opportunities at a base level represent an advantageous combination of circumstances that allow goals to be achieved (Moon et al., 2014). They are to a greater extent sought by actors to create some sort of change, be it the unsolicited change of ideas and practices of others or a response to unforeseen external events - be they favourable or in relation to a crisis. Opportunities are conceptualised in multiple bodies of literature including behaviour and adoption theories, entrepreneurship literature, public policy, and resilience thinking. In adoption theory, opportunities relate primarily to the wider adoption of new technologies, products and practice (Rogers, 2003). Particularly for the understanding of why individuals and institutions adopt changes, the extent to which the change is better than what it is replacing, the role of profit to incentivise adoption, and how system structures shape the arena in which adoption takes place (Moon et al., 2014). Such considerations are particularly relevant to factors influencing the conversion from specialised farming to agroforestry and mixed farms where new lines of production and new technologies are required for agroforestry and mixed farm practices.

As agroforestry and mixed farm systems are typically operated by farm businesses, actors within such systems often create and act on opportunities with the intention of creating profit. Opportunities considered within entrepreneurial literature recognise that opportunities can pre-exist the action of the entrepreneur and can also be created and exploited by the entrepreneur (Short et al., 2010). For example, institutional change, exogenous shocks, societal change, and market demand can all create (or limit) certain opportunities (Moon et al., 2014). At the same time the entrepreneur implements strategies, decisions, and actively participates in different value chain processes to create opportunities.

Resilience thinking recognises that opportunities are not independent of risk and also emerge from responses to external shocks and stresses (Moon et al., 2014). In this context they can be viewed as windows of opportunity that emerge during system transformations (increasingly triggered by crisis) and lead to novel actions by individuals and institutions (Folke et al., 2005; Walker et al., 2006). It is this lens that is of strong relevance to agroforestry and mixed farm VCNs because the opportunities facing the food and farming sector (in the context of climate change) is more comparable to a negotiation of a series of challenging situations than to a sector with numerous, pre-existing opportunities. Such considerations are valuable in our analysis to ensure opportunities are properly contextualised and not risk claiming to be a sole solution to an extremely complex array of threats and challenges facing the sector.

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Moon et al., (2014) in their work synthesise theories of opportunity to provide 3 main types of opportunity for conservation efforts that are highly relevant to AF/MF:

- *Potential*, where actors remove barriers to problem solving by identifying the capabilities within the system that can be manipulated to create support for desired action;
- *Traction*, where actors identify windows of opportunity that arise from exogenous shocks, events, or changes that remove barriers to solving problems;
- *Existing*, where everything is in place for an opportunity (i.e., no barriers exist) and an actor takes advantage of the existing circumstances to solve their problems.

It is from this perspective that we review and analyse opportunities relating to agroforestry and mixed farm systems and their potential for stimulating the wider adoption of those systems. As well as consider the strategies deployed by stakeholders to either create, or capitalise on, opportunities.

To differentiate between the strategies deployed by agroforestry and mixed farm stakeholders to create and capitalise on opportunities, and those of a more conventional and economic relationship with natural resources and land use, in line with the conceptual framework provided D5.1 we refer to agroforestry and mixed farm as '*sustainable business models'*. Here, socioeconomic, technological and geographical dimensions are integrated within the environmental one allowing new configurations of land use and resources with wider social, cultural and ecological value. From this perspective it is the quality of practices that builds sustainability within the business model (Boons and Laasch, 2019). At this level of analysis, we also consider how actors combine and recombine resources, knowledge and learning, and external opportunities to sustain and/or grow agroforestry and mixed farm systems, which in turn could relate to the greater provision of public goods. It is the degree of success by which these goals are realised that structure the practical recommendations of this report

4.2 Rationale and approaches

A mixed method approach was adopted in order to meet task objectives. The objectives require information to be gathered from experienced agroforestry and mixed farm system practitioners, wider value chain actors, and that opportunities identified be ranked by different stakeholder groups, including consumers.

Agroforestry in particular, but for some aspects also mixed farming, are rooted in traditional knowledge, in many cases lost with modern industrial agriculture. The recovery of this tradition in a modern perspective represents the innovation challenge for these practices. Traditions and local knowledge have the capacity to re-orientate modern agriculture towards more sustainable and resilient paths of development (Šūmane et al., 2018). Such knowledge can provide valuable insights into how specific farm and business practices can work in specific locations (Curry and Kirwen, 2014; Šūmane et al., 2018).

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In-depth interviews with agroforestry and mixed farm practitioners were considered the most appropriate method of data collection for experiential knowledge found at agroforestry and mixed farm site- and value chain level. Building on a review of the literature, it was found that an overview of each agroforestry and mixed farm case study farms and associated VCN could be achieved through stakeholder interviews. As such it was deemed of greater benefit to the WP and task research objectives to include the views of consumers as downstream value chain actors in our socioeconomic analysis of agroforestry and mixed farm systems.

Focus groups are widely recognised as an effective research strategy toward such means and have been implemented successfully in the research of agroforestry market opportunities by Escribano et al., (2020).

A Q-Methodological approach was incorporated into the methodology to systematically include value chain stakeholder's subjective viewpoints in the analysis of opportunities. This method was chosen to also compliment and corroborate researcher observations. Q-Methodology is a quali-quantitative methodological approach where participants are presented with a series of statements to be ranked on a sorting matrix according to preference. Best described by Selden et al. (1999) as inverted factor analysis. For Q-Methodology, subjects and variables are inverted so that the statements they read become the subjects and the respondents themselves become the variables (Selden et al., 1999). The purpose of such an approach being that convergent and divergent preferences can be identified across the differing discourses (and stakeholder groups) of the system under investigation. Such an approach has been used to investigate stakeholder preferences of innovations relating to low-input and organic dairy supply chains (Mandolesi et al., 2015). A Q-Methodological approach was also adopted for the investigation of barriers to the development of temperate agroforestry systems (Louah et al., 2017). As such Q-methodology has been chosen to assist the analysis of opportunities for AF/MF systems and add depth and structure to the report's conclusions.

Q-Methodology consists of five steps (McKeown and Thomas, 1988):

1. *The construction of the concourse*. The concourse is considered in Q-Methodology as a collection of all the possible statements an individual could make about the subject at hand. the procedure for constructing the concourse is outlined in Section 4.1.2.

2. *The development of the Q-sample.* A good Q-sample looks to reduce the concourse to a small representative but more manageable number that can be put to participants. a deductive approach (whereby statements are grouped into possible theoretical categories) was preferred over an inductive approach (where patterns emerge during the collection of the statements) due to the specific objectives of the task. Again, the stages at which this process took place are outlined in Section 4.1.2.

3. *Selection of the P set.* As the adoption of Q-Methodology research techniques has been brought in to further our understanding of the points of view of agroforestry and mixed-farm value chain members, the participant sample – P-set – was structured to include a sample of respondents who

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were theoretically relevant to the problem under consideration (Sneegas et al., 2021). The most logical steps for achieving this goal were for the P-set to be formed of those already participating in other task research activiews (i.e., the interview (farmers/supply chain members) and focus group (consumers) participants.

4. *Q-sorting*. As the research protocol was developed during covid-19 lockdown restrictions - as well as data collection occurring in 7 different countries - an online-based approach for Q-sorting was chosen. QMethosoftware provides an easy to use, Q-sort platform. A mixed farm and an agroforestry study was made in the native language for each country, the results were then exported and merged. The merged Q-sorts were then imported back into the program for analysis. Q-sorts are completed by participants using a sorting matrix (see Figure 2 below) where the pre-identified statements are arranged according to a scale (in this case ranging from 'least representative of how I feel' to 'most representative of how I feel').

5. *Q-factor analysis*. The analysis of the Q-Sorts was conducted independently for the two groups of participants - site-level actors (those who were interviewed as part of the case study work) and consumers (participating in the focus groups) and the two separate Q-studies (opportunities for mixed farming and opportunities for agroforestry. Referred to in the the results section as categories (agroforestry site-level actors, agroforestry consumers, mixed farm site-level actors, mixed farm consumers).

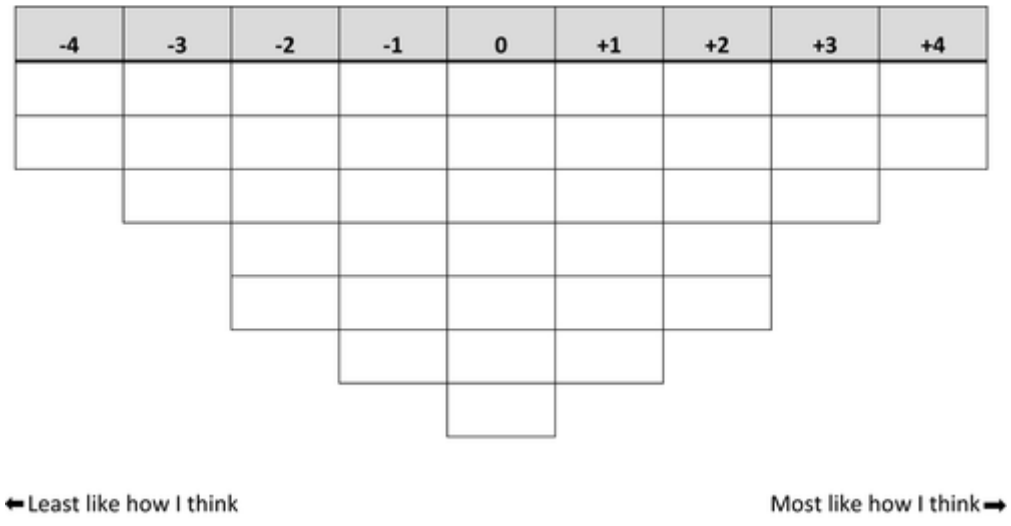

Figure 2: Q-sort grid with quasi-normal distribution taken from Rost, 2020

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4.3 Literature search, preliminary interviews and protocol development

Critical to the formation of D5.2 EIP-Style factsheets and in-depth analysis was the development of a research protocol that could attain results relevant across 7 countries participating in the investigation and capture success factors present in different value chain processes. To meet such criteria, an iterative process was implemented for the development of the research protocol to facilitate the Task's participatory research activities and to ensure research activities carried out in the UK could also be replicated in collaborating countries. The three outputs from the process of protocol development include an interview guide, a consumer focus group schedule, and a final list of Q-Statements - to guide two core participatory research activities (in-depth interviews and focus groups). The protocol was developed via the following steps:

1. A literature search was first convened, starting from the outputs of previous projects (AGROFORWARD, CANTOGETHER etc.). The search was then opened to wider online databases using search terms relevant to the objectives of T5.2. Literature search activity was undertaken systematically to ensure relevant literature and key evidence were overlooked. To make certain data collected maintained relevance to the subject of analysis (European agroforestry and Mixed farm value chain networks), the following inclusion criteria was adopted:
    - That the source's primary evidence be drawn from primarily European examples
    - That the search include a range of sources stemming from both grey and academic literature (information from podcasts and videos also considered in this)
    - That political commentary found in sources is applicable to the current policy context of AF/MF systems.
    - Only the first 50 results of each search term were considered for inclusion to ensure all search terms and task keywords covered in the time available.

2. From the search results a SWOT (strengths, weaknesses, opportunities, threats) analysis was carried out for agroforestry and mixed farm systems.

3. An interview guide drafted based on the SWOT analysis, with also consideration for the core objectives of T5.2 and wider project goals.

4. The guide was tested on UK Agroforestry case study 1 and new elements incorporated. The guide was tested again on UK Agroforestry case study 2 before being submitted to WP5 AGROMIX research partners for further review. Recommendations were incorporated and a final version of the interview guide distributed to T5.2 collaborator: **CU, WR, AEEU, UNIPI, AEEU, CRAN, ORC, VENAG, IfaS, NRDS, and ZALF.**

5. Further findings from both preliminary interviews were considered as evidence in the protocol development and incorporated into the SWOT analysis.

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6. The search results were revisited and a list of potential opportunities for both systems developed. This formed the basis of the Q-Methodology concourse. A total of 148 "opportunities" were identified in the literature and entered into a database. Entries into the database were arranged thematically and reduced to a final list of 50 Q-statements (25 for agroforestry systems and 25 for mixed farm systems). Five clear discourses emerged out of the opportunities identified and the language used in the Q-statement formation was designed to pull out stakeholder viewpoints that might align with those discourses. Although other statements were worded more generally, so that potential new viewpoints could also be observed. The five discourses that emerged from the literature search results included opportunities relating to:
    - Environmental (e.g., waste and pollution reduction, land sparing debates)
    - Animal Welfare (e.g., improved animal husbandry, more natural habitats for livestock)
    - Food Quality (e.g., improvements to food health and nutrition)
    - Locality/regionality (e.g., developing local infrastructure, provision of jobs etc.,)
    - Farm Competitiveness/Profitability (utilising technology to improve production efficiency and supply chain logistics)

7. Information gathered during the SWOT analysis, concourse, preliminary interviews and a review of consumer focus group methodologies provided the initial structure of the T5.2 focus group schedule. The schedule was tested in the UK, amended where appropriate, and distributed to T5.2 researchers.

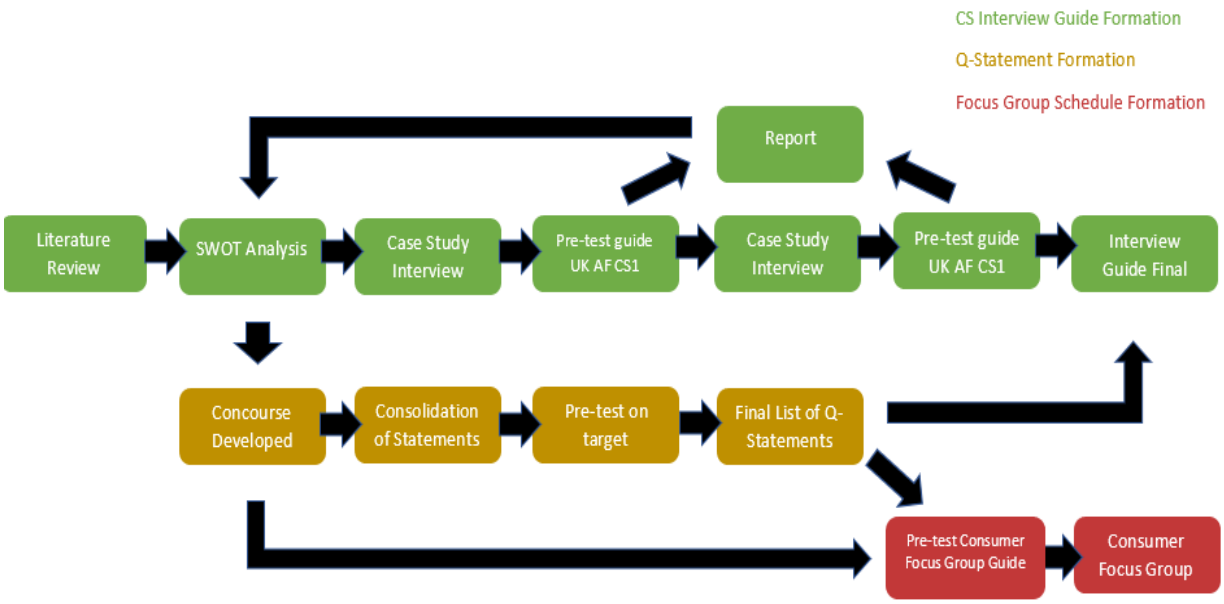

Figure 3: Steps taken in research protocol formation.

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4.4 In-depth interviews and Q-Methodology

4.4.1 Agroforestry and mixed farm case study selection

In line with the Task objectives, it was logical to prioritise well-established sites – particularly for agroforestry systems. For example, with agroforestry case study farm selection, it was deemed that a generally a greater depth of experiences could be learned from sites that had already passed the tree planting and establishment phase. This would ensure that the site already has routes to market for products that are at least in some way part of the agroforestry and mixed farm system adopted. In some cases, the woody component or tree crop of the agroforestry season was yet to be harvested, but other revenue streams were still part of the agroforestry system (e.g., chickens in the grass alleys or a vegetable crop rotation). The guide also instructed interviewers to include interviews with downstream supply chain actors (in addition to farmers) where information on case study value chains is missing. Although in most cases the farm manager or owner (as interviewee) was able to provide a good overview of the farm's value chain. A first selection was done among current AGROMIX pilots, and where it was not possible researchers used farms among trials sites, as well as their own connections outside of AGROMIX if the selection criteria was met (for example, it was required to find a mixed farm case study example in the UK for this task, where the main project pilots are agroforestry). For clarity's sake, the reference case study farms in this report are specific to those case studies involved in this task, rather than to the already established AGROMIX case study network.

4.4.2 Structure of the Interviews

Questions were structured to attain data relating to the following areas:

- *Basic farm information* - Questions in this section focussed on descriptive information such as farm size, legal ownership, main products and services, and farm practices used.

- *Site design and management of agroforestry or mixed farm system* - Where the merits of a particular on-farm decision relating to either agroforestry or mixed farm practices (e.g., the choice of a particular tree species or crop rotation) could be explored in more detail.

- *Conversion to agroforestry and mixed farm* - Relating to potential trade-offs and tensions between *agroforestry and mixed farm* practices and existing farm practices. As well as challenges (economic, knowledge gaps, on-farm infrastructure etc.) faced when setting up the *agroforestry and mixed farm* system. In some cases where the practitioner had inherited the site and had always practiced agroforestry, participants could use questions in this section to reflect on their own personal experience of learning the skills necessary for becoming AF/MF practitioners.

