LIFT

Low-Input Farming and Territories – Integrating knowledge for improving ecosystem based farming

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Socio-economic impact of ecological agriculture at the territorial level

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About the LIFT research project

Ecological approaches to farming practices are gaining interest across Europe. As this interest grows there is a pressing need to assess the potential contributions these practices may make, the contexts in which they function and their attractiveness to farmers as potential adopters. In particular, ecological agriculture must be assessed against the aim of promoting the improved performance and sustainability of farms, rural environment, rural societies and economies, together.

The overall goal of LIFT is to identify the potential benefits of the adoption of ecological farming in the European Union (EU) and to understand how socio-economic and policy factors impact the adoption, performance and sustainability of ecological farming at various scales, from the level of the single farm to that of a territory.

To meet this goal, LIFT will assess the determinants of adoption of ecological approaches, and evaluate the performance and overall sustainability of these approaches in comparison to more conventional agriculture across a range of farm systems and geographic scales. LIFT will also develop new private arrangements and policy instruments that could improve the adoption and subsequent performance and sustainability of the rural nexus. For this, LIFT will suggest an innovative framework for multi-scale sustainability assessment aimed at identifying critical paths toward the adoption of ecological approaches to enhance public goods and ecosystem services delivery. This will be achieved through the integration of transdisciplinary scientific knowledge and stakeholder expertise to co-develop innovative decision-support tools.

The project will inform and support EU priorities relating to agriculture and the environment in order to promote the performance and sustainability of the combined rural system. At least 30 case studies will be performed in order to reflect the enormous variety in the socio-economic and bio-physical conditions for agriculture across the EU.

Project consortium

No.	Participant organisation name	Country
1	**INRAE - Institut National de Recherche pour l'Agriculture, l'Alimentation et l'Environnement**	**FR**
2	VetAgro Sup – Institut d'enseignement supérieur et de recherche en alimentation, santé animale, sciences agronomiques et de l'environnement	FR
3	SRUC – Scotland's Rural College	UK
4	Teagasc – Agriculture and Food Development Authority	IE
5	KU Leuven – Katholieke Universiteit Leuven	BE
6	SLU – Sveriges Lantbruksuniversitet	SE
7	UNIBO – Alma Mater Studiorum – Universita di Bologna	IT
8	BOKU – Universitaet fuer Bodenkultur Wien	AT
9	UBO – Rheinische Friedrich-Wilhelms – Universitat Bonn	DE
10	JRC – Joint Research Centre – European Commission	BE
11	IAE-AR – Institute of Agricultural Economics	RO
12	MTA KRTK – Magyar Tudományos Akadémia Közgazdaság – és Regionális Tudományi Kutatóközpont	HU
13	IRWiR PAN – Instytut Rozwoju Wsi i Rolnictwa Polskiej Akademii Nauk	PL
14	DEMETER – Hellinikos Georgikos Organismos – DIMITRA	GR
15	UNIKENT – University of Kent	UK
16	IT – INRAE Transfert S.A.	FR
17	ECOZEPT Deutschland	DE

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List of acronyms and abbreviations

AES – Agri-environment schemes

AT – Austria

AONB – Area of Natural Beauty

BPS – Basic Payment Scheme

CAP – Common Agricultural Policy

CSA – Case study area

DEFRA - Department for Environment, Food and Rural Affairs

EC – East Crete

ES – Eastern Scotland

ENG – England

EU – European Union

FR – France

GDP – Gross Domestic Product

GHG – Greenhouse gases

GR – Greece

ha – hectare

HB – Hajdú-Bihar

H&I – Highlands & Islands

HUN - Hungary

HW – High Weald

HVE – Haute Valeur Environnementale (French for High Environmental Value)

IPM – Integrated Pest Management

IT – Italy

IV – Ille-et-Vilaine

IWM – Integrated Weed Management

LFA – Less Favoured Areas

LUB – Lubelskie

NGO – Non-governmental organisation

NK – North Kent

PdD – Puy-de-Dôme

PDO – Protected Designation of Origin

PL – Poland

POD – Podlaskie

RAV – Ravenna

ROM - Romania

SAR – Sarthe

SK – Steyr-Kirchdorf

SCO – Scotland

SMS – South and Middle Sweden

SU – Salzburg und Umgebung

SUC – Suceava

SWE – Sweden

UAA – Utilised Agricultural Area

UK – United Kingdom

VES – Veszprém

1 Summary

This deliverable investigates the socio-economic effects of ecological approaches to farming through implementing two participatory approaches, namely Delphi exercise and Q-method, at the level of a case study area (CSA). The focus is on how people and other productive assets are employed and remunerated by ecological approaches to agriculture, particularly those aspects that can influence employment, and drive the prosperity and vitality of local communities and some rural businesses. It is based on the collaborative research on Task 4.2 'Socio-economic impact of ecological agriculture at the territorial level' of the LIFT project between UNIKENT (United Kingdom-UK) (Task Leader), BOKU (Austria), INRAE (France), VetAgro Sup (France), DEMETER (Greece), MTA KRTK (Hungary), UNIBO (Italy), IRWiR PAN (Poland), IAE-AR (Romania), SLU (Sweden), SRUC (UK).

Beginning with the Delphi exercise, this deliverable presents qualitative information extracted from stakeholders in the following four steps. First, the researchers build a presentation of differences between ecological and conventional farming approaches in each CSA. Second, stakeholders elaborate on how they understand ecological farming approaches to exist in each CSA. Third, stakeholders develop a scenario of adoption of ecological approaches to farming depending on two factors: pattern (ecological farms forming clusters or randomly spread within the territory) and rate of adoption 10 years in the future. After establishing this scenario across two rounds, the stakeholders explore the socio-economic effects of their adoption scenario.

The Q-methodology then presents a Q-set of statements that the Delphi has developed and, through factor analysis, studies the key stakeholder perspectives of the socio-economic effects of the perceived adoption of ecological practices in 10 years in the future.

Four key results can be derived from the Delphi exercise and the Q-methodology.

First, a higher adoption of ecological farming approaches, especially so at a 50% adoption rate, is mostly thought by stakeholders in the Delphi Exercise to lead to an increase in skill level and quality of life in on-farm employment. This is as a result of an increased diversity of farming enterprises on farms using ecological farming approaches, the interest generated from this, the knowledge of natural processes and biology required, engagement with nature and change in machinery that is coming into the industry. Strongly related to this need for skills is a predicted increase in the number of advisers and civil servants to deal with more complicated farms and incentives as well as monitoring of ecological effects on farm. An increase in required skill level is repeated across all Q-studies.

Second, especially where farms are clustered together, Delphi Exercise respondents predict an increase in the trade of inputs such as manure and compost replacing synthetic fertiliser, as well as more sharing of capital and labour. Q-methodology highlights that these clusters may support a stronger social movement, more consumers buying local food and increase collaboration between farmers. Supply chains are expected to become shorter as farmers sell more directly and there are fewer intermediaries upstream of the farming sector. As farmers collaborate more with each other on environmental objectives, trading inputs and sharing best practices, farmer relationships should improve in rural communities.

Third, Delphi exercise finds that contracting, machinery purchasers, and machinery traders and dealers could increase, decrease or display no change – the anticipated effects are mixed. Stakeholders are in no doubt that machinery use will change and therefore new skills will need to be learnt, but the wider effect on machinery purchase is uncertain. However, stakeholders conclude that a greater specialisation in machinery will occur leading to changes in farm management as well as the suppliers of this machinery. Q-methodology highlights that ecological practices will not mean the end of

machinery and a lot more labour – often machinery will be useful in weeding and reducing physical labour as technology has significantly improved and skills are improving too in order to use these technologies.

Fourth, Delphi respondents argued that although rural populations might be little affected by ecological farming, a shift in people moving from urban to rural settlements, and thereby a higher rural population density, seeking a more attractive rural environment, might contribute to higher local consumer demand. The Q-methodology highlights that where there is high adoption, rural areas are expected to become more attractive, as landscapes will have a much greater variety of crops instead of fields of monocrops. This variety of crops may include agroforestry (farmers interested in ecological approaches to farming may also be interested in agroforestry as a way of boosting their yields and protecting crops and livestock from the elements) as well as intercropping.

2 Introduction

Research in Task 4.2 focuses on the socio-economic effects of ecological approaches[1] to farming at the territorial level. The main methodology to upscale and investigate the socio-economic impact at a higher territorial level is based on participatory methods, namely Q-methodology and a Delphi exercise. These approaches involve a variety of different stakeholders depending on the approach in use. This deliverable is based on the collaborative research on Task 4.2 'Socio-economic impact of ecological agriculture at the territorial level' of the LIFT project between UNIKENT (UK) (Task Leader), BOKU (Austria), INRAE (France), VetAgro Sup (France), DEMETER (Greece), MTA KRTK (Hungary), UNIBO (Italy), IRWiR PAN (Poland), IAE-AR (Romania), SLU (Sweden), SRUC (UK).

It is difficult to separate out different socio-economic effects at the territorial level into individual pieces of research due to multiple interrelating effects and this is especially so when discussing ecological approaches to farming. Delphi exercise and Q-methodology are two explorative, qualitative approaches that allow experts who are closer to innovations on the ground to explain how they perceive the industry changing in light of further attention regarding ecological approaches to farming. As an explorative exercise, both approaches frame the research in a 10 year forward perspective and explore how stakeholders believe farms in a given CSA will adopt ecological farming approaches. The forward perspective is explored using an 'adoption scenario' approach that investigates two fundamental questions: a) would a low or high percentage of farms in the area adopt ecological practices? And b) would farms adopt as a cluster or be randomly spread across the territory. Given these adoption scenarios, both methods investigate their socio-economic effects.

The deliverable presented here is structured as follows. First, separate descriptions of the CSAs used in the contributing participatory methods are given to explain the context in terms of the geography and general economy of the CSAs. Second, the Delphi exercise is presented, its methodology, adoption scenario and results. The adoption scenario first part separately discusses the stakeholders' opinions on the existence of ecological farming approaches in each CSA as well as their rate and pattern of adoption. Then, the results part of the Delphi synthesises the predicted the socio-economic effects of

[1] Ecological practices are understood in LIFT as low-input practices and/or practices that are environmentally friendly. The originality of LIFT in this view is not to focus on a specific type of ecological approaches, but to cover the whole continuum of farming approaches, from the most conventional to the most ecological, including the widest range of ecological approaches. This comprises the existing nomenclatures such as organic farming, low-input farming, agroecological farming, etc. It also encompasses approaches that are not yet part of a nomenclature, but that can be identified with various criteria such as management practices, on-farm diversification etc. Thus, conventional practices mean non-ecological practices.

the adoption scenarios across all CSAs. Third, the report proceeds with the Q-studies, firstly describing their methodology and then providing separate discussions of the results from each CSA study. At the end of the Q-methodology, a discussion presents a comparative synthesis of Q-methodology results from across all the CSAs. Finally, conclusions are derived from the two participatory methods.

3 Case study area descriptions

This section of the deliverable presents brief descriptions of the CSAs involved in the Delphi exercise and Q-methodology. These CSAs are each unique, varying in relief and topography (flat or mountainous etc.), climatic conditions, land cover and population. All these variations contribute, firstly, to the farm types that predominantly exist in the area (crop, livestock etc.) and secondly to the ecological farming approaches that are applicable. Note that not all CSAs are used in the Delphi due to difficulties in recruiting participants, but all CSAs feature in the Q-methodology.

3.1 Austria – Salzburg und Umgebung and Steyr-Kirchdorf

The two Austrian (AT) CSAs Steyr-Kirchdorf (SK) and Salzburg und Umgebung (SU), located in the federal states of Upper Austria and Salzburg, respectively, are both characterised by dairy farming and multi-purpose dairy breeds. Differences in the case studies relate to the relief of the regions, with Steyr-Kirchdorf being more mountainous than Salzburg und Umgebung. While Steyr-Kirchdorf is more heterogeneous in terms of agricultural landscape and farm structure, Salzburg und Umgebung is more homogenous. The regions also differ in the percentage of organic farming, which is traditionally pronounced in Salzburg und Umgebung and supported by marketing concepts such as hay-milk. Also, the marketing possibilities for farmers are distinctively broader in Salzburg und Umgebung, as here a number of (competing) dairies are available, while in Steyr-Kirchdorf the availability of only 2 dairies weakens farmers' negotiation position regarding price and conditions (management requirements). Moreover, Salzburg und Umgebung lies near the border to Germany, delivering even broader marketing options for the farmers due to the given access to the trans-border market.

3.2 England – High Weald and North Kent

Both England's (ENG) CSAs are located in South East England – the most populous region in the UK with approximately 9.2m inhabitants, 13.7% of the UK total, and very densely populated at 481 inhabitants/km² against a UK average of 275 inhabitants/km² (ONS, 2020).

The CSA of North Kent (NK) includes a number of National Character Areas (Natural England, 2014) and this is an area of diverse agricultural systems, with a mix of livestock, horticulture and arable farms. The North Kent Plains contain fertile loam soils, thus, being characterised by arable, traditional orchards, and soft fruits and vegetables. Grazing marsh is typical in the Great Thames Estuary and mixed farming is widespread on the North Downs.

In contrast, the other CSA in the High Weald (HW) is a home predominantly of pastoral agriculture with areas of horticulture on higher ground, while the low lying, flat areas towards the east contain concentrations of arable farmland. This landscape was granted Area of Outstanding National Beauty status in 1983, recognising the unique High Weald landscape of a mosaic of small farms, the highest concentration of woodland in England (26%) and ridge-top villages.

Farms are on average larger in the North Kent study area, 96.8 hectares (ha), in comparison with 53.1 ha in the High Weald (DEFRA, 2016) and the total farmed area is larger in North Kent (157,340 ha

against 97,937 ha in the High Weald). This is not surprising bearing in mind that a large proportion of farms in the High Weald tend towards the smaller end of the scale (47% less than 20 ha versus 43% in North Kent) while there are a significant number of farms in North Kent larger than 100 ha (25% versus 14% in the High Weald). Compared to the High Weald, North Kent has a far larger proportion of cereal[2] farms (26% against 10%), but a much lower importance of grazing livestock (30% against 53%).

3.3 France – Ille-et-Vilaine, Puy-de-Dôme and Sarthe

The French (FR) CSAs Ille-et-Vilaine (IV) (in Brittany region) and Sarthe (in Pays-de-la-Loire region) are both located in Western France, and Puy-de-Dôme (PdD) (in Auvergne region) is in Central France. The Western case studies are rather flat, having mainly livestock which is quite intensive. Brittany is the most important region nationally in terms of agriculture, particularly for fresh vegetables (83% of national cauliflower production) and for livestock production (58%, 42% and 21% of national pigs, laying hens and dairy cows respectively)[3]. The dairy farms are large, highly capitalised and produce milk at a low price. There is a big issue of pollution from livestock breeding, for example, river pollution and algae proliferation on the seacoast. Sarthe (SAR), meanwhile, is predominantly mixed livestock or mixed crop-livestock farms.

In contrast, the Central Auvergne region, containing Puy-de-Dôme, is divided between mountainous areas, fragmented forests and the Limagne plains. The farm types characterising the region are mostly grazing livestock, namely dairy, cattle and sheep – 70% of the region's farms are located in mountainous areas. Milk production is for cheese and produced at a higher price than in Brittany.

3.4 Greece – East Crete

Crete is the largest and most populated island of Greece (GR), with a population of 623,065 inhabitants, located approximately 160 km south of the Greek mainland and covers an area of 8,336 km^2. The economy of Crete is primarily based on tourism and agriculture with olive trees, vines, vegetables and citrus considered to be the main cultivations. In addition, dairy products play an important role in the Cretan economy, with a range of specialty cheeses being produced.

The Greek CSAs in East Crete (EC), Heraklion and Lasithi, are two of the four Regional Units of Crete towards the eastern part of the island. The southern part of the Heraklion Regional Unit is mountainous, while the majority of farmlands are situated in the central and northern parts of the Regional Unit. Lasithi Regional Unit is the easternmost and least populated region of Crete, bordering the Heraklion Regional Unit to the west. It is mostly mountainous, with a lot of plateaus and it is surrounded by sea on three sides. The southernmost city of Europe and the largest in the Regional Unit, Ierapetra, is known for its many vegetable greenhouses.

Approximately 188,118 ha of the area of Crete is covered by olive oil trees, while the respective area for the whole of Greece is approximately 792,642 ha (HSA[4], 2017). The Cretan olive oil production in 2017 represented 23.4% of the country's total olive oil production, out of which 71.7% was produced in the Regional Units of Heraklion and Lasithi. In 2017 approximately 50,085 ha were occupied by organic olive trees (Duvaleix *et al.,* 2020), including olive groves that were in the process of converting

[2] Farm types are classified using standard output, percentages are authors' own calculations.

[3] Figures are for 2016 and originate from the French National Statistical Office (INSEE) and the French Ministry of Agriculture (Agreste): https://www.insee.fr/en/accueil and https://agreste.agriculture.gouv.fr/agreste-web/

[4] Unless otherwise stated, statistics in the Greek case study presented in this deliverable are from the Hellenic Statistical Authority, https://www.statistics.gr/en/statistics/agr

to an organic farming system. In the study area of Eastern Crete, in the Regional Units of Heraklion and Lasithi, there were nine organic certification bodies in 2017 and 736 organic producers with an area of 3,722 ha of organic olive trees in Heraklion and 290 organic producers with an area of 868 ha in Lasithi (Duvaleix *et al.,* 2020).

Crete also constitutes one of the country's major viticultural centres. The total area of land covered by vines in Crete was about 18,086 ha in 2018, representing approximately 20% of Greece's total area under vines (89,246 ha) (HSA, 2018). In particular, the area under grapes for wine in Crete was around 6,185 ha in 2018, of which the case study areas, Heraklion and Lasithi, accounted for 49% and 13% respectively. In 2017, the area covered with organic vineyards in Heraklion was approximately 271 ha, corresponding to 157 organic producers, and 56.4 ha with 30 organic producers, respectively, in Lasithi (Tzouramani *et al.,* 2019a).

3.5 Hungary – Hajdú-Bihar and Veszprém[5]

The two Hungarian (HUN) CSAs are located in the two extremes of the country with rather different geographical, geological and agricultural characteristics.

Hajdú-Bihar (HB) county is located in the Eastern part of Hungary, near the Romanian border, with Debrecen as the county capital. It is the fourth largest Hungarian county. Geographically, the region is in the Hungarian Great Plain, a flat, agricultural region. Most of its territory belongs to the river Tisza basin, important for its water supply for agriculture. The area is 6,211 km^2 with a population density of 84.8 inhabitants/km^2. As a comparison, the population density of the entire country is 105 inhabitants/km^2. The agricultural area is 544,000 ha with 334,000 ha arable land. The total area of the county is 621,000 ha; thus, it is an evidently prominent agricultural region. Some data with respect to the production structure emphasises its importance: 169,000 ha are used for cereals, 523 ha of grapes, it produces annually 43,800 tons of fruits, 110,000 cattle, and 459,000 pigs.

Veszprém (VES) county is in the Western part of Hungary, in the Western Transdanubia region. The case study is a hilly region, the Bakony mountains occupy the middle of the county. The area of the county is 4,464 km^2, with a population density of 76.42 inhabitants/km^2. The region provides generally unfavourable conditions for agriculture, except viticulture. Some of the most notable wine production areas are located on the western shores of Lake Balaton. Its agricultural production structure is: 61,000 ha cereals, 4,156 ha of vineyards, 6,288 tons of fruit, 517,000 cattle, and 118,000 pigs.

3.6 Italy – Ravenna[6]

Ravenna (RAV) Province is an area of the Emilia-Romagna region in Italy (IT), located in the eastern part of the region. The province is inhabited by about 400,000 people (2020), roughly 9% of the population of the region, and the population density is 209 per km^2, slightly above the overall Italian population density (198 per km^2). The province is a relatively wealthy area with, for example, an unemployment rate (2019) of 4.6%, well below the Italian (10%) and the Emilia-Romagna region rates (5.5%).

63% of the Ravenna province area is allocated to agriculture, a share substantially higher than the Emilia-Romagna region (48%) and of the Italian one (43%). Almost 9,000 farmers are active in the area (2010), cultivating in a total 116,638 ha of land. The area is mostly specialised in permanent crops. 56%

[5] The Hungarian case study data presented in this deliverable are for 2020, and originate from the Hungarian Central Statistical Agency, www.ksh.hu

[6] The Italian case study data are taken from the official statistics of ISTAT, https://www.istat.it/.

of the farms are specialised in permanent crops, which is above the regional figure (30%), but more in line with the Italian one (55%). These figures are even more pronounced by comparing the Utilised Agricultural Areas (UAA). 41% of the Ravenna province UAA is allocated to arable crops, and 37% to permanent crops; the figures for the Emilia-Romagna Region are respectively 50% and 15%, and for Italy are 39% and 21%. The data refers to the 2010 agricultural census.

