MIXED

EFFICIENT AND RESILIENT
MIXED FARMING & AGROFORESTRY

MIXED

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Executive Summary

The aim of the activity described in this Deliverable was to develop an understanding of the current state of mixed farming in Europe, visualise desired future states for mixed farming and identify implementation needs for achieving those future states.

A participatory back casting approach (Kanter et al., 2016) was implemented to identify possible transition pathways to future sustainable mixed farming systems. Back casting sets targets at a future date based on expert judgment, best available technologies and other factors, with technical pathways subsequently developed for achieving those targets by working backwards in time towards the present. It is a problem-solving approach which enables stakeholders to set priorities, rank solutions and identify steps that need to be taken (and when) to reach desired outcomes (Kanter et al., 2016). Back casting workshops were conducted in all 10 countries participating in the MIXED project. In some countries where there are multiple MIXED networks, two separate workshops were conducted. The workshops were organised, conducted and reported by the academic partner and network coordinator in each National Team. In total 13 workshops took place in Austria, Denmark (x2), France (x2), Germany (x2), Poland, Portugal, Romania, Scotland (UK), Switzerland, and The Netherlands

Outputs from each workshop have been collated and a thematic analysis undertaken to categorise the challenges identified along with their envisioned future ideal states and implementation needs foreseen. Six broad themes of challenges were identified from the workshop outputs: technical issues, knowledge and skills, farm business, supply chain, policy, and cultural challenges. Each of these individual challenges is further broken down and presented in sub-categories.

Regardless of the country/region in which the workshop took place, or the type of mixed farming and agroforestry systems (MiFAS) under discussion, the challenge themes identified were remarkably similar. Likewise, there was considerable agreement in workshops as to what the future visions of mixed farming and agroforestry systems and broader contexts (e.g. political, market, technical support etc.) should look like and this provides clear ambition and direction of travel for both the MIXED project and those with a vested interest in MiFAS going forward. Whilst the implementation needs to meet the ideal future visions were often more country specific, they point to different possible pathways to achieving those ideal future visions, that should be considered.

The outputs from these workshops are extremely important for not only providing context for the development of mixed farming and agroforestry in Europe but they also provide alternative future pathways and scenarios for testing in the various activities in MIXED. Whilst the MIXED project cannot provide answers to all the challenges raised in the workshops, the objectives of MIXED are such that through participatory research, data collection and analysis, scenario modelling and communication activities, MIXED will go a long way to facilitating more informed decision making by stakeholders regarding the development of sustainable and resilient mixed farming and agroforestry systems.

Abbreviations

D	Deliverable
EC	European Commission
WP	Work Package
WT	Work Task
MiFAS	Mixed farming and agroforestry systems

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1 Introduction

The overall aims of Work Package 1 in MIXED are to "Develop, improve and implement efficient and resilient MiFAS together with Networks of farmers and related agro-feed, energy, food and non-food value chains". The aim of the activities described specifically in this deliverable was to develop an understanding of the current state of mixed farming in Europe, visualise the desired future states of mixed farming and their contexts and identify implementation needs for achieving those future states.

In this task, a participatory back casting approach (Kanter et al., 2016) was implemented to identify possible transition pathways to future sustainable mixed farming systems. Back casting sets targets at a future date based on expert judgment, best available technologies and other factors, with technical pathways subsequently developed for achieving those targets by working backwards in time towards the present. It is a problem-solving approach which enables stakeholders to set priorities, rank solutions and identify steps that need to be taken (and when) to reach desired outcomes (Kanter et al., 2016). The outcomes of the back casting exercise contribute not only to this deliverable but will provide WP's 2, 3, 4, 5 and 6 with alternative future pathways and scenarios for testing with decision support tools developed in WP5 (Tasks 5.4, 5.5).

1.1 National Teams

The back casting workshops were conducted in all 10 countries participating in the MIXED project. They were organised, conducted and reported by the academic partner and network coordinator in each National Team - the farmer networks in each National Team were not directly involved in this activity. In the majority of countries only one workshop was conducted, but in France, Germany and Denmark, where there are two mixed farming networks dealing with two quite different types of MiFAS, two separate back casting workshops were conducted to take into account very different background contexts and draw on different groups of stakeholders. In total 13 workshops took place in the UK (Scotland), Austria, France (x2), Germany (x2), Denmark (x2), Portugal, Poland, Switzerland, Romania and The Netherlands (Table 1 for details).

Table 1 National Teams, MiFAS represented and workshop details

MiFAS represented	Country	Academic partner	Network coordinator	Workshop details
Poultry production (laying hens) integrated in fruit production	AT	BOKU*	BOKU	Online workshop held 23rd March 2021, 12 participants (organic certification, education, local government, innovative farmers, advisors, journalist) and 4 moderators.

Tall tree fruit farming mixed with livestock and cereal production	CH	FiBL*	Hochstamm-suisse	Online workshop held 3rd March 2021, 6 participants (research, farmer association, retailer, university, IPM umbrella organisation) and 2 moderators.
(Re)wetting of arable land, exchange of land between arable and livestock farmers	DE	IFLS*	Donaumoos	Online workshop held on 23rd March 2021, 10 participants (politics, farmers, research, agency, industry) and 3 moderators.
Integrated agroforestry, grassland and livestock systems			IFLS	Online workshop held on 23rd March 2021, 5 participants (forestry association, supply chain, farmer association, local government) and 2 moderators
Pig and dairy production integrated in energy crop production, local pig breeds integrated in fruit/nut production.	DK	AU*	Organic Denmark	In person workshop held on 11th June 2021, 9 project team (moderators, note takers and photographer) and participants split into two streams for discussions. Stream 1: 10 participants (farmers' association, organic association, academics, local government, farm advisors, animal welfare NGO's) and
Manure/grass protein exchange within a network of livestock and arable farmers			AU	Stream 2: 9 participants (farm/technical/research consultancy, local authority organisations, research, biomass producer).
Pigs integrated in agroforestry systems and cooperation with arable farmers to provide local produced feed sources	FR	AGROOF	AGROOF	Implemented a modified methodology (online discussions, face to face interviews and a small workshop) between March and Jun 2021. Stakeholders included farmers, technical specialists, researchers, supply chain members and producer organisations.
Crop and livestock/manure exchange between farms to produce young cattle meat fed on local produced feed sources		INRA*	INRA	Drew on the findings of previous workshops run as part of the French CASDAR RED SPyCE project:

				Resilience, Efficiency and Sustainability of crop-livestock systems 2017-18 (Mosnier et al., 2020). A similar methodology was applied, and a similar range of stakeholders participated.
Land and manure exchange within a network of arable (peat, sandy land) and livestock farmers	NL	WUR*	WUR	Online workshop held 8th July 2021, 3 participants (all lead or participate in cooperative activities), plus facilitators.
One farm (>2000 ha, 100 employees) with agriculture and product processing. Agroforestry in pasture and crop systems.	PL	IUNG-PIB*	Juchowo	Online workshop held in March 2021, 6 participants (NGO's, agricultural research, agricultural advisory) and 2 moderators.
Integrated production of pasture, cork and high value meat products based on local pig, cattle and sheep breeds	PT	ISA-Ulisboa*	CONSULAI	Online workshop held on 17th March 2021, 10 participants (farming union, farmer, research, supply chain, policy maker) and 7 members of the project team (presentation, moderation, note taking). Previous to this workshop, a network presentation meeting was held, also in online format, on 26th January 2021, which served as a working basis for this meeting.
Integrated livestock, natural pastures and trees supporting agro tourism	RO	IEA-AR*	Tinutul Posadelor	In person workshop held 6th March 2021, 14 participants (agricultural association, agro-forestry cooperative, environment NGO, consultant (x2), policy (x5), mixed farmer (x2), research (x2)) plus facilitators
Grazing cattle/fodder exchange within a network of beef suckler herds and arable farmers (East↔West Scotland)	UK	SRUC/ ABER*	SAOS	Online joint national workshop held on 5th March 2021, 9 participants (research, advisory, levy body, NGO, government) and 4 moderators
Grazing sheep/fodder exchange within a network of livestock and arable farmers (foraging winter cereals)			SRUC	

* National Team Leads

2 Methodological Approach

2.1 Training

A Workshop Guidance document was produced (Appendix 1) and online training conducted in January 2021 with all National Teams. The purpose of the training was to ensure everyone was familiar with the broad methodological approach and to discuss how it could be adapted to suit local conditions and particularly COVID restrictions in each participating country. Some partners chose at the outset to conduct online workshops, whilst others chose to wait until COVID restrictions allowed them to conduct in person meetings (Table 1.). The Workshop Guidance document also included templates for letters of invitation, consent to participate, workshop introductory presentation, workshop feedback and reporting.

As this workshop was designed to look at the broader context in which mixed farming takes place at a national or regional level, it was not necessary to define the MiFAS under discussion beforehand but that the common forms of mixed farming in the country/region would be elucidated during discussion. Partners were also advised that if there were multiple networks in partner countries (e.g., Germany, France, UK and DK), then efforts could be combined and only one workshop conducted - this choice was left to individual National Teams.

2.2 Participants

Participants were drawn from a wider range of stakeholders than the National Teams alone – this enabled a broader discussion of the challenges and future visions for mixed farming in the region/country. A mix of stakeholders from the following categories were considered: farming unions, farming cooperatives, supply chain members/representatives, NGO's (environment, wildlife etc), policy makers, researchers and advisors/consultants. 1-2 representatives from each of these stakeholder categories (allowing for 2-3 working groups of 4-6 people) was appropriate.

2.3 Workshop methodology

Generally speaking, the field of *futures research* is the study of possible, probable and desirable futures, i.e., alternative future scenarios that can be imagined, desired or considered probable. Two main approaches to futures research can be identified (Vidal, 2006):

• first the 'critique' phase of the actual situation, followed by visioning of preferable future situations and identification of the pathways needed to move from the current states to the possible futures.