- *Impact of agroforestry and mixed farm on workload and quality of life* - Participants were invited to discuss the impact (negative and beneficial) of agroforestry and mixed farm systems on their own and their staff's workload, number of daily tasks, labour and skill requirements, and the capital,

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materials and machinery required to meet these demands. Participants were also asked to reflect on, if applicable, their own enjoyment of the farm's aesthetics, purpose, and associated lifestyle as a consequence of implementing agroforestry or mixed farming.

- *Interactions with value chains* - Questions were designed to gather information about how agroforestry or mixed farming has impacted the overall business and marketing opportunities for the farm. This section also investigates how the farm looks to create value around their products and services and valorise different elements of the agroforestry or mixed farm system. This section draws on themes highlighted in both GVC and GPN theories - particularly around the creation and capture of value by different supply chain stakeholders, and the distribution of power in the supply chain.

- *Reflection on the importance of agroforestry or mixed farm practices and products when faced with external shocks and stresses* - Participants were invited to reflect upon the impact of agroforestry or mixed farming on their overall farm ability to adapt or survive external shocks and stresses. As well as to consider what they believe to be the main enabling factors in adapting or surviving external events.

Each section consisted of a small number of core questions followed by a high number of "prompts" to stimulate in-depth discussion around the given subject area. Interviews took between 45 and 90 minutes depending on participant availability. Where data was missing, participants were also asked further questions via email. After the interviews, participants were sent a weblink to complete the sorting of their Q-Statements in their own time.

4.5 Consumer Focus Groups and Q-Methodology

The focus groups were designed with the intention of considering agroforestry and mixed farm system services and products within the everyday food shopping experience, as well as stimulating a discussion around different ways of farming. Product value in agroforestry systems can be generated through the promotion of food quality attributes such as taste, nutritional composition, organic certification (and other premium labels), production methods and animal welfare (Röhrig, Hassler and Roesler, 2020). Trees on farmland and the 'mosaic' landscapes of mixed farms have also been found to have high cultural, aesthetic and recreational value (Nerlich et al., 2013; Riley and Harvey, 2005; van Zanten et al., 2014) The focus groups provided a space in which to explore the market potential of different quality attributes associated with agricultural systems and what factors influence consumer perceptions of such quality attributes.

4.5.1 Recruitment

A short screening questionnaire was presented to potential participants to ensure different ages and gender identities participated. The questionnaire also asked the frequency of which they shopped for 'organic' products. Organic was deemed in this instance as an appropriate indicator of interest in sustainability issues surrounding food production. This was to ensure different perspectives on food shopping were represented. To mitigate the impact of covid-19 restrictions on focus group research activities, recruitment was left to the

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discretion of each researcher, providing the mentioned criteria be met, as restrictions relating to covid-19 varied from country to country. Focus groups included between 8 and 12 participants. Two (including the pilot) were held in the UK (both online due to covid-19 restrictions), one in Belgium and two in Italy.

4.5.2 Focus Group Structure and Topics Covered

The focus groups took the following structure:

Introduction and video - Participants were played a short, neutral video developed by ORC researchers, where specialised, mixed and agroforestry farm systems were explained.

Imagery association round - This draws inspiration from Escribano, Gaspar and Mesias (2020) in their application of projective techniques to the question of market opportunities and logo options for silvopastoral products in the Dehesa region. Projective techniques are based on the belief that the unconscious beliefs and feelings of those involved may emerge if presented in an ambiguous situation - i.e., a situation where there are no right or wrong answers (Escribano, Gaspar and Mesias, 2020; Mesias and Escribano, 2018). Imagery associations is a technique used in focus groups to achieve such means.

Participants were asked to respond from a series of photos depicting specialized, mixed and agroforestry farm landscapes - each specific to the focus group host-nation. The consideration of such landscape images provided an opportunity for participants to discuss the implications that different farming systems could have for the aesthetics and functionality of rural areas. Stimulating a discussion about landscape aesthetics also allowed researchers to explore possible tourism and marketing opportunities for different rural landscapes with differing aesthetic attributes.

Another picture round allowed participants to respond to images of different logos trying to capture attributes of each farm system - each specific to the focus group host-nation. Probing questions for this round were designed to facilitate a discussion around branding clarity of message, visual appearance and which styles may be favourable amongst food shoppers.

In-depth discussion - participants were afforded time to unpack some of the themes raised in more detail. Probing questions also stimulated a discussion around their own personal experiences and knowledge of agroforestry and mixed farming and what about both systems appeals to them as food shoppers. Participants were also asked to consider what about different farm systems may influence their decision to buy or not buy a product.

Q-methodology - The final section of the focus group schedule was designated to sorting of the Q-statements in the sorting matrix. Participants were asked to individually sort opportunities for both agroforestry and mixed farm systems using their sorting matrix. Time was then given afterwards for participants to explore why they arranged their cards in the way that they had.

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5 Catalogue of descriptive EIP-style factsheets of all European case study farms and related VCNs

5.1 Objective

The factsheets were designed with the objective of presenting data in a simple and problem-oriented way. The format is divided into six sections across three pages. In addition to the sections, the format also contemplates visuals, i.e. icons, infographics and images that facilitate understanding of data and contextualization of issues and success factors identified.

Among the sections are:

1. *Section 1. General Information:* this section contains data on the context of the site or region of the case study. The objective is to provide an overview of the region for practitioners and farmers to understand the agricultural context of the case study. Along with this information researchers provide a picture of the region or site.

2. *Section 2. Description of the case study:* this includes some basic farm information (farm age, ownership structure, and origins), the current characteristics of the farm, the current agroforestry or mixed farming practices implemented at the farm, and the farm's main products.

3. *Section 3. Value chain information:* this section contains information on the value chain actors, stages of production, and connections between actors across the chain. The objective of this section was to provide a detailed account of the case study's value chain and capture its complexity. Text summaries of each case studies' value chain were provided by project partners. Simplified value chain actor network diagrams were then developed to represent those value chains and sent back out to project partners to review. Value chain actors were colour coded according to their place within the sociotechnical system. Site-level actors and enterprises (i.e., those individuals, processes and enterprises based at the farm) were depicted in green. Actors relating to policy, information and non-monetary/cultural exchange were coloured in violet. Actors relating to infrastructural, logistical, and supply chain intermediary processes were shown in brown. End-users were shown in yellow.

4. *Section 4. Bottlenecks and challenges:* this section contains data that highlights the main difficulties found when adopting agroforestry and mixed farm agricultural practices. The data displayed in this section also aims to shed light on two aspects of the task objectives: internal difficulties related to the farming operation - identified as bottlenecks, and difficulties that could potentially slowdown or hinder the adoption, still within the farming operation, of these practices - identified as challenges. Within this section, the bottlenecks and challenges experienced by agroforestry and mixed farm

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practitioners are shown at three levels: internal challenges, external shocks and external long-term stresses.

5. *Section 5. Success factors:* this section contains data on success factors from case studies as to what has been key for the continued use of resilient and efficient agroforestry and mixed farm practices.

6. *Section 6. Key System Benefits:* this section found on the final page of the factsheets provides summaries and examples of some of the primary benefits for each case studies value chain network.

5.2 Protocol for Data Selection

The main tool for data collection was in-depth interviews with case study leaders. Data collection was conducted with the help of case study leaders in their respective countries. Case study leaders (researchers collaborating in T5.2) were provided with an interview guide with instructions to follow to ensure quality of data questions relating to task objectives properly covered.

Data collection was carried virtually and personally, either through zoom, skype, skype for business and Microsoft teams or meeting interviewees at their farm (where covid restrictions permitted). Interviewees were advised that for data analysis it would be required for the interview to be recorded. Therefore, before starting the recording, interviewees were asked whether they agree or disagree to record. In all cases positive answers were granted. In those cases where there was the possibility to send a written consent, this approach was chosen. Electronic signatures requested where a written response was not possible (e.g., during covid lock-down). The written consent form provided information for participants about the purpose of the study, objectives, data information handling and storing and two choices where participants could either allow their personal names to be cited or anonymised.

A case study selection criterion was developed as part of the methodological approach to this task. Collaborators were asked to select case studies in accordance with the case study selection criteria for each of the participating countries (AUST, BE, DE, GR, IT, PO, and UK). For the factsheets, a handful of case studies with sufficient “number”, rich in information and fairly good geographic spread was prioritised as the basis of the pool of data to be analysed. Collaborators were asked to prioritise established sites with routes to market for their products. Interviews were held with farm managers and owners, transcribed and interviewers organised information according to the factsheet outline. Case study information provided by case study leaders first went through a screening process. This screening gathered general information on the status of agroforestry and mixed farm practices of each case. For example, bottlenecks, challenges, and succinct contextual information on the farming operation as well as the region. Data selection then considered contexts from starting agroforestry and mixed farm practices, to value chains being set up, to more established and functioning value chains which present more sophisticated mechanisms of marketing, valorisation of products and the involvement of local community members and civic society.

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5.3 EIP-style Factsheets

All 13 EIP-Style factsheets can be found in the Annex at the end of this document. We report below the full list of case studies (Table 1).

Table 1: List of EIP-Style Factsheets by name and corresponding case study number.

Case Study	Factsheet Title
GR01	Agroforestry in the Evrotas river valley (Southern Greece)
GR02	Mixed Farm in the agricultural plain of Thessaly
GR03	Agroforestry in Pelion region (Thessaly, Central Greece)
BG01	Mixed farm with agroforestry in Belgium
IT01	Tenuta di Paganico (Paganico, Grosseto Province) – Agroforestry
IT02	AL CONFIN (Mix Farming) – Italy (Veneto Region)
GER01	Mixed farm with Cattle and Arable in Saxony
GER02	Agroforestry in the historic area of Odernheim am Glan (Rhineland-Palatinate, DE)
POL04	Agroforestry in the Beskid Mountains - Łazy Brzyńskie, Małopolskie region (Lesser Poland)
UK01	Enterprise stacking in a sivolarable system in Suffolk
UK02	Silvopastoral System in the Northeast Cotswolds
UK03	Biodynamic Mixed Farm in East Sussex (UK)
AU01	Agroforestry in the Weinviertel region (Lower Austria, At)

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6 Results and in-depth analysis

6.1 Overview of Agroforestry and Mixed Farm Case Farms and Related VCNs

6.1.1 Farm level – Interviews

A total of 17 farm level interviews were completed with a mix of agroforestry and mixed farms (13 of which were used for EIP-Style factsheets and all for second level analysis). Of these, five were carried out in Poland, three in Greece and the UK, two in Germany and Italy and one in Belgium and Austria. A brief introduction to each of the case studies is given below before the responses to the six areas outlined in the description of the interview guide are summarised.

Table 2: Summary of the 17 Case Studies

Case Study	Total Farm Size (ha)	Main crops	Main Livestock	AF/MF System Type	AF/MF Practices Used
GR01	2	Citrus fruit, figs, mulberries, olives, beans, herbs	N/A	Multi-layered agroforestry system	Companion planting, polycropping, support species planting.
GR02	40	Cereals, legumes, vegetables and livestock fodder crop mixtures	Sheep	Mixed crop and livestock system	Sheep graze on crop stubble. Fodder grown to supplement livestock diets.
GR03	0.5	Fruit and nuts (many different varieties), olives, wine	Ducks, chickens, guinea fowl, turkeys, geese	Polyculture Silvopastoral System	Orchard grazing
BG01	4	Fruit and nut orchards, vegetable garden and edible flower strips.	Goats, pigs, sheep	Silvopastoral	Orchard grazing
IT01	1500	Grapes, olives, wheat, barley, oats, corn	Cattle, pigs	Silvopastoral	Grow hay and straw for animal feed, woodland grazing.
IT02	12	Barley, wheat, triticale, corn, horticulture	Cattle, pigs	Mixed crop and livestock system	Farm cereals (triticale, burley, corn) and unsold vegetables are used for feeding pigs. Manure from the livestock is used to fertilise the soil to improve vegetable production.

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					Weed control is facilitated by a rotation and use of biological/mechanical methods.
GER01	911	Cereals, oilseed rape and legumes	Cattle	Mixed crop and livestock system	Feed is 85% grown on-farm, only mineral feed and coarse colza meal are bought from outside. Dung from livestock is used as organic fertiliser on the arable land
GER02	112	Fruit (apples, pears, cherries, quinces, currant, plums) sold fresh or juiced	Cattle, chickens	Silvopastoral	The chickens are allowed in an area of around 5 ha, and the cows are allowed to graze in around 9 ha orchards.
POL01	96	Wood (for own use)	Cattle	Silvopastoral	Hedgerows and riparian buffer strips. Mobile grazing system.
POL02	85	Wood	Cattle	Silvopastoral	Mobile grazing system through plantations of ash and beech.
POL03	30.5	Wood (for own use) and apples	Cattle	Silvopastoral	Orchard grazing
POL04	60	Blueberries and honey. As well as fruit for own consumption.	Cattle, sheep	Silvopastoral	Orchard grazing, riparian buffer strips, woodland grazing
POL05	38	Wood	Cattle (dairy and to be sold)	Silvopastoral	Riparian buffer strips
UK01	22.5	Cereals, legumes, fruit, hedge laying staves, vegetables, hemp, haberdashery, woodchip	N/A	Silvoarable	Crops grown on a rotation in tree alleys. Woodchip from trees used as fertiliser. Organic crop rotation
UK02	1000	Cereals, vegetables, floristry products	Cattle, sheep, laying hens, turkeys	Silvopastoral	Hens graze 40m wide paddocks in between lines of alder and apple trees and use trees for shade while fertilising soil. Hens provide weed control.
UK03	220	Cereals, vegetables	Cattle (dairy and beef), pigs, sheep, chickens (eggs and meat), ducks, turkeys, geese	Mixed crop and livestock system	Feed grown for animals, animal dung as fertiliser for fields and vegetable garden.
AU01	100	Wood, fruit and nuts, cereals	N/A	Silvoarable	Crop alleys and polycropping for a high-value silvoarable system

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6.1.2 Introduction to the case study farms

6.1.2.1 Greece

6.1.2.1.1 Case study 1 [GR01]

S. L. Farm and S. L. Enterprise is located in the Evrotas river valley, Peloponnese, southern Greece. It is an agroforestry farm that the interviewee took over from her father in 2014. It had been converted to organic in 1985 and received organic certification in 1989. The transition to agroforestry took place from 2016. The farm is 2 ha in size and lies in the flat river valley on a micro-hill 20-40 m above sea level where it enjoys a unique and favourable microclimate. The soil contains high amounts of sand and clay and is good for cultivation.

Prior to the agroforestry conversion, the main crops were citrus (mainly oranges) and old olive trees but now many more species have been incorporated. Citrus trees are sited every 4-5 metres between the olive trees that are laid at 8-12 metres. Between the citrus trees are fruit trees and fig trees and mulberry trees have grown spontaneously. Eucalyptus was planted as well as species such as herbs, self-propagating *faba* beans, cotton as a perennial (on an experimental basis), *Tithonia diversifolia* (Mexican sunflower), *Albizia julibrissin* (Persian silk tree or pink silk tree), *Acacia saligna* (golden wreath wattle) and many more. The focus is on including many different plant layers, plants acting as support species and including many nitrogen fixing species.

The farm sells citrus fruit (oranges, lemons, limes, grapefruit) and olive products. Other produce is used only for home consumption. The farm business itself processes the table olives and bottles and quality checks the olive oil that is pressed by an outside organisation. The citrus fruit and olive oil from the farm are sold to an established network of customers in Greece and overseas, mainly Germany and France. The business also buys in the produce of other small regional farms and sells this on to selected customers including wholesalers supplying supermarkets and agents who then sell on via farmers' markets and direct to consumers.

6.1.2.1.2 Case study 2 [GR02]

This farm is located at the centre of the agricultural plain of Thessaly at an altitude of 500 metres in a semi-mountainous area. It is a mixed farm run by a third-generation female farmer since 2009, although the farm has been in the family since 1921. The farm is 40 hectares in size which includes 16 hectares of natural vegetation in the form of islets which are inaccessible to standard farm machinery and are allocated to grazing. It is managed under the organic farming certification framework and follows the regulations of biodynamic agriculture. Developing initiatives include engagement in Community Supported Agriculture (CSA), agrotourism and the organisation of educational activities. For the future, the goal is to move to a more multifunctional farm design through the introduction of productive perennial crops and the inclusion of further livestock species such as poultry and cattle in a holistic grazing management system (e.g. paddock grazing, silvoarable production).

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The farm is mainly arable, growing cereals (durum wheat, wheat, Emmer wheat, Einkorn wheat, barley, rye, oat), legumes (lentils, chickpeas, beans), vegetables (potatoes, carrots, onions) and livestock fodder crop mixtures. Livestock production includes the rearing of around 100 sheep for milk and meat production. Cereals are self-processed to flour in a self-constructed and small-capacity stone-mill. Pasta products are produced by cooperating manufacturers. Milk is processed into feta-cheese mainly for self-consumption. Products are marketed directly to consumers or through retail shops in Greece. Part of the production is also exported abroad through traders or directly. The personal network of consumers and cooperating retail shops is located in larger urban centres, mainly Athens. During the pandemic, the sale of products through the business's e-shop increased.