3.7 Poland – Lubelskie and Podlaskie[7]

Lubelskie (LUB) Voivodeship is located in the south-eastern part of Poland (PL) bordering Belarus and Ukraine to the east covering an area of 25,155 km^2. More than half of the regional population (almost 1.2m people) live in rural areas and as much as 37% of working people engage in agriculture compared to the country average of 16%. There are about 18,500 farms over 1,400,000 ha of land. 80% of farms are very small, up to 10 ha. Lubelskie's agricultural area is known as the food granary of Poland. This is one of the three best regions in Poland for water conditions, soil quality, agri-climate and landform. Farmers in Lubelskie specialise in crop production, of which cereals (32%) and fruit (22%) constitute the largest parts and crop production is about 65% of the final value of farm output. Livestock production is mainly pork (54%) and cow milk (37%). The region dominates national soft fruit production, producing around 200,000 tons per year and is the second largest producer of tree fruit in the country. Ecological farming approaches in Lubelskie are growing, organic farming currently constitutes an area of 34,000 ha and as of 2015 there were 1,896 certified organic food producers. Food production through organic farming in the area is the highest nationally with 11,000 tons of fruit (total fruit production is about 700,000 tons) and 5,000 tons of vegetables produced per year (20% and 17% respectively of nationwide production from organic farming).

The second CSA, Podlaskie (POD), is a region in north-eastern Poland. It borders other Polish regions to the west, northwest and south, Republic of Belarus to the east, Lithuania to the northeast and the Kaliningrad Oblast of Russia to the north. Podlaskie has a varied landscape with vast forests and numerous lakes, around 30% of the area is under legal protection. Podlaskie has the lowest population density (59 inhabitants/km^2) of the 16 Polish regions, and its largely unspoiled nature is one of its main assets. Agriculture in Podlaskie Voivodeship operates in harsh natural, both climatic and soil conditions – a very short vegetation period, record low temperature, poor soil and periodic water deficits. Despite this, there are over 100,000 farms in the region, average farm size being around 13 ha. The study area is suited to producing milk and beef, whilst crops, potatoes, cereals and sugar beet are also cultivated.

3.8 Romania – Suceava[8]

Suceava (SUC) county lies in the north-eastern part of Romania (ROM), with an area of 8,553 km² (3.6% of the country's territory). The relief of the land is mostly mountainous, covering about 60% of the county's area, the rest being occupied by plateaus and plains. There are 2 national parks and 22 natural reserves in this county. Out of a total 755,094 inhabitants of the county, 56% are living in the rural area (2018). Suceava is one of the poorest counties of Romania, with a gross domestic product (GDP) of 4,918 Euros/inhabitant/year (the national average was 8,600 Euros/capita in the year 2016).

In terms of land cover, agricultural land accounts for 41% (347,632 ha), while forest 53% (453,661 ha). Dividing the agricultural land use into categories, arable land comprises 52%, pastures and hayfields

[7] The Polish case study data presented in this deliverable are from Statistics Poland. Yearbook of the Regions – Poland. Warsaw 2019. https://stat.gov.pl/obszary-tematyczne/roczniki-statystyczne/roczniki-statystyczne/rocznik-statystyczny-wojewodztw-2019,4,14.html

[8] The Romanian case study data are taken from NIS (National Institute of Statistics), http://www.insse.ro .

47%. The agricultural land is mainly farmed by small-sized farms, with an average size of 2.49 ha. Suceava county is in the top ten counties with areas cultivated as organic farming (7,555 ha – 2% of total agricultural area). The crop structure follows the relief of the land: thus, in the plain and hilly areas, cereals are mostly cultivated (maize and wheat); in the high hills and mountainous area, fodder crops are mainly grown. This county has a tradition and favourable conditions for raising cattle and sheep.

3.9 Scotland - Eastern Scotland and Highlands & Islands[9]

The Scottish (SCO) case studies are Eastern Scotland (ES) and Highlands & Islands (H&I). Scotland has just under 18,000 specialist cattle and sheep farms. Most of these farms are located in the west of the country, although there is a concentration of specialist cattle farms in the north east. Scotland also has 2,500 specialist cereal farms, mostly split between the north and south east. The average size of holdings in the country is 306 ha in 2016-17. Scottish full-time hired farm workers work on average 40.4 weekly hours, to which 5.7 seasonal overtime hours are added; these result in total earnings of 12.7 Euros/hour in 2016.

In Scotland 88% of the agricultural land is classified as Less Favoured Areas (LFA) with 80% of cattle and sheep farms operating in a LFA. This has implications for the viability of these farms and the households that they support (Barnes *et al.,* 2020). The financial viability of beef, but in particular sheep farms has been of concern for the last decade (Thomson, 2011). The potential for Brexit-induced price reductions, especially the removal of income support measures, is likely to see an accelerated decline in agricultural activity, land abandonment and moves away from agricultural livelihoods (Moxey and Thomson, 2018).

These trends have raised concerns in relation to biodiversity and the maintenance of traditional landscapes given 55% of Scotland's agricultural land is dedicated to upland sheep and mixed sheep and cattle farming (Stewart and Eccleston, 2020), mostly located in the Highlands and Islands regions. The implications of these changes for landscapes and biodiversity vary from one sub-region to another (Thomson, 2011), but overgrazing is generally understood to be an issue (Ross *et al.,* 2016), particular in the Highlands regions. In terms of ecological farming practices on cattle farms, research suggests that there has been little change in the intensity of farming practices on cattle Scottish cattle farms over recent years (Barnes and Thomson, 2014). One of the major concerns for cattle production are greenhouse gas (GHG) emissions, while for crop production concerns also include use of fertiliser and pesticides.

3.10 Sweden – Plain areas in South and Middle Sweden[10]

The Swedish (SWE) case studies cover the plain areas in South and Middle Sweden (SMS). In Sweden natural conditions significantly affect the conditions for agriculture, e.g. the soil type, topography and the landscape, and the climate. Sweden is divided in three natural agricultural regions: plain areas in South Sweden, forest areas in South Sweden, and North Sweden. The three regions capture the main agricultural geographical variations.

The plain areas in Southern and Middle Sweden include areas around large cities (all large cities in Sweden being located here). The total area is 129,000 km^2 out of which 17% is agricultural land. At country level agricultural land occupies 6.5% of total land area. Plain areas of South Sweden are

[9] Unless otherwise stated, statistics for the Scottish case studies come from the Scottish government, https://www.gov.scot/

[10] The Swedish case study data are taken from Statistics Sweden, https://www.scb.se/en/

recognised for their agricultural activity. Although the landscape and the soil quality are heterogeneous, the region is recognised for its fertile plain districts, with nutrient rich soils and with cereals dominating agricultural production (45% of the area's production in 2018).

While the region occupies one-third of the country total country area, 85% of the UAA and 75% of the agricultural holdings registered in Sweden were situated in this region; employing 80% (in 2013) of the regular labour engaged in agriculture. The contribution to the gross agricultural output was 88%. The gross output of agriculture in Southern Sweden is almost equally divided between crop and livestock output, each contributing with about 5billion Euros. Private, family owned farms are most common, owning or managing about 90% and 85% of the total agricultural land respectively. Corporate farms own or manage only about 5% of the total agricultural land. The average farm size in 2016 was 53 ha. Compared with plain areas in Southern Sweden, farms in the remaining parts of Sweden as a whole are significantly smaller, with an average holding size of about 30 ha. The average farm size at country level is about 40 ha.

Organic production in the Swedish plain areas is increasing, but is relatively slow: from 7.9% converted agricultural land in 2009, 11% in 2013 to 13.8% in 2019. At country level, the share of organically converted land is 20%.

4 Delphi exercise

4.1 Introduction

One widely used approach to study *what can happen* is the Delphi method. The Delphi method attempts, first, to collect the views and opinions of a number of informed people and, second, to harmonise these views across a panel of experts (Börjeson *et al*., 2006). Based on principles outlined in the literature below, a Delphi exercise was designed to investigate the views of participants on the development of ecological farming approaches and its socio-economic consequences at a 10 year forward perspective in their respective CSA.

Expanding the explanation of the process within the Delphi method by Frewer *et al.* (2011) is given in three steps. First, iterated questionnaires are anonymously given to stakeholders. Second, feedback based on their answers is given to the stakeholders. Third, there is a final round of responses where an equal weighting is given to each response to form a group judgement. Frewer *et al.* (2011) summarise three case studies of agri-food policy development using Delphi. In these studies they identify that it is important that round one of a Delphi exercise is qualitative in order for the study to be comprehensive and yet focused. In terms of recruiting stakeholders, snowball sampling (using the contacts of initial stakeholders) and ensuring the questions are of particular relevance to the stakeholders, are useful in boosting participation rates. However, snowball sampling also creates potential biases in that the participants may share a similar network and, thus, opinions. It may be useful, therefore, to use internet approaches to find a balance between a structured mix (an ideal sample of different stakeholders) of participants and snowball sampling (to boost participation).

The three studies summarised by Frewer *et al.* (2011) all used two rounds of quantitative online questionnaires to the stakeholders. The answers of the experts were kept anonymous throughout the exercise. Results from round one were analysed, coded and made anonymous, and then presented again to the experts to give them an opportunity to change their answers and then these responses were analysed again. Changes across these three case studies were, firstly, the inclusion of a

preliminary qualitative online survey and then, this was changed into two interactive workshops for the final case study. These changes were made in order to better inform the quantitative questions in order to build a consensus across the experts. In addition, this demonstrates the possibility of moving from a qualitative study to quantitative results.

Gallego and Bueno (2014) study the use of the Delphi method within the field of information technologies and systems, but their study has wider implications and provides guidelines for using Delphi in other fields. They claim that Delphi is a type of questionnaire, which, through feedback, organises and shares opinions. According to these authors there are four distinct main characteristics of Delphi. The same three steps as described in Frewer *et al.* (2011), but adding that the Delphi exercise is anonymous (each stakeholder does not know the response of another). They also note that an equal weighting is given to each participant when producing the 'group response'.

This Delphi section continues as follows. First an overview is given of the how the exercise were administered across CSAs and second, information on the participants is provided. Third, individual CSA summaries on the nature of ecological practices in the CSA and their adoption scenario are provided. Fourth, a synthesis of the socio-economic effects of ecological practices across all CSAs is made and finally, conclusions are derived.

4.2 Overview

Figure 1 contains a summary of the Delphi exercise. A preliminary stage was necessary to provide information to the participants on the current characteristics of ecological farming approaches in the area. Researchers used primary data from the LIFT large-scale farmer survey (see Tzouramani *et al.,* 2019b – LIFT Deliverable 2.2), existing local literature, expert knowledge and secondary data to characterise farms using ecological versus conventional farming approaches depending on the practices they employ. The LIFT large-scale farmer survey tried to include farms of different types and levels of ecological approaches. Therefore, in some CSAs, a good sample of what exists in the study areas was collected. Following a series of interviews and meetings with stakeholders, the researchers were in a good position to describe what is the main type of ecological approach to farming in the study area and distinguishing these farms from conventional farms. Using this understanding, the researchers were in a position to carry out a fuzzy classification of the surveyed farms into the two groups. Average data of these two groups, including farm size, application of chemicals per hectare, number of different crops grown on a farm and more were used to characterise 'typical' farms fitting both categories for each CSA.

Once the information sheet has been presented to stakeholders, questions in round 1 ask experts their views on how the differences in the farming practices and characteristics of farms using ecological approaches and conventional farms might develop in their area in a 10 year forward perspective. Questions in this round allow stakeholders to build on the broad characterisation given to them in the information sheet and reflect on the key characteristics and technologies employed in farms using ecological farming approaches compared with conventional farms within the CSA.

Rounds 2 and 3 are repeated where experts are first asked whether farms using ecological approaches will develop in clusters or will be randomly spread across the territory; and to approximate the rate of adoption - whether a 'low' or 'high' percentage of the number of farms in each CSA will use ecological farming approaches. LIFT partners were advised to use 10% as 'low' and 50% as 'high' as a starting point but could adjust these percentages to better fit with a realistic percentage of adoption in each CSA. An example of this adjustment, the Romanian CSA description identifies approximately 2% of the agricultural area to use ecological farming approaches and therefore 50% would not be possible at all

in the area. These adoption scenarios concern the possible future development of ecological farming approaches in the respective area and present a foundation on which all respondents are asked for their opinions on the socio-economic effects of a transition to the anticipated scenario 10 years in the future. These socio-economic effects are divided into four broad topics. First, on-farm labour effects of the adoption of ecological farming approaches. Second, employment effects of industries supporting farming. Third, supply chain effects. Fourth, effects on rural communities. The researchers summarised these opinions and presented them again in round 3, asking the respondents if there were any revisions to be made based on the feedback. These summaries allow stakeholders to learn from each other as a group and this is designed so their opinions may be informed with a greater breadth of expert opinion on top of their own. Finally, the Delphi exercise looked for signs of convergence and consensus.

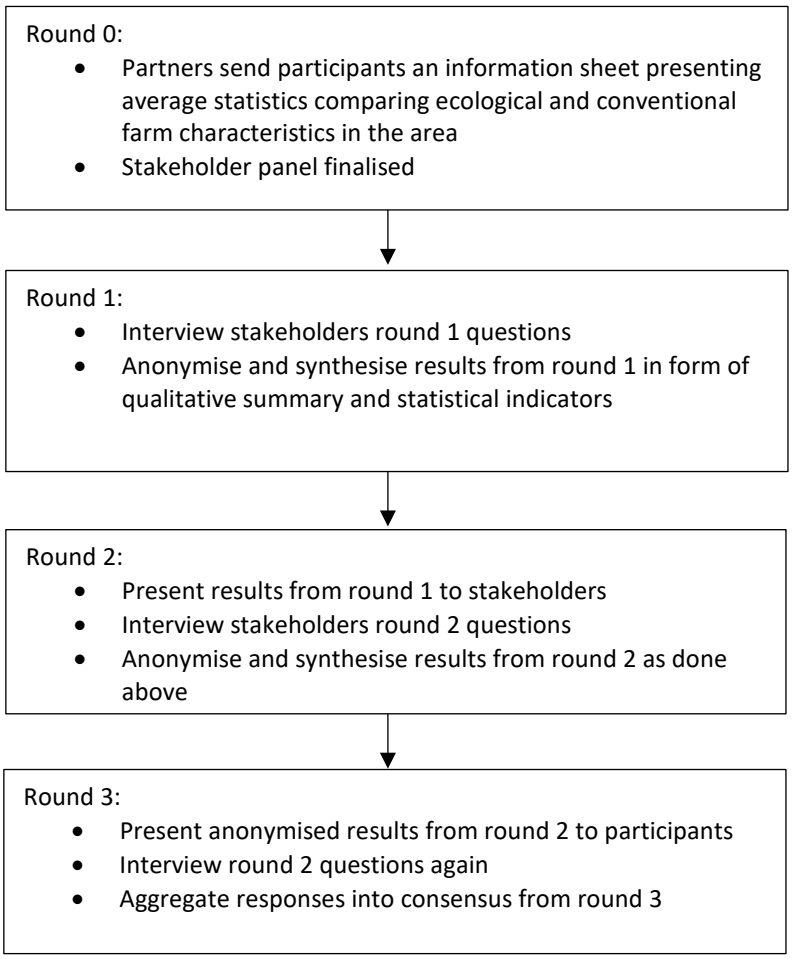

Figure 1: Summary of Delphi process

4.3 Participants

In the Delphi exercise, each LIFT partner involved in the task was asked to interview 10 participants for each CSA and ideally these would be the same 10 participants so that this exercise becomes a group learning exercise. These stakeholders should be familiar with agriculture, land use, farming

technologies and food chain across the territory and it is this territorial knowledge that is crucial. Therefore, the ideal participant would interact with farming across the territory: researchers, civil servants, agronomists, farmer representatives at farmer organisations, food chain managers, land agents (specialist in land and farm sales, tax etc.), non-governmental organisation representatives and others – see Table 1 for information on these participants and their relevant expertise. A total of 154 participants took part in the Delphi exercise across 14 case study areas in 10 countries. A variety of methods were used to collect answers from stakeholders that included face-to-face interviews, interviews through online video teleconferencing software, phone calls, online questionnaires delivered via email from May 2020 to June 2021.

In some cases, participants were unable to remain involved in the whole study and LIFT partners would either continue or replace the participant with someone else. If there were to be a replacement then the participant at least is able to read what has so far been discussed and this may help inform their opinion.

Table 1: Participant information (number of participants) across all CSAs involved in the Delphi exercise

	AT - SU	ENG - HW	ENG - NK	FR - IV	FR - PdD	GR - EC	HUN - VES	IT - RAV	POL - LUB	POL - POD	ROM - SUC	SCO – ES + H&I	SWE - SMS	Total
Gender														
Male	10	6	10	6	11	14	6	7	7	7		3	4	91
Female	2	4		4	1	9	4	6	3	4		3	6	46
Prefer not to say	5					1			1		10			17
Area of work experience														
Researcher	2		2	2	3	6	4	3	1	3		4	3	33
Civil servant	1	1	1	1	4	4	1	2	3	3		2	3	26
Extension officer	4	4	4	4	3	2	1	3	2	2			3	32
Farmer organisation representative (e.g. farmers' union)	3			1	1		1	1	1	1				9
Food chain representative	6			2		9	1	1	3	2				24
Land agent		2	1											3
NGO representative	1	3	2				1	3	1					11
Other					1	3	1				10		1	16
Work experience														
< 5 years	1	1		2	1	4	3	3	1					16
5-10 years	2	2		1		3	3	3	3	3		1	1	21
10-20 years	2	1	2	3	4	8	2	6	2	4		5	2	39
> 20 years	7	6	8	4	7	9	2	1	4	4			7	52
Prefer not to say	5								1		10			16
Total	17	10	10	10	12	24	10	13	11	11	10	6	10	154

4.4 Delphi scenarios in each CSA

This section presents each CSA – firstly with a table using information as supplied to stakeholders before round 1 to help give some context in the CSA of how ecological and conventional farms are different in each region. Next, each CSA description includes a brief summary, from round 1 questions, which had the aim of expanding the representative model comparisons and utilise stakeholder opinion to give a working stakeholder definition of ecological farming in the region. Lastly, for each description, we present the findings from rounds 2 and 3 of the likeliest scenario for the pattern and rate of adoption of ecological farming practices in each CSA. The purpose of this section is to identify how the adoption of ecological practices may differ between each CSA, but also to highlight similarities.

4.4.1 Austria – Salzburg und Umgebung

The Salzburg und Umgebung CSA is characterised by farms being livestock dominated and this was reflected in the importance that stakeholders placed on the future use of different farming approaches. Most important approaches used for identifying differences between ecological farms and conventional farms were machine weeding, followed next by the use of organic manure or compost, then alternative remedies for livestock disease management and finally strip grazing. Meanwhile, ecological farming approaches associated with arable land such as cover crops, precision technologies and low tillage use were the least important differential practices. Stakeholders thought that there would be little difference in farm size between the farming approaches. 43% of the stakeholders thought farms would become mixed crop and livestock production, while 57% thought farms would largely remain specialised in livestock.

The adoption rate of organic farms in the CSA is already close to 50%, therefore, all participants thought the likeliest scenario, after 10 years, would be 50% of farms in the area using ecological farming approaches. They note that they expect only a small increase in the adoption of these approaches in this time frame. As reported in Table 2, stakeholders mostly agreed that farms adopting these ecological practices would occur in a random pattern, imitating the current adoption pattern.

Table 2: Salzburg und Umgebung ecological farming adoption scenarios (Rounds 2 & 3)

	Round 2		**Round 3**	
	Clustered	*Random Pattern*	*Clustered*	*Random Pattern*
Low Adoption Rate (10%)	0%	0%	0%	0%
High Adoption Rate (50%)	9%	**91%**	11%	**89%**

4.4.2 England – High Weald

The experts participating the High Weald identified soil health as the primary difference between a farm using ecological approaches and a conventional farm after 10 years. Arable ecological farmers would increasingly seek to use practices that improve the organic matter in soil, avoid disturbing soil structure (moving to minimum till and direct drill rather than a plough-based system, although certain tillage methods may not suit the heavy clay soils of the area) and keep soil covered. For livestock farms, holistic planned grazing allows the grass to rest for longer, giving it greater growth, potentially absorbing more carbon and in combination with legume and herb-rich swards gives the livestock a diet with greater diversity thus reducing their reliance on medication. The grass is also trampled in, this helps warm the soil as the grass helps insulate the soil, and this system in general allows for livestock to stay out for longer which may result in fewer infections to the herd. Benefits in integrating livestock

and arable systems were identified where livestock could graze cover crops, produce manure and thus incorporate grass in the rotation.

When applying pesticides, herbicides and fertilisers, farmers would be using a more targeted approach and minimise blanket applications. Incorporating more field margins supports more natural pests and a reduction of pesticide use (which in turn also encourages more natural pests). Using Integrated Pest Management (IPM), Integrated Weed Management (IWM) and precision technologies farmers can have a strategy in place for the long-term control of weeds and pests and better target their use of synthetic chemicals. These practices may require more technology and data collection, including the measurement of grass sugars and the nutritional content in organic manure. Diverse grass leys and holistic planned grazing may replace the need to apply fertilisers on pastures.

Diverse grasses, improved soil health and using fewer pesticides, herbicides and synthetic fertilisers allow for more biodiversity and better water quality. Benefits for the farmer include cutting costs through using fewer inputs (fewer passes in a tractor for ploughing and input chemical application reduces fuel use and saves through lower chemical use). Using more grass in the rotation might also help control problems such as black grass.

The above discussion on ecological farming approaches was reflected in the stakeholder rankings of the farm practices where the use of organic manure or compost had the highest average rank, followed by low tillage use and crop-livestock integration. Despite being an area with a lot of livestock, alternative remedies for livestock disease management averaged the lowest ranking.

In terms of farm size, participants thought there would be little difference in farms using ecological approaches and conventional farms - other factors have a more significant effect on farm size such as a high percentage of pre-existing forests and small land parcels with lifestyle buyers purchasing farms. The area is largely specialised into livestock or cereal crops with some horticulture, but stakeholders think after 10 years that the percentage of mixed farming will increase to around 22.5% where stakeholders think it is currently around 20%.