• Second, a representation of a/the future preferable situation(s), followed by the analysis of the actual situation and the necessary actions to move from the current situation to a/the preferable one(s).

The methodology chosen for use in this workshop represents the future research methodology that belongs to the first category, starting from the critique of the current situation. The methodology was

planned with reference to the concept of the Future Workshop (Jungk and Müller 1987; Vidal 2006), a methodology which facilitates participation by actors and stakeholders in addressing real-life situations.

The methodology used was broken down into the key stages suggested by Vidal (2006):

• **The preparation phase (2.1 and 2.2 above):** Here the workshop programme (clear formulation of the aims and objectives, the invited participants, the methods, rules and the timetable of the workshop) was devised by the organizers of the workshop and the facilitators. The local facilities or online forum for the workshop was identified.

• **The critique phase:** Here, current mixed farming systems were critically and thoroughly discussed and investigated. Brainstorming was used as a creative technique followed by structuring and grouping of ideas into main sub-themes and ranking of importance for discussion.

• **The visioning phase:** Here the participants identified ideal futures in relation to the challenges identified in the previous step. Whilst no time constraints were imposed as to when the ideal futures might be achieved, participants were asked to consider what progress could be made over the next 5-10 years. Individual brainstorming was the approach used here, with participants then sharing their ideas in a group discussion.

• **The operationalization and implementation phase**: Here, the ideal futures were evaluated qualitatively, in a group discussion, in terms of their practicability and possible actions required to move toward the ideal futures elaborated.

• **The follow-up phase**: Here the outcomes of the back casting workshop are discussed in the context of the MIXED project and its activities.

The preparation phase occurred prior to the workshop commencing whilst the critique, visioning, and operationalization/implementation formed the activities of the workshop itself. Some aspects of the follow-up phase were included in the summing up session of the workshop itself. Further follow-up activity occurs here in this deliverable with the analysis and reporting of the workshops and subsequent further evaluation of pathways to implementation in other MIXED work packages.

A full description of the methodology is available in Appendix 1.

3 Results

3.1 Context of MiFAS in each country

The National Teams were asked to provide some context (and the extent) of MiFAS in their country/region.

3.1.1 Austria

Although in Austria small-scale agriculture is clearly dominating, the specialization of farms continues to progress. The number of farms where both animal husbandry and arable, vegetable or fruit production are practised are declining. This leads to a concentration of the different branches in some regions with frequently decreasing resilience of the farms. One example is the concentration of apple

orchards in Austria: 80% of all Austrian apples are grown in the southeast of Austria, in the region of Eastern Styria (BMLRT, 2021).

The increasing consumer demand for high-quality, organic food is increasingly satisfied by professionalized and intensified agricultural production. In organic agriculture, too, specialization and a tendency towards industrialization can be observed as side effects of an increase in efficiency. In Austria, since the year 2012, there was almost a doubling of the area under apples to 1,700 ha, which corresponds to a share of 22% of the total area under apples (Statistik Austria, 2018). Most of the organic apple orchards are concentrated in Styria with 70% (BMLRT, 2020). With the expansion of organic fruit-growing areas challenges arise concerning the ecologically appropriate regulation of pest populations. Likewise, organic laying hens are also being kept in large flocks. The outdoor runs are mostly insufficiently structured, and hens intensively use the area near the barns. High nutrient inputs in the proximity of the barns are increasingly and critically discussed (Elbe et al., 2005). However, specialization increases the risk for loss of farm resilience (Knickel et al., 2018), and mixed farming operations (MiFAS), which reconnect livestock and cropping activities are likely to be more resilient.

3.1.2 Denmark

3.1.2.1 Network 1 - Agroforestry

Many organic farmers in Denmark are increasingly considering the contribution of organic farming practices for the delivery of public goods such as biodiversity, c-sequestration, animal welfare and environment (less leaching of nutrients, and protection of groundwater, streams, fjords and sea). However, the integration of trees and shrubs with agricultural crops and animal husbandry is not a common practice in today's organic agricultural systems and there is interest in how agroforestry in organic farming systems can further contribute to the delivery of public goods.

3.1.2.2 Network 2 – Landscape nutrient cycling

Denmark is surrounded by shallow, nutrient vulnerable estuaries. Here agriculture is practiced close to the sea, and almost all drinking water is pumped from rural groundwater reservoirs. Some agricultural areas are highly vulnerable to leaching, and this is especially critical when combined with intensive livestock production. In one such area, situated around one of the inner parts of 'Limfjorden', initiatives are being taken to transform agriculture, including more grasslands and nutrient cycling, for higher nutrient and greenhouse gas efficiency, resilience to climate and other change, and multiple landscape level benefits including protection of the environment as the result. This transformation is linked with new biomass technology through which the grass is turned into protein fodder and feed, with side streams being used for cattle fodder and for biogas production with potential for both improved soils, energy production, fertilisers and various food- and non-food products as outputs.

3.1.3 France

3.1.3.1 INRAE

In France, crop-livestock systems have been decreasing since the second world war. They represented about 21% of farms in the 1980's and are now about 9% (Agreste, 2021). Traditional-integrated crop and livestock systems (ICLS) in Europe have been mostly maintained in less-favoured areas (regions with poorer soil and climatic conditions, such as mountainous and pre-mountainous regions), particularly in association with ruminant production, either cattle or sheep. Segregated cropping and livestock systems have become the dominant form of agriculture in most other regions.

Traditional-ICLS practices enable self-sufficiency and autonomy by producing all the necessary inputs to production, as well as a diversity of food products. Despite these advantages, most crop-livestock farms do not fully connect crops and livestock and still rely on input for fertilisation and animal feeding. Against these two trends, in France, the 4/1000 initiative, an effort to increase soil carbon stocks by 0.4% per year, (French Ministry of Agriculture and the Food and Agriculture Modernization Law, 2021) encourages more multifunctional practices and agroecology, in particular the improvement of soil quality through legume-based diversified rotations and reintegration of livestock into cropping systems.

3.1.3.2 AGROOF

Agroof is working with the association of Baron des Cevennes, a group of around 10 farmers who have decided to create agroforestry systems to promote the value of local oaks and chestnut trees to feed pigs.

Access to pasture is mandatory for certain certification schemes in France such as Label Rouge, organic farming and appellation of origin. Wooded pastures have existed traditionally in Europe for several centuries (extensive silvopastoral systems). Producers are becoming increasingly more interested in them due to the perceived high nutritional and culinary quality of products from agroforestry systems (Rosenvold and Andersen, 2003), and the high potential for added value. Scientific work has highlighted the value of wooded pastures on the taste and nutritional quality of meat, although genetic factors are also important (Lebret, 2008; Mourot and Lebret, 2009). Spanish oak (the "dehesas") or Portuguese oak ("montados") grazing practices are also recognized for their production and environmental qualities, including positive impacts on the landscape.

3.1.4 Germany

3.1.4.1 Extensive farming in the Swabian Donaumoos

Through agroforestry, farmers meet society's demand for healthy, high-quality products that respect animal welfare on agroecological farms. They reduce the negative externalities of the industry and propose facilities that promote adaptation and mitigation of the effects of climate change. This is a break with conventional farming methods in Germany and requires the establishment of relevant and objective standards.

A landscape area of about 10,000 ha (with 2,200 ha of peatland, and 2,700 ha of hillside and floodplain forest) is managed by the Swabian Donaumoos Association. This landscape conservation association is in Bavaria, Germany, and facilitates the development of a close partnership between agriculture and nature conservation. The focus is on preserving and developing an open, ecologically intact wetland landscape. The management of the peatland is based on a compatible land use (including trees and livestock) for nature conservation and climate change protection.

3.1.4.2 Agroforestry (conducted by IfLS)

Despite their various recognised benefits, only a few agroforestry systems are currently implemented in Germany. An essential prerequisite would be the availability of adequate support schemes, such as EU CAP subsidies from pillar I (e.g., Eco-Schemes) and pillar II, which - in turn - requires the recognition of agroforestry as a stand-alone land-use system. In 2021, public discourse and the increasing interest by policymakers may lead to the increased implementation of agroforestry systems. There is a range of more and less loose networks dealing with agroforestry in Germany, often operating on the local or even field level. Most notably, the German Association for Agroforestry (DeFAF) was founded in 2019. Also, the working group Agroforestry Germany is an association of active and interested scientists, consultants and practitioners, dealing with the use and research of modern and traditional agroforestry systems and agroforestry in Germany.

3.1.5 Poland

Specialisation in agriculture, which has been progressing for many years, has led to the formation of regions in Poland with different production profiles. In the north-eastern part of Poland (Podlaskie Voivodeship, the eastern part of the Warmińsko-Mazurskie Voivodeship and the northern part of the Mazowieckie Voivodeship) the farms are specialised in milk production and, to a lesser extent, in meat cattle breeding. In central Poland (Wielkopolskie Voivodeship and the western part of Kujawsko-Pomorskie Voivodeship) agriculture is concentrated mainly on pig production. In turn, the voivodeships of western and south-western Poland (Zachodniopomorskie, Lubuskie, Dolnośląskie and Opolskie voivodeships) are mostly stockless farms, specialised in cereal and oilseed rape production. Stockless farms are also dominant in Lubelskie voivodeship, but they are specialised mainly in production of fruits, vegetables and herbs. Most mixed farms are located in the south-eastern region (Małopolskie, Podkarpackie and Świętokrzyskie voivodeships). These are usually small farms producing mainly for self-sufficiency. Low economic efficiency is a significant barrier to their further development and the prospects for them are rather poor.