6.1.2.1.3 Case study 3 [GR03]

This is a certified organic farm in the Pelion region of Greece and is managed by a small-scale producer, who also runs an organic food store in the nearby city of Volos. On 5 stremmas (equivalent to 0.5 ha) various birds graze beneath fruit and nut trees. Since 1995 the orchard has progressively evolved from a simple cherry and peach orchard to a polyculture system that includes 169 trees (24 tree species) and 79 birds, 20 rabbits, 2 trained dogs and 5 cats. Tree species include pears, apples, persimmon, chestnuts, walnuts, hazelnuts, chokeberries, pomegranates, olives, mulberries, quince and figs. Fowl species include ducks, chicken, guinea fowl, turkey and geese. Main farm products are different fruits and nuts, eggs and further products coming from fruit processing such as dried fruits, jams, juices, fruit liqueurs and wine. Meat and vegetables are produced for self-consumption. Wine and juice making takes place in cooperation with other small-scale producers. Products are sold via the organic food store or directly to consumers. In case of a surplus, products are sold also to other stores.

6.1.2.2 Belgium

6.1.2.2.1 Case study 1 [BG01]

The farm is located in the neighbourhood of a Belgian tourist city. It is a farmer-owned mixed farm with agroforestry that began operations in 2014. It started as a pick-your-own farm but this was short lived as the farm was too near to a busy road, too far from the city and the neighbours are farmers themselves or own kitchen gardens. The farm took an agro-ecological approach from the start and decided to include agroforestry. There is a 3 hectare field for goats which also contains 160 trees of mixed varieties, both traditional (apple, nut, cherry, plum) as well as less common medlar, apricot and rowan berry trees. The farm also includes 10 free range pigs that remain on a terrace because of the impact they have on the soil. There is also a vegetable garden growing high end vegetables and edible flowers. Some trees also produce edible leaves.

Farm products include milk, cheese and yoghurt from the goat milk; specialised vegetables and free range products from the pig. There are three main sales channels for these: a small farm shop selling vegetables

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and fruit from the farm and neighbouring farms; a farmer shop in the nearby tourist city; and deliveries to high end restaurants.

6.1.2.3 Italy

6.1.2.3.1 Case study 1 [IT01]

Tenuta di Paganico is situated in Paganico in the Grosseto Province of northern Italy. It is a JSC company that has been in operation since 1924. It is 1500 hectares in size, of which 1100 hectares are forest, and 400 hectares are arable. From the start, the company focused on silvopastoral practices by integrating forestry, cattle, sheep and equine breeding. It also has an agritourism business.

Main products are cereals (soft wheat, barley, oats, corn for animal feed) and legumes grown for human and animal consumption, hay and straw for animal feed, and pork, beef and cured meats that are sold from the farm gate. There are also 3 hectares of vines, 6 hectares containing 820 olive trees and some wood arboriculture planted with funds under Reg. CEE 2080/92.

The farm works on short food supply chains. It has its own shop and restaurant, selling directly to the public. It also sells in Tuscany. They used to process in-house but now they work with external suppliers and subcontractors to transform some products. A small company in the area produces meat ragu, grapes are processed by a nearby winery, olive oil is processed externally and an agricultural brewery makes beer. From 2022 they will also make pasta using wheat from the farm in a local agricultural factory. The farm is trying to create a network of companies with which they share methods and ideals and through which they are able to offer a diversified supply of products.

6.1.2.3.2 Case study 2 [IT02]

The organic farm lies in the Veneto region of Italy, near the city of Vicenza. It is 12 hectares in size and has been in the same family for four generations, totalling near to 100 years. The farm manager has been in place for the last 20 years. Al Confin is a mixed organic farm that is involved in food production as well as offering a host of other services. It has diversified into processing of traditional products, direct selling via the farm shop, and developed educational and social provision for the local community. Such diversification has been directed to increase farm income and family employment and to the extent that it now engages employees.

Five hectares of the farm are meadow and pasture for suckler cows; 5 hectares are used for arable crops grown in rotation (barley, wheat, triticale and corn) and there are 2 hectares of horticulture including more than 40 species/varieties and different cultivars across the seasons. There are three types of livestock kept on-farm: all are reared outdoors with a free-range system to organic standards using agroecological principles. From the start, the farm kept chickens for eggs and meat. Now annual production is about 1,200

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chickens, 200 guinea fowl and 250 hens that produce sufficient eggs for the farm shop. In addition, the farm keeps outdoor pigs (3 sows and 20-25 growing and fattening pigs) and suckler cows (9-10 head).

Traditional fermented salami is produced from the pigs, beef is produced that is processed in a specialised meat plant; chicken and eggs are sold; vegetables; and cereals. The farm shop sells many of the vegetables harvested from the fields and greenhouse, eggs, chicken as well as the processed products from the farm such as the salami, bread, some flour and other bakery products. Cereals and unsold vegetables are fed to the pigs. Beef is delivered to customers who have pre-ordered. A small amount of farm produce is used to prepare a meal for pupils of a farm kindergarten that teaches young children some aspects of agricultural production.

6.1.2.4 Germany

6.1.2.4.1 Case study 1 [GER01]

Case study 1 is a mixed farm in Saxony, 911 hectares in size. It is a cooperative that has existed in its current form since German reunification. Prior to that, it was a state owned cooperative as was common in the GDR. 60% of the land is leased and the remaining 40% is owned by the cooperative. The farm combines arable and livestock farming (cattle fattening and finishing indoors) and a grazed breeding system. The breeds are mixed but based on Fleckvieh/Simmental cattle. The breeding cattle are grazed on 40 hectares, subdivided into 4 sections. Finishing cattle are bought externally and housed indoors. They remain on the farm for one year before being sold for meat. 85% of feed needs are grown on the farm with only mineral feed and coarse colza meal being brought in from outside.

The main products are cereals, oilseed rape, maize and beef. The oilseed rape is grown on a 4 year rotation to which there are four components: oilseed rape, cereals (wheat, durum wheat etc.), summer crops (maize, peas or sugar beet), winter cereals (e.g. barley). 50-60% of their output is contracted to a local mill (which is also a cooperative) and a local butcher. The remainder is sold wholesale.

6.1.2.4.2 Case study 2 [GER02]

This case study farm is located in the historic area of Odernheim am Glan (Rhineland-Palatinate) and is approximately 112 hectares in size. It is an organic family farm business and has a combination of agroforestry with ancient orchard fruit trees and livestock, namely chicken and cattle. The farm started with the integration of the orchard with beef production in 2009, while the free-range poultry element is a more recent addition. Specifically, the farm comprises 50 hectares of fruit trees (orchard) for both fruit and juice production (apple (mainly), pear, cherry, quince, currant, plum); 5 hectares of forest; 5 hectares of non-arable land; 45 hectares of grassland; and 6 hectares of cropland (cultivated with 4 year cycles of grass followed by one-year of crops to preserve its cropland status).

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Regarding cattle, 50 Glan animals are kept along with their calves and one bull. For most of the year, the animals have access to grazing and are therefore fed with fresh grass and herbs. The calves that are not kept for breeding are slaughtered at 2 years old and the meat is sold in the local farm shop. Free range poultry production began in 2020 and now has 150 hens and 4 roosters. The objective is to contribute to the health of the fruit trees through pest control and manure spreading.

The orchard silvopastoral area is characterised by fruit trees of different rootstock sizes and therefore the animals are organised to prevent damage to the youngest trees. The chickens occupy an area of about 5 hectares while the cattle can range in a 9 hectare area to avoid damage to roots and trees.

In addition, in 2021, a number of trees were planted in 8.5 hectares of the grassland area: 120 trees for timber, 88 walnut trees, 21 marrons and 525 fodder hedges.

The farm is also part of the "die Demonstrationsbetriebe Ökologischer Landbau network" (**https://www.oekolandbau.de/**) together with other 290 farms and participates in guided tours, seminars, and farm festivals for consumers, families and school classes interested in organic farming practices.

Main products sold by the farm are fruits for juice and direct consumption, beef and eggs.

The farm processes the fruit for the production of apple juice (300 tonnes of apples per year) and cider. Of the juice produced, 10 -15% is sold directly in the farm shop, 25-30% to supermarket and 60% to wholesale markets such as Öko-Marktgemeinschaft Saar-Pfalz-Hunsrück GmbH" or "Phönix Naturprodukte GmbH" which is now called "BiUno" or "SONAR", or "NOVUM – Das Gemüseabo GmbH", or "Fair-Handelszentrum Rheinland GmbH". These are initiatives where different farmers join together to sell their products (organic and non: vegetables, fruit, meat, eggs, cheese, dairy products, bread, honey, and delicatessen). This system provides a more direct relationship between consumer and producer providing a wide variety of products available at the regional level.

5% of the fruits produced (plum, apples, cherries, etc) for consumption are sold directly from the farm shop while another 5% is sold directly to other outlets such as supermarkets.

90% of the fruit are sold to the wholesale market "Öko-Marktgemeinschaft Saar-Pfalz-Hunsrück GmbH". The meat is sold on site and also to slow-food restaurants, while the eggs are sold on the farm.

6.1.2.5 Poland

6.1.2.5.1 Case study 1 [POL01]

This farm is located in Krzywa, Lesser Poland and is run by the brother of the farmer at Case study 2. It is 96 hectares in size, has been family owned since 2004 and organic since 2012.

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It has 8 hectares in a silvopastoral system and has 1.5 km of hedgerows, 0.8 km of windbreaks and 0.6 km of wooden riparian buffer strips. The remainder is permanent grassland with hawthorn, hornbeam, birch and alder trees. Livestock are mainly Limousine cattle of which the farm owns around 150 head. The farm is certified organic and follows a mobile grazing system.

Main products are cattle for meat and wood and markets are reached via personal contacts, local channels and through OIKOS. Agroforestry allows the farm to build its brand on the basis of climate and social impact. Presently work is underway on the farm to construct a local agricultural abattoir and processing facility.

6.1.2.5.2 Case study 2 [POL02]

Case study 2 for Poland is also in Krzywa, Lesser Poland and is 85 hectares in size. It is family owned and has been organic since 2016. It has 4 hectares in a silvopastoral system and the farm has 0.5 km of hedgerows and 0.2 km of windbreaks.

The land is mostly permanent grassland with ash and beech trees. Cattle are of the Limousine breed and number about 100 head. It is a certified organic farm and follows a system of mobile grazing designed to increase plant growth and soil carbon accumulation. There is a plan for diversifying animal production on the farm through the introduction of sheep.

Main products are cattle for meat and wood. Marketing channels are found through personal contacts, local channels and OIKOS, often using the contacts of the farmer's brother.

6.1.2.5.3 Case study 3 [POL03]

Case study 3 is located in Łazy Brzyńskie, Małopolskie region (Lesser Poland). It is 30.5 hectares in size and has been established since 1846 at least, making it over 170 years old. It has been organic since 2005. Of the 30.5 hectares, 24.5 hectares are owned and 6 hectares are rented.

The farm follows a silvopastoral system with orchard grazing. Grassland /pasture accounts for 15.5 hectares, orchard for 0.5 hectares, silvopastoral use of the orchard for 2 hectares, arable 0.5 hectares and woodland 12 hectares. The main cattle breeds are hybrids, Limousine, Simental and local breeds, of which there are approximately 30 animals. A mobile grazing system is followed whereby the cattle graze through successive paddocks established along the rows of trees.

The main products from the farm are fruit (apples), meat (beef), calves (weanlings) and some blackcurrants. There is also production of cereals, potatoes, vegetables and poultry for home consumption. The apples are collected by two local organisations for juicing and the cattle by one regional organisation, OIKOS.

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6.1.2.5.4 Case study 4 [POL04]

Case study 4 is located in Skwirtne and is 60 hectares in size of which 15 hectares are owned and 45 hectares are rented. The farm has been owned since 1999. In 2008 it began livestock breeding and in 2014 it became an organic farm. Within the 15 hectares that are owned, there is an orchard of 0.5 hectares with an apiary and 11 ares of American blueberry. The 45 hectares that are rented are mainly grassland. The pasture and mowed grassland has linear trees along streams, ditches and inside the balks; these are mostly fruit trees. There is also a small pine area used for grazing. The 6 cattle are Limousine and the 83 sheep are Blackhead. A mobile grazing system is used with sheep following the cows on the land.

Main products from the farm are cattle and sheep for slaughter, calves (weanlings), lambs, cull cows and ewes, blueberries and honey. There is also fruit produced from the trees that is currently only for home consumption. The sheep and their products are sold in collaboration with the slaughterhouses to individual customers and to Lidl supermarket. Beef is sold to shops, at fairs and to a lesser extent to restaurants together with other products processed by OIKOS. The meat is considered to be of a premium quality because of its organic status.

6.1.2.5.5 Case study 5 [POL05]

This case study farm is located in Zdynia. It is 38 hectares in size. The farm has been owned since 1988 and organic since 2000. Of the 38 hectares, 18 hectares are owned, and 20 hectares are rented. The land is mostly permanent pasture with 10 acres (0.1 hectares) of potatoes for home consumption. The cultivation of other crops is impossible because of the nature of the soil, being thin and stony with the threat of slugs and snails. 6-7 hectares of the pasture includes solitaire trees or small tree complexes. There are small sections of stream with buffer strips enriched with new plantings. The farm has 30 head of cattle, Polish reds, Polish red-white and Limousine hybrids. The grazing system is in plots.

Main products from the farm are milk, calves, cull dairy cows and wood, although the latter is only for home energy purposes and is a temporary measure.

6.1.2.6 UK

6.1.2.6.1 Case study 1 [UK01]

This long-standing agroforestry site in the arable heartland of eastern England is 22.5 hectares in size. It is a family farm bought by the current owners' parents in 1992. The farm incorporates four silvoarable agroforestry systems into an organic arable rotation. All trees are planted in north-south rows with an organic arable and vegetable crop rotation grown in the 10-12m wide alleys between the tree rows.

Products grown are diverse and include lentils, wheat, barley, oats, chia, squash, apples, hazel for hedge laying staves, willow chippings for the on-farm biomass boiler as well as glamping pods for agritourism and various on-farm courses, an on-site bakery and CSA initiative.

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The farm's marketing strategy is to bring customers to the farm. This is partly done by having footpaths around the farm that allow walkers to walk the perimeter of the land and see what is on offer. This helps to sell the glamping pods. Another route is to process raw crops on-farm, through the on-site bakery, in order to add value. They also produce crops for high value, niche markets, such as lentils and chia. The hazel staves are also a high value item. The farm takes a share of profits from the on-site bakery once these reach an agreed amount and it takes a small share of the produce from the CSA initiative for use in its bakery/kitchen on-site.

6.1.2.6.2 Case study 2 [UK02]

The farm located in the northeast Cotswolds is 1000 hectares in size and, founded in the early 2000s, is now a limited company. The farm is home to 400 beef cows, 120 dairy cows, 1250 sheep, about 6000 laying hens, 1000 turkeys for the Christmas market, 30 acres of market garden and roughly 100 hectares of arable. For the last 5 years it has predominantly been a livestock farm and has its own abattoir. The AF system is located in a 12-hectare chicken field which is laid out in 12 ranges. Here the houses are moved annually so that the chickens have a half hectare block to roam in. The planting took place 3 years ago and included 800 fruit trees (35 different apple varieties and one damson) alongside 3000 alder trees interspersed with cornus (dogwood), twisted willow, twisted hazel, holly, goat willow, and white willow. Additionally, the farm has 10km of hedgerows and about 50,000 trees planted over the last 10 years

Products from the farm are numerous but include eggs, apples, damsons, kale, rhubarb, sheep meat, beef, milk and turkeys. In addition, the 30 acres of market garden contain over 300 crops ranging from high value salad crops as well as other ground level annuals and perennials, interspersed with avenues of trees like bullace, plums, rowan, quince, medlar, walnut and apple. Branches from the cornus, twisted willow, twisted hazel, holly, goat willow and white willow trees are used in flower arranging workshops and the willow is used by the market garden team to construct Christmas wreath frames

Besides a popular on-farm shop, the farm has 4 shops in London which are run as separate businesses but still have the same owners and are the farm's sole buyers. The farm also has a sizeable wholesale operation with Ocado. In addition, the farm has multiple cafes and restaurants both at the farm and in London as well as production units (kitchens and bakeries) where their produce can be sold. There has also been a shift at the farm over the last few years towards carrying out more of their own online orders. Initially set up as a Christmas market for items like hampers or turkeys, they now spread their own online sales throughout the year with select items from their shop as well as meat boxes.

In addition, UK02 offers a wide range of cookery schools, floristry workshops, open-days, talks, as well as holiday cottages and courses at its own on-site wellness spa. The farm also hosts two big festivals every year, one in summer, and one at harvest, both set in the market garden.

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6.1.2.6.3 Case study 3 [UK03]

This case study farm found in East Sussex, is 283 hectares (700 acres) in size and is a private limited company owned by a cooperative of 600 shareholders, operating as a social enterprise for the benefit of the community.

The farm has 40 beef cattle, 10 dairy cattle, about 50 ewes, pigs, chickens, turkeys and geese for Christmas, sometimes ducks and it grows a range of vegetables, some arable crops and quite a lot of animal feed. The farm shop brings in the largest share of farm income but there is also a café on site, a small care home for adults with learning disabilities, and it also draws in some subsidies. Over half the shop sales are from the farm itself but it also buys in other produce to sell on. There is a very small online presence, but this is not further exploited because the ethos of the farm is to bring people to the site to encourage them to engage with agriculture.

Main products are meat, milk, vegetables, flour and chicken. Most sales of beef, lamb and pork are through the farm shop. Small amounts go to three other destinations: a kitchen on the farm that makes pies, pasties, sausage rolls and ready meals that are sold in the farm shop; the on-site café; and to feed the team at the farm a two-course lunch every day. In addition, some burgers are sold to a hotel and some chickens to the sister farm, another biodynamic farm run by the cooperative located a few miles away. All poultry are slaughtered on site but the other animals go off site to an organic abattoir about 20 miles away. There is also a bakery on site and the farm plans to supply them with flour. The dairy produces two products – raw milk which it sells from a vending machine on-site on a bring your own bottle/buy a bottle basis, and any surplus milk is made into yoghurt for the shop. Very occasionally if the milk cannot be used, it is sold wholesale. The vegetables are sold through the shop and to wholesale in glut years.