Discussing the likeliest adoption scenario for ecological farming approaches in the High Weald, most stakeholders thought farms using these approaches would cluster together and the adoption rate would be high – this was the consensus reached in the third round and was the likeliest in the second round as shown in Table 3. Innovative and forward-thinking farmers may often be spread through sectors and areas, although farmer clusters may develop to encourage farmers in the cluster in support of examples such as biodiversity and water. The new agri-environment scheme (AES) proposed in England post-Brexit points towards providing an incentive to support farmers working together at a local and landscape level thus encouraging a cluster formation of farms. In the High Weald, examples of attempts to form cluster groups of farms include those of the Area of Natural Beauty (AONB) unit and the Kent Wildlife Trust. After 10 years, indeed clusters may form around those forward-thinking individuals as farmers are inclined to look over the fence and observe what is happening next door and if it is working. Environmental practices are becoming more mainstream what 10 years ago may have seemed niche. The High Weald has a lot of livestock, often grazed extensively with lower input levels and relatively a high proportion of woodland. In addition, the High Weald has a lot of smaller, potentially hobby, farms where the farms might be more environmentally minded and therefore pursue environmental objectives.

Table 3: High Weald ecological farming adoption scenarios (Rounds 2 & 3)

	Round 2		Round 3	
	Clustered	*Random Pattern*	*Clustered*	*Random Pattern*
Low Adoption Rate (10%)	20%	10%	5%	10%
High Adoption Rate (50%)	**40%**	30%	**60%**	25%

4.4.3 England – North Kent

Stakeholders in the North Kent CSA see farming to be on a continuum where most farms are somewhere between growing a monoculture and wilding. After 10 years, more farmers will use regenerative farming principles: lower use of synthetic fertilisers and pesticides (replaced to some degree with organic fertilisers, reduced use through precision farming and biological controls); an increased use of minimum or zero tillage methods; careful use of rotations incorporating fallows; increased crop-livestock integration; more/larger wildlife strips, margins, buffer strips, beetle banks, woodland and hedgerows; higher use of organic manure and compost; soils will be covered year round with cover crops; more under-sowing and catch crops; holistic-planned grazing. This does not mean to say that changes will be absolute – farmers may still need to use synthetic chemicals and ploughing e.g. to combat black grass.

In light of the above, a 'regenerative' farm ('conservation agriculture') that integrates the above practices might be a good proxy for a farm using ecological approaches that will exist in North Kent after 10 years. The farm may become more ecological through incorporating the same practices, but in being organic i.e. going completely without synthetic inputs on farm.

After the stakeholders have come to a broad consensus on what they consider to be a 'typical' farm using ecological approaches, over two rounds the pattern and rate of adoption of ecological farming practices in 10 years were discussed. First, in terms of the adoption pattern of these ecological farming approaches, peer effects take shape on farmers and being geographically closer encourages more opportunities to meet and discuss and share knowledge thus encouraging clustering. Also, peer pressure from neighbouring farmers might lead the farmer to want to be seen as greener. In addition, stakeholders acknowledged that there are environmental benefits to clustering – reflected in a suggested tier 2 financial incentive to clustering in the newly proposed post-Brexit subsidy scheme. These clustering subsidies will encourage farmers to working together on local environmental issues which may encourage similar practices to be used and more cooperation. Other participants argued the pattern would be randomly spread due to the individualistic nature of farmers and that farmers can be conservative in nature - not wanting to change their practices. This is exemplified through the current low take up of Countryside Stewardship schemes. Some participants said that the pattern would start out spread and then cluster in 10 years.

Farmers tend to take a more risk averse and long timeframe perspective which is highlighted here where there may be pioneers and example farms and so closer to 10% of farms adopting ecological practices – at least this was behind most stakeholders choosing a low rate of adoption in the second round. Other stakeholders emphasise the sheer drop in Basic Payment Scheme (BPS) (rural grants and payments to help support the farming industry) may lead to a lot of change in the industry and take up of ecological practices might become necessary. Following from the definition provided in round 1, stakeholders argued for an increase, including examples such as an increased incentive provided from water companies to farm more ecologically in river catchment areas. Into the third round, the adoption

rate increased, as the take up of environmental payments and drop in BPS lead stakeholders into thinking more farms will be forced to take up ecological practices. The recent updates on the post-Brexit replacement to Common Agricultural Policy (CAP) in the Sustainable Farm Incentive may have impacted the thoughts of stakeholders between rounds as a growing consensus forms that adoption rates would be higher.

Table 4: North Kent ecological farming adoption scenarios (Rounds 2 & 3)

	Round 2		**Round 3**	
	Clustered	*Random Pattern*	*Clustered*	*Random Pattern*
Low Adoption Rate (10%)	10%	**45%**	15%	20%
High Adoption Rate (50%)	25%	20%	**35%**	30%

4.4.4 France – Ille-et-Vilaine

In Ille-et-Vilaine farms using ecological approaches are predicted to use more diverse and longer crop rotations with a greater variety of different crops compared with conventional farms. This diversity in crops and their rotations is considered to be the main difference in practice use between the different farming approaches in the area. Stakeholders thought that these crop rotations would reduce the farm's vulnerability to pests and disease. Given the region's significant contribution to livestock production, livestock related practices were the focal point of the discussion. Participants argued that livestock forage would become more balanced and meadow-based, making up a greater source of their protein needs (through a legume mix that also helps fix nitrogen) and a reduced use of concentrated feed. In addition, on these farms using ecological approaches, livestock density would decrease, animal manure storage and application of manure would improve, strip grazing may become more widespread and these farms would pursue a greater use of organic labelling. Respondents added, as the next category of important differential practices, that an increased use of nitrogen fixing crops, reduced tillage and increased soil cover should improve soil life and boost earthworm production. Although farms using ecological approaches might be tempted to use ploughing methods to cope with weeds, respondents argue that farms would attempt to incorporate reduced tillage operations on their crops and use machine weeding to control weeds. Integrating different practices such as livestock and crop production already takes place and includes the use of cover and catch crops as this is mandatory in certain nitrate vulnerable zones.

Farm size comparisons depend on maintaining production levels, where, for the same level of production, the farms using ecological approaches need to be slightly larger than conventional farms as stakeholders considered that livestock density needs to be reduced and therefore the farm would be less productive.

In the second round, respondents were evenly divided between clustered and random patterns of adoption (shown in Table 5). Farms using ecological approaches would cluster for reasons that include: neighbours learning from or following each other; farms involved in collectives such as machinery sharing and local development groups promoting ecological techniques; these farms are more likely to appear on low-yielding soils; downstream from food producers, retail and food processors give incentives for farms to rationalise where an example is that collection of produce becomes easier with farms closely interlinked; proximity of the value chains to peri-urban consumption centres within identified catchment areas, for example, the proximity of the Rennes agglomeration for short distribution channels; public policies from local authorities encouraging the implementation of

ecological approach using farms in certain territories due to water quality issues around a catchment area as an example; other specific measures included in AES relating to environmental features such as watersheds, natural areas and wetlands.

The other respondents thought that ecological farms will be spread randomly throughout the area because they anticipate a growing consensus around the need for ecological farming approaches. This view envisages farmers across the CSA adopting these approaches instead of in isolated clusters. Another reason is that groups may form in networks where digital tools and online farm visits allow for a random pattern of adoption rather than a geographic formation of clusters.

According to stakeholders, the rate of adoption for these ecological farming approaches depends on: the definition of 'ecological'; adopting more ecological approaches depends on the market (price/differentiation, consumer willingness to pay); and policies at national, regional and sub-regional level.

Table 5: Ille-et-Vilaine ecological farming adoption scenarios (Rounds 2 & 3)

	Round 2		**Round 3**	
	Clustered	*Random Pattern*	*Clustered*	*Random Pattern*
Low Adoption Rate (10%)	17%	17%	17%	8%
High Adoption Rate (50%)	**34%**	**34%**	**58%**	17%

4.4.5 France – Puy-de-Dôme

Key differences in approaches between farms using ecological approaches and conventional farms in this area as highlighted by stakeholders in Puy-de-Dôme are: crop diversification including diverse crop rotations and intercropping, keeping the soil covered, more landscape features such as hedges and grass strips, reducing use of chemical inputs. The number of crops is considered as the most important in defining ecological farming approaches. In contrast to Ille-et-Vilaine above, stakeholders in Puy-de-Dôme thought that farms using ecological approaches would be slightly smaller, may need more labour, thus restricting the farm growing too big, but the produce receives a better price which might make up for smaller farms and lower output. In terms of an increase in mixed farming (most farms in the area being specialised as livestock or crop type farms), the panel thought this would be difficult given a need to redesign the farm's production system. Without sufficient demand for livestock products, livestock farming is not profitable enough, and thus current arable farms are unlikely to integrate livestock. Otherwise, some parts of the area are not suitable to growing crops; mixing crops and livestock would be very demanding in terms of skills required and labour hours.

Most respondents believed that ecological farms will be spread geographically throughout the CSA. Not many gave justifications, but one explained that they see little reason why the farmers would cluster when pursuing new ecological approaches. However, several respondents noted that the decision of whether to adopt ecological practices or not is strongly linked to factors that include geo-pedoclimatic conditions (e.g. rainfall, soil, altitude), accentuated by climate change. These factors also often determine the choice of production - livestock (already strongly oriented towards ecological approaches) versus large crops - and lead to different regulations (e.g. stricter restrictions for a watershed to preserve water quality) and different economic profiles of farms (e.g. protected designation of origin-PDO zone). Therefore, this may contribute to geographical clustering. One respondent noted that clustering may depend on the role played by the actors in the agricultural sectors and other institutions such as local government. There may be a consolidation of practices if

the industry pushes towards these types of production (e.g. territorial innovation labs) and/or if there is an institutional impulse (examples: short distribution channels, circular economy, territorial food projects).

Responses to the adoption rate of ecological practices from round 2 are evenly distributed among the three rates: 'low', 'intermediate' and 'high', where in Table 6 the intermediate choices are equally divided across low and high. Stakeholders in round 3 adjusted their opinion to choose a lower forecasted rate of adoption. Factors mentioned that are a hindrance to adoption are: lack of confidence; the difficulty of changing practices; fear of the risks involved; reluctance to change (especially in the Limagne plains part of the region); current dependence on imported soybeans. Factors that could accelerate adoption include: public policies (financial incentives such as CAP subsidies for these practices, regulatory obligation of certain practices, etc.); more conventional farms experiencing increasing risks, difficulties and extra costs; positive examples from pioneering farms; change in mindset of young farmers who settle down (generational change); increased profitability of ecological practices due to labelling such as HVE ('Haute Valeur Environnementale', i.e. High Environmental Value) and PDO; societal pressure; incentives from downstream industries. Several respondents believed that there will be a stronger adoption in the mountainous areas, especially for cattle farms, rather than in Limagne plains.

Table 6: Puy-de-Dôme ecological farming adoption scenarios (Rounds 2 & 3)

	Round 2		**Round 3**	
	Clustered	*Random Pattern*	*Clustered*	*Random Pattern*
Low Adoption Rate (10%)	0%	**50%**	0%	**67%**
High Adoption Rate (50%)	25%	25%	25%	8%

4.4.6 Greece – East Crete

Stakeholders highlighted what they considered to be a number of different ecological practices and approaches relevant to East Crete. The ecological practices that stakeholders highlighted as most important are the protection and enhancement of biodiversity on and around the farm, as well as the utilisation of this biodiversity (in order, for example, to reduce the need for additional farming interventions through the presence of parasitic wasps etc.). Next most important practices are the use of organic fertilisers, organic plant-protection products and low tillage.

Regarding whether farms incorporating ecological farming approaches would be larger or smaller than an average conventional farm of the area, 50% of the respondents answered that it would be larger, 46% that it would be smaller and 4% did not answer. Seven key reasons were outlined by stakeholders for an ecological farm to be a different size from a conventional farm. First, the issue of land fragmentation endangers small areas under organic farming surrounded by areas worked with conventional methods. Second, a larger area is needed, as the economic benefits from economies of scale may have a larger effect in farms incorporating ecological approaches compared with conventional farms. Third, a larger area is needed for ecological approaches, compared to conventional ones, for growing multiple crops (intercropping) to strengthen the ecosystem. Fourth, it is easier to control the diverse activities in ecological farming approaches on a smaller scale. Fifth, ecological farming approaches are inherent to small-scale production and economies. Sixth, ecological farms have higher demands on labour, applications and farming interventions, and consequently increased production costs which as the farm becomes larger may further increase the total costs and become

unfeasible. Seventh, large farms tend to follow conventional agriculture, however, there have been cases such as wineries owning large areas with vineyards, that have turned to organic farming due to a market demand for such products (added value).

Table 7 below shows participants views on how the adoption pattern of ecological farming approaches could be formed over the next 10 years in East Crete, according to the 4 different hypothetical ecological farming adoption scenarios presented to them through the above questions. As indicated in the table, the most likely scenario for the region of East Crete, according to respondents' views in both Delphi rounds, is that of the adoption of ecological farming approaches from a high (in relative terms for Crete) proportion (around 15%) of the region's farms, with these farms randomly spread across the territory. In fact, the percentage of participants who chose this scenario is almost identical between the two rounds with an infinitesimal increase from 37% in the first round to 38% in the second. The main reason stated in both rounds by the respondents of this scenario, for farms to be scattered across the territory, is the rugged terrain of Crete. Regarding the high adoption rate of farms, climate change with its extreme weather events, the need to ensure a better quality of life and health and the implementation of the European Green Deal, were stated by the respondents in the second round as reasons that will lead to a shift in the agricultural sector towards more ecological approaches. In the third round, one of the respondents underlined that several farmers will take up ecological farming practices with the primary objective of adding value to the products.

It should be noted that for this CSA, the 5% and the 15% of the farms were selected as the minimum and maximum forecasting levels, respectively, regarding the adoption rate of farms, as this seemed more realistic for the area perspective.

Table 7: East Crete ecological farming adoption scenarios (Rounds 2 & 3)

	Round 2		**Round 3**	
	Clustered	*Random Pattern*	*Clustered*	*Random Pattern*
Low Adoption Rate (5%)	11%	26%	6%	31%
High Adoption Rate (15%)	26%	**37%**	25%	**38%**

4.4.7 Hungary – Veszprem

In Veszprém county ecological approaches thought most likely to be adopted here reflect the cereals production focus of the study area with low tillage use, increased number of crop varieties including use of nitrogen fixing legumes and an extensive use of cover crops. However, use of organic manure or compost and integrating crops with livestock are further approaches identified by stakeholders as possibly being adopted in the future. This reflects the expert opinion that farms will increasingly become mixed in order to benefit from these practices. All experts thought that ecological farms would be significantly smaller as they expect these farms to need a higher labour demand given the need for more diverse systems and there would be difficulties in incorporating machines or automation in combination with the practices.

As shown in Table 8, all the experts (100%) agreed during both rounds that a low rate of adoption would be probable over the next ten years in Veszprém county. The experts moved towards reaching a consensus throughout the Delphi exercise as the orientation of ecological farms would probably be clustered.

Table 8: Veszprem ecological farming adoption scenarios (Rounds 2 & 3)

	Round 2		Round 3	
	Clustered	*Random Pattern*	*Clustered*	*Random Pattern*
Low Adoption Rate (10%)	**50%**	**50%**	**70%**	30%
High Adoption Rate (50%)	0%	0%	0%	0%

4.4.8 Italy – Ravenna

Most participants in Ravenna ranked alternative remedies for livestock disease as the most important ecological practice to be adopted by farms specialising in ecological farming approaches. This is followed by strip grazing, then precision technologies and next the extensive use of cover crops. In terms of size comparisons, on balance, stakeholders argued that there will be little difference between farms implementing ecological approaches compared with conventional farms. Respondents do not see size as a differentiating characteristic of an ecological farming approaches - ecology and size are not correlated in their opinion. Although there was some nuance here where some stakeholders thought farms with ecological approaches may specialise into a few eco-products. These farms may be quite small whereas others thought farms using ecological approaches may need more land in order to manage the natural balance and cycles of the approaches. A slim majority of respondents, 54%, argued that when replacing chemical inputs with natural processes and non-chemical interventions such as biological control of adversities, rotations, green manure, organic fertilisation and mechanical control of weeds, performance and productivity would be negatively affected. Meanwhile, the other respondents thought that it was impossible to use ecological approaches to replace conventional farming methods with minimal impact to performance. In terms of specialisation, 69% of stakeholders thought farms using ecological approaches would remain specialised due to the high incidence of fruit farms, the lack of livestock in the region and the high cost to change farming approaches. Participants also argued that the study area has a high level of agricultural production which pushes overproduction and short production cycles where nature is a factor of production rather than conservation.

Discussing the scenario of adoption, the opinion of the panel does not change from round 2 to round 3, and participants believe that the adoption of ecological farming approaches will be closer to a low proportion (of around 10%) of the region's farms, and that such farms would be spread across the territory of the CSA, as shown in Table 9.

Table 9: Ravenna ecological farming adoption scenarios (Rounds 2 & 3)

	Round 2		Round 3	
	Clustered	*Random Pattern*	*Clustered*	*Random Pattern*
Low Adoption Rate (10%)	23%	**46%**	30%	**60%**
High Adoption Rate (50%)	8%	3%	0%	10%

4.4.9 Poland – Lubelskie

Important ecological practices in the Lubelskie CSA are predicted to include crop rotation, introducing natural enemies of pests combined with employing IPM, selecting appropriate plant varieties, applying organic fertilisers and incorporating agroforestry. However, some stakeholders felt that ecological approaches are not always sufficient to manage risks of pest outbreaks and reduced output. For the

specific area, most (80%) stakeholders thought farms using ecological approaches would remain specialised in plant production as these farms were less labour intensive than if they were to integrate with livestock. The proportion of mixed livestock and crop farms would represent around 10-30% of farms with ecological approaches. A small majority of participants thought organic farms would be the same or larger than conventional farms as production may be more profitable while others thought these farms would be smaller as a result of bigger workloads and a more diversified production. Adoption rates of ecological practices will strongly depend on how profitable they will be.

In this study area there was some evidence of stakeholders influencing each other between rounds when considering the arguments for clustering. If an ecological farming system is successful then the neighbouring farm would be more likely to adopt these approaches too and a snowball effect may ensue into a clustered adoption. Organic products might receive higher sales in cities so those farms located nearby are likely to cluster into organic farming. However, all participants argued that adoption rates would be low (Table 10) as agriculture in general is not seen to be a popular industry, outward migration from rural areas, unclear legal regulations and labour shortages.

Table 10: Lubelskie ecological farming adoption scenarios (Rounds 2 & 3)

	Round 2		**Round 3**	
	Clustered	*Random Pattern*	*Clustered*	*Random Pattern*
Low Adoption Rate (10%)	**50%**	**50%**	**70%**	0%
High Adoption Rate (50%)	0%	0%	0%	0%

4.4.10 Poland – Podlaskie

The use of organic manure and organic feed were considered by most participants to be the most important practice to separate farms using ecological approaches and conventional farms in Podlaskie in the future. This argument continued with stakeholders thinking that most farms using ecological approaches would be mixed livestock and crop production because the manure from the livestock can be used for the crops and the livestock feed will be from its own products. Stakeholders anticipate little difference in the size between farms with ecological approaches and conventional farms.

Most participants think that ecological approach using farms will remain spread through the territory (Table 11), that although farmers will need to cooperate to optimise production and sales organisation, it is not necessary to cluster farms for this to happen. If clustering does happen it may be for reasons of soil quality and other environmental characteristics. Adoption rates were considered to be low by all stakeholders for economic reasons such as the level of subsidies, prices of ecological products and necessary investment outlays being prohibitive to adopting ecological practices. Decline in productivity, complex weed control and natural biological interventions requiring an increased workload, further detract from farms adopting ecological practices.

Table 11: Podlaskie ecological farming adoption scenarios (Rounds 2 & 3)

	Round 2		**Round 3**	
	Clustered	*Random Pattern*	*Clustered*	*Random Pattern*
Low Adoption Rate (10%)	18%	**82%**	18%	**82%**
High Adoption Rate (50%)	0%	0%	0%	0%

4.4.11 Romania – Suceava

In terms of practices used on ecological farms compared with conventional farms, Suceava experts' answers lead to a general consensus on the utilisation of traditional farming practices, of local inputs (mainly organic inputs such as manure), with no chemicals and limited use of mechanical work. Indeed, 80% of stakeholders thought use of organic fertilisers to be the most important practice characterising ecological farms. On the other hand, in terms of the size differences, a weaker consensus resulted from the answers of experts participating in this exercise. While some consider that the size of a farm using ecological approaches could be small to medium (or at least equal to the size of a conventional farm), others have in view a larger size or consider that there is no link between farm size and its ecological characteristics. Whether farms would be mixed or specialised very much depends on the landscape – in the mountainous part of the area, farms would largely be specialised as livestock, as the main crop source able to be grown is grass and hay. Meanwhile in the Dornolor Basin most farms are already mixed, perhaps 80-85%. In terms of integrating different ecological practices, participants thought it was possible to integrate livestock and crop farms with reduced tillage and cover/catch crops. Integrating these practices may reduce transport costs where necessary inputs such as manure, fodder and straw are increasingly found on a single farm. These practices may help to regenerate soil fertility on the land, possibly causing productivity to increase and farmers might receive better prices.