Juchowo Village Project is situated in Juchowo, a small village in the north-west of Poland. One of the project's core institutions is FSK Juchowo (Stanisław Karłowski Foundation). FSK Juchowo carries out various activities in the field of education and pedagogy, sociotherapy (rehabilitation of people with disabilities), scientific research and nature protection. Juchowo's 1,900 hectare biodynamic farm concentrates on dairy cattle and animal fodder production (grass and hay), but also on cereals, root crops and, to a minor extent, vegetables and fruit. One of the major challenges on the farm is to improve soil fertility without using any kind of artificial fertilizers. The soil, rather poor and sandy by nature, has been devastated by inappropriate cultivation in the past. To cope with this challenge, approximately 10 km of tree lines, tree rows and hedges have been planted in Juchowo over the last two decades to protect soil from water and wind erosion, but also to shape the landscape and provide habitats for animals and

plants. The beneficial impact of trees and hedges on agricultural production is still relatively unquantified in the context of Juchowo farm.

3.1.6 Portugal

In Portugal, farmers practice a specific type of Mixed Farming and Agroforestry System, named Montado. Montado is a UNESCO protected Mediterranean mixed system, comprising agroforestry activities and extensive livestock production. The system is dominated by scattered oak trees (*Quercus suber, Q. ilex, Q. rotundifolia*), associated with native pastures, forages, or feed crops. The livestock (beef cattle, sheep, goats and/or pigs) are characterised by low stocking rates, adapted to the poor soils and unfavourable climate conditions of the region.

Climate change and soil degradation, as well as poor crop management practices, have resulted in the decline of the Montado, due to weakening of root systems, drought, and the proliferation of pests. A new paradigm is required to adapt to climate change, while ensuring the economic viability and environmental sustainability of the farms.

3.1.7 Scotland, UK

In the UK, MIXED is implemented by SRUC, Aberystwyth University, SAC Consulting and SAOS in collaboration with two groups of farmers practicing mixed farming in Scotland. The first is the East-West Cattle Grazing Project – a network of farmers trialling movements of breeding cattle from west to east for out wintering on forage crops and the return of the breeding cattle from east to west Scotland for summer/backend grazing. The second is Sheep Grazing Winter Cereals – a network of farmers grazing sheep on winter cereals to the benefit of both the livestock and cereal crop.

Agriculture in Scotland includes both specialized and mixed farming. Scottish agriculture comprises 80% grass and rough grazing, and is dominated by cattle and sheep farming, which contribute around 42% of Scottish agricultural output (Economic Report of Scottish Agriculture, 2020). The east coast regions of Angus, Fife and East Lothian are characterised by arable farms, predominantly growing cereals, oilseeds and field scale vegetable production. As you move west and north, the importance of livestock increases. The farms in these areas typically have low stocking densities of beef and sheep.

Traditionally mixed systems include cereals, beef and sheep. In the most productive cropping areas very few farmers have livestock anymore. Agroforestry is not common, however increasing the area of forestry and woodland is the aim of Scotland's Forestry Strategy 2019–2029. In the last 100 years, forest and woodland cover in Scotland has increased from around 5% to 18.5%; this percentage is higher than the rest of the UK but is still well below the European Union (EU) average of 38% (The Scottish Government, 2019). Most of the wood produced in Scotland for downstream processing and manufacture is softwood from fast-growing conifer species (The Scottish Government, 2019)

Around 23% of agricultural land in Scotland is tenanted or crofted (The Scottish Government, 2015), compared with 15% of land in England (Defra, 2019), highlighting a key difference in farm structures in Scotland compared to the rest of the UK.

3.1.8 Switzerland

High-trunk fruit trees are fruit trees whose first branches begin at a height of 1.60 metres (1.20 m for stone fruit) and form large round crowns. They surround farms and villages as orchards, line roads and paths as avenues or are loosely distributed across the landscape as meadows. They thus differ from modern low-trunk orchards, which are grown as low spindles and are in dense, closed plantations. After the Second World War, the structural change in agriculture (high-trunk trees in the open landscape were increasingly seen as obstacles to production) and the expansion of the settled area initiated a decline in high-trunk orchards. More than 80% of the 15 million high-trunk fruit trees that were counted in the 1950 census have disappeared. The current stock is estimated at 2.3 million trees. There is however, a revival of interest in high-trunk fruit tree orchards with animals (dairy and/or beef) grazing underneath for their potential to deliver on biodiversity and other public goods objectives.

The Netherlands

The Veenkoloniën is in the northeast of the Netherlands and mixed farming in the region can be characterised as multi-farm landscape (Low et al., 2021), more specifically it is a cooperation between dairy and arable farmers. The cooperation is stimulated by an increasing need to close nutrient cycles locally and by opportunities to improve crop rotation (Spiegel et al., 2021).

Due to a relatively low organic matter content in the soil, temperatures in the topsoil vary, making the soil unsuitable for cultivation of many crops and vegetables. Consequently, the region largely relies on starch potato production in a 1:2-1:3 rotation with starch potato being rotated every second or third year with mainly sugar beet and wheat. Although starch potato is the most profitable crop in the region, such a tight crop rotation increases the risk of plant parasitic nematodes. Yet, extending crop rotation to control for nematode risk is challenging, as current price margins are already low. With an estimated net present value per hectare of arable land of 2,541 €/ha (Diogo et al. 2017), the region ranks amongst the least profitable in the Netherlands. This is why cooperation with dairy farms, to provide both manure to the cropping farms and enable a source of income (and feed for grazing dairy cows) from pasture breaks in the cropping rotation, is possibly promising. However, the relatively limited number of dairy farmers in the Veenkoloniën makes cooperation between arable and dairy farmers still uncertain.

3.2 Challenges, future visions and the way forward for mixed farming

This section presents a summary of the outputs from the critique, visioning and implementation phases of the back casting workshops. Outputs from each country workshop have been collated and a thematic analysis undertaken to categorise the challenges identified (critique phase) along with their envisioned future ideal states (visioning phase) and implementation needs foreseen (implementation phase). Six broad themes of challenges were identified from the workshop outputs, technical issues, knowledge and skills, farm business, supply chain, policy, and cultural challenges. Each of these individual challenges is further broken down into sub-categories, which are listed, along with the workshops in which they were raised in Table 2 below and presented in detail in the following sections. Each challenge sub-category is hyperlinked in Table 2 for ease of navigation around Section 3.2. In each of the sections 3.2.1 to 3.2.6, the workshops that raised the issues within the challenge theme are listed in the introduction paragraph

to the section and then within sub-themes the future vision and implementation needs are identified according to the specific workshop in which they were mentioned.

Table 2 Challenge themes and sub-categories (hyperlinked to relevant section) and the country workshops in which they were raised.

Challenge theme	Challenge sub-category	Country workshop(s) in which the challenge was raised									
		AT	CH	DE	DK	FR	NL	PL	PT	RO	UK
Technical	Agroforestry[1]		X		X	X				X	X
	Crop and livestock	X		X	X		X				
	Machinery				X						
Knowledge and skills	Knowledge transfer	X			X	X		X	X		X
	Research and demonstration	X	X	X	X				X		
	Training needs for mixed farming systems	X						X			X
	Ecosystems impact training		X	X				X	X		
	Agroforestry training		X	X		X					
Farm business	Perceived low profitability								X		X
	Reward for public goods			X	X			X	X		X
	High investment requirements							X			X
	Business development	X		X					X		X
Supply chain	Lack of market for mixed farming and agroforestry products	X	X			X		X	X	X	X
	Cooperation	X	X		X	X				X	X
	Consumer communication	X	X	X		X			X		
	Integration in the supply chain		X		X	X			X	X	
Policy	”Silo” approach to policy making			X	X	X		X		X	X
	Existing policy pre-conceptions		X		X			X		X	
	Administrative barriers				X				X	X	X
	Metrics				X				X		X
	Structural issues	X			X	X				X	X
Cultural	Farming as a career							X			X
	Motivation		X						X		X
	Trust and cooperation	X					X	X			
	Societal expectations			X	X						X
	Gender roles	X									

[1] See also Section 3.2.2. Knowledge and Skills challenges, with which there is some overlap.

3.2.1 Technical challenges, future visions and implementation needs

Specific technical challenges were identified in most workshops, the exceptions being Poland and Portugal. It should be noted that there is overlap between this section on technical challenges and section 3.2.2 on knowledge and skills challenges and between these two sections, all country workshops are represented. The technical challenges identified have been further grouped into those related specifically to agroforestry, crop and livestock interactions and machinery. Whilst not all challenges were fully developed through to the visioning and implementation stages in all workshops, it is important that they are still captured under each of the challenge themes.

3.2.1.1 Agroforestry

Challenge

- How to harvest (safe, cost-effective, efficient) high-trunk crops that have had animals grazing underneath them (i.e., avoid faecal contamination).
- Opportunities and cost implications of hand-picking fruit from high-stem trees (workload, methods, efficiency, cost, biodiversity, etc.).
- Farm machinery (e.g., cultivators, drills, mowers) not compatible with agroforestry plantations (e.g., too wide for rows).
- Understanding of agroforestry and silvo-pastoral systems with pigs (e.g., nutritional analysis of fruit; impact of fruit consumption on meat quality; feeding autonomy; animal welfare; pasture management and soil erosion; tree protection; tree plantation design).
- Integrating trees in livestock pasture systems which are in arable rotation (e.g., cereal production between pig grazing – by including trees, there is a loss of production (yield) and inflexibility when tilling, seeding and harvesting around the trees).
- Difficult to design agroforestry systems that meet multiple goals (e.g., reduced nutrient leaching vs more biodiversity vs carbon seq. vs production of tree fodder).
- Adapting agroforestry systems that produce a diverse range of products, from other climatic regions to suit local conditions (e.g., alternative forestry products (nuts) for Scotland).
- Managing wild populations of animals during woodland establishment (e.g., deer causing damage to young trees in Scotland).