6.1.2.7 Austria

6.1.2.7.1 Case study 1 [AU01]

This agroforestry farm in Austria is located in the Weinviertel region of Lower Austria to the northeast of the country. It is an organic arable farm that used to only produce cereals but as it became increasingly difficult to buy agricultural land, the family started to purchase forest areas. Twelve years ago they started alley cropping by planting fruit trees (walnut and mulberry) on the agricultural land. The farm is now about 100 hectares in size of which 25 hectares are cereal production, 75 hectares are forest (hardwood) and there is alley cropping of walnut and mulberry trees.

The reason for the agroforestry was to produce high quality timber as well to diversify the product base, to reduce soil erosion and to tap into nutrients in the deeper soil layers. Walnut and mulberry trees allow for the production of a liqueur and schnapps from the nuts and fruits, which are traditional in the region and are sold in the local farmer community shop. The tree crops allow the farmer to diversify income whilst waiting 60 years to harvest the trees. The forestry wood is used for firewood and pellets and is transported to the local biomass plant.

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6.2 Findings from the farm level case studies

6.2.1 Basic farm information

An important structural element that applies to most (11) of the case study farms is that they are family owned and run and three have been in the same family for two or more generations. GR02 has belonged to the same family since 1921 and is now run by a third-generation farmer (since 2009); IT01 has been managed by the same family for approximately 100 years and passed through four generations; POL03 has been owned for over 170 years, since at least 1846. Seven others have more recent ownership from the late 1900s through to as recent as 2016 and the remaining case studies are owned by private limited companies or farm co-operatives.

There is quite a size variability within the sample with the smallest farm (GR01) being just 2 hectares in size and the largest (IT01) being 1500 hectares. The latter farm and UK02 (1000 hectares) are company owned while the largest family-owned farm is GER02 with 112 hectares. Farm ownership appears to have an influence on farm size.

As identified in the introductory paragraphs above, the range of products originating from the case study farms is vast and is affected by many factors such as location, altitude, soil type and rainfall, type of system (agroforestry or mixed), proximity to major cities, farm size, labour availability and expertise, market demand and family preference. Half of the 17 case studies practice agroforestry, the majority of which combine different tree varieties with livestock and three with just crops. Eight of the case studies are mixed farms combining crops and livestock and of these, two have also introduced agroforestry enterprises.

6.2.2 Site design and management of agroforestry or mixed farm system case studies

The sample covers a wide range of mixed farm and agroforestry practices and innovative site designs. The stakeholders interviewed carry out these practices in their local contexts, utilising knowledge at their disposal as well as unique combinations of livestock, crop and plant breeds to develop resilient farm systems. Site design typologies and practices that embody the principles of mixed farming and agroforestry have been well documented in previous EU research programs such as AGROFORWARD, SustainFARM, CANTOGETHER, and SUREFARM, and include but are not exclusive to: silvopasture, silvoarable, forest farming, high value tree-crop/tree-livestock systems (whereby the trees yield crops in addition to the produce of the alleys), crop-livestock rotation, circular system, feed supplementation, fodder cropping, grazing crop stubble, low-input systems, and bricolage.

Of the site designs implemented, silvopastoralism is the most prominent. Ten of the farms had field layouts that could be classified under the umbrella term of a silvopastoral system. Within those, four graze livestock in orchards (predominantly apple orchards, as well as smaller quantities of fruit and nut trees). BG01 rotates sheep and goats through their orchards whilst GR03 does the same but with poultry. UK02 also has chickens

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amongst rows of apple trees - although in this case their predominant tree planting in the silvopasture system was alder for woodchip. GER02 and POL04 graze cattle amongst apple tree orchards. All four could be considered here as high value agroforestry systems as both the production lines from the livestock and from the fruit and nut trees yield a commercial crop either annually or every two years. IT01, rather than the agroforestry treelines seen in some of the case studies, grazes cattle through low-density woodland. POL01, POL02, POL03, and POL05 operate a rotating paddock grazing system, where cattle graze permanent grassland paddocks, with trees acting as borders/buffer strips. The planting here provides shading, windbreaks and fodder for the animals, as well as timber for the farmer. Each tree-livestock configuration has different implications for the grazing patterns adopted. With tree lines and orchards seeing more grazing underneath the foot of the trees and the livestock thus playing a greater role in farm weed management. While tree enclosed paddocks are suited to more typical grazing patterns, and the larger plots of permanent grassland afford the opportunity for other land uses such as hay making.

The three tree-crop case studies also cover different agroforestry practices. UK01 is a leading agroforestry research facility and consequently has many different examples of tree-crop system designs. The early tree planting carried out at the farm involved hardwood and apple tree rows with arable and horticultural cropping in the alleys. In this system a companion planting approach was adopted, and the previous farm manager experimented with different tree combinations. Later the planting has wider crop alleys with a greater number of fruit trees. Whilst the most recent planting has wider crop alleys again with hazel and willow tree rows managed for woodchip. While GR01 exhibits perhaps one of the most intricate planting regimes - with a highly integrated and multi-layered tree crop system managed for fruit, olive and horticultural production. This site is focussed much more on ecological density and biodiversity in its planting, using techniques such as companion planting, identifying key supportive species and maximising nitrogen fixing where possible. Although UK01 has a number of hardwood trees planted in some of its older tree lines, AU01 is the site design that most explicitly focuses on hardwood production. The agroforestry system here, builds on its already existing 75-hectare hardwood forest with tree lines consisting of walnut and mulberry trees. The nuts produced by those trees, as well as fruit from the mulberries, as intermediary products, offset the long timeframe for profits from the hardwood.

Four of the case studies (GER02, GR02, UK03, IT02) provide examples of mixed crop-livestock systems. Although a number of learnings on mixed farm practices could be taken from other case studies such as UK02, where agroforestry takes up a small section of a much larger mixed farm. The degree of integration between crops and livestock varies.

Manure management is integral to the site design of all the case study farms that house livestock. With the natural dispersion of manure occurring in fields with livestock and fertilising the soil as well as manure from the livestock sheds being spread on fields. However, it is clear with the mixed farm case studies that livestock manure plays a vital role in their response to relatively adverse conditions for crop production, where soil is of a lower quality. Livestock are introduced in these systems for fields that are in fallow to rest fields from persistent cropping.

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Crop production lines are also incorporated into the livestock feeding program. Three main practices emerge out of the case studies where feed produced on-site supplements livestock diets and consequently reduces wastage and input dependency. The first was stubble grazing, where livestock are released onto livestock fields post-harvest where the remaining crop stubble can be grazed - as exhibited in GR01. Growing fodder crops (inc. straw and hay production) as seen in UK03, GER01, GR01 and on the mixed farm element of UK02. UK03 and GER01 also grow their own livestock feed. For GER01, 85% of the farm's animal feed is grown on-site. As for UK03 they are able to grow most of their cattle and sheep feed but struggle with growing all their own pig and poultry feed due to the higher protein levels required in feed for those animals. IT02 also supplements livestock diets with food grown at the farm - however this is done more from the perspective of not wasting unsold cereals and vegetables.

6.2.3 Challenges of Mixed Farm and Agroforestry Site Designs Faced by Stakeholders

At UK01, one issue that was mentioned was that due to the narrow alleys and relatively small land area (just over 50 acres) the machinery used is relatively small and therefore the labour and workload at the farm is fairly intensive. The interviewee commented that other sites planted for commercial purposes would probably be spread over a much greater area with wider spacing between the tree lines to allow for large machinery. A downside of smaller systems is workers often have to spend the same amount of time setting up their machinery for crop harvest and maintenance as a more commercial set up but might only go out and harvest for one hour whereas a larger farm can harvest for a whole day with the same set up time.

At UK02 the main challenge in maintaining the system is weed control and mowing. For various reasons they are using a ride-on lawnmower which takes a very long time and is an unpopular task at the farm. Due to the sheer number of turns the lawnmower has to make, this kicks up a lot of dust during the summer making the task particularly challenging. One way they have responded to this is by using a slow biodegradable weed suppressant mulch mat which is wool-based. At UK02 narrow inter-row tree spacings also have meant occasional irrigation has been required during dry spells.

The Belgian farm (BG01) mentioned that the farm is located at a higher altitude and 30cm below the ground surface is an impenetrable iron layer. Trees could not be planted along the contour lines because of the drainage channels and so the planting locations are not optimal. It was also found in UK02 that sloping fields also had an influence on the growth rates of trees lower down as much of the field can be sodden throughout the year.

This highlights that both crop/pasture widths and tree spacings within the row not only have ecological implications, but also a number of practical and commercial consequences if not gotten right from the offset.

From a mixed farming perspective, it is clear that most of the challenges relating to site design are influenced by the different impacts that livestock and crop production can have on the fields when the ground is damp

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and in some case (e.g., pigs in more northerly case studies) it is not suitable to have livestock in fields at certain times of the year at all due to heavy damage.

6.2.4 Efficiencies of Site Design in Agroforestry and Mixed Farm Case Studies.

GR03 mentioned that the different system components may support each other. While dogs are trained to protect livestock from wild animals, when it comes to the threat from predating birds, guinea fowl play an important role warning other fowls with their alarming calls. The presence of trees and bushes on the farm provide many hiding opportunities for the fowl so that the number of animal losses is very low. Free grazing animals and feeding rabbits with fallen fruits has the advantage of reducing the pressure of harmful insects and other pests using fallen fruits as a means of overwintering or propagation. Overall, the farm design improves and sustains ecosystem balance visible in the high presence of bats on the farm.

GR01 benefits from its prime location. Being located in the rather flat landscape of Evrotas river valley, on a “micro-hill” (20-40 m above sea level), the farm experiences a unique and favourable microclimate. While neighbouring farms are sometimes affected by frosts, this is not the case on GR01. Soil is described as containing high amounts of sand and clay and to be favourable for cultivation: “digging is easy”, “growing food is easy”.

At IT02 that is surrounded by conventional farms, border edges were planted thirty and fifteen years ago in order to reduce pesticide contamination risk from the neighbouring farms. This farm also sees benefits from the systems it has in operation. These are: better soil fertility, especially for horticulture, mainly due to rotation, use of compost (produced on farm using vegetables by-products and animal manure) as well as green manure; weed control facilitated by correct rotation and use of biological/mechanical methods; better animal welfare in the free-range system adopted for all animal (cows, pigs and poultry); and limited or affordable costs of investment for an animal shed in an outdoor system.

IT01 also refers to benefits from its system to animal welfare. There are no parasite problems, there are no pathologies other than that related to traumatic events due to normal grazing, e.g., interventions on the hooves, etc. Compared to intensive breeding where a control on the inputs and a control on the microclimate of the barn are implemented, they focus on placing the animal in a "biodiverse" environment that gives the animal more choice over routine. For example, they always leave an old farm stable open where, depending on the rotation, the animals can find food, but the animals usually prefer to go to sleep in the woods at night.

6.2.5 Conversion to AF or MF

The journey to becoming an agroforestry or mixed farm has varied between the case studies with some having this status since when the farm was established or taken on and others introducing agroforestry or changing the activity mix more recently. This Section presents results from the case study farms to describe

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what has enabled the conversion to, or continuation, of agroforestry or mixed farming, as well the challenges that farmers have been presented with.

6.2.5.1 Enablers to conversion or maintenance of an agroforestry or mixed farming system

The farmer at GR01 has, since 2016, been transitioning her citrus farm towards agroforestry, mostly olive and citrus, incorporating many species such as mulberry and fig trees as support species. The farmer was encouraged into the sector following contact with a young farmer managing another complex agroforestry farm and her interest stemmed from there. As well as becoming self-sufficient in fruit and gaining experience in the suitability of different support species in the local context, the farmer hoped she would be able to provide cuttings for other farming projects of species that are beneficial for the Greek context. Diversification of farm income allows the farmer to risk experimenting with different species and to allocate a part of the farm to research and training, for example for Erasmus workshops. The income also allows the farmer to fund an NGO that she has started to promote regenerative agroforestry farming in Greece.

Something that helped with the conversion to mixed farming at GR02 was the personal advice and support provided by a German consultant on biodynamic agriculture. His regular visits to the farm (twice a year) and a continuous email exchange helped the mixed farming system to evolve. Getting to know more like-minded people engaged in biodynamic agriculture further helped in the progress of transformation.

For IT01 the farm has focused on agroforestry since its establishment in 1929 but it has been able to sustain this partly due to different funds available under the CAP, for example, measures for restructuring an on-farm mill and developing the farm shop; participation in regional integrated supply chain plans and operating groups; incentives for organic, coupled aid for durum wheat, legumes, olive trees and local livestock breeds. Also, participation in research projects such as Horizon 2020 opens the farm to new connections, resources and knowledge.

IT02 began to diversify its product mix and on-farm services about 15 years ago in order to respond to the difficulties of income inconsistency and problems of intensive animal production. Having the experience of parents helped with the transition to mixed farming, especially for the beef enterprise and for the pigs, information was gleaned from courses, visits to other farms and help from experts. Local elderly residents were able to share experiences of processing traditional products, particularly fermented salami. This farmer believes that the correct attitude in terms of being open to testing new techniques or new cultivars and production mechanisms, is helpful in successfully diversifying farm production.

At AU01, the implementation of agroforestry measures on the family farm was relatively easy as both the farmer and his father have a forestry background and training. The farmer also received support through a network of other farmers and the Austrian Chamber of Agriculture.

Factors that enable the farmer at POL05 in terms of mixed farming are his inherited knowledge in terms of dates of agricultural operations, soil management and tree maintenance; agricultural television programs for

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learning about changes to the law and eligibility for CAP payments (given limited time to travel to workshops); and getting involved in research surveys, mostly regarding reproduction and milk performance indices.

UK02 has introduced an agroforestry enterprise, covering the majority of upfront costs with Woodland Trust grant funding. This coincided with investment already going on at the time in waterworks and fencing in the same field and with the Soil Association's Organic Standards requiring that animals have shelter.

In summary, the factors encouraging and enabling conversion to, and maintenance of agroforestry and mixed farming systems in the case studies include:

- Contact with like-minded farmers
- The opportunity for providing planting material for local farmers
- Diversification of farming income to maintain a more constant income stream
- Ability to fund other on-farm services and activities
- Availability of funds for conversion
- Participation in research projects
- Access to local supply chain groups
- Family experience with AF/MF
- Information availability from local courses, online, television programs, farm visits, local and visiting experts

6.2.5.2 Challenges to conversion or maintenance of an agroforestry or mixed farming systems

A number of challenges faced by respondents in converting to, or maintaining, an agroforestry or mixed farming system were identified. Some examples are given here and these are further discussed in the following sections.

GR02 stated that a lack of suitable fencing equipment and experience with outdoor grazing systems are the main challenges for mixed farming in Greece. Other problems are the lack of know-how and information sources as well as difficulties in sourcing suitable farm inputs. Exchange with like-minded people is limited as biodynamic cultivation is quite uncommon in Greece and local agronomists are lacking practical knowledge. Sourcing information from abroad or from agronomic literature, however, is also seen as risky, as farming conditions are variable. Practical knowledge must be gained and adapted on-farm.

At GR02, the machinery bought during farm conversion, a manure spreader and a special hoe for cereals, had to be imported. If there was a stronger culture of cooperation among farmers, it would be easier to invest in the necessary equipment. Another option would be the path of subcontracting to avoid machinery investments. However, given the low number of local organic farmers needing such equipment, this is not a feasible option.

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GR03 mentioned that traps to deal with fruit fly in cherries (Rhagoletis cerasi) were not available in Greece and had to be imported from Germany. Sourcing suitable farming inputs, organic fodder for instance, but also tree saplings, adapted to organic growing conditions also continues to be a challenge. Having been buying tree saplings from tree nurseries in the past, has led to the observation that these trees are not very resistant or that they carry illness. Therefore, trees are sourced via personal connections or propagated on-farm from seeds or cuttings of productive and resistant trees.

This farm also refers to the lack of advice and know-how, especially regarding organic pest management.

A factor mentioned by BG01 that makes conversion to agroforestry quite difficult is the supply of new trees to develop a system. Because of the current interest in food forests, there are tree shortages and those on the market now are younger and will take a longer time to bear fruit, although they will be better adapted to local conditions.

At IT02, a lack of support and even resistance to the conversion to mixed farming came from neighbouring farms: running an organic farm when surrounded by conventional cultivation risks cross contamination and neighbouring farms did not like the shade created by the farm's buffer strips. This farmer chose to self-fund on-farm investments rather than take on the cost of bank loans which has extended the time to transition to mixed farming but has also encouraged him to develop his own small equipment and animal shelters.

Other challenges remain: the production of a large range of vegetables requires different types of equipment that are sometimes only used for a few weeks each year; similarly for livestock production where different species have different needs. During the transition, the farm has built its own small facility for poultry slaughtering and pork meat processing but for pig slaughtering and beef deboning, external support is still needed. This entails high costs of animal transportation and with only a small number of animals slaughtered each time, production costs increase leaving a reduced margin for the farmer.

Challenges to maintaining an agroforestry farm as outlined by POL01 and POL02 included that farmers' organisations in Poland are poorly developed in terms of agroforestry knowledge, that there is a lack of policy support for this at local, regional and national levels as well as excessive bureaucratization; managing cash flow whilst also investing in new infrastructure and new markets is an issue and political uncertainties in relation to subsidies and local planning make continuation of agroforestry on-farm more difficult.