In this area, 70% of respondents considered that ecological farming approaches could significantly grow into a high adoption rate in expectation of subsidies and a growing market for such products, yet given the geographic particularities of the area, ecological farms would be rather dispersed across the territory (50% of respondents chose this option, see Table 12). At the same time, 30% respondents considered that there would be a low adoption rate of ecological practices, and in terms of territorial distribution this will be dispersed across the region as villages are scattered and farmers isolated so they would need to be motivated and informed to adopt. There was a small change between rounds.

Table 12: Suceava ecological farming adoption scenarios (Rounds 2 & 3)

	Round 2		**Round 3**	
	Clustered	*Random Pattern*	*Clustered*	*Random Pattern*
Low Adoption Rate (10%)	0%	30%	0%	33%
High Adoption Rate (20%)	20%	**50%**	22%	**44%**

4.4.12 Scotland – Eastern Scotland and Highlands & Islands

In Eastern Scotland, participants were asked to list what approaches would be considered to be 'ecological' in the area and in particular which of these ecological farms would specialise in, 10 years in the future. A diversity of practices results, with a slight focus on specific categories depending on the participants' area of research or activity focus. The main categories of intervention for this region – which is mostly occupied by arable crops (due to the high quality of the soil), with specialist livestock, including dairy, occurring in commercial intensive regime – focus on five categories. First, soil health and compaction reduction (practices: minimum and zero tillage, direct drilling, injection of slurries). Second, IPM (practices: longer and diversified crop rotations, targeted pesticide applications). Third, expansion of semi-natural features (practices: field margins, in-field diversity, agroforestry, integration with surrounding natural systems). Fourth, reducing climate impacts (practices: inclusion of legumes, integration of livestock in crop systems, anaerobic digestion,

targeted fertiliser applications). Livestock health and productivity (practices: precision farming, diet fine-tuning).

Most participants agreed that ecological processes could replace the use of chemical inputs, although in the case of plant and animal pests, there would probably always be a need for pesticide use to ensure farm viability. It was the opinion shared by the three pest management specialists, that targeted applications of pesticides would probably always be part of the toolbox. One emphasised how increasingly difficult it will become for farmers to get better at doing targeted applications and depend less on insecticides, with so many of the modern ones coming off the market due to bans. Another highlighted how much IPM in Scotland will have to depend on natural pest regulation practices (starting with crop rotations), but increasing the number of naturally occurring beneficial pest predators to be at the necessary levels will take a lot of active management of semi-natural features and soil health, and specialised ecological knowledge – all of which will take time. As for commercial biological control, this was seen by the participants as too expensive for all but the specialist soft fruit farmers to invest in.

Respondents were all quick to defend that ecological farming approaches can be adopted regardless of the size of the farm. There will be, of course, practices that are more viable for smaller farms and others where a certain scale is needed for economic feasibility or for ecological benefits to materialise. But even in the latter case, some participants pointed out, farmer cooperatives and other such forms of farmer collaboration could achieve the necessary scale for smaller farms.

The participants who discussed the Highlands & Islands emphasised how there are two distinct systems: one constituted by hill and mountainous pasture, which occupies the vast majority of the farming area; and some pockets of by-land, where cropping in small plots is possible. Participants pointed out that ecological practices – such as extensive and low-density livestock systems, semi-natural features, low use of chemical inputs – are already standard practice in the Highlands & Islands. However, the system currently lacks environmental or economic viability: something that can only be solved through better management of the semi-natural habitats and grazing systems, and business diversification. As with Eastern Scotland, participants agreed that size is not a limiting factor for ecological farming approach adoption and again these approaches can be adopted regardless of the size of the farm.

Although there was consensus over policy drivers, participants in Eastern Scotland were divided over the adoption of ecological practices and this depended partly on whether farmers would adopt the full suite of practices in the 'ideal model' farm using ecological approaches, or just be moving towards that ideal where the full suite will take longer to adopt and meanwhile most farms may be transitioning and especially with the policy incentive. As for whether adoption of ecological farming approaches would happen in a clustered or a spread-out pattern, participants were in agreement that it would most likely be a mix of both.

Already at a high level of adoption on crofts and upland farming of around 80% in the Highlands & Islands, stakeholders expect that ecological practices will be maintained around this level (see Table 13) and still here there is a policy impact of upcoming subsidies to provide public goods. Although a stakeholder argues that the type of farming practices in these areas still causes devastation of biodiversity and nutrient leaching, therefore questioning whether these practices really are ecological. In terms of pattern of adoption, participants considered that clustering would be less common than for Eastern Scotland, mostly due to the highly isolated nature of many of the Highlands & Islands farms, which stretch across large plots of land.

Table 13: Eastern Scotland and Highlands & Islands ecological farming adoption scenarios (Rounds 2 & 3)

	Round 2		Round 3	
	Clustered	*Random Pattern*	*Clustered*	*Random Pattern*
Low Adoption Rate (10%)	10%	10%	10%	10%
High Adoption Rate (50%)	15%	**65%**	15%	**65%**

4.4.13 Sweden – Plain areas in South and Middle Sweden

Swedish participants were asked about the socio-economic effects of a transition to organic farming specifically from conventional farming in the agriculturally intensive plain areas of Sweden.

The Swedish panel, on the whole after 10 years, argued that ecological processes could successfully replace chemical inputs and these include: crop variety and crop selection, mechanical control, crop rotation; weed control via cultivation of grassland or cover crops; plant protection via crop rotation and biological control; plant management via green manure, natural nitrogen fixation, and use of manure; resistance breeding and genetic engineering become important components in this. Mechanical weed control becomes possible through more automated machines. IPM, IWM and machine weeding were considered some of the most important practices. Stakeholders argued that farm sizes will continue to grow whether farms are ecological or not.

When discussing the scenario of adoption, there was little change between rounds. Firstly, for pattern of adoption, in the study area, organic farms are spread randomly, not clustered and stakeholders see little reason for this to change. The current percentage of organic farming in Sweden is about 20%, with an average increase per year of 1%, so stakeholders predicted that the adoption rate would be between 25% and 35% after 10 years (Table 14).

Table 14: Plains ecological farming adoption scenarios (Rounds 2 & 3)

	Round 2		Round 3	
	Clustered	*Random Pattern*	*Clustered*	*Random Pattern*
Low Adoption Rate (25%)	10%	**40%**	10%	**40%**
High Adoption Rate (35%)	10%	**40%**	10%	**40%**

4.5 Results: socio-economic effects of the Delphi scenarios

After describing the adoption scenarios of ecological farming approaches in each CSA above, we continue to study the socio-economic effects of these scenarios across all CSAs and summarise the most insightful results – the commonalities and differences in the unique participating CSAs. These effects are studied in sections reflecting the question structure of the Delphi exercise (questions are included in the Appendix 1): on-farm labour effects, effects on industries supporting farming, supply chain effects and the effects on rural communities.

Note that we focus on the effects as recorded in the third round rather than presenting both rounds as some teams only implemented one round of questions and this round has given an opportunity for stakeholders to have considered the viewpoints of other experts in the group and adjust their ratings accordingly.

4.5.1 On-farm labour effects of ecological agriculture adoption

The below discussions for on-farm labour effects compare and contrast these effects across all CSAs involved in the Delphi exercise. These effects are summarised in Table 15, towards the end of this sub-section. Participants were asked to rate on a Likert scale of 1-10 each labour effect for whether they expect a large decrease (1 the largest decrease), no change (a rating of 5) or a large increase (10 the largest increase) in the labour effect of the adoption of ecological approaches 10 years in the future. The numbers presented in the table are an average rating of all participants in round 3 for each CSA. Results from round 2 appear in the Appendix 1 in Table 18.

4.5.1.1 *Total employment*

The Hungarian, Greek, French and Scottish CSAs all predict a small increase in the necessary employment for a transition to ecological farming approaches after 10 years. Statistics in France on organic farming shows that more labour is required on these farms. French stakeholders argued that ecological farming requires more monitoring of crops and livestock, more time-consuming interventions on the soil and engagement with animals. This is echoed in Greece and Hungary, where it was felt that practices require more applications and repetitions, for example cover crops needing more sowing; weeding; use of natural plant protection remedies. In Hungary it was felt there was less potential in automation and to maintain output levels, a larger area would need to be farmed given lower expected yields, thus requiring more labour for the same output. English stakeholders thought that integrating livestock with crops would require more labour needs. In addition, English and French experts thought a diversity of skills would be needed which could be achieved through either the cooperation of farmers across farms of different types, or additional staff on each farm with specialisations across the different farm types. Meanwhile, in Scotland, although some experts thought labour saving techniques may reduce employment, employment may be shifted and even increase in specialist positions linked to knowledge-based techniques and monitoring that ecological farming approaches will require, possibly leading to a small increase in total labour requirement.

In North Kent, experts considered that the high cost of labour would continue to drive down labour requirement - when minimising the use of synthetic inputs necessary with ecological farming approaches through precision technologies and reduced tillage, labour will also be targeted as a possible saving on the farm which these technologies may evolve to replace too. In contrast to Hungarian stakeholders, French, Greek and English experts thought automation through technologies such as robotics would be possible, which may mitigate any anticipated additional labour requirement from ecological farming approaches. Furthermore, although some Polish stakeholders thought the work would increase in farms using ecological approaches, some of this may be taken up with an increased use of mechanisation. Other countries including Austria, Italy, Romania, Sweden had a very little increase or no change in total labour requirement from ecological farming approaches for a mixture of the above stated reasons; that the adoption pattern may not change a lot; or that they see little difference on total labour of ecological and conventional farming approaches.

4.5.1.2 *Full-time/part-time and family/hired labour*

As a result of more hours needing to be worked overall, part-time work is expected to increase in France. Jobs, such as processing and direct sales, are associated more with ecological farming approaches, sometimes handled part-time, and will increase the number of workers. English stakeholders thought that part-time farming would increase due to most farms in England being family farms and as stakeholders expect a fall in income from ecological farming approaches, these family workers will need to take up different jobs alongside their farming careers. Working both on the farm and in another job part-time, would therefore be to supplement their farming income from alternative

sources. Otherwise, farmers may work across a number of farms, in some instances sharing their labour whilst in others being hired across a number of farms. In these situations, in the English case studies, total farm labour on individual farms may decrease and across the area so farm labour would decrease too. In contrast to the above, Austrian farms which are mostly family run think that farm labour would remain full-time and perhaps increasingly so, although farms may cooperate more and farms might become larger and more specialised which is what justifies the further use of family labour on these farms. The same logic applies in Sweden and Austria where working hours will increase and this will be taken up by family farmers and thus full-time jobs will increase there too. The increase in labour on Romanian farms is expected to be taken up by both full-time and part-time jobs, some however predict this won't all be due to hiring more staff, but could be through increasing number of family hours worked.

4.5.1.3 *Labour flexibility*

In terms of flexibility, most CSA stakeholders think little will change in terms of work flexibility on ecological farms where the experts think that there is no correlation when a farm has changed to ecological farming practices – experts felt that for best results specific tasks should be done at certain times of day and working hours depend on weather conditions and growth stages of each crop. The stakeholders in the English CSAs think that there will be an increase in flexibility where stakeholders share concerns over ecological farm revenues – thus making up the shortfall with other on-farm diversification such as agri-tourism or even non-farm jobs such as Information Technology which are less flexible and may force flexibility onto the farms. In addition, some in the English CSAs think that ecological practices such as IPM and IWM encourage farmers to farm more proactively, and improved soil health will allow the soil to better cope with weather extremes. Italian stakeholders emphasise this last point where farmers respect the natural production cycle of the seasons and more diversified activities allow for greater on-farm flexibility. The Italians continue to highlight that conventional practices follow more restrictive application timings and standardised processes. Another factor is that growing a variety of crops and integrating livestock spread associated labour peaks across more farm enterprises across the year, which was mentioned in most CSAs including the ones with highest changes in flexibility – the Scottish CSAs and the High Weald (England). Other stakeholders in all CSAs also argued there would be less flexibility on farms using ecological approaches – integrating livestock or even needing to make more frequent inspections and possibly interventions resulting in less flexibility. In France, as labour needs may increase on tasks such as monitoring, this may reduce flexibility (a view echoed in Poland) and it was felt that the window for livestock intervention would become smaller and thus may increase peak periods of work. However, some French stakeholders believe herd sizes may decrease which allows for more flexibility, grass systems are less demanding and in contrast to England, experts here feel ecological practices would be more profitable and thus allow more free time. In Romania, flexibility depends on sourcing enough labour.

4.5.1.4 *Skill requirements*

All CSAs report an increase in the requirement for skills as effects on farm labour given the pattern and rate of adoption of ecological practices in the respective CSA. The most frequently cited reason across all case studies is the nature of more diverse activities that would be practised on farms with ecological approaches (this includes integrating different farm production types, more variety of crops, value-added activities). Further diversifying production processes involve integrating lots of different ecological practices such as use of cover and catch crops with direct drill technologies and livestock – in France this integration is seen to be hampered due to a lack of skills. Observing changes in ecological farming approaches requires knowledge to understand the processes within the context of environment, climate as well as the market. Engaging with new technologies that minimise input use

and soil disturbance also require new skills to be learnt to use the technology and to name but a few: precision technology, direct drills, roller crimpers (tool used to cut down cover crops and leave the crop as a mulch), drones, robots, artificial intelligence, automated milking, virtual fencing, on-farm weather stations, soil mapping. These new technologies require farmers to be more aware and may be too technical to manage, supervise and interpret measurements. A Scottish stakeholder referred to the transition in practices as moving from an input-based system to a knowledge-based system. Precision technology and different technologies will at least need new training to learn how to use these machines. Stakeholders did however also explain that farmers using conventional approaches have skills too, this change in farming practices may just result in a change in skill set rather than in an increase.

4.5.1.5 *Quality of life*

Quality of life is also reported as increasing across all case studies: some case studies demonstrate a larger increase in quality of life such as in France, Greece, Hungary, Italy, High Weald (England), Scotland and Sweden while North Kent (England) and Austria only show small improvements. The reasons for increases across these areas are due to the increased engagement of farmers with nature, more biodiversity, a lower chemical exposure, and that farmers become more self-sufficient. An increase in collaboration also improves social ties and farmers may feel that they belong more strongly within the community. North Kent, Greek, French, Hungarian, Romanian and Polish stakeholders emphasised a link between profitability and quality of life – in North Kent, the view was pessimistic with lower yields and minimal price changes, while in the Podlaskie area of Poland, Greece, France, Hungary and Romania, this was optimistic where stakeholders envisaged increased prices, a higher demand for organic products and increased incomes. CSA stakeholders who thought flexibility may increase where time has been saved, also see this as positively affecting quality of life.

4.5.1.6 *Migrant labour*

Overall, little change was predicted for the requirement of migrant labour with small decreases in some areas, barely any change in others and a few slight increases. In North Kent and Scotland, as with total labour, migrant labour is usually used for repetitive tasks in fruit orchards and soft fruit farms, which technology could replace, as this is a general labour-saving technology that may be brought onto farms using both conventional and ecological approaches. The Scottish respondents thought national labour unlikely to substitute for the manual and hard labour that foreign labour usually is used for – they therefore see this sticking at a high level. In some cases, increases in migrant labour might be required where available local labour and skills are in short supply, this includes farms in Hungary, the High Weald (England) and both Polish case studies (where this is emphasised the most).

4.5.1.7 *Gender*

An increase in gender balance means farms have more equal roles shared between males and females and here most stakeholders across study areas saw little difference of a conversion to ecological farming approaches and its impact on gender balance. Stakeholders say they observe a general trend in more women managing farms, but this is due to factors shared across the farming sector and wider industry as societal expectations change. Scottish participants believe that an increase in the number of female farm heads is expected to speed up in the coming decade. Respondents in Romania, and supported in the other CSAs, add that gender does not matter, but the qualifications and abilities of the person managing the farm, although a few stakeholders here and in some other case studies still associate men as traditionally managing livestock (and thus, increased use of livestock on farms might result in an increase in men in this argument), and family farm traditions of the male taking over the farm will still persist and may continue to do so in years to come. In the English CSAs, a stakeholder

discusses that there remains a perception that on family farms women still share the burden of childcare responsibilities. However, in France, Hungary and England some opinions were expressed where stakeholders thought ecological farming approaches could increase the number of female farm managers closer to equality with men. In France, shorter supply chains and direct sales to consumers, more associated with farms using ecological approaches, may encourage more women to be involved. In addition, the increased quality of life and positive environmental image may encourage more women. Similarly, in England, stakeholders noted that in environmental and conservation organisations there tend to be more women than men and therefore an ecological form of farming that pursues conservation objectives may be a role more attractive to women.

4.5.1.8 *Wages*

Wages refer to paid wages to hired hands rather than family farm income. Across CSAs, wages overall are seen to have a slight increase on farms using ecological farming approaches. As expressed above, with the link to quality of life and farm income, stakeholders in North Kent think wages may decrease on farms using ecological approaches if earnings were to decrease. However, as it is difficult to envisage a drop in wages, where wages are currently around the minimum wage level in England, English stakeholders expected no change. Otherwise, in France, Poland and Romania, wages are thought to rise due to three reasons. First, wages should increase in line with an expected rise in farm profitability (lower inputs with the aim to maintain yields). Second, more value added will be generated on farms with ecological approaches. Third, there will be an increase in direct sales with a higher product valuation and fewer intermediaries between these farms and consumers. Consumer demand might increase for food produced from ecological approaches in the future with consumers accepting a higher price. In addition, a view expressed across most CSAs is that ecological farming approaches need to attract more skilled labour, therefore, wages are expected to rise as a result. This is especially noted in Scotland where respondents argue a slight increase in the wage will need to partially account for more high-wage specialists coming into the industry. Other stakeholders across most CSAs thought that the wages offered in the broader labour market would have a far bigger effect on wages at the territorial level, hence the relatively low anticipated change in farm wages.

Table 15: Labour effects round 3 average rating – a Likert scale from 1-10 where 1 is a large decrease, 5 no change and 10 a large increase

Labour factors		AT – SU	ENG – HW	ENG – NK	FR – IV	FR – PdD	GR – EC	HUN - VES	IT - RAV	PL – LUB	PL - POD	RO - SUC	SCO – ES + H&I	SWE – SMS	Average
a)	Total farm employment across the area	5.2	5.3	4.2	6.0	6.2	6.0	6.1	5.2	5.3	5.1	5.4	6.0	5.0	5.5
b)	Flexibility of working hours	5.3	6.3	5.9	5.2	5.8	4.8	5.3	6.2	4.7	5.4	5.0	6.1	5.0	5.5
c)	Quality of life of farmers	5.9	6.8	5.7	7.0	6.7	7.9	6.5	7.1	6.1	6.4	6.3	6.2	7.0	6.6
d)	Skill level of farmers	6.7	7.4	6.2	7.5	7.6	7.2	7.2	7.1	6.9	7.5	6.7	6.5	8.0	7.1
e)	Need for migrant labour	5.4	5.4	4.8	5.0	5.0	5.1	5.8	4.9	5.6	6.6	5.1	5.8	6.0	5.4
f)	Gender balance of farm heads	5.8	6.5	5.8	5.5	6.4	5.3	5.4	5.8	4.7	4.9	4.7	8.0	5.0	5.7
g)	Wage level	5.9	5.6	5.0	5.8	5.7	5.7	5.8	5.7	5.1	5.6	6.3	6.5	6.0	5.7

4.5.2 Employment effects on industries supporting farming

In most CSAs, stakeholders identified that the number of advisory service personnel, including farm advisors and civil servants, will need to increase (Table 16). This is largely a result of facilitating changes in policy and the breadth of new information and advice that is needed to support ecological approaches to agriculture. Romanian respondents felt strongest for a need to increase the number of advisory personnel arguing that there are not enough advisors in the territory to provide the necessary information on ecological farming approaches. If the number is not to increase, then stakeholders on the whole thought there would be no change. In the French Ille-et-Vilaine CSA stakeholders think that advisory service personnel would need to develop more skills and knowledge. They added another necessary change would be a shift in mindset from maximising production to generating ecosystem services and public goods in combination with producing food. In both Polish CSAs stakeholders argued that the quality of advisors would need to increase, not necessarily the number. In the few rare instances where stakeholders thought the number of advisory personnel would decrease, this was where funding may be difficult to find as expressed in North Kent where stakeholders had negative views on the profitability and available money through ecological farming approaches. However, other stakeholders in England, High Weald, supporting the Polish and Romanian viewpoints, argue that it cannot be expected from an advisor to know everything. Advisors should have their specialisations (along with a base general knowledge), therefore there needs to be enough advisors to cover these specialisations, at least advisors who are technical and others more administrative. Meanwhile some did argue, in the French and English case studies in particular, that older advisors who did not like the changes are more likely to retire and then be replaced by new advisors with a stronger ecological interest.

Table 16: Would the advisory service need to increase in personnel, decrease or no change? (% of respondents in each round per CSA)

Case Study	Round 2			Round 3		
	Increase	*Decrease*	*No change*	*Increase*	*Decrease*	*No change*
Austria – Salzburg und Umgebung	36%	0%	64%	22%	11%	67%
England – High Weald	70%	0%	30%	70%	0%	30%
England – North Kent	40%	10%	50%	60%	10%	30%
France – Ille-et-Vilaine	33%	17%	50%	50%	0%	50%
France – Puy-de-Dôme	67%	0%	33%	75%	0%	25%
Greece – East Crete	74%	10%	16%	94%	0%	6%
Hungary – Veszprem	80%	0%	20%	90%	0%	10%
Italy - Ravenna	69%	0%	31%	80%	0%	20%
Poland – Lubelskie	50%	0%	50%	50%	0%	50%
Poland - Podlaskie	46%	0%	54%	46%	0%	54%
Romania - Suceava	90%	0%	10%	100%	0%	0%
Scotland	67%	0%	33%	-	-	-
Sweden	-	-	-	-	-	-

4.5.2.1 *Farm advisor additional skills*

Shared across all CSAs in the Delphi exercise was a need for farm advisors to improve their technical knowledge and specialisations of ecological approaches on farm as well as in their understanding of uses for newer machinery and data in smart farming and more. This section combines what was mentioned by stakeholders across all CSAs.