Future Visions

- Practical, safe, and economic systems for harvesting fruit by hand without contamination from livestock manure. (CH)
- Crop management technology and robots suitable for use in divers cropping systems with agroforestry. (DK)
- Alternative tree varieties suited to Scottish conditions, and which produce a diverse range of products (UK)
- Defined deer management systems at the landscape scale. (UK)

Implementation needs

- Solutions related to hand picking top fruit (picking):
    - Develop knowledge (research) on which top fruit tree varieties produce the highest yielding and best quality fruit but also produce fruit more densely which makes hand picking more efficient (the picker can harvest more fruit before having to move) and economically viable.
    - Subsidies to pay for hand picking could make it more economically attractive, but this would need political will.

    - Effective marketing could motivate consumer willingness to pay a price premium for hand-picked fruit to cover the labour expenditure. (CH)
- Farmers' perceptions of what is technologically possible needs changing. (DK)
- Cooperation between the fruit sector and animal experts can find alternative (and technological) ways of grazing during the harvesting periods (CH).
- To address agroforestry and silvo-pastoral challenges with pigs in France:
    - Tree selection (variety and genetic identification) to improve tree productivity (oak with soft acorns) by evaluating individual tree and plot productivity in traditional fodder tree plantations.
    - Assess the impact of the agroforestry fruit on the main parameters of the meat quality (unsaturated fats for fresh or dried meats). Assess the economic impact of such a feeding strategy (extra-cost for fruit production and consumption vs better price of the final product).
    - Integrate fruit into livestock feeding strategies - coupling quality (see above) and productivity.
    - Assess the protection potential (shade, wind) of trees (species choice, pruning techniques). Develop pig housing with integration of trees or vegetation directly in the house architecture (with specific protection for the woody species against the pigs).
    - Research into the management of agroforestry systems with pigs in arable rotations in the Cevennes context (e.g., stocking rates, rotation length, integration of fodder crop production, seeding techniques, housing, use of nose rings in pigs).
    - Research into the protection of trees from pigs during establishment. (FR)

3.2.1.2 Crop and livestock

Challenge

- Grass production as a solution to many environmental problems (building organic matter, producing biomass for energy) might engender a new grass-based monocultural landscape instead of diversity.
- Developing and translating sustainable pasture management techniques to different environments (e.g., managing forest pasture, N and other nutrient supplies in alpine pastures, reducing herbicide use in pig grazed alpine pastures to control dock).
- Increasing circularity: Could dairy (and other livestock) farms (partially) switch to local fodder crops?
- Developing land exchange between arable and livestock (dairy) farmers for mutual benefit.

Future Visions

- Making visible both advantages and disadvantages of green biomass production for biofuels. (DK)
- Improve the organic matter content of arable topsoil through increased links (manure, grazed grassland in rotation) with livestock farmers. (NL)

Implementation needs

- Finding alternative and accessible protein sources other than grass. (DK)
- Develop and encourage implementation of sustainable (alpine) pasture management (e.g., adjust stocking density; optimize design of outdoor areas around housing; well-managed mobile housing solutions; subsidies; regulation). (AT)
- Reactivation of the circular farming economy (e.g., more solid manure composting, cropland rotation, more livestock on the farmland, reduced agricultural use of moors, more catch crops). (DE)

3.2.1.3 Machinery

Challenge

- Means of production often geared towards large-scale monoculture –Machinery not adaptable to small scale production.

Future Visions

- Overcoming challenges of machinery that is suited solely for large-scale monoculture.

Implementation needs

- Initiate collaborative knowledge sharing with successful companies experienced in share economies (e.g., Airbnb) to develop split/shared investment systems (50% farmers and 50% investors/local stakeholders/other public interests). (DK)
- Creating economic advantages by shared ownership and smart solutions to reuse/adjust existing production apparatus. (DK)

3.2.1.4 Concluding remarks – Technical challenges

Most technical challenges related to agroforestry and more general challenges related to system design and sustainability impact, came from workshops in countries where agroforestry was not currently a common farming practice (e.g., UK, DK). In the FR workshop there was considerable discussion around the implementation needs for designing an agroforestry system that delivered multiple sustainability outcomes. More specific technical challenges related to top-fruit production came from AT and CH. There were no agroforestry challenges from the PT workshop classified as technical despite this being the type of mixed farming system represented in MIXED. However, there is some considerable overlap between the challenges categorised into the technical theme, and those that come under the knowledge and skills theme – the latter being categorised based on specific mention of the need for knowledge, training or skill development, which in many cases was to address a technical challenge. Crop and livestock interaction technical challenges focussed on designing the most effective ways of introducing either crops, grassland or livestock into existing specialised farming systems. Machinery technical challenges (some also mentioned under the agroforestry sub-heading) related to the appropriateness of existing machinery for mixed farming system scale.

3.2.2 Knowledge and skills challenges, future visions and implementation needs

Knowledge and skills challenges were identified in all workshops except NL and RO. These challenges have been further categorised into five sub-groups relating to: knowledge transfer, research and demonstration, training needs for mixed farming, training on ecosystems impacts and training specifically for agroforestry.

3.2.2.1 Knowledge transfer

Challenge

- Existing Knowledge transfer mechanisms (education & consulting) promote specialization.
- Too little innovation in farm advisory services.
- Lack of mixed farming skills in advisory services and few agroforestry specialists.

Future Visions

- Farm advice and knowledge should be
    - locally developed,
    - embedded in cooperative ideas and scientific applications,

    - involve private industry and regulating authority stakeholders,
    - be financially supported by the state. (DK)
- Advisors trained in mixed farming and agroforestry systems.

Implementation needs

- Identify where mixed farming and agroforestry knowledge is lacking. (DK)
- Train advisors in mixed farming techniques and the facilitation skills for peer-to-peer learning. (UK)
- Translate mixed farming research to farmer friendly material and country specific contexts. (UK)
- Develop information materials on MiFAS. (PL)
- Train government inspectors to deliver more helpful advice at farm level rather than just undertaking regulatory checking. (UK)
- Identify the benefits of precision farming in the mixed farming context. (DK)

3.2.2.2 Research and demonstration

Challenges

- Comparatively few farms are currently practicing MiFAS - model demonstration farms would be needed to demonstrate these farming practices.
- How to best incorporate farmers/case studies in research, R&D, and subsequent communication activities?

Future visions

- Research and advisory systems that show the benefits of MiFAS through demonstration. (DK)
- Multidisciplinary collaboration that moves beyond current agroforestry research niches. (DE)
- Two-way communication between farmers and scientists. (PT)
- Topic-specific 'living labs' and 'lighthouses' (entire regions) as practical illustrative models for MiFAS. (AT)
- Basic and applied research under different farming conditions. (DK)
- Getting more farms (especially the large professional farms) involved in agroforestry. (DK)
- Farmers having the room (time, support, resources) to experiment with MiFAS. (DK)
- More (coordinated) research, innovation and development projects including a wide range of the stakeholders in the value/knowledge chain. (DK)
- Multi-stakeholder knowledge "hubs" with partners from universities, municipalities, farmers, advisors, fodder/seed companies (Ausumgård as a Danish exemplar). (DK)
- " Open access" to knowledge, for instance the SEGES database. (DK)

Implementation needs

- Gather and disseminate knowledge on best practice from other countries, focusing on countries outside of the EU. (DK)
- Look in other places for MiFAS solutions - curricula do not have to be designed from scratch. Networking with colleagues outside Switzerland might reveal existing programs that could be adopted. (CH)
- Further investment in both agronomic and social research to find solutions for environmentally friendly plant protection. (CH)
- Forming networks [Communities of Practice] could help with the dissemination of knowledge and give young farmers confidence to try mixed farming with high-stem trees. (CH)
- Use of monitor farm networks and greater emphasis on peer-to-peer learning, use of farmer ambassadors who speak to the media. (UK)

- Development of multi-actor network(s) to discuss the MiFAS management options within the CAP framework, followed by development of an "Inspiration-catalogue" listing various possibilities and targeted at farmers and consultants. (DK)
- Regulating authority and policy support for creating multi-actor networks. (DK)
- Creating 'liberated' farms for innovation hubs. Living lab approach with farms free of regulation. (DK)
- Collect and synthesise existing (national and international) knowledge and practical experiences and transform this into a "knowledge-catalogue". (DK)
- Formulate a project proposal with the main emphasis on compiling and synthesizing existing knowledge. (DK)
- Re-thinking "ERFA-groups": ERFA-groups are knowledge sharing groups between farmers having similar production systems, rethinking them could involve putting together farmers with different experiences from different production systems. (DK)

3.2.2.3 Training needs for mixed farming systems

Challenges

- Diverse production systems require multiple skills and today farmers are often specialized in one single strand of production.
- How to balance biodiversity, soil fertility, and air quality in fruit tree protection and produce commercially attractive fruit?
- Skills/knowledge gap in terms of whole-farm systems approach.
- "Low" general awareness of MiFAS.
- Administrative and financial skills needed for cooperation between dairy and arable farmers (e.g., entitlement to CAP payments; implications for derogation; manure spreading regulations etc.).
- Labour shortage as well as the need for specialised skills – inhibits mixed systems (in small and larger structures).