POL05 mentioned a few barriers to the establishment of agroforestry on the mixed farm. These included a lack of land for purchase, lack of demand for agroforestry products, issues with the drainage canals network and bureaucratic difficulties. This is that planting trees can lead to objections from the payment agency regarding the area declared for CAP subsidies. The interpretation of aerial photos is very subjective in terms of the horizontal projection of the tree crowns. Despite this, the farmer here maintains a certain number of trees as solitaires or as buffer strips for protection purposes.

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Challenges faced at POL05 also include a lack of trust between farmers, so collaboration is weak. Bank credit is limited as the farmer has no credit history. Rapid changes in legislation restrict investment and development, particularly for organic farming law. Cattle sales are restricted; maintenance of local breeds is a subject of a preservation programme with special rules that limit suitable stock management

For UK01 that was established initially as an agroforestry farm, it was difficult to list the challenges that would face farmers now in setting up a business, but it was noted that in reality this would more likely occur on part of a larger farm rather than a farm converting to agroforestry as a whole. It was considered though that UK funding structures often do not favour agroforestry innovators in UK farming systems.

At UK02, challenges in the establishment of the agroforestry enterprise were largely animal related as the field perimeter fence made the field deer and predator proof and as a result, the hare population exploded causing significant tree damage. The tree guards could protect the trees from small creatures such as voles, but the hare population did need to be controlled.

Wildlife damage has also been a risk at GR02 where crop damage by wild boars is a concern on plots located at a higher level to the main farm infrastructure. On certain plots only lentils can be grown as a legume, for example, as they are less preferred by wild boars, limiting, however, available diversification options. Local farmers have reduced chickpea and corn cultivation in the last few years leading to a subsequent outmigration of the necessary farming labour.

The presence of wolves in the area restricts the extension of the outdoor grazing period. Trained herding dogs and sophisticated electric fences could help with this but as yet are lacking.

GR03 refers to a lack of experience in the early days meaning that insufficient fencing and trained dogs led to a high loss of animals.

GER02 also mentioned that protecting trees from animal damage is difficult. Different options to protect especially the younger trees from the cattle have been considered, including electric fencing, the application of substances as a repellent for the animals and the application of plastic tree guards.

At UK02, for the grazing paddocks (21 in total), one barrier facing the planting of trees along each of the paddock boundaries (currently marked by electric fencing) is the up-front costs before the trees are established. First the initial cost of buying and planting the trees (although this could potentially be supported by grant funding). And second, the loss of grazing as areas would need to be fenced off whilst waiting for the trees to establish.

AU01 also referred to the cost of planting new trees in terms of a much higher workload during establishment for the selection of seedlings, tree care and the high costs of seedlings of good quality. For the Austrian case study, it was also found that the funding legislation presented a challenge as agroforestry is not included in the legislation and planting trees within an agricultural area is not permitted. External help was needed to

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understand the legislative situation on what subsidies apply within the available measures. An additional problem in Austria is that land is being acquired by speculators, particularly land that is close to the capital city. This land is not being used productively, its price is high, and it is difficult to generate a return on the investment through farming. Lastly, with agricultural prices at high levels currently, there is little interest in planting trees on agricultural land.

In summary, some of the challenges hindering the conversion to, and maintenance of, agroforestry and mixed farming systems are:

- Difficulties of accessing suitable equipment in countries where AF/MF is not common
- Difficulties in accessing farm inputs, including new trees and land for purchase
- Availability of low-cost investment funding
- Land availability at affordable cost
- Crop damage and risks to livestock from wild animals
- Up-front costs to conversion
- Reduced profits while land is fenced off to allow tree establishment
- Lack of local know-how
- Irrelevance of international know-how that is not suited to local conditions
- Low numbers and lack of cooperation between farmers reduces opportunities for equipment sharing
- Lack of effective farmer organisation
- Local resistance to systems perceived as new to the area
- Sizeable equipment needs given the variable nature of mixed farming
- Sizeable range of skills needed given the variable nature of mixed farming
- High per unit costs of animal transportation given the low numbers involved
- Little policy support; lots of bureaucracy
- Political uncertainty hinders long-term investment
- Lack of markets for products from agroforestry systems

6.2.6 Impact of AF/MF on workload and quality of life

Whilst respondents alluded to many benefits of living and working on a mixed or agroforestry farm, there were a number of challenges identified, some common to a number of farms. These are outlined below.

6.2.6.1 Challenges for workload and quality of life

One of the many challenges of running an agroforestry or mixed farm according to respondents was that these are more labour intensive than a conventional farm. GR01 states that support species have to be pruned, which would not be necessary in other systems. GR02 mentions that running the farm and business as a single person means being involved in multiple activities with a high workload. Livestock rearing in

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particular requires a daily presence throughout the year and entails enormous personal commitment. Improving know-how and optimizing grazing management are seen as necessary for reducing workload (for example though using mobile electric fences). GR03 refers also to the high workload involved in running the farm throughout the year in terms of irrigation, pruning and the differing harvest times.

Finding suitably skilled labour is a problem that is frequently alluded to. GR01 mentions the need to train recruits to avoid, for example, when brush cutting the weeds, cutting down the newly established tree seedlings. Labour is often provided by migrants who do not stay long term, meaning a continuous change of hired staff who require training.

IT02 finds that with three types of livestock on-farm and a large number of vegetables produced each season, management of the daily work schedule is very complex. A high level of specialisation is required and achieving this represents a challenge for the farm manager. There is a time saving with outdoor free range animals in terms of cleaning animal sheds and feeding, but more time, expertise and workers are required for the handling and moving of beef cattle and pigs in the fields and there is a high demand for vet services.

Finding staff that have the skillset to work in a mixed farm is difficult. Compared with a conventional farm where it may be necessary to learn 2 or 3 main operations, in mixed farming, with many different operations, mostly manual, workers need to be repeatedly trained in order to learn a work task or to prevent injury. Turnover of young employees is high – 2-3 years – with the main reasons for leaving the job being linked to moving on in life, finding the work too manually demanding, starting their own farming activities and looking for higher wages.

POL05 stated that the workload on a dairy farm is very high and increasing and to maintain costs and profits at their current levels would require scaling up production. This limits opportunities to diversify production. The interviewee felt that there were insufficient workers available as they tend not to be interested in the type of work or the salary rates available. POL03 also mentioned the need for more specialised knowledge on the agroforestry farm.

Another quandary at UK02 is minimising labour costs during harvest time. In a bumper year, it is difficult to harvest all the produce before it deteriorates and so the farm tries to extend the harvesting season by diversifying its produce range. This also minimises risk as the farm is not over reliant on one crop that could fail.

The list of challenges is therefore quite extensive but these can be summarised as follows:

- More labour intensive compared with a conventional farm
- Running the business singlehanded is intense due to the high variability of the workload
- Livestock rearing necessitates year-round presence on the farm
- Shortage of skilled labour
- Short term nature of labour on-farm meaning constant need to reskill

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- Management of daily work schedule is complex given the variety of crops and livestock
- Smaller scale of operation means proportionally more time spent setting up equipment relative to using the equipment
- Spreading harvest over a number of weeks to avoid labour shortages

6.2.6.2 Benefits for workload and quality of life

In terms of benefits, many of the case studies alluded to the pleasure of working in a system that is ecologically sound (e.g. GR01, IT02). IT01 believed the lack of chemicals in the system created better working conditions. POL01 enjoyed the fact that the farm contributes to biodiversity and helps with climate mitigation.

GR01 also mentioned that farming system resilience through the diversity of crops, leading to increased biodiversity, also brought personal pleasure in working and living on the farm. GR03 describes the farm as *'a paradise on earth providing a high degree of self-subsistence, joy and satisfaction'*. Being able to consume home-produced meat is seen as a benefit as is the psychological pleasure of working in the farm environment.

GER01 alluded to the circular nature of the mixed farm as being beneficial in that the livestock produce organic fertiliser and the crops produced feed the livestock. The farmer here enjoys his work as he has a sense that livestock and arable on the same farm just belong together. POL05 mentioned that the farming system allowed him to substitute in products that he would normally have to buy, for example, he could make his own fence posts from wood produced on the farm. GR02 acknowledged that grazing harvested fields helps minimise spontaneous vegetation (weed) growth, while partly also contributing to soil fertilisation. Production of fodder crops, mainly mixtures of legumes and grasses, is seen to contribute to soil improvement prior to the next crop.

For GR02 keeping livestock is described as providing a high degree of personal satisfaction and psychological balance. Animals are seen as a vital factor on the farm: "a farm is alive, if there are animals". A high degree of autonomy and self-subsistence in food are highlighted as important benefits of this way of farming and life. Especially during the pandemic leading a life in nature proved to be much less restrictive.

POL02 mentioned that the farm brought local community engagement and a sense of belonging to a social network. POL03 thought that the farming system maintained sustainable management of rented land and avoided land belonging to many village inhabitants being unproductive and becoming abandoned.

UK01 referred to the aesthetic value of the farm especially when compared with the monocropping of the neighbouring farm. This encouraged in walkers from surrounding areas. The feeling here was that rather than being a negative aspect, the mix of crops and livestock within the same space required a whole mix of talent on-farm leading to the development of many different skill sets.

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At UK02 which combines a market garden with the agroforestry system, during the off-season when there is less to do in the market garden, there is plenty of work in the agroforestry system such as pruning and harvesting apples so this evens out the workload over the course of the year.

In summary, benefits identified in the interviews for workload and quality of life include:

- the pleasure of working on a farm that uses sustainable methods
- a sense of being part of a closed system where outputs from livestock are used to fertilise crop fodder
- the ability to use farm-grown produce as inputs to the farming system
- animals are good for psychological balance
- an outdoor life proved positive, particularly during the pandemic
- a sense of community and belonging
- sustaining land that may otherwise become abandoned
- aesthetically pleasing and hence attracts tourism
- the mix of demands offers roles for a range of skill sets
- having different activities on-farm evens out the workload over the course of the year

6.2.7 Interactions with value chains

The range of products and on-farm processing taking place at the case study farms is described in the introduction to each farm earlier. The sample covers a multitude of activity across livestock, crop and agroforestry systems with many different value chain operations developing according to the local context in which the farm is situated. This Section looks at some of the challenges faced by farms in interacting with value chains and the way by which they have overcome these, as well as looking at some of the further opportunities that the systems offer.

6.2.7.1 Challenges faced by AF/MF systems in interacting with value chains

One of the problems referred to by a number of respondents seems to be informing or persuading consumers that products coming from a mixed farm or an agroforestry system are any different from a conventional system, or even from an organic system.

POL01 for example stated that agroforestry is not recognised and wider marketing activities focus on promoting grass-fed livestock and reducing carbon footprints. POL02 agreed with POL01 that sales depend on personal contacts and is very difficult to find markets for the products. AU01 stated that no added value or higher prices can be achieved by mentioning agroforestry practices due to a lack of awareness of the meaning and practices of agroforestry among consumers and farmers.

GR02 stated that building up market opportunities and transferring the message of the underlying farming system to customers is not straightforward. There seems to be little awareness of “meat/milk/cheese from

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free grazing" and biodynamic products. The need is to engage in information and awareness building among customers but this is difficult to achieve when a lone farmer is already engaged in multiple farming activities.

At IT02 consumer awareness is also an issue. Consumer linkage with farm products and activities is well established and relationships are maintained with farm initiatives including social and cultural events. But not many customers know enough about mixed farming or agroforestry and show more interest in other aspects of food such as organic, or in animal welfare using outdoor systems. The farm manager believes that social apps will be important in helping customers to understand the story regarding production techniques used on the farm and the methods used for processing traditional products.

IT01 also has issues with communication but in this case it is more concerned with being remote from customers. The company's location has provided the opportunity to specialise but this takes them away from safe markets such as Florence with markets of Montalicino, Monte Amiata and Grosseto being more realistic. Communicating with these markets does require effort. They have now created a coordination network to better reach markets. They have service supply contracts that are non-binding and they also work more closely with consumers. They have invested heavily in marketing to communicate and further advance the company's image and logo.

GR03 mentions the issue of packaging for organic produce. This requires more packaging than conventional produce to avoid claims of cross-contamination with conventional inputs which goes against the ethos of the organic sector.

Issues of small scale create marketing challenges for UK01. The site does not have the production capacity to engage in conventional markets, a factor exacerbated by the diversity of crop varieties to ensure longer harvest seasons and greater resilience. To respond to this, the farm looks to bring consumers to the farm where a fair price can be set in accordance with the products' quality and value. Having walkers near to the farm may be a way to encourage the letting of their glamping pods or subscription to some of the courses that run on-farm. In addition, the farm has targeted markets where their products will attract a higher price. For example, rather than bulk sell flour, they have built an on-site bakery come kitchen to make their own sourdough bread, using as many different products from the farm as possible.

Similarly, with the arable production at UK01, they have targeted more niche and quirky products such as lentils and chia, not commonly grown in the UK. The lentils for example are sold at £3000 a tonne, far higher than any expected return from UK cereal markets. Lastly, the farm collaborates with third party stakeholders. For example, the bakery/kitchen is set up at the farm as a separate enterprise using UK01 flour and other products. UK01 in turn claims a share of profits above an agreed amount. This minimises the risk for both parties as the bakery has free access to high quality ingredients and is able to secure a fair income from their products whilst concurrently UK01 does not lose any money on the business overheads and retains an opportunity to make some money back if the business does well. The bakery also provides an opportunity to produce high-quality end-use products such as sourdough bread at the farm.

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BG01 has found that competition between supermarkets and its farm shop in the local tourist city has been a challenge. The latter is able to open 7 days a week but the labour cost for doing this is very high.

In summary, challenges identified in interacting with value chains include:

- Products from agroforestry and mixed farm systems do not differ in appearance to those from conventional systems so cannot attract a premium
- Sales are dependent on personal contacts
- Low awareness of agroforestry and mixed farm systems amongst consumers
- Lack of time for farmers to engage in awareness increasing activity
- Long distance from main markets
- Small scale of production makes integration in conventional markets more difficult
- Competition with large scale supermarkets that can operate at lower per unit cost

Responses to some of these challenges have been to:

- Maintain consumer linkages through farm initiatives such as social and cultural events
- Agree supply contracts with target markets
- Heavily invest in marketing to better communicate messages
- Bring customers to the farm so price is set that reflects production costs
- Develop on-site processing facilities to add value
- Focus on higher value niche crops

6.2.7.2 Further opportunities in interactions with value chains

A number of opportunities have been listed above as responses to challenges in engaging with the value chain system. In addition, the quality of products from these farming systems was noted by respondents.

For GR02, the high quality of products was quickly recognised by customers in larger urban centres and a network of consumers has built up over the years. Direct marketing routes are connected to Athens mostly, where there is a higher demand for environmentally friendly and nutritional food. This network relies on personal relationships and interactions which are described as very important and valuable. In this context, the goal is to engage in Community Supported Agriculture (CSA) in the future. POL04 also believes the high quality of his products is enough to convince potential customers and middlemen and he is getting return custom.

The respondent at GER01 thought that the fact that products come from a mixed farm does not have any impact on their marketing and this has more to do with quality than anything else. For example, the mill is more concerned with the quality of the grain and how well it bakes rather than in its origin. One of the benefits of the mixed farm is that it contributes towards local food availability and reduces the travel time for foods.

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At AU01, the representation of the Austrian agroforestry association's logo on the farm draws attention to the sector, even though the production system does not allow for added value in terms of the selling and pricing of goods. By responding to questions about the logo, the farmer is increasing education awareness about the sector. Most interest currently comes from the organic agriculture organisation of Austria, the Chamber of Agriculture and research institutes.

In summary, further opportunities have included:

- Producing high quality produce that consumers recognise and value
- Directly marketing to main centres
- Developing personal relationships
- Producing in line with what downstream processors require
- Producing food locally, reducing food miles

6.2.8 Reflection

Participants were afforded the opportunity to reflect on the situation for their style of farming more broadly - within the context of numerous global economic, climate and health challenges. This part of the interview process was done with the intention of uncovering longer term stresses and opportunities these experienced practitioners were considering. Participants chose to answer this question in a number of ways. Some chose to reflect on the situation of their farm in the context of these greater external challenges (e.g., economic recession, covid-19 restrictions etc.) whilst others focussed on much broader issues such as policy and funding frameworks. Others chose to consider these questions from the perspective of the greater population and discussed market forces and consumer perceptions of food.

The resilience of agroforestry and mixed farm systems was a theme coming through a number of the interviews across the countries with respondents considering that the small size, ownership structure, objectives and multi-enterprise nature of the sites offered many opportunities for increased resilience. Firstly, they offer the farming family the ability to self-subsist and remain independent from external shocks to the food supply system to a greater extent than non-farming families or those involved in conventional farming. Second, the sites are small and flexible enough and have a sufficient crop/tree/livestock mix to enable changes in enterprise combinations to weather market and environmental fluctuations. Thirdly, the multiple income sources (from either different crop/tree/livestock combinations or from different on-farm activities) allow the sites to cross subsidise different activities and enterprises, so where one enterprise is performing well at any one time (for example, when prices are higher), funds from this can be used to maintain other parts of the farm that may be doing less well at that point in time. The income from differing enterprises on-site, for example an organic food store, also allows the sustenance of the ongoing development of the farm. Fourth, the flexibility of crop mixes allows a shift in the crop mix as consumer tastes change, or market prices vary. Lastly, for those sites with livestock, in times of inflation, stocking rates can be reduced, allowing the farmer to liquidate assets and continue paying employees.