Knowledge of soil health, skills to identify wildlife (plants and animals) is key, ecology and land management knowledge, good communication to network and pull together farms into clusters. Advisors need to keep abreast of advances in science and communicate these to land managers. An understanding of the administration behind grant applications is necessary and how to make a farm eligible for these grants. These advisors need to be further specialised in theoretical and technical knowledge of flora and fauna alongside a general knowledge of ecological processes on farm. They need to be able to monitor soil conditions and mitigate risks in climatic local conditions. An unnecessary specialisation is in 'ecological' against 'conventional', advisers need to be able to advise on all the tools in the farmer's toolbox and how different practices need adapting to the geology, soil and climate of the farm. Advisors also need to have a long-term and short-term vision with greater openness to trial and experimentation as well as adapting their evaluation criteria to look at cumulative effects and the holistic picture on farm.

4.5.2.2 *Civil service additional skills*

Again, respondents across CSAs tended to discuss similar points so this section combines their thoughts.

A good understanding of agricultural work and land management, administrative skills in managing payments and tax, communication between themselves, those working in agriculture and other stakeholders involved in the food chain. Policy makers need to understand the practical implications behind their policies. They should pay less attention on control and regulation, but more on monitoring and rewarding innovation and the use of ecological practices. Greater flexibility in the implementation of regulations to specific cases needs to be made possible and this requires a stronger understanding of effects on the ground. Civil servants need to be able to join up different threads of research into their policy making as well as think long-term, systemic viability of farming and land management. They also need to develop a culture of trust and engage more closely with farmers and other land managers.

4.5.2.3 *Food chain actor requiring biggest change*

Respondents in each CSA were asked to rank between different actors in the food chain as to which needs to make the biggest change in skills and knowledge to increase the adoption rate of ecological farming approaches in the CSA. The possible actors were both upstream and downstream of farming, covering the production (farmers, input suppliers, farm advisers, civil servants) and consumption (consumers, retailers, wholesalers and food & drink manufacturers) sides of the market.

Unanimous across all CSAs was that farmers would need to make the biggest change in adjusting to ecological farming approaches. This is as a result of significant changes in their practices to minimise input use, integrate crops and livestock together, graze outdoor for longer in the year, grow a diversity of crops and manage them in a way that is different from before. All these changes require a change in their knowledge and skills. This transition and knowledge acquisition is supported by agronomists and other farm advisors who were close to the highest rank of change for most CSAs which is unsurprising given the list of skills and increased number of advisors expected by the respondents.

Next, there is some disagreement of the next most significant actors needing change. Some experts refer to change in the demand side of the market – the retailers and consumers, whilst others continue to emphasise required change in input suppliers as well as the civil service. Nonetheless, all these actors are in the next bracket of required change. Austrian, Greek, Hungarian, Romanian and English (High Weald) stakeholders all consider consumers their second most important required change. This is not in terms of knowledge, but a greater appreciation and interest is required in how their food is produced and the differing implications of different production systems and practices. Consumers need to understand what goes into the different prices of each farm product rather than just seeing a cheap ('conventional') product against an expensive ('ecological') product. Consumers may then increasingly buy directly from farmers and this may help make ecological farming approaches more profitable to farmers. Respondents however debated if retailers would have more effect than consumers – consumers may demand an ecological product and thereby push a retailer to demand it from producers, but through marketing and not supplying a product in the first place, so retailers promote more conventional products whilst limiting the selection in alternatives. Civil servants are also ranked highly as in England and Scotland: there are already significant changes in policy and there is an upcoming change in the CAP which needs to encourage sustainable farming (economically, ecologically and socially). Italian, French and Romanian stakeholders emphasise input suppliers need to make more change as farms use fewer synthetic pesticides, herbicides and fertilisers so their products need to adapt, but also capital machinery may become more specialised.

Otherwise, wholesalers were often seen as stuck in the middle of the supply chain with little ability to adapt. However, some stakeholders in England pointed out that farmers often seek to be on supermarket contracts rather than wholesaler contracts as the price is better for their product. Similarly, food and drink manufacturers did not receive a lot of discussion as other actors seemed more important, although some stakeholders pointed out that, as they seek profits and consumers do not always know what they use in their products, a shift to using more ecological produce is important here too.

As this was a ranking question, the objective was to calculate Kendall's W (see Cafiso *et al.*, 2013) which measures the extent to which stakeholders agree or disagree with each other, and comparison between rounds allows to examine if group learning has occurred or not. Not all LIFT partners however implemented these ranking questions in two rounds to compare. In the French and Polish case studies, Kendall's W could be implemented only in round 2, for most significant change of actor in food chain. In both Polish CSAs there was strong agreement, while in Ille-et-Vilaine agreement was weak and Puy-de-Dôme agreement was moderate. In most other CSAs there was a change towards agreement: in Austria from weak to strong, in Greece from moderate to a stronger moderate, and in Hungary from moderate to good. These positive changes exemplify that after hearing explanations for why an actor is more important, then others agree with the explanations and are happy to change their original opinion. In the High Weald there was unusually no change. Otherwise, there was a drop in agreement in CSAs: in North Kent and Italy from weak to a weaker agreement, in Romania from strong to moderate. Disagreement, on the other hand, exemplified where points explaining why a wholesaler may be more important than a farmer, may lead some to change their opinions in support of one whilst the others support the other, and greater divergence in opinion occurs. This disagreement is especially the case here, and where most tend to have weak agreement or just moderate and especially after another round, is because all actors are summarised as needing change across all CSAs. As there is importance in each actor, so opinions diverge.

4.5.3 Supply chains

4.5.3.1 *Input trade*

Respondents in each CSA were also asked to rank between different inputs in terms of what input will experience the biggest change in trade levels between farms following the adoption of ecological practices. Trade in inputs may grow, especially where farms form clusters and work as a community of farms using ecological approaches. Where stakeholders in CSAs think the future pattern of adoption will be randomly spread, these farms might still trade these inputs, but this trade is expected to be lower. The choice of inputs includes animal manure, compost, seeds and plantlets (young plants and seedlings), bulk feed and coarse fodder, concentrated feed, shared labour (farmers sharing their labour across farms) and shared machinery (farmers sharing their machinery between farms).

Across CSAs, stakeholders mainly argued that a change in trade of manure and compost would be the most significant as these organically replace synthetic fertiliser use on farms. Respondents also argue that with greater expected integration of livestock and crops, livestock farms may increasingly trade or barter manure for straw and other feed from arable farms if farms were to cluster in the CSA. If farms using ecological approaches develop in a more spread-out fashion, then the farm size may increase and instead encourage the farm to become a mixed farm, internalising this cycling of inputs as otherwise it can be costly to transport such bulky goods. The most significant inputs that depend on clustering seems to be in machinery and labour. Isolated farms find it less convenient to share labour and assets. Therefore, CSAs such as those in France, England, Scotland and Sweden rank the sharing of machinery and labour higher (with bigger expected change) – regardless of whether these areas have more livestock or arable types of farms. Regions expecting more isolated farms using ecological approaches such as in Austria, Poland and Romania expect much lower sharing of machinery and labour. However, an input relevant to farm type is that of seeds and plantlets. In more livestock intensive CSAs such as Austria, the High Weald (England – note not North Kent which has fewer livestock farms) and Romania, stakeholders predict an increase in the exchange of seeds and plantlets. These regions specialising in livestock farming swap seeds to keep their grass swards diverse and thereby give their livestock a diverse and natural diet. High Weald participants discuss that seed is often exchanged in the form of 'green hay' where species rich swards are cut and shared between farms to enrich their species diversity and this is subsidised through AES payments.

This question also features Kendall's W. It is noticeable here that most CSAs after round 3 have a slightly stronger agreement compared with the question on actors in the food chain as there tends to be more agreement on the change in trade of inputs. Italian, Greek, English (both CSAs) stakeholders go from weaker to a stronger weak agreement. Austrian, Hungarian and Romanian experts move from weak agreement to moderate agreement.

4.5.3.2 *Contract farming, purchase of capital machinery and machinery traders*

Farmers are increasingly shifting to smaller, more specialised machinery which will suit ecological farming practices through avoiding soil compaction, but also precisely target fertiliser and crop protection applications as well as novel technologies to weed crops. These changes are expected to affect contract farming, purchase of capital machinery and machinery traders. This, as always, depends on the adoption rate of ecological farming approaches where a lower adoption encourages less change. Therefore, some CSAs such as in Hungary and Sweden envisage little change. Meanwhile, experts in all other CSAs argue that machinery will become more specialised on specific tasks and applications, but also more versatile to handle a variety of farming conditions. Having more specialised machinery may encourage more contracting of specific equipment or alternatively this contracting could be replaced on clusters of farms by sharing of specialised equipment. Similar inferences can be

made for the purchases of machinery. More contracting and sharing encourages lower purchases of machinery while isolated farms using ecological approaches may want to purchase their own machinery or use contractors. Although potentially fewer purchases may be made at once, with more sharing and greater use, machinery may be bought more frequently. Likewise, ecological farming approaches may promote more attempts to repair and frequently service machinery, thereby reducing the purchase of more machinery. Most stakeholders anticipate an increase in initial purchases, however, as the practices are increasingly used and more farmers adopt ecological farming practices. Stakeholders often linked the number of traders and dealers with the reported change in machinery purchases. More purchases so more traders, fewer purchases so fewer traders. However, there may be a break in this relationship as traders offer more follow up services in terms of software maintenance as well as offering more repair services. In addition, purchases may be smaller in value, but more sales may take place in quantity. Alternatively, traders and dealers may concentrate and centralise in one vision, or, they can spread out and become more specialised.

4.5.3.3 *Overall supply chains*

In terms of whether supply chains, upstream and downstream from farming, would change, stakeholders broadly fell into two camps. Where the adoption of ecological farming approaches was limited, the effects on supply chains were limited too as is the case in Sweden and a mixture across all CSAs. Other stakeholders across all CSAs envision supply chains becoming smaller with fewer intermediaries and more direct sales going directly from farmer to consumer. Stakeholders view there to be a growing demand for food produced through ecological farming approaches. These shortened supply chains will also promote more local trade. French stakeholders added that supply and inputs may become more diversified to reflect a greater diversity of crops and enterprises being produced on farm.

4.5.4 Effects on rural communities

4.5.4.1 *Size of rural population and rental or purchase price of homes in rural areas*

Most stakeholders in all CSAs predicted that a change in ecological farming practices has little impact on the size of the rural population as well as the purchase or rental price of homes in rural areas. There are other, more significant drivers such as the desire to move away from the city and have more space and fresh air in the open countryside. There may be a small impact as noted in France, Greece, Hungary, Poland and Romania where employment opportunities increase on farms using ecological approaches, thereby growing the rural population. Similar intuition is applied to house prices. There are other more significant factors affecting house prices, although ecological farming practices might make the areas more attractive and interesting with more diversity, but this is more likely to be a change that is noticed once the population has moved homes rather than a factor beforehand.

Respondents in England, France and Romania did however note a possible reversal in effects – if rural areas are in general in higher demand and people move there, so the demand for local and direct sales may increase. A larger market that may prefer produce from ecological farming approaches may encourage more farms to adopt these practices.

4.5.4.2 *Changing relationships between farmers*

Without much change in the adoption rate of ecological practices in Austria and Sweden, little change in relationships is expected between farmers. Although a few respondents in Austria and most in all other CSAs expect there to be an improvement in relationships between farmers with more cooperation and trade in inputs, as well as sharing of best practice and a return to communities with

close relationships among the local population. Some argue that changes are even necessary for farms to survive large policy changes, changes in climate and changes in consumer tastes.

4.6 Conclusions from the Delphi exercise

Defining a 'typical' farm that may use ecological farming approaches was one of the most challenging yet important aspects of the Delphi exercise. Researchers set out some broad outlines for characterising ecological and conventional practices, allowing for stakeholders to share their opinions on defining the nature of ecological farming approaches in the given CSA. This then allowed the discussion to develop into outlining the scenario - the pattern and rate of adoption of ecological practices in the CSA. Once this adoption scenario and characteristics of farms using ecological farming approaches was established for each CSA 10 years in the future (approximately 2030), then questions were asked anticipating the effects of this adoption scenario. Effects of this adoption in terms of all the following: on-farm employment at a territorial level; employment in farming related operations such as advisory services; supply chain effects; changes in rural communities.

Characteristics of farms using ecological farming approaches often depended on the nature of farm types in the area – factors such as use of organic manure, organic feed, alternative remedied to livestock disease management and strip grazing are naturally more important in areas with more livestock farms whereas where farms are more mixed or with more cereal and horticultural crops, so the number of different crops, reduced tillage and reduced use of synthetic chemicals become far more important. Often characteristics of farms using ecological or conventional approaches may be similar, for example in terms of farm size.

As can be expected, changes in effects will be larger if the pattern and rate of adoption changes, especially to a high and clustered adoption of ecological practices. This is predicted to occur only in Ille-et-Vilaine in France, Scotland (already relatively high adoption) and the High Weald and North Kent in England. Note that a big reason for the Scottish and English case studies to have this pattern of adoption is due to the change in policies following the departure of the UK from the EU. The BPS is expected to be removed and replaced with subsidies only in return for the production of environmental services and public goods, which will push many farmers into adopting ecological practices. Other CSAs had a variable adoption rate and pattern as it depended on local conditions and type of farming, for example mountainous areas with more isolated livestock farms in Austria, Romania and Puy-de-Dôme in France.

In terms of the socio-economic effects, there might not be a big difference between these farming approaches as they will still need to use labour, machinery, advisers and transitioning tillage method, or livestock. The approach might not bring very large changes in employment, trade of inputs and rural communities. At a territorial level, unless scenarios predict a big change in adoption, change in employment and other factors may be muted as other factors such as overall industrial employment and market dynamics have a stronger impact. This is especially the case in terms of effects on rural population and rural house prices as respondents believe other factors are more important.

However, six key main effects of an adoption scenario of ecological approaches on socio-economic effects can be drawn from the Delphi exercise:

First, skill level and quality of life in on-farm employment are frequently thought by stakeholders to increase as a result of the diversity of farming enterprises, the interest generated from this, the knowledge of natural processes and biology required, engagement with nature and new machinery that is coming into the industry. Strongly related to this need for skills is a predicted increase in the

number of advisers and civil servants to deal with more complicated farms and incentives as well as monitoring of ecological effects on farm.

Second, especially where farms using ecological approaches are clustered together, respondents predict an increase in the trade of inputs such as manure and compost replacing synthetic fertiliser, as well as more sharing of capital and labour.

Third, contracting, machinery purchasers, and machinery traders and dealers could increase, decrease or no change – the anticipated effects are mixed. But, stakeholders conclude that a greater specialisation in machinery will occur leading to changes in farm management as well as the suppliers of this machinery.

Fourth, supply chains are expected to become shorter with more direct sales and fewer intermediaries.

Fifth, although rural populations might be little affected from ecological farming, larger rural populations seeking a more attractive rural environment might contribute to higher local consumer demand.

Finally, overall farmer relationships are expected to grow closer as a result of cooperation to meet environmental objectives, trading inputs and sharing best practice.

Kendall's W in Delphi exercise usually shows an increase in agreement between respondents. However, a mixed picture emerges here. In terms of the actor in supply chains needing to improve the most in terms of knowledge, an increase in agreement happened as often farmers were highlighted to needing the most change. However, there was some disagreement as other actors were re-evaluated to being more important. This finally concludes that all actors need to make a change in skills and knowledge in light of a transition to ecological farming approaches. In contrast, most stakeholders considered manure and compost to have the biggest change in trade, followed closely by the sharing of machinery and other capital items.

A weakness of the current study is the length and breadth of the interviews which led to a lot of content being covered, but without sufficient detail on a given question. However, as a general exploration, the above conclusions provide avenues for further research. In addition, this study shows that care needs to be taken in applying a suitable definition of ecological approaches to farming for each CSA and adjusting its pattern and rate of adoption to local circumstances.

A key insight for policymakers is that economic returns to ecological agriculture is an important factor in the survival of these farms as well as contributing to the quality of life of the farm and the health of rural communities and local environment. In the UK, depending on how well the transition away from the BPS, farming incentives may provide a template for how to, or how not to, implement payment for public goods.

5 Q-methodology

5.1 Introduction

Q-methodology attempts to measure attitudes (Cross, 2005) and human subjectivity (Kampen and Tamas, 2013). In this instance, research on Task 4.2 has used the Q-method to gather the attitudes of stakeholders on the adoption and socio-economic effects of ecological farming approaches. This methodology attempts to rank-order statements along a continuum, for example, from 'agree' to 'disagree' (Cross, 2005). The statements are sorted into what may resemble a normal distribution, where the tails are the extreme statements that sit closest to agreement with the stakeholder or disagreement on the other tail. The distribution forms 'a model of subjective preference' (Cross, 2005, p. 209). For the topic area being studied, the data from the Q-sort is what the stakeholders make of a ranking of items that are presented in front of them. Q-method typically uses cut up pieces of paper or cards with statements on them for participants to sort. The sample of items that make up the 'Q-set' usually comprises of 10 to 100 items and this 'set' and 'sampling' need to take place to create this 'Q-set' (Cross, 2005). Stakeholders will be asked to rank-order individually and they do not need to be gathered together. We adapt this ordering of statements: from 'fully agree' to 'fully disagree', instead becomes from 'most likely' to 'least likely'. A grid (see Appendix 2) is used as a visual aid to help stakeholders sort these statements along a Likert scale where -4 is 'least likely' and +4 is 'most likely'. This rank-order is in anticipation of how the adoption scenario embedded among the statements would relate with socio-economic effects 10 years in the future.

An advantage of the Q-method is that it is specially adjusted for a small sample size (Giannoulis *et al*., 2010). Giannoulis *et al.* (2010) used Q-method on a sample of 23 journalists from 9 different newspapers to study beliefs on environmental issues. Another study uses a sample of 61 Mexican American women to sort 36 images of children into weight categories to investigate perceptions of childhood obesity (Bayles, 2010). In another study on the perceptions of rurality, the sample size was of 10 people (Duenckmann, 2010). Another example from a brief examination of the Q-sort literature is of a paper with sample size of 75 engaged in a stakeholder dialogue (Cuppen *et al.*, 2010). The authors use this dialogue in order to gain the perspectives of the stakeholders on energy from biomass and the Q-sort is used as a method to select stakeholders for these dialogues. Both Cuppen *et al.* (2010) and Bayles (2010) use a mix of different stakeholders, including farmers, academics and local councillors, in their use of Q-methodology. Additional recent publications, Grimsrud *et al.* (2020) and Zepharovich *et al.* (2020) respectively use 15 participants to sort 46 statements and 25 participants for 36 statements. A statistically robust analysis in Q-method requires at least 1 participant for every 3 statements (Webler *et al.,* 2009).

This section proceeds by discussing how the statements were selected, the description of participants, how the analysis was carried out, the extracted factors for each CSA and finally a discussion comparing and contrasting all the factors across all the sixteen CSAs to participate in the Q-methodology.

The design of the results is such that the reader may consider the different viewpoints from the discourse outlined in the Q-set from stakeholders in each CSA with background information as to each CSA provided above in this report.

5.2 Selection of statements

We constructed a concourse starting with five broad categories, identified by researchers, of socio-economic effects and related effects of ecological farming approaches: adoption pattern and rate, ecosystem services, nature of farm labour, labour market and the wider rural economy. Including

ecosystem services allows participants to identify how ecological and conventional farming approaches may have different impacts, framing the concourse relative to these different approaches. Statements fitting into adoption pattern and rate allow participants to quantify how these aspects may further impact socio-economic effects. The nature of farm labour helps to outline how attractive the farming industry is for employees. Statements in this category cover peak work (need for seasonal and possibly migrant labour), a varied job may be more interesting than one which is repetitive and a more physical, manual job may be less attractive and at a territorial level this may have a different impact from farm level. The focus of this deliverable on socio-economic effects thereby focuses on labour and the wider rural economy.

From these five broad categories, approximately 60 statements were chosen stemming from 6 stakeholder workshops organised in the LIFT project and involving 23 stakeholders, and supplemented with statements derived from media sources that include farming radio and online news media. Several pilot sorts were conducted to evaluate the statements in terms of understanding and balance. The final Q-set of statements (see Appendix 2) were chosen through a process of iteration between LIFT researchers. In the end 26 statements were selected: 3 statements to set out the adoption pattern and rate, 4 statements to capture effects on ecosystem services, 3 for nature of farm labour, 8 for labour market and 8 for the wider rural economy. There is no particular reason for this weighting other than the chosen statements were thought capable to capture the largest amount of viewpoints, and the focus of the study is on socio-economic effects. Using the Likert scale on the grid for the Q-set, as shown in the Appendix 2, participants were asked to fit each of their 26 statements into each of the 26 grid spaces from what they thought was 'least likely' and 'most likely'. Each individual Q-sort of the Q-set is individual to each participant.