Future visions

- Mixed farming requires a holistic understanding of agricultural processes. It therefore needs systemic learning and education on all levels (young, old, urban, rural). (AT)
- Enrichment of secondary and higher school curriculum with MiFAS principles. (PL)
- Agro-ecological University course, CPD for farmers and industry, shared peer-to-peer learning and networking. (UK)
- Advice, training, support to ensure agro-ecological farming approaches are entrenched in the farming community. (UK)

Implementation needs

- To move the farming industry to a more systems mentality, with agro-ecology being the norm. To do this key performance indicators for agro-ecological objectives are needed, as are models for collaboration between specialists and generalists in order to share risk. Evidence to underpin mixed farming and agroforestry needs to be extrapolated to different (Scottish) conditions. (UK)
- Creating a system for training farmers in MiFAS production. (PL)
- Promotion of MiFAS among organic farmers as a way of creating buffer zones limiting the loss of nutrients. (PL)
- Understand the varied possibilities of mixed farming and how to make trade-offs without compromising business viability. (UK)
- Updated agricultural vocational school curricula which addresses the current (and future) demand for skilled workers able to operate modern machinery and work in modern processing facilities, or

to have the necessary financial, management and marketing knowledge to run commercially oriented farms. (RO)
- Legislative requirement for farm development plans that incorporates training. (UK)

3.2.2.4 Ecosystems impact training

Challenges

- Knowledge of the impact of climate change on MiFAS and how MiFAS can be mobilised to mitigate against this impact.
- Ecosystem (e.g., Montado) health and sustainability via better regeneration and maintenance practices, pest prevention and control.
- How to increase humus content in the soil.
- Lack of knowledge of ecological relationships and benefits.
- MiFAS are/have been lost due to intensification for value creation, which results in biodiversity loss.

Future visions

- Education is needed on various aspects of climate change (e.g., in the Montado preserving soil organic matter by reducing soil mobilization, water management solutions etc.). (PT)
- Making funds for the implementation of environmentally friendly innovations accessible to farmers. (PL)
- Training for improved drainage management in peatlands. (DE)
- Training to support a sustainable and healthy Montado (e.g., through education of all workers; focus on prevention rather than elimination of pests, use Forest Intervention Areas for education and demonstration etc.) (PT)

Implementation needs

- A political system (financial support based on actions implemented) to incentivise farmers to implement sustainable farming practices in high tree orchard/grazing livestock systems. (CH)
- Enhanced commitment of, and collaboration with nature associations. (DE)

3.2.2.5 Agroforestry training

Challenges

- Forestry culture and knowledge in farm estates (in the UK) has “died out.”
- More knowledge is needed on various topics related to orchard planning.
- Lack of knowledge on the effects of integrating trees (spatial design, number of trees, tree varieties/combinations etc.) on the environment, biodiversity, climate and animal welfare.
- Farmers and advisors lack knowledge of tree species, their nutritional value in livestock rations and the general planning of tree plantations.

Future visions

- Integration of agroforestry into (educational) training. (DE)
- Tree care and tree species selection needs to be emphasised in the basic education of trainee farmers. If topics do not receive a lot of attention in education, they can be perceived to be of limited relevance. (CH)
- Orchard planning should be included in farm advisor training. (CH)
- Connecting with the cultural past through rediscovery of old knowledge (e.g., on orchard planning), although this is accepted as being labour intensive, which means there must be some incentives for farmers to do it. (CH)

Implementation needs

- Farmers need tools to help them choosing tree and shrub species and varieties, integrating fodder trees in a daily forage table, and models to assess tree plantation options. (FR)

3.2.2.6 Concluding remarks - Knowledge and skills challenges

This was a theme discussed widely across the workshops (probably only second to policy challenges) and highlighted issues associated with a lack of understanding of farming systems in a sector where increasing specialisation has been the norm for many years. The discussions also highlighted the need for improved knowledge transfer systems, including expertise in MiFAS of those doing the Knowledge Transfer, and the need for effective demonstration of MiFAS approaches to encourage peer to peer learning. As mentioned in the concluding thoughts of Section 3.2.1, there were specific training needs identified for both mixed farming and agroforestry systems, many of which overlap with or complement the discussions on technical challenges.

3.2.3 Farm business challenges, future visions and implementation needs

Business related challenges were identified in DE, PL, PT, UK, FR, AT and DK. These were further grouped into three sub-categories: perceived low profitability, lack of reward for public goods and high investment requirements.

3.2.3.1 Perceived low profitability

Challenges

- Risk of financial drawbacks (loss of production) in MiFAS.
- Low attractiveness and economic efficiency of MiFAS due to high production costs and lack of a market for mixed products.
- Viability, profitability, and sustainability of the Montado.
- Economic imbalances between crops and livestock - insufficient profitability of livestock production.
- The perception that more integrated farming is going to lead to reduced income, reduced output, or financial difficulty.

Future Visions

- A system is needed that ensures farmers have all the available evidence at their 'fingertips,' so they can make an informed decision about the implications of transitioning to a mixed system. (UK)
- Enhanced awareness of [one's] business' finances, and a relatively strong financial position would help farmers make long-term decisions with regard to mixed farming and help withstand periods of reduced output/profit margins and perhaps susceptibility to market fluctuations. (UK)

Implementation needs

- Changing perceptions that more integrated farming will lead to financial difficulty would be helped by the availability of accurate evidence, data measurement tools and opportunities, and the will to capture that data; both on the individual farm level and in terms of the general pros and cons of moving to a mixed system. (UK)

3.2.3.2 Reward for public goods

Challenges

- Farming must still be profitable for the farmer even if the green agenda is pushed.
- The often high costs associated with shifting production towards a green agenda.

Future Visions

- Development of a (simple) grade/score-based support payment rewarding farmers who facilitate (expected) positive effects within biodiversity, climate, environment, animal welfare etc. through the implementation of agroforestry. (DK)
- The mixed farm is producing public goods that are better for the environment, hitting biodiversity goals, and are of higher quality as a result. (UK)
- Society is educated about the value of mixed agriculture. (DE)
- Valuation and payment for ecosystem services provided by agroforestry. (DK)
- Encouraging MiFAS farmers to publicly promote their products and practices as public benefits (on banners, information boards, etc.). (PL)
- Create conditions for minimal need for importation of food into a country. (DE)
- Support of local markets. (PL)

Implementation needs

- Create demand for ecosystem services delivered via mixed farming systems. (DK)

3.2.3.3 High investment requirements

Challenges

- Large initial investments are required for MiFAS.
- Farmers do not have the necessary financial leeway to adapt their operational structures and processes and maintain profitability.

Future Visions

- Low-interest loans, partly non-returnable loans. (PL)

Implementation needs

- Government support – in all facets – to facilitate smooth transition to mixed systems. (UK)

3.2.3.4 Business development

Whilst there was no specific challenge identified related to business development, there was general discussion around the concept under this farm business challenges theme, and future visions and implementation needs were described.

Future Visions

- Adaptable farmers and farm businesses. (DE)
- Farm Advisory Services providing business training for large numbers rather than advice-when-requested. (UK)
- Innovative direct marketing (partly digitized). (AT)

Implementation needs

- Pitching education at the right level – including when to engage learners for maximum impact and providing more advanced knowledge to those who want it. (UK)
- Harness the benefits of peer-to-peer teaching and learning rather than relying so much on traditional one-to-many approaches for giving farm advice; connecting groups of farmers together to learn from each other. (UK)
- Consult with farmers about their perception of the SWOT for mixed farming on their land and in collaboration with their neighbour landowners. (UK)
- Farm business focus on resilience rather than stability as climate change makes farming inherently unstable. (UK)

- Multidisciplinary support in message framing/persuasive messaging/behaviour change to encourage farmers to change to more positive farming behaviours. (UK)

3.2.3.5 Concluding remarks – Farm business challenges

This theme was dominated by discussions related to how mixed farming and agroforestry systems can be rewarded for both the food and public goods they produce. Discussion centred around the perceived lower profitability of MiFAS (due to higher labour costs, lower yields and lack of market premium for MiFAS products) and the need for a system to measure and reward public goods produced from MiFAS. There was also a general discussion around the need for farm planning and better understanding of costs of production across farming in general, but more specifically in MiFAS where there is often a complex mix of enterprises.

3.2.4 Supply chain challenges, future visions and implementation needs

Supply chain related challenges were identified and discussed in CH, UK, DE, FR, AT, DK, PL, PT and RO. This theme was further sub-categorised into challenges specifically related to lack of market for mixed farming and agroforestry products, cooperation, consumer communication and supply chain integration.

3.2.4.1 Lack of market for mixed farming and agroforestry products

Challenges

- Adding value with the term "agroforestry" - currently it's difficult to charge a price premium because of low consumer awareness.
- Selling fruit for a reasonable price.
- Good valuation of products, in particular animal products.
- Absence of clear market value for MiFAS outputs.
- Limited outlets (limited demand) and too few primary producers of green biomass.
- Reduction of value added by conventional marketing systems in which specialization is the standard currently; mixed systems need differentiated markets.

Future Visions

- A subsidy system that reflects the extra efforts of agroforestry systems, and payments attached to environmental and animal welfare benefits. (CH)
- The public goods value and outcomes of MiFAS are recognised and attract benefits. (UK)
- Product identification system for MiFAS products. (PL)
- Marketing path towards tourism and gastronomy. (AT)
- Support procurement of MiFAS food products for institutions (public procurement). (AT)
- Niche markets [for crop-livestock systems] relying on tourism, the image of terroir/diversified landscape, local inputs and encourage collaborative arrangements. (FR)
- Insurance to address market volatility. (FR)

Implementation needs

- Development of alternative selling channels for the small farmers. Wet markets are popular in urban areas, as they are perceived by consumers as supplying more diversified, cleaner, fresher and better-quality vegetables and fruit, at lower prices, as opposed to longer preserved and more processed products in the super- and hypermarkets. (RO)
- Avoid adding a new label "agroforestry"; instead, try to embed the concept in an existing suite of labels. (CH)

- Farmers encouraged to take more control of how they market their goods, including establishing local food economies; better collaboration between farmers to develop codes of practice to deliver measurable public good outcomes. (UK)

3.2.4.2 Cooperation

Challenges

- Reluctance for farmers to associate which prevents concentration of supply; hence wholesalers and retailers are not interested in buying products from small farmers, due to high transaction costs.