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Another theme mentioned by more than one farm was collaboration: either the current lack of collaboration between farmers with similar objectives, or the benefits of collaboration and the potential this can offer to maximise ecological value while minimising costs. Specifically, collaboration can help with knowledge sharing so the group learns about new methods together. It also offers potential for labour and machinery sharing: collectively owning a wood chipper, for example, would mean the cost of the machine is spread, the labour costs can be absorbed by the farm businesses and also give greater flexibility over when in the year the work is carried out, and working collaboratively will enhance each farms' capacity to maximise public and private investment, especially as funding for whole landscape management projects increases under the new Environmental Land Management Scheme (ELMS).

The whole ethos of agroforestry and mixed farming as a mechanism for survival and adaptation against climate change was a common theme across the interviews. The systems can reduce dependence on external inputs, allow the development of new lines of vegetable seed production, allow for diversifying feed production for livestock and an increased production of firewood from the agroforestry enterprise makes a farm more resilient in times of energy crisis. Trees and management systems can be designed to protect against water shortages and trees can be selected that can survive late frost and drought, as climate changes. The high organic matter in soil as a result of livestock on the land increases water infiltration and can help in resisting the impact of climate change.

Consumer demand was also a theme coming out of some of the interviews. An increase in the uptake of organic foods was acknowledged as was the increasing market for niche and novel products. This led to the suggestion of planting older tree varieties in order to grow unique products. The need to develop consumer awareness of the benefits of products from agroforestry and mixed farm systems was also referred to in order to secure markets for these but also to try to attract higher prices for products that are seen as different to those coming from conventional systems.

Other points picked up in the final reflection were the benefits of being able to use trial and error on-farm to find optimal crop and livestock combinations; the benefits of agroforestry and mixed farm systems through COVID-19 lockdowns as they offered farm families outdoor freedom in attractive environments, while meeting the increased demand for organic products and for fresh foods; the threat of livestock disease such as ASF in terms of limiting productive capacity and the difficulties of finding sufficient skilled labour. Finally, one respondent pointed to the opportunity in future to consider trees as more than providers of timber, fuel and fruit but as sources of wider environmental services such as offering biodiversity net gain, nutrient neutrality, natural flood management and carbon markets.

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6.3 In-depth analysis of selected VCNs

6.3.1 Supply chain level – Consumer Focus Groups

Two focus groups were held in the UK (UK_FG01 and UK_FG02), two in Italy (IT_FG01 and IT_FG02) and one in Belgium (BE_FG01) with a mix of consumers selected at random, although they were told the theme was to be around 'organic food'. In the UK, the sessions consisted of three main components: discussion around a photo of each of a mixed farm (aerial), a section of an agroforestry farm and a field from a specialist farm; questions about a selection of farm and food logos; and a more open discussion about different types of farming system. In Belgium, the session comprised two parts: discussion around four photos (one silvoarable, two silvopastoral and one mixed farm) and a selection of logos. In Italy, discussion centred around the video provided by the ORC showing the different farming systems and some photos of different farming landscapes that were appropriate to the local context. The groups appeared to have varying levels of knowledge regarding the different systems and awareness of the advertising materials.

6.3.1.1 Imagery association round

Agroforestry depictions, positive attributes

In the UK (UK_FG01&02), more positive points raised about agroforestry when examining the different photos were that the trees would provide shelter for animals and would provide the farmer with an income from timber and fruit sales. It was felt the agroforestry farm looked more like a working farm on a condensed scale with more activity fitted into a smaller space. The feeling was that it seemed more productive than a mixed farm and easier to maintain as everything is laid out in a straight line. Recognition was also given to the oxygen that trees on the land would produce and the benefits to planting more trees generally. A couple of participants felt that the agroforestry landscape would be pleasing to the eye on a country walk.

One participant did wonder if agroforestry might be an easier way of farming and provide a better way of life: having watched the Jeremy Clarkson farm programmes where the only profit after a year's hard work was £13, it was recognised that some change is necessary in the industry.

IT_FG02 largely believed that agroforestry could be an interesting innovative system for their own locality that is dominated by large intensive agricultural systems. They thought that more trees in the fields would certainly be beneficial to the environment in terms of wildlife and birds; they would lead to less erosion at the river edges; the landscape would be improved, resembling what it used to look like before conventional agriculture became the norm. The beneficial effects on carbon sequestration generated by planting and increasing the number of trees was hinted at by one group participant.

The IT_FG01 participants agree with the opinion that agroforestry can be necessary with numerous benefits (reducing the need for chemical fertilisers, diversifying income sources and keeping the agrosystem more

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resilient). Some stressed the related benefits such as the increase in biodiversity, landscape enhancement, better animal welfare, etc., and these are the main elements that are captured in the images presented.

BE_FG01 respondents recognised a need to reduce output of meat and dairy whilst maintaining a lower output using more sustainable farming methods, which the photos perhaps represent. Another advantage of the silvoarable photo was that such a system would be good for biodiversity.

Agroforestry depictions, negative attributes

More negative for UK respondents was the fact that, given the farmer needs to make as much profit as possible from every inch of land, the trees in an agroforestry system take up too much land and do not bring an income. They also use up a lot of water which takes this away from the crops that are growing in the aisles. It was felt a change of mindset would be needed to get farmers to plant trees down the middle of their fields and this would more likely occur amongst the younger farmer generation than older ones who are more set in their ways. A Belgian respondent queried whether the silvoarable system created a lot more work for the farmer. Another, whilst acknowledging the corridors created for birds and small mammals, queried whether the system would be too intense for the landscape and suggested it might benefit from having half the number of rows of trees.

IT_FG02 had some similar concerns about agroforestry. They thought that the mechanisation of intensive farming with its focus on one or two crops may conflict with the introduction of trees into fields making it more difficult to operate the technology. In addition, the trees take up space on high value productive land, reducing profit margins and creating shadow for arable crops. It was suggested the only means to encourage such planting would be via subsidies and legislation on climate change impact.

One IT_FG01 respondent found the topic valuable but felt the risk that the average consumer will not be able to grasp the differences with intensive agriculture, focusing on a mere evaluation based on the "things" that insist on a specific parcel of land.

Concern for BE_FG01 around the photo of orchards combined with chickens was about safety from foxes. Although it was thought that perhaps the trees would be less vulnerable to insects, one respondent did query what the purpose of such a system would be, given it would create work for the farmer and bring very little return in terms of the number of eggs produced. Similarly for a photo of a silvopastoral system (trees combined with pigs) respondents recognised the better life for the livestock but queried whether they would find sufficient food under the trees, whether it would create pollution and whether the presence of wild boars could introduce the pigs to disease.

Mixed farming depiction, positive attributes

The mixed farm photo seemed to be the most popular for the UK groups: it was felt that this demonstrated a better use of agricultural land. Reference was made indirectly to the closed loop system whereby animals

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fertilise the land whilst grazing and then consume the crops that are produced there. The fact the animals are moved between fields allows the land to 'have a rest' and overall, everything in the system is used.

IT_FG02 was positive about the organic mixed farm discussed. They felt that the one example of such a farm in an area that is dominated by conventional, specialised farming, was beneficial in that the small animal production unit created less potential pollution issues from manure run-off into the water courses when compared with a large dairy farm with monocropping corn production. The organic nature of the farm also pointed to an absence of pesticide and chemical usage, which the group believed affect human health and the environment.

For some participants of the IT_FG01 the images of mixed systems are reassuring and reflect a greater typicality of the countryside they are used to. For them, MF presents the highest level of diversification, with the animal component, pasture and forest in the same image, "*This high diversification is the one that best fits my idea of the countryside*". Then, most respondents feel that MF can contribute to modernising traditional agricultural systems and sustaining their competitiveness, although they are more varied and complex even in management. MF can be a good opportunity to combine the need for a more sustainable and environmentally friendly agricultural production system and the need to develop modern techniques to increase production. Others see greater complexity as a benefit for the resilience of the whole socio-ecological system, especially from the perspective of climate change, and therefore against particularly adverse climatic events as a way to promote a new equilibrium.

Mixed farming depiction, negative attributes

Most IT_FG01 participants believe that MF could be more expensive and not fit properly with the current farmers' knowledge.

Not necessarily related to the photo of the farm itself, some participants of IT_FG02 thought that food from an organic mixed farm may be prohibitively expensive for a large number of consumers who are not in higher income brackets.

Specialised farming, positive attributes

The UK specialised farm photo was favoured particularly from an aesthetic perspective. One contributor made the comment that this seemed the most natural environment and would allow for increased biodiversity. There was consensus that this would be a good place to go for a picnic. Another contributor during UK_FG01 disagreed with others in the group and felt that specialised farming was the most sensible use of the land because it could grow the most crops.

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6.3.1.2 Discussion around the logos

In the UK (UK_FG01&02), the logos were not generally found to be very impressive or to fulfil any objective.

The Soil Association logo was considered by one to be a recycling logo, it was not particularly noticeable, a bit bland, contained too much writing, and should have had some green colouring to it rather than the plain black font.

The Pasture for Life logo produced much debate as participants were either not clear of the meaning of 'pasture' themselves or were not sure others would know what this means. One suggested the only mainstream usage of the word is in 'pasteurised milk'. The feeling was that the logo itself was more organic than the Soil Association logo because it was at least green and had some trees in the background, but the overall layout was very similar to other logos and it was not clear what the message was. It was suggested that something that said 'Only pasture' or '100% pasture fed' and the inclusion of some animal images might give a clearer impression as to what the logo was about. There was a comment that having 'For Life' on a piece of meat was clearly contradictory.

The RSPCA Farm Assured logo was also not familiar to the group, although one mentioned that they were aware of the Red Tractor logo. Again, the group questioned what the message was: they could see it was something to do with animals, but their understanding did not go further than this. One suggested it meant the animals had been 'farmed kindly' or well treated but they felt it would be beneficial if some words were attached to the logo. One group suggested that again the logo was contradictory as the RSPCA is all about prevention of cruelty and yet here they are endorsing dead livestock.

The group liked the *local foods labels* which they considered to be niche but were not sure what they were about.

The agroforestry label used by EURAF was popular, and some thought it showed the association between the trees, land and livestock well for those who were not familiar with the term. It was also considered a good logo for those for whom English is not the first language as it was more pictorial, and similarly for those with learning difficulties the fact that the principles are summed up in a picture was very appealing.

Some however questioned whether people would know what 'Agroforestry' is. One suggested it might mean that he was going to get 'Agro' if he went to the 'forest'. A couple suggested that 'Eco-forestry' might explain the concepts of agroforestry more clearly. One questioned whether 'Agroforestry' in this logo referred to a company rather than being a generic term as it was less clear if the latter was true exactly what it was supposed to be advertising. Interestingly, the Italian group picked up on the same issue that the term 'agroforestry' was unfamiliar.

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In comparison with the *Woodland Trust* logo, it was felt that the Agroforestry logo was more eye catching but would be improved if it used the Woodland Trust logo colours. There was a comment that the Woodland Trust title gave the impression that there is an organisation behind the picture whereas the Agroforestry one did not do this and it would be more trusted if it converted to something like 'Agroforestry Trust'.

The Carbon Footprint Standard logo was very unpopular. The group did not like the picture of a foot nor the fact that 'Carbon' appeared upside down and required the reader to turn the head in order to fully take it in. One commented that the arrow was going in the wrong direction in comparison with the text. There was some feeling that people more generally have heard enough about carbon footprint or do not understand the concept. It was felt that a logo required something that explains this immediately, or as one participant put, is 'in the face'. One respondent mentioned that it would be wrong to label meat products with this logo given the amount of diesel that is used in rearing livestock on farm.

BE_FG01 offered few comments on the logos. One participant was sceptical about labels in general, querying whether they have decent control systems in place for the products that they cover. One mentioned preferring to buy direct from the farmer in food markets where it is possible to discuss production methods with the producer. One recognised the Weidemelk label as being one that guarantees cattle have been pasture fed and this was considered a good logo, but the participant queried on what grounds being outside is considered better.

Almost all participants of the IT_FG01 have a minimum knowledge of at least two thirds of the logos presented (GIs, Organic, National Quality System of Integrated Production, Sustainable agriculture, Glyphosate Free, Regenerative Organic Certified, Ethical Breeding). Among them are then divided into those who find the logos appropriate to the message and associated practices, some find the brands very captivating and that arouse curiosity, and those who do not perceive what lies behind the brand. Among the first, one respondent found the logo on Regenerative agriculture as the most significant because it has a 360 degree approach. For the latter the logos are often unclear and not very reassuring, we talk about products through sustainable agricultural practices, but we never understand specifically what makes those products such. These participants report the lack of information on the certification criteria.

6.3.1.3 Discussion around different farming types

UK groups UK_FG01&02

In terms of more general awareness of the terms 'agroforestry' and 'mixed farming', there was mixed response with one or two having heard of the latter and others only hearing reference in Jeremy Clarkson's recent television appearances.

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Positive attributes of the different systems

When discussing the benefits of the different systems, it was felt that mixed farming would be more profitable than the other systems, particularly where the focus is on just one product. One did point out that this of course depends on the product grown, giving the example of pumpkins vs. wheat/barley, the latter bringing the specialised farmer excess profits. It was also pointed out that whilst mixed farming or agroforestry may allow the land a rest, if the farmer specialises in one product and is very good at it and becomes known for it, then that farmer may do very well in terms of profit. This is balanced by the fact that in a bad year for one crop, the mixed farm has a number of other product lines to fall back on.

Negative attributes of the different systems

In a discussion around the negative impacts of the different systems, it was reiterated that in an agroforestry system, trees take up too much space and therefore lead to lost profits. It was also felt regarding this and the mixed system that animals are expensive to feed and to care for and so more was to be made from growing crops on the land. With the rise of veganism, more people are turning away from animal products so a greater focus on crops could be beneficial.

Sustainability was mentioned as important and one contributor recognised that growing a single crop is the least sustainable system and the least natural. Agroforestry was here seen as better for biodiversity and more sustainable with the trees offering better soil sustainability. Other factors considered important were high animal welfare and supporting local farmers by buying local. It was felt that a mix of animals and crops on farm was the most beneficial for jobs as this would create jobs for more people with different skills.

Final comments included that, at the moment, several in the group did not understand a lot of the elements mentioned in the focus group and felt that they needed educating. It was not that they were not interested but they felt that further advertising was needed. With current pressures on incomes and increasingly busy lifestyles, consumers maybe do not have the time to read logos and take an interest in where they buy their food. They want to be able to buy a decent meal and get it on the table.

Italian group IT_FG01

Prior to the focus group, the majority of participants were not aware of agroforestry and mixed farms. Most respondents did not know the definitions or rather, they did not associate them with specific agricultural practices. Some had heard of it in specialized courses (eg. permaculture). For the more informed, agroforestry encompasses many different practices, some simple and modern, others more "extreme" and which are unlikely to be widely disseminated. Surely everyone converges on the need for more information on how the food they buy is produced and if it respects virtuous practices. Many say they prefer a higher price for an "agroforestry" product than for a certified organic product.

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Positive attributes of the different systems

What really triggers participants is the idea of positive synergy between different systems (even at different levels and scales). The majority appreciated the fact that these practices represent a rediscovery of the agricultural tradition, a renewal for which there is still much to discover and experience.

In a discussion on the positive aspects, it emerged that the benefits, as well as the costs, vary greatly from the system and above all geographic location. A coffee producer in Costa Rica may have a direct advantage in producing coffee with an agroforestry system and therefore see a greater direct return, while for European farms this depends a lot on the type of system. For an intensive and lowland producer, it is very difficult to imagine a change. However, the advantage can be to open up to the organic and sustainable market, while for the consumer the advantage is to increase the choice of high-quality products. Certainly, the costs are higher, both on one side and the other and while for the consumer the choice and replacement with a less sustainable and less expensive product are fast, for the producer this involves a considerable investment of resources.

Positive aspects of sustainability were discussed for AF/MF, such as carbon sequestration, soil health and fertility, biodiversity as well as advantages in weed control and natural pest control.

Negative attributes of the different systems

Some believe that from a technical point of view a disadvantage would be animals that may interfere with the crops as they are growing, also the limited use (or no use) or machines. This point raises the problem of information. While AF/MF can be a solution to many economic, social and environmental problems related to agriculture, often the innovation of these practices is not accompanied by the implementation by the institutions. There is a lack of information for consumers as well as for the farmers who have to develop it. Training and greater exchange of information are needed to develop the hard and soft skills necessary to make these approaches operational and more practicable. For some, the absence of criteria in the design and development of such systems can compromise their benefits. For others, to improve the ability to support AF / MF the consumer needs simple information on the label and more efforts on marketing and communication through events/experiences.

Further discussion - UK groups only

In UK_FG02, the participants were asked what they value when doing their food shopping. A number of factors were mentioned. One liked the traffic light system for dietary advice. One mentioned that they had never heard of these different farming systems before although they were aware of the term ‘organic’, which had different connotations for different group members. Some thought it meant the food was more expensive, some that it was higher quality, some that it used less chemicals, one that it meant non-GMO, and one thought it referred to the way the animals were fed and the land treated. There was recognition that it was good for the environment and biodiversity. There was a sentiment that the government should bring in

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more trees as these can help to offset the methane from farm animals as well as providing natural shade for animals.

The feeling was that within farming, the less chemicals that are used, the better, as these can leach into water sources. For this reason, participants felt that manure was a better fertiliser. It should also be beneficial for cost as the farmer brings less inputs onto the farm and can therefore offer a lower price to the consumer.