5.3 Participants

Partners were advised to target approximately 20 participants per CSA in order to extract as many different factors and viewpoints as possible from the Q-set. Not all CSAs managed to recruit 20, but all partners found at least 9 participants – the minimum suggested through the literature (Webler *et al.,* 2009). These participants are also intended to have knowledge of farming practices and technologies across the CSA, but we expanded the sample to also include farmers given that they often do cooperate with others in the CSA and know the local landscape and climate. A total of 271 participants from 16 different CSAs in 10 different countries took part in this Q-methodology. A variety of methods were used to collect Q-sorts from stakeholders that included face-to-face meetings, meetings through online video teleconferencing software, phone calls, Q-study sent over email, from May 2020 to June 2021.

For most CSAs, partners were able to ask participants their thoughts on why they sorted Q statements in the way that they did. This facilitated easier interpretation, greater depth to the interpretation and a more cohesive stakeholder perspective to emerge. Where these additional notes were not possible due to resource constraints, an attempt has still been made to summarise the stakeholder viewpoint contained within the factor.

Table 17: Participant information (number of participants) across all CSAs involved in the Q-methodology

	AT - SK	AT - SU	ENG - HW	ENG - NK	FR – IV	FR - PdD	FR - SAR	GR - EC	HUN - HB	HUN - VES	IT - RAV	PL - LUB	PL - POD	ROM - SUC	SCO – ES + H&I	SWE - SMS	Total
Gender																	
Male	10	14	11	16	10	11	3		15	11	7	12	13	6	2		141
Female	5	4	3	5	4	4	8		5	8	2	8	7	14	7		84
Prefer not to say						1		22		1						22	46
Area of work experience																	
Researcher	1	2		1	8	3		5	19	10	1	2	3		4	2	61
Civil servant	1	1	1	1	2	8	8	5		4	2	3	3	7		3	49
Extension officer	1	6	1	1	4	2	1	2		1	1	3	2	1	1	8	35
Farmer	7	3	4	12				1	1	2	1	5	3	8		8	35
Food chain	2	3						7			1	6	7	1		1	28
Land agent			2	1										3			6
NGO representative	1	1	6	4		2				3	3	1	2		1		21
Other	2	2		1		1	2	2	3						3		16
Work experience																	
< 5 years	1	3	3		1	2			2	5	1	4	2				23
5-10 years	1	5	1	5	7	6	1		2	4	2	5	4	9	1		45
10-20 years	2	4	4	2	6	8	7		7	5	6	7	6	9	4		70
> 20 years	11	6	6	14			6		9	5		4	8	2	2		86
Prefer not to say								22		1					2	22	47
Total	15	18	14	21	14	16	11	22	20	20	9	20	20	20	9	22	271

5.4 Data analysis

This section describes the process for analysing data across all CSAs so that the resulting factors would be as comparable and consistent as possible.

Researchers were advised to use PQMethod program by Schmolck (2013), while some analysed their factors in Stata and another using a package in R. Centroid factor analyses were carried out rather than principle component analysis due to the explorative nature of the study (Barry and Proops, 1999).

A Varimax rotation was applied to the unrotated factors following recent papers in the literature (Grimsrud *et al.,* 2020) and (Zepharovich *et al.,* 2020). After selecting the Varimax option in PQMethod, we need criteria with which to choose how many factors we should rotate. Although using principle component analysis, Grimsrud *et al.,* (2020) explain their decision in choosing three factors (using 15 participants) with a cut-off point aiding their decision. As a rough guide, Watts and Stenner (2012) suggest starting with 1 factor for every 6 participants which matches with Grimsrud *et al.*, (2020). Our aim is to find an appropriate number of factors to maximise the number of Q-sorts that load significantly onto them and explain a significant amount of study variance (Watts and Stenner, 2012) – this might be as much art as it is science. The advised decision criterion for choosing a factor is that at least 2 Q-sorts load onto each and each factor should have an eigenvalue of at least 1. The final set of statements can be referred to in Appendix 2.

5.5 Results

The below section interprets factors identified through the Q-analysis as described above. Each factor begins with a set structure to support the decision rule as identified above and how significant this factor is in terms of explained variance. In each factor, the number of Q-sorts – the rank-order combination of an individual participant – is given which load significantly onto an identified factor. The significantly loading Q-sorts will tend to correlate with each other to give numbers that indicate its degree of agreement. Combined with notes that researchers have made from these significant loadings, an interpretation can form of the viewpoint or factor based on sorting Q-items relative to each other in the concourse. Once these interpretations have been discussed – a summary heading is offered by researchers of this viewpoint. In the following interpretations for each factor, the figures between brackets give (Statement number/degrees of agreement), and the matching statement number can be seen in the set of statements in Appendix 2.

5.5.1 Austria – Salzburg und Umgebung

Factor 1 – High adoption requires skills: Factor 1 is defined by 6 significantly loading Q-sorts, explaining 21% of the variance in the study and has an eigenvalue of 3.8. This first factor is characterised by stakeholders believing it is very likely that 50% (1/+4) of farms will adopt ecological practices 10 years in the future and very unlikely that it will be as low as 10% (2/-4). In this viewpoint, farmers will need to increase their level of skills (12/+3) and more migrant labour will be required (24/+2) on farms. However, employment opportunities in farming will decrease (8/-2), which may be related to a perceived fall in household income from farming (18/+2), although the nature of work on farm will become less physically demanding (13/-2). These labour changes are despite stakeholders thinking that mob/strip grazing will be used more (19/+2), and considering that they argue this practice at least maintains the current requirement for labour if it does not increase it (20/-2). Participants also think that strict certification will exist on food produce through ecological farming approaches (17/+3), ecological farming approaches will not just be a limited social movement (16/-3) and residents and users will find rural areas more attractive (21/-3).

Factor 2 – Mid-level adoption supports family farming: Factor 2 is defined by 5 significantly loading Q-sorts, explaining 18% of the variance in the study and has an eigenvalue of 3.2. This viewpoint is similar to the previous one, here participants think 50% of farmers adopting ecological practices is more likely (1/+4) than 10% (2/+1). Here, skills are not seen as so important (12/+0) and participants think migrant labour will decrease (24/-2), instead a transition to a mid-level adoption rate of ecological practices is carried out through an increase in family labour (23/-3), and this work will continue to be less physically demanding (13/-3). Employment opportunities are seen to slightly increase here (8/+1), but again the intuition around mob/strip grazing is unclear as it is again seen to increase (19/+3), but in this viewpoint, participants think the practice decreases the labour requirement on farms (20/+2).

Factor 3 – *Strict certification and low adoption:* Factor 3 is defined by 5 significantly loading Q-sorts, explaining 18% of the variance in the study and has an eigenvalue of 3.1. This viewpoint opposes the previous two where participants think a 10% adoption rate is very likely (2/+3), but 50% adoption is not likely (1/-3). One of the strongest aspects of this perspective is that farms using ecological approaches will be tightly certified (17/+4) as such and this may be a difficult status to attain, or it may discourage farms from using ecological approaches, at least to the level set in the certifying requirements. In this scenario, consumers are thought to buy more of their food locally (15/-4), there will still be a change in the landscape appearance (4/-2) and ecological farming approaches will still be more than just a limited social movement (16/-2). In terms of labour effects, family labour is thought to decrease (23/+2) and farmers will need to increase their level of skills (12/+3) as their daily routine becomes more varied (10/+2), but their need to do physical labour diminishes (13/-2).

5.5.2 Austria – Steyr-Kirchdorf

Compared with the previous Austrian CSA, it is noticeable that stakeholders perceive a lower adoption of ecological practices across all perspectives which reflects the reduced percentage of organic farmers in the area as previously noted in the CSA description.

Factor 1 – Attractive strip grazing farms: Factor 1 is defined by 6 significantly loading Q-sorts, explaining 21% of the variance in the study and has an eigenvalue of 3.8. In this viewpoint, stakeholders thought 10% of farms adopting ecological practices (2/+2) to be more likely than 50% (1/+1) and cooperation will increase between farmers who are in close proximity to each other (14/+2). The most significant statement here is that more livestock farmers will use mob/strip grazing (19/+4), followed by participants ranking rural areas as becoming more attractive for residents and users (21/-4). Reflecting that in the CSA, there are only two working dairies and farmers have a weak negotiating position, so a change in practices will lead to a fall in farming income as a proportion of household income (18/+3) and the indicated strict certification (17/+3) may bear little difference in a price change. Alternatively, farm income may fall as the individual farmer is anticipated to face more peaks of labour work (9/-2), which also indicates periods of low work when farmers may pick up alternative jobs. In addition, an increase in family labour (23/-1) as well as farmer cooperation may mean that farmers support each other more as participants believe that the hiring of seasonal labour (22/-2) as well as use of migrant labour will decrease (24/-3). There is an expectation that farmers increase their skill level (12/+2) and on gender terms, female labour is not expected to increase by any more than male labour (26/-3).

Factor 2 – Skilled peaks of certified ecological farm work: Factor 2 is defined by 4 significantly loading Q-sorts, explaining 19% of the variance in the study and has an eigenvalue of 2.9. This factor places a great importance on requiring farmers to increase their skill level (12/+4), their ecological practices will be strictly certified (17/+3) as such and there will be peaks of labour work for the individual farmer (9/-4). In this viewpoint, stakeholders think a 50% adoption rate is unlikely (1/-3), 10% is considered to be neutral (2/0) so the adoption rate towards the lower end of the spectrum and this is a scenario that

suggests there to be little change in this rate despite strict certification. The skills may be necessary for the certification itself. The farms that do adopt ecological practices would be closely connected as clusters (3/+3) in the CSA however. This clustering and minimal adoption rate is still expected to improve water quality (5/+2), result in change in the local landscape appearance (4/-3) and including an increase in hedgerows (7/-1). Participants think consumers may buy more locally (15/-2) and ecological farming approaches still remain more than just a limited social movement (16/-2). Overall employment opportunities are expected to increase (8/+2) as well as a rise in the demand for female labour specifically (26/+2) and a reduction in mob grazing (19/-2).

Factor 3 – Welcoming skilled seasonal and migrant labour: Factor 3 is defined by 4 significantly loading Q-sorts, explaining 14% of the variance in the study and has an eigenvalue of 2.2. This viewpoint shows family labour decreasing (23/+4), but farmers increasing their own level of skills (12/+3) which is accompanied by a rise in migrant (24/+2) and seasonal labour (22/+2), potentially where the migrant labour brings the skills onto the farm. The labour work is perceived to be less physical (13/-3), but with little daily variation and in peaks (9/-3), which may also suit the use of seasonal and migrant labour. This perspective has 10% as the likeliest adoption rate (2/+2) versus (1/0), but enough change such that rural areas become more attractive (21/-4) and ecological farming approaches to be more than just a limited social movement (16/-2).

5.5.1 England – High Weald

Factor 1 – Skilled ecological movement: Factor 1 is defined by 7 significantly loading Q-sorts, explaining 28% of the variance in the study and has an eigenvalue of 6.58. Starting with the pattern of adoption stakeholders identify that at least 10% of farms in the study area will be using ecological farming approaches (2/+3) - indeed this proportion may already be the case - this rate will be somewhere between 10% and 50%, possibly not yet at 50% in 10 years' time (1/+1), that is of farms being regenerative. In addition, these farms employing ecological approaches are likely to form in clusters (3/+2) as farmers cooperate more with neighbouring farmers (14/+3). Stakeholders suggest local cooperation should take place for biodiversity reasons such as wildlife corridors. This increase in ecological practice participation and local cooperation is predicted to result in improved soil quality (6/-3) and as a further result, increased water quality (5/+2) as soils hold water like a sponge rather than letting water runoff into nearby water bodies with the soil nutrients. In addition, the number and size of hedgerows will increase (7/-3) where stakeholders point out they may be a source of nutrients for grazing livestock and provide a windbreak as well as homes for birds and other wildlife. An important statement in this factor (more important than in factor 2) is that farmers will need to increase their level of skills (12/+4) – more knowledge is required and following Brexit, where the CAP was seen to be prescriptive among farmers, this 'freedom' may enable farmers to rediscover knowledge on when to make interventions on farm, but in line with environmental objectives. Another statement with a strong opinion was that ecological farming approaches will be more than just a limited social movement (16/-4): there is already support in newspapers on ecological farming practices, more farmers will adopt ecological practices and more consumers will buy their food locally (15/-2). In addition, study participants foresee that rural areas will become more attractive to residents and users (21/-2), although this may be a subjective viewpoint and different to those coming from urban environments.

Factor 2 – Transformative mob grazing: Factor 2 is defined by 6 significantly loading Q-sorts, explaining 27% of the variance in the study and has an eigenvalue of 1.05. The scenario in this perspective is one where stakeholders view 50% of farms using ecological approaches more likely (1/+2) than 10% (2/-2), but also that farms using ecological approaches will form in clusters (3/+1), just at a lesser extent. The High Weald has a lot of lifestyle and hobby farmers as it is close to London and an AONB – these farmers

are likely to farm with an environmental objective. Meanwhile clusters are likely as farmers are sharing their experiences and future agricultural subsidies encourage cooperation among neighbours (14/+3) for wildlife corridors and increasing biodiversity. As a result of this adoption, the environmental effects are similar to factor 1 where soil (6/-4) and water quality will improve (5/+3) as well as the number and size of hedgerows (7/-3) (also receiving financial incentives). In this factor, mob grazing stands out where participants think that this will increase (19/+4) in the future as they see the practice being a better way of managing livestock and grazing: it reduces the amount of inputs farmers need (fertiliser on the grass and medicines in animals) while increasing the livestock density the grassland is able to support. The stakeholders believe this practice will deliver improvements in the ecological side of the farm, soil and water quality as examples and various organisations including the High Weald AONB team promote its use. The use of this practice is associated with an increase in skill level (12/+2) where farmers are able to more closely observe their animals and need to understand the biology in their soils, managing grasslands and nature around them. The farmer's labour would change. Livestock are kept in barns for a shorter amount of time, therefore less clearing out and feeding in the barns throughout the year as well as lower requirement for medicines. Farmers would need to move livestock more often (possible through automation) and this may free their time to spend more time observing the livestock. These changes, including observing livestock more, enables the farmer to take better care of the livestock, but also to spend time diversifying into other enterprises and this leads to an increase in employment opportunities (8/+1) in this scenario and factor.

5.5.2 England - North Kent

Factor 1 – High and clustered adoption needs skilled land managers: Factor 1 is defined by 8 significantly loading Q-sorts, explaining 23% of the variance in the study and has an eigenvalue of 5.98. This factor presents the case where 50% of farms adopt ecological farming practices (1/+3) and their adoption pattern is clustered (3/+3). Participants argued a 50% adoption rate is likely as subsidies might become necessary for the farm business to survive and under a change in policy, subsidies are restricted to be paid when farms provide public goods through adopting ecological practices such as no till farming and environmental land management. Clusters are already taking shape in the CSA where farms share best practice. Another participant refers to the Lawson review ('Making space for nature' – an independent review studying England's wildlife sites and their capability of responding and adapting to climate change and other demands on the land (Lawton *et al.*, 2010)), emphasising how small, isolated pockets will not be sufficient for nature conservation to succeed – bigger landscape scale clusters of farms are necessary and this is supported through the upcoming government policy change.

In this scenario of high adoption and clusters of farms with ecological approaches, stakeholders envision there to be significant change in the landscape appearance (4/-3) as farmers would be encouraged to use cover crops, mixed rotations and companion cropping (less mono-cropping). Another example, an increase in the size and number of hedgerows (7/-4) is expected as upcoming grant schemes starting in the next 10 years' will further encourage their expansion, but a participant in another defining sort in this factor argues that hedges will not necessarily be planted, but the focus would be on planting woodland on infertile soils. Overall, stakeholders believe this appearance will be more attractive to residents and users (21/-2). Expanding from this perspective is that ecological farming approaches will become a pervasive social movement (16/-3) where the wider rural economy will be more resilient (11/+2) with consumers buying more of their food locally (15/-2) and farmers will cooperate more with each other (14/+1).

In order to facilitate this adoption, this stakeholder perspective highlights that farmers will need to increase their level of skills (12/+4): diversified cropping, use of artificial intelligence will increase,

knowledge of biodiversity, managing recruitments. A farmer already using ecological approaches adds that they need to glean more knowledge and take more time over management decisions to make the system work. The diverse cropping and practices on farms with ecological approaches should lead to a farmer's daily routine becoming more varied (10/+2) and labour work to be more spread across the year (9/+2).

Factor 2 – Low percentage certified ecological: Factor 2 is defined by 4 significantly loading Q-sorts, explaining 11% of the variance in the study and has an eigenvalue of 1.71. In this perspective, stakeholders anticipate a lower adoption rate of ecological farming approaches, 10% being likely (2/+3) while 50% is unlikely (1/-2). This is where these farms are certified as ecological (17/+4), where they use a complete suite of ecological practices rather than adopting a few. Given this low adoption, stakeholders think soil (6/-3) and water quality will improve (5/+3) – probably as farms become more ecological, just not certifiably so. Participants consider that the Department for Environment, Food and Rural Affairs (DEFRA) will want to make sure that their grants are justifiable, and consumers are more interested in knowing about the provenance of their food. However, stakeholders believe consumers will continue to use supermarkets for their convenience (15/+1) and purchase low-cost relative to more expensive locally priced foods. With a low adoption of ecological practices, a withdrawal of BPS subsidies, and consumers not increasingly buying local, stakeholders predict income from farming will decrease as a proportion of household income (18/+2).

On farm labour, farm work in its nature is perceived to become less physically demanding (13/-4), the ecological practices will not make farm work anymore physically demanding and associated technologies may even further reduce the physical strain. The statement on women and physical labour received strong disagreement (26/-2) in this factor – participants highlight that what matters is the right person in terms of their skills and competencies for the job and that female labour should not be treated any differently from male labour on farms.

Factor 3 – Skilled migrant labour demanded: Factor 3 is defined by 5 significantly loading Q-sorts, explaining 13% of the variance in the study and has an eigenvalue of 1.99. As with factor 1, factor 3 presents a perspective where 50% of farms adopt ecological practices (2/+1) and these farms using ecological approaches are more likely to form into clusters (3/+1). Reflecting these clusters, farmers will cooperate more with one another (14/+3), but here is a stronger emphasis on the form of that cooperation – an increase in trade of locally sourced inputs (25/-4). This perspective explains that farms with ecological approaches will still need more migrant labour (24/+4) as the local population are perceived as unlikely to have the skills and willingness to fill the gap for seasonal labour. In North Kent, although there may be a high proportion of farms with ecological approaches, there will still be intensive cropping of soft fruits (e.g. strawberries and raspberries) and top fruit orchards, and therefore a need for seasonal migrant labour. Although in their explanations, participants highlighted that migrant labour is needed where seasonal labour is needed – the statement discussing seasonal labour features neutrally in this factor (22/0). At the same time, skills have a higher significance (12/+3) and as put by the participant before, it may be the skills that migrant labour brings, that farmers using ecological approaches are most interested in utilising on farm.

5.5.3 France – Ille-et-Vilaine

Factor 1 – High adoption requires skills: Factor 1 is defined by 6 significantly loading Q-sorts, accounts for 17% of the variance and has an eigenvalue of 3.43. Here 50% of farms are perceived to be more likely (1/+3) to adopt ecological practices than 10% (2/-3), as ecological practices can already be found in many farms today, already surpassing 10%, and this will only increase in time. Societal expectations, environmental regulations and consumer demand (15/-4) – in itself predicted to remain strong and

increase over the coming years – will also promote closer to 50% of farms adopting ecological practices. In this scenario, stakeholders foresee farmers acquiring more skills (12/+4) to implement ecological approaches and other diversifications that require additional skills and knowledge that is not already widespread among the farming population. Family labour (23/+3) is also set to decrease, but the modernisation of equipment and integration of new agricultural services may improve existing working conditions and make the nature of farm work less physically demanding (13/-3).

Factor 2 – Resilient ecological clusters: Factor 2 is defined by 3 significantly loading Q-sorts, accounts for 15% of the variance and has an eigenvalue of 1.47. Faced with crises and globalisation, stakeholders argue that food sovereignty must be regained at a national, or even a territorial level – a resilient rural economy (11/+4), and that this goes hand in hand with greater autonomy and greater diversity that occurs in agriculture. Stakeholders feel that ecological agriculture suits a diversification of systems and as a result, ecological cropping systems make the work of farmers more varied (10/+3) and more interesting. Ecological agriculture is argued to be more than just a limited social movement (16/-3) – 'an agroecological transition is underway', which should accelerate under the impetus of professional standards and supported with eco-schemes. This transition will provide more ecosystem services such as a change in soil quality (6/-3) and more and taller hedges (7/-4). This perspective adds that stakeholders think clusters of closely connected farms using ecological approaches will form in the area in the organisation of professional networks (3/+3).

Factor 3 – Ecological agriculture and generational change: Factor 3 is defined by 5 significantly loading Q-sorts, accounts for 15% of the variance and has an eigenvalue of 1.57. This perspective presents farms adopting ecological approaches in a lower adoption scenario. Already 10% of farms adopt ecological farming approaches, but here stakeholders think the adoption rate will be closer to this (2/+3) than 50% (1/-4). Stakeholders perceive there to be insufficient dynamism in the agricultural industry as a whole to setting up new farmers relative to retirements, as about 50% of farmers are over 53 years old and only a one third are predicted to be replaced in the next 10 years, leaving an aging population that are likelier to continue with farming as they know it. Younger people are felt to seek a job that is more in tune with society and only some of those entering the industry might be ecological. Older farms might be put off by the drop in production volumes anticipated in ecological farming approaches as well as the risk in adopting different practices, so even with attractive financing there is closer to 10% adoption of AES and organic conversion. Stakeholders also show scepticism on the affordability of ecological produce for those on lower incomes. Labour features strongly in this perspective, even given the views of lower adoption. Despite the aforementioned concerns over labour dynamism, study participants think that employment opportunities will increase (8/+4) as the diversity of agricultural systems and projects that constitutes ecological farming approaches make it more attractive to younger generations than farming as a whole. In addition, farmers are said to need to increase their level of skills (12/+3). The nature of farm work, through modernisation of equipment and new technologies is expected to be less physically demanding (13/-3) and labour work may be more spread throughout the year (9/-3) – more in line with wider society – which altogether may make farming more attractive to younger generations.