Future Visions

- Stronger local food supply chains (UK, AT) and local cooperatives throughout the value chain. (DK)
- Local anchoring of production through support to local innovators who can function as 'lighthouses' for the local community; farming cooperatives with shared machinery; investment by the local community on local farms to ensure engagement, commitment and support to local produce. (DK)
- Whole supply chains developed together at the regional level. (AT)
- Regional synergies (beyond farm level) - promote circular economy and territorial synergies by supporting collective actions (machinery cooperatives, shared rotations, mechanisation). (FR)

Implementation needs

- A cooperative/association with a larger number of members would have the necessary financial means to employ professionals as managers. This might be a solution to overcome the current reluctance to associate which is often fuelled by a lack of trust among potential members. (RO)
- Cooperation with major retailers but problem remains at to how to motivate them? (CH)
- Refer to Fur and Samsø (Danish islands) as exemplars of "locally embedded production systems with exchanges between farmers (manure, biomass, land, machinery). (DK)

3.2.4.3 Consumer communication

Challenges

- Consumer interest in mixed operations, but increasingly one-sided forms of operation: Contact between producer - consumer is increasingly weakened.

Future Visions

- Broader societal groups better informed about MiFAS and their benefits. (AT)
- Public awareness of agroforestry via a publicity campaign that communicates its biodiversity, sustainability, and animal welfare aspects. (CH)
- Targeted consumer information and raised consumer awareness by "actively shaping the flow of information/multimedia communication; developing marketing concepts (e.g., for special products, interesting product combinations) and establish a label for agroforestry." (DE)
- "Michelin-starred chefs or cookery schools to enhance the value of meat products in the sector (fresh or processed meat)." (FR)

Implementation needs

No implementation needs were described for this challenge.

3.2.4.4 Integration in the supply chain

Challenges

- Long complex supply chains are the norm.
- MiFAS' need differentiated markets and there is a lack of infrastructure for processing smaller batch sizes from mixed systems (e.g., lack of regional slaughterhouses).
- Value chains are often not geared towards local production.
- Unestablished (regional) value chains and weak infrastructure for agroforestry.
- Poor integration in agri-food chains (e.g., lack of storage & sales facilities).
- Quality control policies are poorly applied (if applied at all), allowing for imported low quality/falsified cheap products to enter the markets (dairy products, honey).

Future Visions

- Development of short (agri-food) chains through training for marketing local products, increasing consumer awareness and information, financial support for short chains and improved specific regulations for agro-tourism to allow local farmers to supply food to them. (RO)
- Improved storage facilities so that local suppliers can adequately (and economically) supply large retailers. (RO)
- Development of agri-food sectors entirely integrated upstream and downstream to enable shared risks and planning. (FR)
- Long-term contracts for purchasing fruit/nuts that give farmers confidence to plant the trees. (CH)
- Increased focus (scientific, political) on the challenges and problems that occur in the value-chain of imported foods. (DK)

Implementation needs

- Better political and financial support for selling/value chain infrastructure. (CH)

3.2.4.5 Concluding remarks – Supply chain challenges

There was crossover in this section with the discussion on business challenges (Section 3.2.3), particularly in relation to the lack of markets for MiFAS products and the need to measure and reward public good outputs. Cooperation between smaller mixed farming and agroforestry enterprises was identified as being essential in many countries to establish more localised, shorter supply chains to facilitate communication about the benefits of MiFAS with consumers and thereby attract price premia for products. Short, more localised/regionalised supply chains were discussed to encourage greater integration between supply chain actors which could lead to cost savings in terms of machinery inputs, processing and marketing.

3.2.5 Policy challenges, future vision and implementation needs

Policy challenges to MiFAS were described in CH, PL, UK, DE, PT, DK, FR, AT and RO. These challenges were further sub-categorised into those related to the perceived "silo" approach to policy making, existing policy pre-conceptions, weaknesses in current policy approaches, administrative barriers, lack of or inappropriate metrics for MiFAS and finally policy related structural issues.

3.2.5.1 "Silo" approach to policy making

Challenges

- "Silo" mentality amongst policy makers resulting in (e.g. agricultural and forestry) policy not being integrated.
- Lack of financial support for mixed farming and the needs of MiFAS operators not perceived by agricultural policy makers.
- High level of bureaucracy and administrative effort due to the intersection of several policy areas, and agriculture subsidy systems not always suitable for MiFAS.

- Legal conditions/regulations inhibit MiFAS ("the more diverse, the more difficult").
- Legal regulations and funding guidelines often inhibit MiFAS (e.g., organic status of forest pasture [laws in Austria]).
- Animal husbandry and plant production as separate regulatory domains (national) and generalized regulations (EU) that do not always fit local contexts.
- Monetary support system does not map MiFAS needs (e.g., more labour required).
- The challenge of integrating animal husbandry into agroforestry systems which is hampered by outdated legislation, including a rigid separation of land-uses for agriculture and forestry.
- Current lack in support schemes [for agroforestry] and their associated administrative difficulties, both of which have their origin at the EU- and even WTO-level."
- Risk of losing common agricultural subsidies if planting trees in feasible agroforestry designs.

Future Visions

- Integration of farming and forestry policy to reduce tokenism among agroforestry. (UK)
- Remove 'silo thinking' by encouraging collaboration at all levels of agriculture, via policy, education, CPD/training, etc. (UK)
- Encourage industries and sectors to consider the big picture and not just confine their operations to their skillset or areas of interest. (UK)
- Establish agroforestry as the "fourth land-use category" AND integrate agroforestry as an Eco Scheme into CAP funding. (DE)
- Authorities allow for complexity in agroforestry systems in Germany AND integrate the complexity and multifunctionality of agroforestry in legislation and regulation. (DE)
- Create a wide range of legal instruments to facilitate the functioning of MiFAS. (PL)
- An integrated policy agenda focusing on best outcome rather than the easiest way of delivering an outcome. (UK)
- Rather than just seeing food as a commodity – as a calorie – that all the other issues surrounding its production and consumption (e.g., pesticide use and human health, air pollution sources from agriculture) are considered by policy makers. (UK)
- Encourage and reward collaboration. (UK)
- A "free-choice subsidy/support payment-system" with a list of, for example, ten aspects (biodiversity, climate, environment, animal welfare etc.) and if the farming systems perform on a minimum of e.g., three aspects, they will receive agroforestry subsidies/support payment. (DK)
- A long-term policy horizon to fit with the long-term nature of agroforestry. (UK)
- Lobbying activities that foster cooperation between farming and animal welfare and nature conservation associations to support and strengthen the development of agroforestry systems. (DE)

Implementation needs

- Policy makers and government should avoid trying to simplify complex problems. Specialism, climate change and carbon sequestration, land ownership, land operation/management - and how they all interact – is a complex system with complex challenges. 'For the sake of simplicity' often leads to misinformed and ineffective attempts at resolution. (UK)
- There are some specific regulations for agro-tourism that need to be changed, such as allowing the use of local products in agro-tourism facilities, so that neighbouring farms can supply local products. (RO)
- Explore the regulations [in France] about livestock breeding systems in forestry land and also environmental legislation (e.g. water protection). Imagine some contract between landowners and farmers (conventional lease or sharecropping agreement). (FR)
- Find a way to encourage greater public and industry connection to the growing process and prioritise biodiversity. (UK)

- Invite policy makers to farm visits to show agroforestry in practice and to discuss knowledge gaps etc. (DK)
- Use knowledge from other valuations of land-use (e.g., afforestation, ground water protection schemes, set-aside of carbon rich lowland soils, etc.). (DK)
- Government, scientists, and farmer representatives should collaborate to help reconcile the tension (what the market wants, what it needs, and what the farmer is paid for) and help farmers reconcile competing needs. (UK)

3.2.5.2 Existing policy pre-conceptions

Challenges

- Disproportionately higher (often hidden) support for intensive conventional production than for pro-environmental, sustainable production.
- We are led to believe that [specialisation] is how you make the most money
- Global context which encourages specialization: political (aid, policies, public), economic (sectors, markets), and support (advice, training) aspects.

Future Visions

- Lobbying for MiFAS and financial support (subsidies) for MiFAS (all countries).
- Regulations that accommodate the green transition (biodiversity and sustainability) and not the status quo production systems. (DK)
- Greening of conventional agricultural production through political and legal solutions. For example: "Implementation of a comprehensive tax regulation system, including the introduction of tax credits" and "Tightening the 'the polluter-pays' principle." (PL)
- Focus on extensive animal breeds and alternative livestock systems. (PL)

Implementation needs

- Lobby actions on the part of the labels (e.g., IP Suisse) might contribute to convincing the state to subsidise environmentally sustainable production. (CH)
- Frame the messages around mixed farming to change industry perception that it is only being pushed by environmental lobbyists. Instead it is a legitimate option and a flexible and economically sound model for businesses to be looking at. (UK)
- Better qualified personnel (with improved professional skills) in technical positions in public institutions. (RO)

3.2.5.3 Perceived weaknesses in current policy measures

Challenges

- CAP: low effectiveness of pro-environmental EU policies.
- Misuse of instruments/tools and support.
- Water environment regulations limit and restrict possible land use.
- The EU regulation framework is not always suitable for Danish conditions.