The group was asked whether they would be prepared to pay more for products from an agroforestry system and the feeling was no, they would not, as it is easier to run such a farm and costs and prices should be lower. Participants questioned whether this could be used as a marketing ploy to allow the farmer to charge more for the same product. Participants queried how many trees the farmer would need to plant before he could claim he was running an agroforestry system and whether a low number of trees would in fact not be that beneficial for the environment.

Finally, participants were asked what they looked for when buying a food product and why. Responses varied: quality products but in reduced quantities; value for money given inflation is high; offers around the supermarket; ethically sustainable products that have travelled shorter distances and are seasonal, organic, sustainable; price; occasional treats; familiarity; cruelty free products.

Conclusion

Whilst largely unaware of the different farming systems, collectively the groups were able to suggest the headline highs and lows of the different systems when asked and were aware of the different trends amongst food and farming initiatives – animal welfare, carbon emissions, food miles, sustainability, soil quality, farming costs. Some of this knowledge has come from television (e.g, from the recent Jeremy Clarkson television series). Given the low awareness of the different systems, it might be a long educational process to convince consumers that any higher prices from agroforestry or mixed farming systems are worth paying, especially in the current climate of high inflation across the economic spectrum.

Particularly seen in the UK focus groups was a genuine interest in how more sustainable food production methods could be funded. The high cost of sustainable produce was recognised as a fundamental barrier to purchasing and other options such as public funding measures were discussed.

6.3.2 Analysis of Opportunities – Q-Methodology

The analysis of the Q-Sorts gathered after interviews at the site -level with case study farmers/farm managers and during the consumer focus groups, was carried out using QMethodsoftware - the program was also chosen for its ability to facilitate the Q-Methodology online and in multiple countries. A study was created for each separate participating country to accommodate for language differences. The Q-Sort data were then extracted from the software, merged offline and then re-imported back into the system for analysis. The Q-

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Statements (see Figure 4) were given the same number across the differently translated studies to ensure Q-Sorts would be the same when merged. Q-Sorts are captured numerically within the program on a scale of -4 to +4 (-4 being the opportunity participants considered the least representative of how they felt and +4 being the most). Factor analysis was then used to identify patterns across the individual Q-Sorts. It was decided the most logical method for extracting viewpoints on opportunities held by different stakeholder groups was to carry out four analyses independently. For agroforestry opportunities, factor analysis was undertaken on the Q-Sorts submitted by agroforestry site-level actors (farmers, farm managers and practitioners interviewed) (10 participants) and for consumers taking part in the focus groups (30 participants). For mixed farm opportunities, factor analysis was undertaken on the Q-Sorts submitted by mixed farm site-level actors interviewed (farmers, farm managers and practitioners interviewed) (7 participants) and for consumers taking part in the focus groups (26 participants).

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Table 3: List of Opportunities (Q-Statements)

Agroforestry Opportunities	Mixed Farm Opportunities
"1. Less productive land with poor quality soil, and where land plots are marginal, can be better utilised by agroforestry. "	"1. Less productive land with poor quality soil, and where land plots are marginal, can be better utilised by mixed farm systems. "
"2. Agroforestry systems allow farmers to make money from small-scale and large-scale bioenergy production."	"2. Mixed farm systems allow farmers to make money from a more diverse range of products."
"3. Small-scale, local bioenergy production from agroforestry sites can support a circular, bio-based economy."	"3. A highly integrated network of mixed farm systems can support a circular, regional economy."
"4. Agroforestry should be primarily focused on timber and woodchip production."	"4. Mixed farm systems should primarily focus on reducing external inputs such as imported animal feed."
"5. Trees in agroforestry systems should be used for fruit and nut production to improve regional food security."	"5. Higher crop or produce diversity in mixed farm systems can improve regional food security."
"6. Productive land should be only used to produce food through monocropping rather than agroforestry. "	"6. Productive land should be only used to produce food through monocropping rather than mixed farm systems. "
"7. Agroforestry should be primarily promoted in protected areas such as Natura 2000 sites."	"7. Mixed farm systems should be primarily promoted in protected areas such as Natura 2000 sites."
"8. Agroforestry should be primarily promoted on organic farms rather than conventional."	"8. Mixed farming should be primarily promoted on organic farms rather than on conventional farms."
"9. A certain share of agricultural land should be used for hedgerow and tree planting in all European farms."	"9. A certain share of agricultural land should be used for livestock production in all European farms."
"10. There is potential for agroforestry to capitalise on food product labelling that targets customers looking to buy authentic regional food. "	"10. There is potential for mixed farm systems to capitalise on food product labelling that targets customers looking to buy authentic regional food.”
"11. There is potential for agroforestry to capitalise on product labelling that targets customers looking to buy food associated with a low carbon footprint and a smaller climate change impact. "	"11. There is potential for mixed farms to capitalise on product labelling that targets customers looking to buy food associated with a low carbon footprint and a smaller climate change impact. "

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"12. Agroforestry farm products will appeal to customers who want their food to be sprayed with less chemicals."	"12. Mixed farm system products will appeal to customers who want their food to be sprayed with less chemicals."
"13. More European farms should incorporate agroforestry systems so that less money is invested in agrochemicals (pesticides, herbicides etc.)."	"13. More European crop farms should incorporate livestock systems so that less money is invested in agro-chemicals (pesticides, herbicides, artificial fertilisers etc.) for growing crops."
"14. Agroforestry producers can advertise better on-farm animal husbandry such as free-range forest hens."	"14. Mixed farm producers can advertise better on-farm animal husbandry such grass-fed beef or lamb."
"15. Agroforestry produce is sometimes considered more nutritious than mass-produced food which presents an opportunity to market to consumers looking for healthier food. "	"15. Mixed farm produce is sometimes considered more nutritious than mass-produced food which presents an opportunity to market to consumers looking for healthier food. "
"16. Agroforestry landscapes have a much higher aesthetic value compared to monoculture farming systems and can attract walkers and day-visitors."	"16. Mixed farm landscapes have a much higher aesthetic value compared to monoculture farming systems and can attract day-visitors and walkers."
"17. Agroforestry farms should develop tourism infrastructure (e.g. restaurants, glamping, B&Bs) as they are often more picturesque landscapes. "	"17. Mixed farms should develop tourism infrastructure (e.g., restaurants, glamping, B&Bs) as they are often more picturesque landscapes. "
"18. Stakeholders in agroforestry supply chains should invest in digital technology to strengthen supply chain infrastructure by improving logistics, market transactions and product traceability."	"18. Stakeholders in mixed farm supply chains should invest in digital technology to strengthen supply chain infrastructure by improving logistics, market transactions and product traceability."
"19. Decision support tools providing information through a phone app, or a computer software can help agroforestry producers with the management of their site and make their farm more competitive. "	"19. Decision support tools providing information through a phone app, or a computer software can help mixed farm producers with the management of their site and make their farm more competitive. "
"20. Agroforestry could look to opportunities for private financing as they often provide a greater number of public goods (e.g., habitats, cleaner water, more carbon sinks) than other farms."	"20. Mixed farm systems could look to opportunities for private financing for the public goods (e.g., habitats, cleaner water, more carbon sinks) they provide."
"21. Agroforestry systems often have higher carbon sequestration (absorption) potential which can be capitalised on in carbon markets. "	"21. Well-managed grassland in mixed farm systems can sequester (absorb) high amounts of carbon compared to monocropping and could capitalise on carbon markets. "

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"22. The profitability of agroforestry practices could be increased by public funding programmes looking to reduce climate change." "23. Only agroforestry with trees and crops should be promoted because livestock has a negative impact on climate change." "24. Agroforestry systems should be better represented in public funding programmes because they provide a great number of skilled jobs." "25. The interactions between trees, crops and livestock can be managed to contribute to national policies for sustainable intensification and risk management."	"22. The profitability of mixed farm practices could be increased by public funding programmes looking to reduce climate change." "23. The wider adoption of mixed farm systems will reduce the amount of land dedicated just to livestock production. " "24. Mixed farm systems should be better represented in public funding programmes because they provide a great number of skilled jobs." "25. The interactions between crops and livestock can be managed to contribute to national policies for sustainable intensification and risk management."

Using centroid factor analysis, several factors were found for each of the categories analysed. A number of tests were run and it was decided that two factors would be considered for each of the categories (see Table 4 and 5 below) First a scree plot was made for each of the categories where factors were plotted in a line graph according to their eigenvalues and factors above the bottom slope of the curve were considered (Watts and Stenner, 2012). Across all categories the eigenvalue for each factor selected was above 1 and the composite reliability score was satisfactory. With both the mixed farm and the agroforestry consumer categories, it became clear that consensus was forming and just one factor could have been selected. However, it was deemed of benefit to the study to include the two factors (viewpoints) to have greater exploratory power in the analysis and as can be seen in Tables 4 and 5 agroforestry consumer factor 2 and mixed farm consumer factor 2 inclusion could be justified as their scores on multiple grounds were satisfactory. As a further precautionary measure, Humphrey's Rule was applied, whereby factors should be retained if they are more than twice the value of the standard error.

Table 4: Factor Selection for Agroforestry Opportunity Q-Sorts

Agroforestry Opportunities	**Site-level Actors**	**Consumers**	**Site-level Actors**	**Consumers**
	Factor 1	**Factor 1**	**Factor 2**	**Factor 2**
Eigenvalues	1.0154	6.88292	2.34672	3.11279
% Explained Variance	10	23	23	10
Cumulative % Expln Var	10	23	34	33
Humphrey's Rule	0.27967	0.50936	0.43995	0.29512
Standard Error	0.05	0.05	0.05	0.05

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Table 5: Factor Selection for Mixed Farm Opportunity Q-Sorts

Mixed Farm Opportunities	Site-level Actors	Consumers	Site-level Actors	Consumers
	Factor 1	**Factor 1**	**Factor 2**	**Factor 2**
Eigenvalues	1.31022	5.70574	1.01321	2.38671
% Explained Variance	19	22	14	9
Cumulative % Expln Var	19	22	33	31
Humphrey's Rule	0.41604	0.53393	0.2933	0.48151
Standard Error	0.05	0.05	0.05	0.05

Once the two factors were selected, varimax rotation was used ''to maximize the amount of study variance explained'' (Watts and Stenner, 2012). Varimax focuses on the mathematically superior solution, ensuring that the factors prioritise exploratory power rather than explanatory power. Varimax rotation was deemed more applicable to the different categories because in this instance they are already broken up according to respondent groupings. Doing so provided factor arrays (Factor 1 and Factor 2) for each of the categories of analysis. The outputs from these analyses were considered according to 1) the subjective composite viewpoints that emerged and 2) consensus statements (Mandolesi et al., 2015). The factors themselves are the subjective composite viewpoints that emerged from the participants in the Q sorting process - put simply as a possible Q-Sort emerging out of the P-set under analysis. These factors have been examined and characterised for each category below. Consensus statements i.e., similarly liked or disliked between the 2 factors – were identified for understanding the positions represented by the factor groups. These are presented in the sections below for agroforestry opportunities and then for mixed farm opportunities to identify commonalities between site-level actor and consumer Q-sorts.

6.3.2.1 Agroforestry

6.3.2.1.1 Farmers

- *Factor 1 - efficient use of land and public policy*

For Factor 1, statements concerning the wider policy context for different farm systems and the growing recognition of agricultural land uses as a tool for the provision of public goods, were ranked highly. Within this factor, the opportunities that were ranked favourably would suggest a consensus amongst the practitioners surveyed that opportunities for agroforestry lie in the practices capacity as an efficient land use that yields multiple public goods. High rankings were given to opportunities relating to tree and hedgerow planting on agricultural land (+3), the establishment of agroforestry on Natura2000 sites (+4), and the better utilisation of marginal land (+2). Within Factor 1, agroforestry site-level actors also recognised the potential for both public financing (+2), private financing (+2), and carbon markets (+3) as future revenue streams for agroforestry.

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- *Factor 2 - capitalising on agroforestry product quality attributes*

Factor 1 is characterised by a preference for opportunities relating to different product labelling strategies that utilise agroforestry product quality attributes to appeal to a wider customer base. These include labelling foods to demonstrate to customers a lower carbon footprint (+2), authentic production techniques (+4), and that the food is healthier (+1).

Consensus Statements:

- *"24. Agroforestry systems should be better represented in public funding programmes because they provide a great number of skilled jobs."*
- *"3. Small-scale, local bioenergy production from agroforestry sites can support a circular, bio-based economy."*
- *"1. Less productive land with poor quality soil, and where land plots are marginal, can be better utilised by agroforestry. "*

Statements that were ranked favourably in both Factors 1 and 2 by site-level actors include opportunities relating to local employment and local energy production - statement 24) and statement 3. Consensus that agroforestry has an opportunity to better utilise less productive land with poor quality soil was also found.

6.3.2.1.2 Consumers

- *Factor 1 - Farming for healthier food and public goods.*

Factor 2 for this category saw an interest shown by consumers in agroforestry's ability to reduce the use of chemicals in food production and potentially improve the nutritional content of food. Labelling to demonstrate a lower climate impact (+2), marketing to consumers who want their food to be chemical free (+4) and appealing to consumers looking for healthier food (+2), were all highly ranked statements. As well as opportunities for agroforestry to provide wider public goods such as skilled jobs (+3) and improve the aesthetic value of farmland to attract day visitors and walkers (+1).

- *Factor 2 - Supporting agroforestry.*

Within Factor 2, higher scores were again given to opportunities relating to public goods. However, more emphasis was seen to be placed on public and private financing of agroforestry rather than marketable product quality attributes. Opportunities for agroforestry to capitalise on support from policies for sustainable intensification/risk management (+4), private financing for public goods (+2), and income from local bioenergy production (+2) were all ranked favourably.

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Consensus Statements

- *"11. There is potential for agroforestry to capitalise on product labelling that targets customers looking to buy food associated with a low carbon footprint and a smaller climate change impact. "*
- *"22. The profitability of agroforestry practices could be increased by public funding programmes looking to reduce climate change."*
- *"10. There is potential for agroforestry to capitalise on food product labelling that targets customers looking to buy authentic regional food. "*

A consensus between both factors could be established for opportunities related to product labelling activities that demonstrate agroforestry product's lower carbon footprint (statement 11) and the use of traditional production techniques to produce authentic regional food (statement 10). As well as a broader recognition of agroforestry's role in mitigating climate change and that the profits of such a system should be supplemented by public funding.

6.3.2.2 Mixed farming

6.3.2.2.1 Site-level actors

- *Factor 1 - mixed farming and the provision of public goods.*

Similar to the factor arrays produced in the agroforestry analysis, Factor 1 for this category shows a strong consideration for the opportunity of mixed farm systems to relate to many conceivable public goods. Such as the provision of skilled jobs (+3), better animal husbandry (+2), opportunities for private financing for the provision of public goods (+2), reducing inputs (+2) and improving regional food security (+1).

- *Factor 2 - carbon reduction and regional opportunities*

Factor 2 has split priorities with one set of highly ranked opportunities relating to reducing climate impact and carbon emissions while other preferred opportunities in this factor could be linked to potential regional benefits. The possibility of permanent grassland capitalising on emerging carbon markets (statement 11) and the potential for advertising the lower carbon footprint of mixed farm system products both were given a ranking of +3 in Factor 2. Opportunities relating to the perceived regional benefits of mixed farm systems such as food security (+2) and the provision of skilled jobs (+2) were also given consideration.

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Consensus Statements:

- *"8. Mixed farming should be primarily promoted on organic farms rather than on conventional farms."*
- *"24. Mixed farm systems should be better represented in public funding programmes because they provide a great number of skilled jobs."*
- *"4. Mixed farm systems should primarily focus on reducing external inputs such as imported animal feed."*

Site-level actors showed an overwhelming consensus for statement 8 (that mixed farming should be primarily promoted on organic farms rather than on conventional) with both factors 1 and 2 ranking the statement at +4. This finding corresponds to much of the qualitative findings from the interview data, where mixed crop and livestock farming was considered by many stakeholders as an important part of a farms' organic rotation.

6.3.2.2.2 Consumers

- *Factor 1 - diversification and collaboration.*

The role of mixed farming in enabling diversity of production was ranked +4 for factor 1. Within this factor, consumers also considered the opportunity for the diverse production that mixed farming brings to improve regional food security (+2). Consideration was also given to opportunities relating to regional scale collaboration between mixed farms (+3).

- *Factor 2 - Public support mechanisms for mixed farming*

For factor 2, a clear sentiment for the representation of mixed farming in public support schemes was observable across the three top ranked opportunities. The potential for mixed farming to feature in national policies for sustainable intensification and risk management (+4), public funding programs looking to reduce the impact of climate change (+3), and support for mixed farming because of its capacity to provide skilled jobs (+3) were all favoured in this factor by consumers.

Consensus Statements

- *"11. There is potential for mixed farms to capitalise on product labelling that targets customers looking to buy food associated with a low carbon footprint and a smaller climate change impact. "*
- *"12. Mixed farm system products will appeal to customers who want their food to be sprayed with less chemicals."*
- *"10. There is potential for mixed farm systems to capitalise on food product labelling that targets customers looking to buy authentic regional food. "*

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The opportunities that drew the most consensus from both factors all relate to the marketability of different mixed farm product quality attributes such as lower chemical usage and carbon footprint, and the appeal authentic regional food may have for customers.

6.3.3 Summary of findings from the Q-Methodology

This research exercise has provided the chance to explore the significance of opportunities for different categories of food supply chain stakeholders. What was generally observable in factors found in all four categories was a consensus that agroforestry and mixed farm systems yield a number of public goods that are eligible for public funding and private financing. This viewpoint was held from two different perspectives in the different factors identified. 1) that there are opportunities for public support for agroforestry and mixed farming as a more efficient use of farmland; 2) that agroforestry and mixed farming systems should be paid (publicly and privately) for their provision of wider public goods such as skilled employment, local food security, and carbon sequestration.