5.5.4 France – Puy-de-Dôme

Factor 1 – Resilient rural movement promoting skills: Factor 1 is defined by 10 significantly loading Q-sorts, accounts for 34% of the variance and has an eigenvalue of 5.71. Rural economy features strongly in this perspective where stakeholders foresee ecological farming approaches supporting a resilient wider rural economy (11/+3) where consumers buy a lot more of their food locally (15/-3) and ecological farming approaches is more than just a limited social movement (16/-4). On consumers, stakeholders believe they want more local with minimal travel and healthier products, this is a trend

accentuated by COVID-19. In addition, consumers want to know more and more about what it is that they are eating – where it came from, how it was produced, how it may impact on their health as well as the environment. Stakeholders directly attribute environmental benefits to ecological farming approaches such as an improvement in soil quality (6/-3). This strengthened rural economy with growing demand for ecological farming approaches may promote more farmers adopting these approaches and thus leading to changes in their labour. Study participants argue that farmers will need a strong set of technical skills (12/+4) to maximise the ecological impact of new practices whilst also maintaining sufficient production to earn a living. In addition to these technical skills, a holistic system of livestock and crops needs to be managed carefully. As this form of farming deals with a lot of living beings in crop and livestock, but also their interactions with biological predators, soil microfauna and more, the practices will need to be adapted to the pedoclimatic conditions as well as wider changes that include societal, climatic, scientific. Complementing this diversity of skill requirements is a predicted daily routine that is varied (10/+3) in accordance with the diversification of activity on farms using ecological approaches.

Factor 2 – Lower adoption, less labour but more skills: Factor 2 is defined by 4 significantly loading Q-sorts, accounts for 16% of the variance and has an eigenvalue of 2.39. The study had a relatively broad definition of ecological farming approaches for which stakeholders anticipate that 10% would be easy to reach (2/+3) and this may already be the adoption rate. However, this viewpoint tends towards a lower adoption as 50% adoption (1/-3) was thought unlikely where the anticipated demand in organic products is not foreseen to increase significantly as households will not allocate that much more of their household budget to food. Study participants envisaged that migrant labour will decrease (24/-4) as agricultural practice changes in the future will seek to minimise this and that family labour too will decrease (23/-3). However, stakeholders argue that mob/strip grazing requires more working time (20/-3) as well as an increase in the use of this practice (19/+2) to mitigate a drop in family and migrant labour, but potentially an increase in the use of hired labour.

5.5.5 France – Sarthe

Factor 1 – Following a conventional trend: Factor 1 is defined by 3 significantly loading Q-sorts, accounts for 15% of the variance and has an eigenvalue of 2.80. This viewpoint can be described as remaining on trend. A 10% adoption rate is considered much more likely (2/+3) than 50% (1/-4), reflecting what is possibly the current situation and these practices being diffused through the farming community, but not at any significant speed. In addition, stakeholders think that ecological farming will remain a limited movement (16/+3); mechanisation will continue to be used, thereby not making the nature of work physically demanding (13/-3); nor do participants think there to be much reason from ecological farming to demand more female labour as opposed to male labour (26/-3). Another continual development is that of skill level (12/+4) – adopting ecological practices will require farmers to adapt their knowledge and adapt to changes in climate.

Factor 2 – Growing social movement: Factor 2 is defined by 4 significantly loading Q-sorts, accounts for 16% of the variance and has an eigenvalue of 1.34. This factor contrasts from the previous one in that ecological farming as an idea of an environmentally and health friendly form of agriculture is seen to be growing as a movement (16/-3) in the population and particularly the young. Complementing this view is that participants think consumers will buy more of their food locally (15/-4), that this is happening more now already, and public policies are being provided to support buying local. This viewpoint presents ecological farming adoption to be more likely going forward with 10% the most likely adoption rate (2/+3), but 50% (1/+1) also associated with a small likelihood which may be facilitated through the growing movement and consumer spending. As a result of this growing movement, hedgerows are likely to increase (7/-3) – they cannot be removed due to regulations and

ecological farming approaches support the installation of more hedgerows. Facilitating this increase in ecological farming approaches is that more livestock farmers will use mob/strip grazing (19/+4) and seasonal labour may also need to increase in the CSA (22/+3).

5.5.6 Greece - East Crete

Factor 1 – Interconnected ecological farms: Factor 1 is defined by 7 significantly loading Q-sorts, accounts for 19% of the variance and has an eigenvalue of 5.50. It is characterised by a strong feeling that in the next 10 years a small percentage (10%) of farms in Crete will adopt ecological farming approaches (2/+4), that will be closely connected in the form of clusters (3/+3); while simultaneously farmers will increase their skills (12/+3). According to this viewpoint, rural areas will become more attractive both for residents and users (21/+2); while it is considered unlikely that consumers will not turn to buying a lot more of their food locally (1/-4), that more livestock farmers will use mob/strip grazing (19/-2), or that income from farming will decrease as a proportion of household income (18/-3). Moreover, the effect of adoption of ecological farming approaches will be unimportant in terms of the quality of water (5/0), the resilience of the rural economy of Crete (11/0) and the need for labour (seasonal (22/0) or migrant (24/0)).

Factor 2 – Environment and eco-system services: Factor 2 is defined by 3 significantly loading Q-sorts, accounts for 13% of the variance and has an eigenvalue of 2.43. It is characterised by a strong feeling that the wider rural economy will be more resilient (11/+4), the quality of water will improve (5/+3), and consumers will buy a lot more of their food locally (15/-3). According to this viewpoint, ecological farming approaches will not be a limited social movement (16/-4) with insubstantial ecosystem services and small-scale impact on the landscape appearance of rural areas (4/-2). Moreover, the need for labour, whether migrant (22/0) or seasonal (24/-1), and the farmers' level of skill in a farm using ecological approaches are considered unimportant or unlikely (12/+1).

Factor 3 – Skills and labour: Factor 3 is defined by 4 significantly loading Q-sorts, accounts for 12% of the variance and has an eigenvalue of 1.63. It is characterised by a strong feeling that farmers will need to increase their skill level (12/+4), more migrant (24/+3) and seasonal labour (22/+2) will be needed, while the landscape appearance of rural areas will not change significantly (7/+2). According to this viewpoint, it is unlikely that the wider rural economy will become more resilient (11/-4), or that farms using ecological approaches will form clusters (3/-2) and that the water quality will improve (5/-2).

Comparing the three factors, it is visible that each one represents a clear viewpoint. Factor 1 is centred around the belief that adoption of ecological farming practices will lead to an increase in cooperation among neighbouring farms (14/+2) and farmers but will not provide more opportunities for employment (7/0) or ecosystem services (16/-1). On the contrary, factor 2 centres on the belief that the adoption of ecological farming practices will act as a trigger for the increase in resilience of the area's wider rural economy (8: +4) and quality of water (3/+3); whereas in the other viewpoints, the effect of ecological farming approaches on the resilience of the rural area (11/0), (11/-4) and water quality (5/0), (5/-2) is either unimportant or highly unlikely. Lastly, factor 3 focuses on the belief that adoption of ecological farming practices will lead to an increase in demand for labour (migrant (24: +3) and seasonal (22: +2)), given that the nature of work on farms will be more physically demanding (13/+1), without resulting in an increase in the resilience of the area's wider rural economy (8/-4) or in water quality (5/-2).

5.5.7 Hungary – Hajdú-Bihar

Factor 1 – Mixed labour effects: Factor 1 is defined by 7 significantly loading Q-sorts, accounts for 38.6% of the variance and has an eigenvalue of 7.4. The statements collected into factor 1 are rather

heterogenous. Stakeholders think a 10% adoption rate (2/+2) will be much more likely than 50% (1/-3). The statements otherwise seem to mostly focus on expected farm labour characteristics. Most importantly, it is strongly expected, that farmers increase their skill levels (12/+4) and the nature of the work won't become more physically demanding (13/-4). As a trade-off perhaps, the amount of family labour is not expected to increase (23/+1), employment opportunities are set to decrease (8/-2) and peaks of labour work are set to become worse (9/-3).

Factor 2 – Low adoption and more family involvement: Factor 2 is defined by 6 significantly loading Q-sorts, accounts for 13.69% of the variance and has an eigenvalue of 2.62. Factor 2 does not seem to be qualitatively very different from factors 1 and 3. This factor thought 50% adoption rate to be very unlikely (1/-4) and 10% was thought to be possible (2/+1) – this factor seems to portray the lowest expected adoption rate. This viewpoint also imagines clustering to be the least likely (3/-1). Curiously, the expected socio-economic effects of this viewpoint could be interpreted as a mix of viewpoints from factors 1 and 3. Similar to factor 1, the most important positive statement is that farmers will need to increase their level of skills (12/+3), whilst the most unlikely statement is that the nature of work on farms will be more physically demanding (13/-3), shared across all factors. In common with factor 3 are some statements with respect to the overall landscape, such as that there will be little change in the landscape appearance of rural areas (4/+2).

Factor 3 – Minimal landscape change, smaller rural economy: Factor 3 is defined by significantly loading Q-sorts, accounts for 10% of the variance and has an eigenvalue of 1.92. Factor 3 may be characterised as collecting statements with respect to overall rural landscape, labour and economy given a small adoption of ecological farming practices. To that effect, little change may be expected in the landscape of rural areas (4/+4), a statement that may be interpreted both positively and negatively subject to the present state of the landscape, although a small change is an increase in number and size of hedgerows (7/+3). Most of the statements however are rather pessimistic. Consumers are not expected to shift their demand towards more locally produced food (15/+3), ecological certification schemes are not expected to tighten (17/-1), and perhaps more importantly, increase of rural economy's resilience (11/-1) and water quality are unlikely (5/-3). Overall employment opportunities are expected to be lower (8/-4) in this scenario and that includes the use of family labour on farm (23/+2).

5.5.8 Hungary – Veszprém

Factor 1 – Increased adoption with positive effects: Factor 1 is defined by 11 significantly loading Q-sorts, accounts for 35.14% variance and has an eigenvalue of 7.39. It appears this factor can be characterised as optimistic, with expectations that 10% of farms will be ecological (2/+3), the rural economy's resilience increases (11/+3) and that farm employment opportunities will increase (8/+1).

Factor 2 – Limited adoption and effects: Factor 2 is defined by 3 significantly loading Q-sorts, accounts for 18.9% variance and has an eigenvalue of 2.34. In contrast to factor 1, factor 2 might somewhat be characterised as pessimistic, considering ecological farming practices to remain a limited social movement (16/+4) without real impact on rural way of life. Also, respondents in this factor doubt the potential of rural economy with respect to resilience (11/-2).

Factor 3 – Limited adoption but some positive effects: Factor 3 is defined by 2 significantly loading Q-sorts, accounts for 14.1% variance and has an eigenvalue of 1.45. This factor expresses cautiously positive expectations, with respect to increasing requirement for local seasonal labour (22/+3), but not migrant labour (24/-4). It might be easier to recruit local labour as stakeholders believe ecological farming approaches to in the future be less physically demanding (13/-3). Rural economy resilience is also expected to improve slightly (11/+1). However, stakeholders have low expectations with regard to the spread of ecological farming practices.

Overall, respondents do not trust the future expansion of ecological farming practices. In all factors the statement '50% of farms will adopt ecological farming practices' receives low scores (respectively for each factor, factor scores were (1/-4) (1/-3) (1/-1)).

5.5.9 Italy – Ravenna

Factor 1 – Cooperation and more skill: Factor 1 is defined by 6 significantly loading Q-sorts, accounts for 30% study variance and has an eigenvalue of 3.41. In this viewpoint a 50% adoption rate is unlikely and the 10% rate is considered likely, but close to neutral so stakeholders expect a limited adoption rate in the area. Rural economy and rural labour market aspects are the most prominent. In this factor participants are convinced that farmers will need to increase their level of skills (12/+4), moreover, experts of this factor believe that the wider rural economy will be more resilient (11/+3) and that after 10 years, farmers will cooperate more with neighbouring farmers and farms close to them (14/+3). On the other hand, respondents expressed strong disagreement with the idea that in 10 years little change would happen to soil quality (6/-4), or that there would not be change in trade of locally sourced inputs (25/-3). Further, respondents did not believe that ecological farming would be a limited social movement and would not provide substantial ecosystem services (16/-3).

Factor 2 – Improved working conditions and attractive rural areas: Factor 2 is defined by 3 significantly loading Q-sorts, accounts for 17% study variance and has an eigenvalue of 0.86. As in factor 1, in factor 2 the most agreed statement is that farmer will need to increase their level of skills (21/+4). Respondents in this factor strongly believe that within 10 years, rural areas will become more attractive for foreign residents and users (21/+3) and that there will be no change in the number and/or size of hedgerows (7/+3). Further, experts strongly disagreed with the idea that after 10 years 50% of farms would adopt ecological farming practices (1/-4), nor they believe farms adopting ecological approaches would form clusters of closely connected farms within the CSA. However, a 10% adoption rate is considered more likely than in factor 1. Finally, respondents opposed the notion that in 10 years the nature of work on farms would be more physically demanding.

5.5.10 Poland – Lubelskie

Factor 1 – Limited movement agriculture: Factor 1 is defined by 9 significantly loading Q-sorts, accounts for 49% of the variance and has an eigenvalue of 10.01. Participants in this factor were very pessimistic on the future of ecological farming approaches, arguing that it will be a limited social movement (16/+3) as farmers do not want to adopt ecological practices since the latter are usually not economically viable and certification (17/+3) may require a lot of paper work. On this point, stakeholders also think that there will be strict certification in the future to validate the quality of practice used on farm which may inhibit adoption as stakeholders believe that adoption of ecological practices will be very low – especially not at 50% (1/-4) and still unlikely to be at 10% (2/-2). Although, where ecological farming practices do exist, stakeholders predict consumers buying more local food (15/-3) as this is a growing trend and rural areas will look more attractive (21/-3). Also, for those adopting farms, skill level is seen as a necessary increase (12/+4) as ecological farming approaches is understood to be more complex than conventional, with frequent innovations in techniques and technology that farmers need to constantly learn.

Factor 2 – A fledgling social movement: Factor 2 is defined by 4 significantly loading Q-sorts, accounts for 9% of the variance and has an eigenvalue of 1.62. In contrast to the previous perspective, this factor has stakeholders considering the possibility that a 10% adoption rate is feasible (2/+3) with farmers growing more interested in the practices, and as society becomes more and more aware about the importance of ecosystem services, it will be more than a limited social movement (16/-3). This

perspective also maintains that farmers will need to increase their skill level (12/+4) and certification will be strict in the future (17/+3).

5.5.11 Poland – Podlaskie

Factor 1 – Limited movement agriculture: Factor 1 is defined by 6 significantly loading Q-sorts, accounts for 38% of the variance and has an eigenvalue of 9.33. It is worth noting that this factor 1 is similar to the other Polish CSA where again the adoption rate is predicted to be very low – especially not 50% (1/-4) but also unlikely to be 10% (2/-3) as stakeholders consider demand for organic food to be too low and therefore ecological food production might not be economically viable. Study participants explain that this is in part due to low overall wages in Poland making organic food unaffordable and this in turn leads to turning away from a 'healthy diet' and a limited social movement (16/-3). Certification (17/+3) is also a component to this factor where consumers want to ensure what they buy is 100% organic. Another similarity with factor 1 in Lubelskie is that stakeholders anticipate consumers to buy more locally (15/-3) for those who can afford to buy food based on quality. In production terms, again skill level is seen to be very important (12/+4) as farmers require knowledge to use nature to their advantage and skill in using new technologies and techniques.

Factor 2 – A transformed rural life: Factor 2 is defined by 3 significantly loading Q-sorts, accounts for 11% of the variance and has an eigenvalue of 1.68. In contrast to factor 1, this viewpoint has ecological farming creating a more resilient rural economy (11/+3) where consumers buy more of their food locally (15/-3), appreciating its quality. Changes take place in farm labour terms with work becoming more physically demanding (13/+3), a decrease in total employment opportunities (8/-3) and an increase in skill level (12/+3) as farmers work with new machinery and autonomous technologies. The final change in rural life is that of rural areas becoming more attractive (21/-4) as the quality of the rural environment improves.

Factor 3 – Unchanged clusters of family farms: Factor 3 is defined by 2 significantly loading Q-sorts, accounts for 13% of the variance and has an eigenvalue of 1.29. This perspective perhaps contains the idyllic view of rural farms – little changed, but attractive landscape appearances (21/-4) shaped partly through EU and Polish policies which aim to sustain rural areas. Stakeholders think that these farms will form clusters (3/+3), but that a high adoption rate of ecological practices is unlikely, especially not 50% (1/-4) but also unlikely at 10% (2/-2). Study participants also believe that due to a lack of workforce, farmers will be forced to rely on themselves and their family (23/-3) for additional labour and their labour will need to increase in skills too (12/+4).

5.5.12 Romania – Suceava

Factor 1 – Slower adoption, changing labour dynamics: Factor 1 is defined by 3 significantly loading Q-sorts, accounts for 17% of the variance and has an eigenvalue of 8.10. Participants think that after 10 years a 10% adoption rate is more likely (2/+4) than 50% (1/0). Already the CSA contains a considerable number of farms using ecological approaches, so the resulting adoption rate would be in between, and thus this factor expresses a lower anticipated progression in adoption over 10 years. In order to ensure a successful implementation of ecological practices, farmers must increase their level of skills (12/+3), both for the conversion of land to ecological farming approaches and for an efficient management of farm's activities. The farms in the CSAs are predominantly dairy, and mechanisation compliant with ecological farming approaches may reduce the physical strain of farm labour (13/-3). However, this machinery will need additional skills and labour to handle it. Given a deficit of permanent and seasonal hired work, family labour is expected to increase (23/-4). Participants think that certification may become stricter (17/+3) as ecological farming practice use grows and predict that farms will cooperate less with neighbouring farmers (14/-3).

Factor 2 – Faster adoption, certification and return migration: Factor 2 is defined by 3 significantly loading Q-sorts, accounts for 24% of the variance and has an eigenvalue of 2.10. Similar to factor 1, participants identify that the study area already has a considerable number of farms having adopted ecological approaches; but this viewpoint envisages a faster increase in adoption of ecological farming practices as a 50% adoption rate is considered likely (1/+2) and a 10% adoption unlikely (2/-3). Respondents in this factor argue that the process of converting to ecological farming approaches has accelerated over the last few years and therefore, they think that stricter rules may be implemented through national legislation. In addition, ecological farming practices are thought likely to make rural areas more attractive (21/-3) which may encourage young people working abroad and retired people living in cities to spend more time in their home villages. Again, stakeholders expect family labour to increase on farms (23/-4), more support may be available from those abroad or in cities and skill levels should increase too (12/+3). Another expected result is an improvement in water quality (5/+3) and already there is evidence of lower levels of nitrates in rivers.

5.5.13 Scotland – Eastern Scotland and Highlands & Islands

Factor 1 – Policy-driven systems change: Factor 1 is defined by 4 significantly loading Q-sorts, accounts for 26.5% of the variance, and has an eigenvalue of 2.38. Participants were generally in agreement that ecological farming approaches would result necessarily in more resilience to the system: improving habitats, increasing biodiversity, help prevent declines in soil, air and water quality. These changes should build resilience as the community (11/+4) is better able to overcome climatic and economic shocks. In addition, given the changes in the UK payments-based system following its departure from the EU, farmers may have no choice but to become ecological in order to receive subsidies, which, accompanied with system changes, would result in widespread resilience. Ecological farming approaches are expected to drive farms towards diversification and receive a smaller proportion of household income through farming (18/-4), but again driving resilience. Further complementing this resilience is that with adopting more ecological farming approaches, consumers will buy more locally (15/-3), spurred on by COVID, driving a preference for healthier, local options. As the upcoming policy is seen to promote a rise in ecological farming approaches, participants argue this rise will lead to a need for a certification scheme (17/+3) to be developed and implemented, both for rewarding farming and as a part of monitoring. Delivering system changes, many participants highlighted that farmers using ecological farming approaches would be more demanding in skills (12/+3) compared with conventional farming approaches and that they faced a considerable challenge in acquiring these skills. Others suggested rather than skills, it would be an increase in knowledge that is required, particularly knowledge of processes underpinning ecological farming approaches: nutrient cycling, photosynthesis, pollination and biological pest control taken as examples.

Also associated with this factor are strong and neutral reactions to the statement that there will be more demand for female labour for manual operations (26/-3). Some participants (both male and female) thought this statement was too complicated and therefore assigned it as neutral. Others (all female) were very much incensed by the statement, arguing that it does not fit with the other statements in the concourse and strongly oppose to it being formulated and included at all. Participants here hope that in 10 years in the future there will be less differentiation on who is providing the labour – physical or otherwise in nature – and therefore think the statement to be very unlikely.