Future Visions

- Appointment of free municipalities/free countries in relation to EU regulation. (DK)
- Increased focus on local solutions developed in collaboration with local stakeholders. (DK)
- To overcome institutional challenges in Romania: "Simplification of current rules and regulations based on previous experience and good practices; harmonization of practices in funding agencies; institutional reform in order to better adapt to local development needs; flexible funding programs, able to adapt to the local needs; improved quality of human resources in public institutions and improved vocational education and training." (RO)

- Meeting water environment regulations through the involvement of local stakeholders/landowners and with the acknowledgement of regional differences and similarities. (DK)
- Governments could be more prescriptive about land management practices, as they have historically (e.g., Dig for Victory during WW2). (UK)
- Fair prices paid for food at the point of purchase so that subsidise for agriculture are not needed. (UK)

Implementation needs

- More bottom-up approaches, local meetings, resources, focus and changes in local cultural approaches. (DK)
- Make animal welfare and conservation schemes mandatory. (DK)
- Promote widespread awareness of what 'payment for public goods' does to the market. (UK)
- To meet water environment regulations initiated local/municipal strategies supported by the state authorities. (DK)
- Mixed farming systems currently fit poorly into support funding structures - change regulation concerning flexibility of the status of landscape elements. (AT)
- Distribute knowledge about regulation, compensation and reasons for changes in landscape to farmers well in advance for implementation. (DK)

3.2.5.4 Administrative barriers

Challenges

- How farmers interact with and are constrained by those [policy environment-] imposed systems of payment allocation.
- High administrative requirements and risks associated with animal production (animal welfare, sanitary conditions).
- Large administrative burden – e.g., specific, and separate licence requirements for all aspects (maintenance, felling, grubbing up, etc.) of the oak trees in the Montado.

Future Visions

- Have an accurate system of measures in place to understand where we are now vis-à-vis the impact of changes made by individual farmers to the whole system. (UK)
- Reconcile the tension between what the market wants, what it needs, and what the farmer is paid for. (UK)

Implementation needs

- The regulating authorities must centrally administer and initiate a unification of the different regulations (plant production/husbandry/trees) to simplify and unify regulation processes. (DK)
- A simpler payment scheme system AND the option to 'opt out' of support payment schemes if it makes practical sense. (DK)
- Interpretation and implementation of rules and regulations should be similar all over the country. (RO)
- Improve farmer autonomy to make decisions and to do things a bit differently, not in the interests of agri business in general but in the interests of the individual farm and farm business. (UK)

3.2.5.5 Metrics

Challenges

- Industry obsession with carbon. Not the right metric to be using, at least as an overriding factor. What should we be measuring instead?

- What is the value of sustainability? What is the value of ecosystem services?

Future Visions

- Recognise and monetise the range of potential products of agroforestry. (UK)
- A widely accepted, evidence-based metric on which to judge farm effectiveness and efficiency. (UK)
- A measure of overall agroecosystem health, possibly multifaceted, but allows for intra-farm assessment (i.e., year-on-year improvements) rather than encouraging inter-farm comparison and competition. (UK)

Implementation needs

- Consult with stakeholders about what data is needed, how to capture them, and how to encourage stakeholders to be involved in measurement, to facilitate the view of food production as a process not just a commodity/outcome. (UK)
- More transparency regarding priorities and goals associated with the different payment schemes. (DK)
- Stakeholders must collaborate to overcome the difficulties of biodiversity assessment, both technically and on the level of personal barriers to undertaking the work. (UK)
- Share case studies of successful agroforestry systems from other countries. (UK)
- Encourage recognition that benchmarks can be helpful when utilised appropriately (e.g., once your intra-farm assessment is measuring up to scrutiny). (UK)
- Because of its policy emphasis, demonstrate how Net-Zero looks via mixed demo systems. (UK)
- Collaboration between the scientific community and farmers to identify the appropriate matrices/parameters for assessment and ways to encourage implementation of the measurement solutions. (UK)

3.2.5.6 Structural issues

Challenges

- Land tenure – a high proportion of tenant farmers in Scotland – short tenancies mean little incentive for woodland management.
- Many different landowners make land politics and landscape changes complicated.
- Land fragmentation (very small farms, many small plots).
- Labour shortage – as well as the specialised skills needed – inhibits mixed systems (in small and larger structures).
- Price pressure forces specialization (e.g., organic pigs); the resulting development inhibits small-scale value chains.

Future Visions

- More room for alternative ownership models. (DK)
- Policy solutions to help land fragmentation issues in Romania. (e.g., establishing agricultural associations (pooling together farmers' plots); increasing farm size through land lease; changing the regulations regarding the land market; fostering land consolidation through plot exchanges; fostering land consolidation through land taxation regimes). (RO)
- Flexible tenancy cycles with better sharing of resources between landowner and tenant. (UK)
- More comprehensive training, reactivate agricultural apprenticeships (Swiss concept). (AT)
- Improved incentives for workforces (e.g., increase of salaries; decrease of salary taxation; improved regulations regarding labour contracts (mainly for daily workers)). (RO)
- Reduced incidental wage costs (incl. social security). (AT)

- Policy shift that discourages seasonal rentals that often bring corresponding poor land management practices (e.g., penalties for leaving soil in a worse state after a let than at the outset (NB. This relies on availability of accurate measures)). (UK)
- Partnership with landowners to increase the availability of land suitable for pigs. (FR)

Implementation needs

- Land tenure and ownership - agreements between tenants and landowners with shared obligation and reward for land management. (UK)

3.2.5.7 Concluding remarks – Policy challenges

Policy challenges were discussed in greater depth than any other challenge, with participants identifying problems with existing policy to support MiFAS, for example an entrenched silo approach to agricultural and environmental policy making across Europe, existing pre-conceptions about specialisation in agriculture being the most efficient approach to farming and general weaknesses with the current CAP to support MiFAS. The lack of metrics tailored to evaluate the sustainability performance of MiFAS was also identified as a weakness when it came to influencing policy makers as to the benefits of MiFAS over other forms of agriculture. Metrics used by policy makers are often assessed at a single point in time, and it is possible due to their diversity, that MiFAS might buffer adverse events and lead to maybe less productive but more stable operations over time. Heavy administrative burdens associated with the multiple enterprises seen in MiFAS was perceived as a barrier to encouraging others to take up mixed farming and agro-forestry practices. Structural issues, for example, a prevalence of short-term tenancies in Scotland, was observed to be a barrier to agro-forestry particularly, due to the long-term nature of forestry systems.

3.2.6 Cultural challenges, future vision and implementation needs

Cultural challenges to MiFAS were described in AT, CH, DE, DK, NL, PL, PT and UK. These challenges were further sub-categorised into those related to farming as a career, motivation, trust and cooperation, society expectations and gender roles.

3.2.6.1 Farming as a career

Challenges

- Low attractiveness of the farming profession resulting in a lack of young people in agriculture.

Future Visions

- Conditions created to make the farming profession more attractive. (PL)

Implementation needs

- Entrance and exit schemes for farmers that allow for a greater proportion of younger/more innovative farmers to be in control of the farm; leadership and empowerment training for next generation of farmers; innovative partnership structures within family or with new entrants; career progression structure in farming; increased diversity in farming communities; structural changes to tenant/landowner relations to facilitate innovation by tenant farmers; capital available for entry into farming; better range of digital technology to communicate with the farming community where there is a high prevalence of dyslexia. (UK)

3.2.6.2 Motivation

Challenges

- Lacking the workforce and motivation to adopt/maintain livestock.

- Advanced average farmer age means they will not directly benefit from planting trees on their farm.
- There is political pressure to produce sustainably, but farmers must be motivated to implement the results of agronomic research, which has some implications regarding knowledge and incentives.
- Inertia – making change is difficult, especially in farming businesses.

Future Visions

- An empowered younger generation of farmers spearheading a changed culture. (UK)
- A population of farmers who are forward thinking. (UK)

Implementation needs

No specific implementation needs were described.

3.2.6.3 Trust and cooperation

Challenges

- Low level of trust in cooperation among farmers in relation to crop and soil management (e.g., "is my neighbour taking good care of the land (disease, weeds, heavy machinery, crop choice)". Cooperation is not always easy, not all farmers are ready. (NL)
- There is a lot of good will and talk but implementing cooperative practices takes time, especially when it must be done in collaboration with local councils and governmental bodies.

Future Visions

- Mechanisms in place to encourage farmers to form groups and cooperatives. (PL)
- New cooperation concepts (within and between companies). (AT)

Implementation needs

- Establish appropriate production standards for MiFAS to facilitate farmer groups and co-ops. (PL)

3.2.6.4 Societal expectations

Challenges

- Low acceptance of the realities of rural and agricultural functioning.
- Lack of awareness in society - what is [MiFAS] worth?
- Strong societal expectation on the maintenance of landscapes and the environment.

Future Visions

- Improved understanding of good farming practices and ecosystem service delivery in urban communities. (UK)
- Recognition (through markets or policy) of the value of production of food and ecosystems services. (UK)
- Society understands that agriculture "fulfils an important task for society as a whole – and this is not just food production." (DE)
- Raised public and policymaker awareness of how farmers have to feed the country in the face of volatility and chaotic political situations, social challenges, and dealing with ever changing and ever more dramatic weather events. (UK)
- Societal support for and understanding of the [sustainability and biodiversity] goals and means to get there.

Implementation needs

- Think carefully about how to portray mixed farming systems to capitalise on 'changing winds,'(e.g., tie in to increased emphasis of people's environmental values). (UK)
- Farmers talk to the general public/society and show how they do things. (DK)
- Create demonstration farms (e.g., Monitor Farm Programme) that show the benefits of a mixed system, on lots of different levels. (UK)
- More and broader (not only farmer magazines) dissemination of the 'good stories' to highlight the positive effects of agroforestry. (DK)
- Support (economically/regulatory) for local initiatives and projects aimed at improving sustainability that offer communities the chance to get involved. For example, via grant funding to municipalities that can be given to green initiatives based on multi-stakeholder knowledge sharing in relation to sustainability and biodiversity. (DK)

3.2.6.5 Gender roles

Challenge

- In relation to labour and skills shortages that inhibit MiFAS development: Gender roles have a reinforcing [self-perpetuating?] effect.