More divergent viewpoints were identified when considering opportunities relating to a third possible income stream for agroforestry and mixed farm systems - the increasing of farm product profitability. The marketability of different product quality attributes such as nutrition, carbon footprint, less chemicals etc. was viewed favourably by site-level actors and consumers for agroforestry opportunities. Participants seemed to hold divergent viewpoints for such market-based opportunities in the case of mixed farming. Here while there was consensus amongst consumers for marketing opportunities; the site-level stakeholders seemed to find the opportunities concerning the farm system itself and regional benefits more relatable. This would suggest that although consumers participating in this study consider the benefits of both agroforestry and mixed farming as marketable, mixed farming site level actors did not consider this to be as relevant.

Returning to the different discourses identified during the literature search, it is clear that opportunities relating to the environmental, regional/local, and food quality benefits of agroforestry and mixed farm systems, are considered favourably by both site-level actors and consumers. Whereas opportunities relating to the role both farm systems could play in improving animal welfare feature much less frequently in the higher rankings of opportunities. The same could be said for opportunities relating to tourism. Finally, across all four categories analysed, opportunities relating to technological solutions to improve on-farm efficiency and supply chain logistics (i.e., the farm profitability discourse), were not considered relatable by the participants.

6.3.4 Discussion

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A summary of the challenges of both the agroforestry and mixed farm systems is presented below, based on findings from the farm interviews. Following this some potential opportunities are presented and discussed, taken from the same sources. These findings are considered alongside findings from the focus groups and Q-methodology.

6.3.4.1 Challenges of the agroforestry farm system

The challenges identified from the fieldwork are presented in Table 6. Many of these are associated with setting up an agroforestry enterprise on-farm, particularly where the venture is new to the geographic area. Even before this point, given the current high price of agricultural commodities, some interviewees referred to the issue of using up productive land by planting trees and thereby forgoing the income that could be obtained in current markets. This is compounded by the fact that it takes so long to see a return from trees when they are newly planted.

Once the decision to plant has been taken, respondents have found issues with input supply, including sourcing new trees that will thrive on the farm; a lack of expertise in local farm circles and from traditional agronomists who work in the locality; and poor reception of the new enterprise from neighbouring farms. Those with ongoing enterprises commented on the high workload involved in running a number of different enterprises on-farm and issues with staff turnover and the need for recurrent training. Lastly, as pointed out by farm respondents and reflected in the comments coming from the consumer focus groups, the term 'agroforestry' is unfamiliar to many consumers and they are therefore unwilling to pay higher prices for the products from these systems as they cannot attribute value to something they know little about.

Table 6: Challenges reported by agroforestry case studies

CHALLENGE	**SPECIFICS**
Livestock damage	Livestock (e.g. goats, cattle) will eat from the trees so they have to be protected which entails work and expense. Pigs create a lot of manure and have to be rotated each week to avoid soil compaction.
Lengthy investment period	It takes a long time from initial investment in the trees to seeing a first harvest and a return.
Supply of new trees	It is more difficult to purchase new trees currently as there is increased interest in food forests. The trees that are available tend to be younger and take a longer time to bear fruit.
Pruning costs	The cost of annual pruning is high as it is very time consuming.

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Pesticide costs	It may be necessary to buy pesticides to protect against tree pests to preserve the economic value and quality of the fruit.
Labour issues	An agroforestry system is labour and knowledge intensive. Labour in agriculture is mostly built on temporary engagement of people, often migrants, making it difficult to establish a holistic understanding of the agroforestry system.
High training costs	Training hired labour in understanding the system and its needs (e.g., not cutting down the newly established tree seedlings while weeding).
Lack of agronomic expertise	Where the farm type differs from the mainstream farming system in the locale, often agronomic expertise is lacking.
Lack of local support	Other farmers in the area may not welcome a new farming system.
Scale of production	Where crop alleys are narrow and space limited, the machinery used is relatively small and therefore the labour and workload is fairly intensive. Smaller machinery and smaller yields reduce efficiency. The setup of machinery takes as long as a larger farm but to harvest for only a fraction of the time.
Older trees	Where trees age and create shade, it is more difficult to plant crops in the alleys. Older (larger) trees are more difficult to harvest if not properly maintained.
Trees vs. crops	Where prices for agricultural products are high, there is less willingness to plant trees on productive land.
Policy restrictions	Some farmers are concerned that where planting trees there may be an effect on the amount of subsidies received.
Size of marketable surplus	High unpredictability of the availability of marketable products, potentially creating problems within the value chain.
Consumer knowledge	It is necessary to engage with customers in order to educate them to acknowledge seasonality and variability.
Competition with supermarkets	Supermarkets can afford higher costs due to the higher volumes they are trading compared with farm shops associated with agroforestry systems.

Challenges identified regarding mixed farm systems are listed in Table 7. There is some overlap here with the points raised regarding agroforestry but many of the points are unique to mixed farms. These stem from the very nature of the farm itself: the mixed nature of the business entails the need for a workforce with a widely varied skill base; creates a very high workload, particularly where the farm encompasses a livestock enterprise; and has need for a wide variety of equipment to meet the needs of differing crops and crop/livestock combinations. The livestock themselves can cause damage to the crops.

Low returns per unit of output also seems to be a common problem, partly caused by the need for highly skilled staff and a variety of equipment but also because with dealing with small quantities of output,

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economies of scale are not realised. For example, producers need to rely on markets other than supermarkets for their sales due to issues of harvest size and yet the supermarkets set the price for commodities. Supermarkets are able to keep prices lower because they are dealing with significantly higher throughput from conventional farms. Mixed farms often send small numbers of livestock for slaughter and so have higher per animal costs of transport. Because of a lack of consumer awareness of the benefits of mixed farm production, they are not willing to pay higher prices for the produce and so again, the mixed farm sees lower profits as a result of keeping prices low and yet facing higher per unit costs.

Table 7: Challenges reported by mixed farm case studies

CHALLENGE	SPECIFICS
High and varied workload	The mixed farm is involved in many different crops and livestock and combinations of these and so the workload for staff is very high.
Demands of livestock rearing	Livestock are particularly demanding when combined with crops on the mixed farm as they need a daily presence on-site throughout the year.
Livestock damage	An increase in livestock damage to crops is a common challenge when combining crops and livestock
Need for variety in expertise	The mixed farm combines many different crop and livestock enterprises and so requires many different skills of its workforce that have to be continually trained to meet the technical demands of the job as well as the skill to do this safely. Changing the crop mix means changing the skills required of the workforce.
Problems in sourcing inputs	Where the farm requires specialist inputs including suitable fencing, this can be difficult to source if the farm type is not common in the locale.
Lack of agronomic expertise	Where the farm type differs from the mainstream farming system in the locale, often agronomic expertise is lacking.
Suitability of available know-how	Where information about a specialised farming system is made available in the literature, this does not apply to different farming regions. It is therefore difficult to source knowledge that applies to the individual circumstance.
Grazing management risk	As poultry and pigs show a high level of resistance to dominant bacterial and viral diseases, they risk parasitic infection if the grazing is not managed properly.
Dangers of cross-contamination	Where the farm is small and surrounded by conventional farms there is a risk of cross contamination when neighbouring farms do not share the same objectives or respect for the landscape.
Varied equipment needs	Where the mixed farm is producing a small amount of a wide range of vegetables, the farm equipment demands are high.
Competition with supermarkets	Supermarkets set the expected price of food and this often is less than what it costs to produce on a mixed farm. The result is low returns to the farm and low wages to staff.

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Difficulties of investing in machinery	Equipment costs are high but options for reducing these costs are limited. A lack of cooperation between farmers makes joint ownership difficult and the low number of organic farmers precludes subcontracting.
High costs of transportation	Given the smaller size of production compared with a conventional farm, the per unit cost of livestock transportation to slaughter is higher, increasing the production costs and reducing the farmer's margin.
Lack of consumer awareness	Consumers may lack knowledge and experience of organic, free range farming systems and market outlets that offer higher returns may be difficult to identify.

Some opportunities for agroforestry and mixed farming systems were identified in the data collection. These are summarised in Table 8 and can be seen as internal to the farm production system, external in the farm's association with the outside environment, and value chain opportunities.

Taking the first of these, perhaps the most striking attribute of these systems is their ability to diversify in order to make them more resilient to external shocks. They can diversify their crop mix, their enterprise mix, their mix of on-farm activities (kindergarten, educational sessions, basket making, bakery, farm shop etc.) and their mix of market outlets (direct to consumers, to restaurants, to in-town farm shops, to processors etc.). Where failure on one element threatens then resources can be switched to another element, or income used to maintain the failing crop/enterprise. The diversification also allows for the distribution of scarce labour resources across the seasons.

The very nature of agroforestry and mixed farm systems often creates a closed loop system whereby livestock graze the land and deposit manure which fertilises the plants which are often used as feed. The grazing helps to maintain the quality of the pasture through reducing weed cover. Both systems are beneficial for the farm's biodiversity. Both farm types have also given the farmer the chance to experiment, to push the boundaries, and to see what different crop combinations work either together or alongside the trees/livestock, and being small scale, learning rather than financial loss comes from any mistakes.

Both the capacity of agroforestry and mixed farm systems to diversify and reduce dependence on external inputs demonstrate the land use efficiency of both systems which were system attributes considered favourably in the consumer focus groups and in the Q-Methodology results. With the ranking of opportunities in the Q-Methodology, evidence of consensus across participating VCN stakeholder groups that agroforestry and mixed farming could deliver a more efficient land use and should be supported to do so by policy strategies.

What is also noticeable about some of the responses is the extent to which living or working on one of these farms provides personal satisfaction to those involved. This has been particularly important during the COVID-19 lockdowns and has often created opportunities for others to share in the countryside experience whether it be by taking a walk near to, or around, an agroforestry system or mixed farm, or coming to the farm to buy from one of the many outlets present. The results from the Q-methodology also adds that there is sentiment to support agroforestry and mixed farming as a means of providing meaningful, skilled jobs.

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In terms of opportunities external to the farm, several mentioned the possibility of engaging in research projects as a result of the type of production carried out on the farm. This creates a win-win situation with research institutions being able to experiment on-farm or collect data from the farms' current production, and the farmer learning new techniques and engaging in discussion with interested and knowledgeable parties.

The sense of community was also mentioned by a number of farmer respondents as these farm types create a sense of belonging amongst the communities that they serve.

Opportunities with farm value chains were also noted. In the focus groups there was a lack of awareness of different farm types but a willingness to learn, if the right resources were available. The high quality of organic produce is appreciated and through the right educational experiences, highlighting the benefits of the agroforestry and mixed farm production systems, it may be possible to develop demand for these products. Currently producers are often involved in short supply chains which are good for the environment in terms of reducing food miles and good for the consumer in terms of providing a fresh product that has been harvested at the optimum time. In the Q-methodology, the variable preference given to opportunities relating to the marketability of different agroforestry and mixed farm product quality attributes, suggests that marketing opportunities do depend on the nature of the product's supply chains.

Lastly, by creating opportunities for customers to enjoy visits to the farm to stay for holidays, to eat in cafes, to buy from the shop or to learn to make baskets, there is a chance that memories taken home will lead to ongoing purchasing habits. The aesthetic value of agroforestry and mixed farm systems as places to visit, were also highlighted during the focus groups. However, opportunities relating to agritourism and farm visits were given a lower priority during the Q-Methodology and thus suggest that such opportunities are context specific and perhaps more relatable to farms in specific locations, rather than to the sector as a whole.

Table 8: Opportunities from agroforestry and mixed farming systems

OPPORTUNITY	SPECIFICS
FARM LEVEL OPPORTUNITIES - INTERNAL	
Environmental benefits	Grazing harvested fields helps to minimise spontaneous growth while also contributing to soil fertilisation. Production of fodder crops, mainly mixtures of legumes and grasses, contributes to soil improvement prior to the next crop. Agroforestry and mixed farming are good for biodiversity.
Mental health benefits	Keeping livestock provides a high degree of personal satisfaction and psychological balance. Animals are seen as a vital factor on the farm. A high degree of autonomy and self-subsistence in food are highlighted as important benefits of this way of farming and life.

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Grant funding	Where available, grant money can fund the up-front costs for agroforestry establishment.
Home produced inputs	Having different enterprises on the farm allows for the use of outputs from one enterprise to be used as inputs to another.
On farm experimentation	The small-scale nature of some agroforestry and mixed farming systems allows farmers to experiment with a small crop or change to the system design before implementing on a larger scale.
Benefits of diversification	• Having a number of different enterprises on the farm reduces risk in the face of crop or market failure. • A diverse income from a number of farming activities allows the farm to fund other on-farm activities such as engagement in NGOs and educational outreach. • Different enterprises on the farm allows a more equal distribution of labour across the seasons. • The mix of tasks on-farm due to the range of enterprises requires a varied expertise and provides openings for specialised labour. • A range of enterprises on-farm offers the opportunity to diversify into processing (such as on-farm production of flour that feeds the bakery), on-farm sales and tourism on-site.
FARM LEVEL OPPORTUNITIES - EXTERNAL	
Research	Engaging in this type of farming system brings opportunities for engagement in research projects and the resultant mutual learning.
Preventing land abandonment	Incentives to support agroforestry may prevent areas of land being abandoned owners age or as land is purchased speculatively.
Sense of community	The smaller scale nature of such a farm brings with it a sense of community and connectedness which benefits both the farm and farm workers and those in the community or visiting the farm.
VALUE CHAIN OPPORTUNITIES	
High quality of products	The products from such systems are high quality and in demand with customers who are looking for environmentally friendly, nutritional food.
Local food	The short supply chains with which many of these farms engage mean local food for local people, reducing food miles and improving the quality of food on offer.
Tourism	Having an aesthetically pleasing farm attracts tourists to the area, adding income for the farm and for the local community. It also impacts demand for farm products once the tourists leave the area.

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7 Concluding Remarks

This deliverable builds on the conceptual and analytical work of AGROMIX D5.1 to provide an evidence base for further socioeconomic and policy focussed investigations being carried out as part of this project and subsequent research. The task represents a key stage in the research program where in-depth stakeholder engagement, facilitated through participatory research activities, can unlock further understanding of the real-life challenges and opportunities faced by agroforestry and mixed farming practitioners. The methodology adopted for this means also affords the chance for deeper analysis of innovations and market opportunities for agroforestry and mixed farming. This is done with the view to better inform policy recommendations emerging out of the research program and the dual nature (factsheets and report) of the outputs provided in this deliverable, afford the opportunity for the wider dissemination of findings.

A core objective of the task was to provide an overview of different agroforestry and mixed farming successful VCN characteristics. This was achieved through the profiling of established agroforestry and mixed farms in case study factsheets. The deliverable provides 13 examples of agroforestry VCN in 7 European countries, in different climatic regions. The factsheets provide lists of enabling factors for different agroforestry and mixed farm VCNs and offer practical information regarding what has worked well for different farms that have adopted these practices.

The deliverable also summarises the main bottlenecks and challenges faced by agroforestry and mixed farm practitioners. These ranged from internal challenges and points of friction within the workflow and daily tasks of farmers practising agroforestry and mixed farming, to the external, structural stresses. From the factsheets and the in-depth analysis, it is possible to conclude that even though most farmers who participated in this task found an enjoyment of their work as agroforestry and mixed farming practitioners and saw a value in what they are doing, there remain numerous challenges in terms of workload, required expertise, labour shortages, and the divergence from more commonplace agricultural production lines, that could present significant barriers to the wider adoption of agroforestry and mixed farming. Concern over a lack of consumer awareness and supermarkets setting the bottom line for food prices were the most prominent concerns felt by practitioners. Of the case studies reviewed, almost all fared well during external shocks such as Covid-19 and were able to keep yielding numerous public goods such as continued employment for their staff and as an outdoor space to visit.

Finally, the deliverable considers a number of opportunities for agroforestry and mixed farming. Some are context specific innovations on-site that could alleviate challenges faced by practitioners and are captured in the EIP-style factsheets. While other opportunities, identified in the in-depth analysis, relate more to the agroforestry and mixed farming sector as a whole. Those opportunities were considered from a range of perspectives as a result of the focus groups and Q-Methodology. It was found that the strongest consensus across VCN stakeholders was for opportunities for agroforestry and mixed farming practitioners to be supported in the delivery of the different public goods by both public and private financing to improve the profitability of those systems.

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9 Annex

This Annex contains the 13 EIP-style factsheets of the case studies.

Table 1: List of EIP-Style Factsheets by name and corresponding case study number.

Case Study	Factsheet Title
GR01	Agroforestry in the Evrotas river valley (Southern Greece)
GR02	Mixed Farm in the agricultural plain of Thessaly
GR03	Agroforestry in Pelion region (Thessaly, Central Greece)
BG01	Mixed farm with agroforestry in Belgium
IT01	Tenuta di Paganico (Paganico, Grosseto Province) – Agroforestry
IT02	AL CONFIN (Mix Farming) – Italy (Veneto Region)
GER01	Mixed farm with Cattle and Arable in Saxony
GER02	Agroforestry in the historic area of Odernheim am Glan (Rhineland-Palatinate, DE)
POL04	Agroforestry in the Beskid Mountains - Łazy Brzyńskie, Małopolskie region (Lesser Poland)
UK01	Enterprise stacking in a sivolarable system in Suffolk
UK02	Silvopastoral System in the Northeast Cotswolds
UK03	Biodynamic Mixed Farm in East Sussex (UK)
AU01	Agroforestry in the Weinviertel region (Lower Austria, At)

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