Factor 2 – A limited social movement: Factor 2 is defined by 3 significantly loading Q-sorts, accounts for 20.7% of the variance and has an eigenvalue of 1.86. This factor contrasts with the previous one, here participants think that as a timeframe, 10 years offer limited scope for substantial change and therefore they predict that a 10% adoption rate is more likely (2/+4). This change would be especially

limited without sufficient financial compensation (belief alone is insufficient). Without much change in farming practices, these participants therefore believed that there would be little change in the landscape appearance of rural areas (4/+3). Also, a participant sees farming as nearly always being conventional in Eastern Scotland with its negative environmental effects as persisting; another shares their experience with teachers of farmers expressing doubts that ecological farming approaches could feed an ever-growing human population. Therefore, they expect that much like organic farming, ecological/sustainable farming approaches will just be a limited social movement (16/+3) taken up mainly by hobby farmers who are not maximising yields and profits. As this would only be a limited movement in this viewpoint, there would not be another certification scheme (17/-3) like organic, as uptake will be partly driven by policy. In addition, as ecological farming approaches will incorporate a scatter of different practices, it will be hard for a concrete certification scheme to develop. The last couple aspects of this viewpoint relate to labour. Participants think that there will not be an increase in overall employment (8/-4), possibly in part-time labour, but not full-time jobs, particularly with more mechanisation and precision farming and in line with diversifying the farm business (18/+2). Similarly, low wages might not be able to attract new entrants to the sector (although there may be some turnover with new schemes paying older farmers to retire). The other labour aspect, relating to work on the farm being more physically demanding (13/-3), is that adopting ecological practices is expected to take place alongside the adoption of labour-saving mechanisation and precision technologies which may reduce this demand.

Factor 3 – Changes are already happening: Factor 3 is defined by 2 significantly loading Q-sorts, accounts for 18.1% of the variance and has an eigenvalue of 1.63. In this final viewpoint, water quality (5/+4), soil quality (6/-3), rural area attractiveness (21/-4), uptake of mob/strip grazing (19/+3) are envisioned as changing after 10 years as a result of adopting ecological practices. Although identified as not a big issue in Scotland, water quality is expected to improve due to an expected reduction of nitrogen leaching due to ecological farming approaches. Soil quality was recognised as one of the many benefits in particular of ecological farming approaches. Soil health is here evaluated through biological, physical and chemical indicators. Contributing to these improvements in Eastern Scotland would be an increased adoption of mob/strip grazing, that may in turn reduce the need for fertiliser inputs and enhance the cycle of nutrients. Increased adoption of mob/strip grazing might be made easier with an increase in cooperation (14/+2) between different farms as ecological clusters (3/+3), which participants think likely to occur in order to increase crop-livestock integration and its benefits for nutrient cycling. Participants already think that Scottish rural areas are attractive, but ecological practices might make them even more so as it encourages the regeneration of fauna and flora.

5.5.14 Sweden - Plain areas in South and Middle Sweden

Factor 1 – Skilled cooperation: Factor 1 is defined by 8 significantly loading Q-sorts, explaining 25% of the variance in the study and has an eigenvalue of 12.07. In this factor, stakeholders think that a 25% adoption rate of ecological farming approaches is likely (2/+2), while 50% is very unlikely (1/-4). Skills are ranked as very important (12/+4) in this viewpoint and similarly farmers are anticipated to cooperate more with neighbours (14/+3). Female labour is not considered to be in more demand compared with male labour (26/-3). In addition, participants believe that consumers will not necessarily buy more of their food locally (15/+3), but that ecological farming will be more than just a limited social movement (16/-3).

Factor 2 – Little future change: Factor 2 is defined by 5 significantly loading Q-sorts, explaining 21% of the variance in the study and has an eigenvalue of 1.41. This factor has a similar predicted adoption rate as the previous scenario, but the 25% rate is emphasised as relatively more likely (2/+4) compared to other statements, while the 50% is emphasised as unlikely (1/-4). Certification (17/-3) is voiced here

more prominently – stakeholders do not think that there will be strict regulation on being ecological perhaps maintaining its current general definition. Also, little change is envisioned to take place in the landscape appearance (4/+3), except participants think the number and size of hedgerows may increase (7/-3). Lastly, consumers are not expected to change their habits much either (15/+3).

5.6 Discussion of the Q-methodology

The aim of this study was to analyse the socio-economic effects of the adoption of ecological practices across a wide variety of CSAs in 10 different EU countries. Q-methodology allows researchers to present a concourse of different opinions that exist relating to these effects to farmers and other stakeholders involved with managing or interacting with the land. The Q-methodology elicits views from experts on an uncertain future and explores the possible barriers and effects of adopting ecological practices.

A consistent viewpoint across all CSAs is the need of skilled farmers in the adoption of ecological practices. This is regardless of the pattern and rate of adoption – to continue farming and incorporating any ecological practices, a greater understanding of natural processes, knowledge of new technology and techniques, understanding of how changes in the environment may affect the farm as well as adapting to new policies, are needed. In some cases migrant labour contributes this requirement of skill which may be interpreted as stakeholders perceiving that farmers welcome the skill set possessed by experienced migrants and lacking in the local population.

Other changes are often dependent on the pattern and rate of adoption. Interestingly, each CSA has opposing factors that reflect viewpoints depending on the pattern and rate of adoption expected after 10 years. Those expecting a high adoption rate may be due to policy incentives such as in England and Scotland upon leaving the EU and a new agricultural policy. These same countries also have a viewpoint reflecting a lower adoption rate, where consumer demand is lower, the policies might not be implemented very well and certification that defines a farm as ecological is stricter. This dichotomy is shared across all CSAs, although the distinction might not be as large in Sweden as the others, and the Romanian CSA is discussed more in terms of speed of adoption rather than level (although an increased speed results in higher adoption). This bifurcation may be due to differences in definition of what exactly is an ecological farm in the area, whether it needs the full suite of ecological practices or moving in that direction. The factors sharing a low adoption viewpoint as in Sweden and Hungary expect minimal change in effects too, which is to be expected. In contrast, even when these practices see a low future adoption, their changes will complement the conventional practices, rarely require more physical labour, but occasionally more family labour as other sources of labour are difficult to find and family labour is more flexible.

Often where there are viewpoints of clusters of high adoption of ecological farming approaches, this is where there is a supportive movement behind the practices, especially notable in France and Poland. These movements are promoted by strong consumer demand for ecological products, cooperation between farmers and result in resilient rural economies. Where adoption is higher, landscape changes and ecosystem service provision are expected to be higher as in Italy and Greece.

In areas with more livestock, examples including the High Weald in England, Puy-de-Dôme in France, Scotland and the Austrian case studies, strip/mob grazing is expected to drive a transition to ecological farming approaches. However, opinions differ as to whether strip/mob grazing will increase or decrease labour requirements – it will certainly lead to an increase in required skill level. This distinction in labour needs may come down to the time spent with animals and level of automation. As reported in the High Weald, adoption of the practice reduces the amount of time the livestock

spend indoors, reducing peak times of labour as well as time clearing out the barns and feeding animals. If, as is possible here, automation is possible with electric fences then labour can indeed be reduced, otherwise it involves a lot of time moving fences. When time is freed, farmers find they are able to spend more time observing the livestock and keeping them in good health.

Weaknesses in the study include the extent to which the statements capture the entire discourse on socio-economic effects of ecological agriculture. This is a broad topic and further statements could have been created to reflect this. Illustrating this, is the single and unfortunately controversial statement relating to gender which reflected a stereotype as mentioned in the media. This statement could have been more neutral and less complicated regarding female labour and ecological farming, and then to capture more of the discourse combined with a statement about female managers on farms.

6 Conclusions

These two different methods, Delphi exercise and Q-methodology, have allowed for the study of complex qualitative questions in a structured manner in order to forecast the socio-economic effects of adopting ecological practices after 10 years. In an ideal setting, the Delphi should have been organised in advance of the Q-methodology from where statements could be created to manage the entire discourse, but due to time management concerns, the studies were run concurrently.

Both approaches reflected the complexity of adopting ecological approaches across all these different CSAs and their resulting diverse socio-economic effects. The Delphi exercise does this by first asking stakeholders about ecological practices existing in the study area and then how practices are adopted in the study area, before continuing onto the socio-economic effect questions which are then iterated across two rounds. Q-methodology meanwhile asks participants to sort a list of statements that outline the pattern and rate of adoption as well as possible socio-economic effects of this adoption scenario. As participants sort these statements, they may explain to researchers the reasons behind their individual Q-sort which provides added material from which researchers can interpret the subsequent factors.

Depending on local conditions, geography, farm type and national policies, ecological practices vary in each CSA. This leads to a variation in the pattern and rate of adoption of these practices in 10 years' time. Depending on this adoption, effects differ to be stronger in areas with higher and more clustered adoption. Meanwhile more spread and lower adoption often leads to little to no change, but skill level is something that, even given a small increase in ecological approaches, is expected to change.

Four key results are taken from the Delphi exercise and the Q-methodology.

First, skill level and quality of life in on-farm employment are frequently thought by stakeholders in the Delphi Exercise to increase as a result of the diversity of farming enterprises, the interest generated from this, the knowledge of natural processes and biology required, engagement with nature and new machinery that is coming into the industry. Strongly related to this need for skills is a predicted increase in the number of advisers and civil servants to deal with more complicated farms and incentives as well as monitoring of ecological effects on farm. An increase in required skill level is repeated across all Q-studies.

Second, especially where farms are clustered together, Delphi Exercise respondents predict an increase in the trade of inputs such as manure and compost replacing synthetic fertiliser, as well as more sharing of machinery and labour. Q-methodology highlights that these clusters may support a

stronger social movement, more consumers buying local food, and may increase collaboration between farmers. Supply chains are expected to become shorter as farmers sell more direct and there are fewer intermediaries upstream of the farming sector. As farmers collaborate more with each other on environmental objectives, trading inputs and sharing best practice, farmer relationships should improve in rural communities.

Third, Delphi exercise finds that contracting, machinery purchasers, and machinery traders and dealers could increase, decrease or not change – the anticipated effects are mixed. But, stakeholders conclude that a greater specialisation in machinery will occur leading to changes in farm management as well as the suppliers of this machinery. Q highlights that ecological practices will not mean the end of machinery and a lot more labour – often machinery will be useful in weeding and reducing physical labour as technology has significantly improved and skills are improving too in order to use these technologies.

Fourth, Delphi exercise respondents argued that although rural populations might be little affected from ecological farming, larger rural populations seeking a more attractive rural environment might contribute to higher local consumer demand. Q-methodology highlights that where there is high adoption, rural areas are expected to become more attractive as landscapes will have a much greater variety of crops instead of large fields of monocrops. This variety of crops may include agroforestry as well as intercropping.

Interesting policy recommendations come out from the divergence in policy between the two UK countries of England and Scotland. Stakeholders here anticipate a far higher uptake of ecological practices as the BPS is withdrawn and replaced only with AES. Stakeholders perceive that, in order to survive, many farms may need to adopt these practices which are predicted to make significant improvements in soil and water quality as well as biodiversity as a result. However, these farms still need to remain profitable, and in more fertile ground in North Kent farms may become more intensive.

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8 Appendices

8.1 Appendix 1 – Delphi exercise

8.1.1 Delphi questions

Delphi Round 1 Questions

1) What farm practices would an ecological farm use as opposed to a conventional farm? Would this type of farm be large or small compared to an average conventional farm in the area? Why? Please explain.

Please rank (on a scale from 1 being least important to 12 most important) the below farming practices into what is most important to defining an ecological farm		
Practice	% Top Rank	Average rating
Low tillage use		
Integrated Pest Management		
Integrated Weed Management		
Machine weeding		
Manual weeding		
Precision technologies		
Use of organic manure or compost		
Number of crops		
Extensive use of cover crops		
Strip grazing		
Integration of crop and livestock at farm level		
Alternative remedies for livestock disease management		

2) Statement	Rating
On a scale of 1-9 where 1 is significantly smaller, 5 is no change and 9 is significantly larger please indicate the size comparison of an ecological farm with a conventional farm.	

3) Is it possible to use natural processes to replace the use of chemical inputs on the farms in the area? If yes, what natural processes? If not, why?

4) If more farms became ecological in the way set out in the farm representative model, would more farms across the study area become mixed or would they remain specialised in livestock

or crop production? What proportion of the region's farms would become mixed livestock with crop production farms?

5) On the farms in the study area, is it realistic or not to have a system that integrates livestock, cover and catch crops, and direct drill practices? Please explain.

6) In the study area, is it realistic or not to only have farming systems that integrate crops and livestock?

7) Would there be a large need for machinery on an ecological farm in your area?

8) Would the type of practices implemented in ecological farms require the use of more or less labour, in terms of people and number of hours worked? Why?

Delphi Rounds 2 & 3 Questions

Section 1 - Pattern of adoption

Please fill out the %s in the below table with explanations for questions 1 and 2 of this section.

	Round 2		**Round 3**	
	Clustered – C	*Random Pattern - R*	*Clustered – C*	*Random Pattern - R*
Low Adoption Rate (L - 10%)	L-C: %	L-R: %	L-C: %	L-R: %
High Adoption Rate (H - 50%)	H-C: %	H-R: %	H-C: %	H-R: %

1) If farms were to adopt this ecological farming system in your case study area, would these farms be clustered together or spread across the territory? Please explain.

2) Would adoption of this regional ecological farming system be closer to a low (of around 10%) or a high proportion (around 50%) of the region's farms? Please explain.

Section 2 - On-farm employment effects across the study area

Questions 4-11 provide qualitative information supporting the Likert scale below in question 3.

3) What would be the impact on the following?		**Large decrease**			**Little change**			**Large increase**		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
a)	Total farm employment across the area	☐	☐	☐	☐	☐	☐	☐	☐	☐
b)	Need for migrant labour	☐	☐	☐	☐	☐	☐	☐	☐	☐
c)	Wage level	☐	☐	☐	☐	☐	☐	☐	☐	☐
d)	Gender balance of farm heads	☐	☐	☐	☐	☐	☐	☐	☐	☐
e)	Flexibility of working hours	☐	☐	☐	☐	☐	☐	☐	☐	☐
f)	Skill level of farmers	☐	☐	☐	☐	☐	☐	☐	☐	☐
g)	Quality of life of farmers	☐	☐	☐	☐	☐	☐	☐	☐	☐

4) What would the impact be on total farm employment across the area? Please explain.

5) Would there be differences in the nature of this employment, i.e. would there be more or fewer jobs that are full-time or part-time, would more or fewer farmers become self-employed or hired on the farm or in other areas of the value chain? Please explain.

6) Would farmers in an ecological farming system be able to work hours that are more or less flexible? Why?

7) Would the quality of life change for farmers within ecological farms? Positively or negatively, how might it change?

8) Would there be an increase, decrease or no change to the need for skills in the labour force? Please explain.

9) Would there need to be more, less or no change to migrant labour? Please explain.

10) Would there be more farm heads who are female, or more farm heads who are male? Please explain.

11) What would the effect on farm wages in the area be? Please explain.

Section 3 - Employment effects on industries supporting farming

12) Would the advisory service need to increase in personnel, decrease or no change?

13) What additional skills of farm advisors would be required by ecological farming?

14) What would be additional skills of civil service required by ecological farming?

15) Which actors in the food chain – up and downstream of agriculture - need to change their skills? Please explain.

16) Rank (on a scale from 1 being least change and 8 the biggest change) the following actors in the food chain into where the biggest change in skills and knowledge for engagement with ecological farming would need to be

Actor	Rank
Farmers	
Input suppliers	
Extension agents	
Civil service	
Consumers	
Retailers	
Food and drink manufacturers	
Wholesalers	

Section 4 - Supply chain effects

17) How would this impact on trade in inputs between farms, e.g. manure, seeds, hay?

18) Considering the list of below inputs, please rank (on a scale from 1 being having least change to 7 having most change) which input will have the biggest change in trade levels between farms?

Input	Rank
Animal manure	
Compost	
Seeds and plantlets	
Bulk feed and coarse fodder	
Concentrated feed	
Shared labour	
Shared machinery or equipment	

19) What would the effect be on contract farming?

20) How would this impact the purchase of tractors and other machinery?

21) How would this change the number of traders and dealers of machinery who operate in the region?

22) Would this modify supply chains?

Section 5 - Effects on rural communities

23) Would there be a change in the size of the rural population and thereby a change in demand for rural services? Please explain what may happen.

24) How would this affect the rental/purchase price of homes in rural areas?

25) How might relationships between farmers change?

8.1.2 Delphi on-farm labour results

Table 18: Labour effects round 2 average rating

Labour factors		AT – SU	ENG – HW	ENG – NK	FR – IV	FR – PdD	GR – EC	HUN - VES	IT - RAV	PL - LUB	PL - POD	ROM - SUC	SCO – ES + H&I	SWE – SMS	Average
a)	Total farm employment across the area	5.5	5.3	4.5	6.0	6.2	6.6	6.0	4.9	5.3	5.1	5.6	6.0	5.0	5.5
b)	Flexibility of working hours	4.3	6.2	5.3	5.2	5.8	5.4	5.8	5.5	4.7	5.4	5.6	6.1	5.0	5.4
c)	Quality of life of farmers	5.5	6.8	5.6	7.0	6.7	6.9	6.0	6.9	6.1	6.4	6.7	6.2	7.0	6.4
d)	Skill level of farmers	6.1	7.4	6.1	7.5	7.6	7.2	6.7	7.1	6.9	7.5	6.8	6.5	8.0	7.0
e)	Need for migrant labour	6.0	5.5	5.3	5.0	5.0	6.5	5.5	5.5	5.6	6.6	4.9	5.8	6.0	5.6
f)	Gender balance of farm heads	6.0	6.6	5.7	5.5	6.4	5.3	5.6	5.4	4.7	4.9	4.6	8.0	5.0	5.7
g)	Wage level	5.1	5.5	4.7	5.8	5.7	6.3	5.9	5.6	5.1	5.6	6.1	6.5	6.0	5.7

Note: Participants were asked to rate on a Likert scale of 1-10 each labour effect for whether they expect a large decrease (1 the largest decrease), no change (a rating of 5) or a large increase (10 the largest increase) in the labour effect of the adoption of ecological approaches 10 years in the future. The numbers presented in the table are an average rating of all participants in round 2 for each CSA.

8.2 Appendix 2 – Q-Method

8.2.1 Distribution grid for Q-sorts

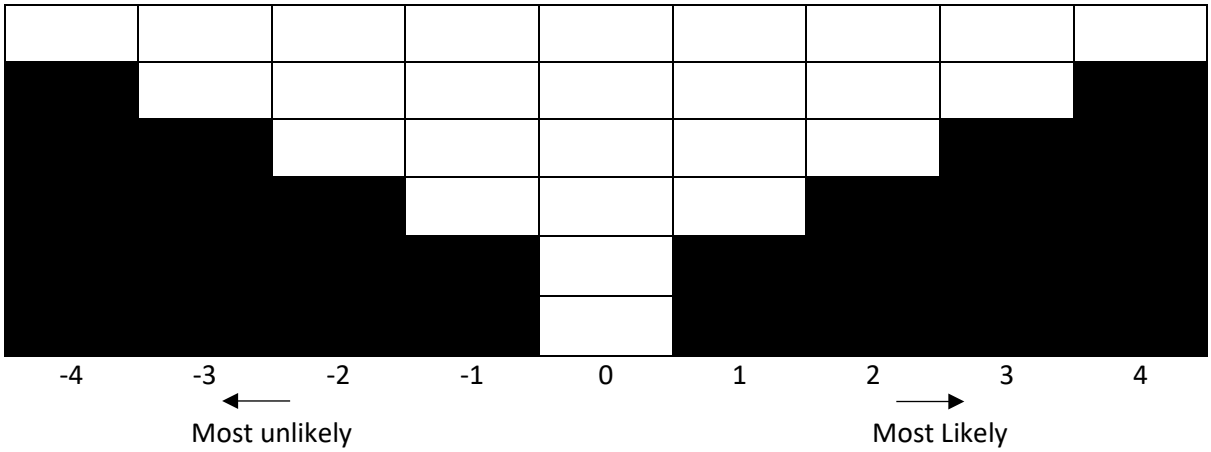

Figure 2: Distribution grid for Q-sorts

8.2.2 Q-set of statements

1) 50% of farms will adopt ecological farming practices.
2) 10% of farms in the case study area will adopt ecological farming practices.
3) Ecological farms will form clusters of closely connected farms within the case study area.
4) There will be little change in the landscape appearance of rural areas.
5) Water quality will improve.
6) Little change will happen to soil quality.
7) There will be no change in the number and/or size of hedgerows.
8) Employment opportunities in farming will increase.
9) The need for labour work of an individual farmer will be spread throughout the year.
10) The farmer's daily routine will become more varied.
11) The wider rural economy will be more resilient.
12) Farmers will need to increase their level of skills.
13) The nature of work on farms will be more physically demanding.
14) Farmers will cooperate more with neighbouring farmers and farms close to them.

15) Consumers will not buy a lot more of their food locally.

16) Ecological farming will be a limited social movement and will not provide substantial eco-system services.

17) There will be tight certification to define farms as ecological.

18) As a proportion of household income, income from farming will decrease.

19) More livestock farmers will use mob/strip grazing.

20) Mob/strip grazing will decrease the requirement for labour.

21) Rural areas will become no more attractive for residents and users.

22) There will be more need of seasonal labour.

23) The use of family labour will decrease.

24) There will be more need of migrant labour.

25) There will be no change in trade of locally sourced inputs.

26) There will be more demand for female labour for manual operations.