Future visions

- Specifically address women, address gender roles (in a broad sense) in relation to labour and skills shortage in MiFAS. (AT)

Implementation needs

None specifically described

3.2.6.6 Concluding remarks – Cultural challenges

Discussion focussed on the lack of attractiveness of farming as a career for young people and the need for this to change in order to encourage older farmers (often with entrenched ideas/ways of doing things) to retire and new, more innovative farmers to enter the industry. Lack of motivation (and perhaps incentive) to move from specialised systems to those where crops and livestock are integrated was also identified as a challenge. This links closely with the knowledge and skills challenges which highlighted the lack of knowledge/understanding of mixed farming system approaches and the reinforcement through education and identified policy challenges, that specialisation is better. Lack of trust and cooperation was also mentioned here (see supply chain challenges as well) as a barrier to establishing useful collaborative relationships (peer to peer and supply chain) to support the shift to MiFAS. Pressures from society regarding the delivery of public goods (including landscape maintenance) were observed to be a challenge generally for farming, with the general public being perceived as having little understanding of farming and its contribution to society, particularly the case with MiFAS for which there was no clear set of production principles/rules that could be communicated to the public (in contrast to certified organic, for example). Gender was mentioned specifically in the context of labour and skills shortage in MiFAS and the need to consider the specific needs of both men and women in the workforce to address these issues over the long term.

4 Conclusions

The aim of these back casting workshops was to develop an understanding of the current state of mixed farming in Europe, visualise the desired future states of mixed farming and identify implementation needs for achieving those future states.

Regardless of the country/region in which the workshop took place, or the type of MiFAS under discussion, the challenge themes identified were remarkably similar. Likewise, there was considerable agreement in workshops as to what the future visions of mixed farming and agroforestry systems should look like and this provides clear ambition and direction of travel for both the MIXED project and those with a vested interest in MiFAS going forward. Whilst the implementation needs to meet the ideal future visions were often more country specific, they point to different possible pathways to achieving those ideal future visions, that should be considered.

The outputs from these workshops are extremely important for not only providing context for the development of mixed farming and agroforestry in Europe but also provide alternative future pathways and scenarios for testing in the various activities in MIXED. Whilst it is clear that MIXED cannot provide answers to all the challenges identified in the workshops, Table 3 below, which maps MIXED objectives with identified challenge themes, indicates that even if the challenge cannot be resolved, MIXED will go a long way to facilitating (through participatory research, data collection and analysis, scenario modelling and communication activities) more informed decision making by stakeholders regarding the development of mixed farming and agroforestry systems.

It is essential that this report is reflected on and the contents used by all those involved in the MIXED project to inform and frame research and communication activities within the real world context.

Table 3 Mapping of identified challenges across MIXED objectives

		Identified MiFAS Challenges					
MIXED WP Description	**MIXED WP No.**	**Technical**	**Knowledge and skills**	**Farm business**	**Supply chain**	**Policy**	**Cultural**
Developing efficient and resilient MiFAS through the multi-actor approach and transdisciplinary learning.	WP1	**x**	**x**	**x**	**x**	**x**	**x**
Assessment of impacts: efficiency, resilience, and adaptation and mitigation to climate change.	WP2 - Farm	**x**	**x**				
	WP3 - Landscape	**x**	**x**			**x**	
	WP4 – Supply chain		**x**		**x**	**x**	
Farm-level decision-support for optimizing efficiency, resilience and environmental benefits.	WP5		**x**	**x**		**x**	

Multiscale integrated assessment of efficient and resilient MiFAS.	WP6			**x**		**x**	**x**
Communication, dissemination and outreach.	WP7		**x**			**x**	**x**

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6 Appendix – Back casting Workshop Guidelines

GRANT AGREEMENT 862357

MULTI-ACTOR AND TRANSDISCIPLINARY DEVELOPMENT OF EFFICIENT AND RESILIENT MIXED FARMING AND AGROFORESTRY SYSTEMS (MIXED)

Future Scenarios of Mixed Farming in Europe – Workshop and Reporting Guidelines

Authors: Pip Nicholas-Davies and Simon Payne (ABER) and Robert Home (FIBL)

For the delivery of:

Task 1.2 Understanding the current state and visualising the future state of mixed farming in Europe.

D1.1 European MiFAS 'state of the art' and future scenario publication [Month 12].

Table of Contents

1 Introduction and Objectives

The overall aims of work package 1 are to "Develop, improve and implement efficient and resilient MiFAS together with Networks of farmers and related agro-feed, energy, food and non-food value chains". The aim of Task 1.2 specifically is to understand the current state and visualise the future state of mixed farming in Europe.

In this workshop, a participatory back casting approach (Kanter et al., 2016) will be implemented to identify possible transition pathways to future sustainable mixed farming systems. Back casting sets targets at a future date based on expert judgment, best available technologies and other factors, with technical pathways subsequently developed for achieving those targets by working backwards in time towards the present. It is a problem-solving approach which enables stakeholders to set priorities, rank solutions and identify steps that need to be taken (and when) to reach desired outcomes (Kanter et al., 2016). The outcomes of the back casting exercise will contribute to the publication D1.1 European MiFAS 'state of the art' and future scenarios and provide WP's 2, 3, 4, 5 and 6 with alternative future pathways and scenarios for testing with decision support tools developed in WP5 (Tasks 5.4, 5.5).

2 The Preparation Phase

Workshop training will take place with all Participatory Learning Hubs (PLHs) to familiarise themselves with the methodology and to assist with adjustments to the workshop timetable for local conditions. The training will also cover the reporting requirements for the workshop.

In terms of defining the type of mixed farming systems under discussion in the workshop, we believe that given this workshop is designed to look at the broader context in which mixed farming takes place at a national or regional level it is not necessary to define the MiFAS under discussion beforehand but that the common forms of mixed farming in the country/region will be elucidated during discussion. If the are multiple networks in partner countries it is possible merge the back-casting workshops with the approval of Task 1.2 Leaders.

Table 1[■]: Network theme organisation and general characteristics of 14 existing networks.
*) 1: Arable crops integrated with livestock, 2: Livestock and energy crops (or other fodder trees), 3: Fruit/nut trees/bushes and livestock or arable crops

		Network theme*			No. of farms				Livestock specie				Production		Market		Mixed scale	
Network no.	Country	1	2	3	1-10	11-30	31-50	>1.000	Cattle	Pig	Poultry	Sheep	Conven-tional	Organic	Mainstre	Niche	Within farms	Between farms
1	DK		X	X	X				X	X	X			X	X	X	X	
2	DK	X				X			X	X			X		X			X
3	UK	X			X				X				X		X			X
4	UK	X			X							X	X		X			X
5	DE	X					X		X				X			X		X
6	DE		X	X		X			X		X		X			X	X	
7	CH			X				X	X				X	X	X		X	
8	AU			X	X						X			X	X		X	
9	Fr		X			X				X			X	X		X	x	X
10	Fr	X				X			X				X		X			X
11	Ro			X			X		X			X	X	X		X	X	
12	NL	X						X	X				X		X			X
13	PL		X	X	X				X		X			X		X	X	
14	PT	X	X			X			X	X		X	X	X	X		X	

The timings of the workshops can be adapted to suit local conditions, though a full day (10am - 4pm with a break for lunch) should be allowed for. As a broad outline: participants are welcomed in plenary to the workshop and the aims of the workshop and the MIXED project are presented. The participants then spend the rest of the day working in small pre-defined groups under the leadership of group facilitators and with the help of an assistant. The facilitator leads the discussion and gives instructions but does not give any answers or otherwise influence the outcome of the group. An assistant is needed in every group to help the group's facilitator and take notes/photos/recordings. The number of facilitators and assistants needed will depend on the number of participants. At the end of the day the groups return to plenary to present a summary of their outcomes and discuss how transferable their solutions and innovations might be to other geographical regions.

2.1 Participants and recruitment

Ideally participants should be drawn from a broader range of stakeholders than the Participatory Learning Hub alone – this will enable a broader discussion of the barriers and enabling environment for mixed farming in the region/country. A more detailed focus within the Participatory Learning Hubs will occur in subsequent workshops (e.g., Task 2.1). A mix of stakeholders from the following categories should be considered: farming unions, farming cooperatives, supply chain members/representatives, NGO's (environment, wildlife etc), policy makers, researchers. 1-2 representatives from each of these stakeholder categories (allowing for 2-3 working groups of 4-6 people) would be appropriate.

Participants should be recruited by the workshop organisers (PLH academic and industry leads) by personal invitation (letter, email (template available) or phone call). On agreement of attendance, participants will be a consent form to be completed prior to commencement of the workshop (can be on the day).

Just prior to the meeting, participants who have agreed to attend should be allocated to working groups for the workshop. Ideally a range of stakeholder types should be allocated to each working group to facilitate co-learning and a broad perspective on the mixed farming system being discussed.

2.2 Organisation

Table 1. below (Section 4.1) suggests timings for the workshop. This can be adapted somewhat to meet local stakeholder expectations in terms of start and finish time and break lengths, however, each of the key activities (critique, visioning and implementation phases) will require the specified time as a minimum to allow for sufficient discussion. If COVID restrictions prevent in person meetings at the time the workshop is scheduled, an alternative online workshop methodology will be implemented. Workshop organisers and participants should adhere to local COVID rules at all times and adapt the workshop methodology as appropriate to ensure e.g. appropriate group sizes, social distancing, hygiene practices.

A meeting room that comfortably holds 15 people (preferable with natural light and ventilation!) is required for the plenary sessions and smaller breakout areas for the group work. If the plenary room is large enough it is possible for each group to work in a corner of the room though this is not always ideal in terms of noise levels. The plenary room will require audio-visual facilities for the introduction presentation. Breakout rooms will require large post-it notes (different colours – pink, green, yellow, orange), sticky dots (large green and red and small black for voting), pens for writing, flip chart paper and tape and clear wall space for arranging post-its. Assistants will require note taking material, a camera (phone is fine) and if possible voice recorders (permission will have to be obtained by the participants in the consent form described in 2.1 above) to record the session discussions.

Appropriate refreshments (lunch, tea/coffee and snacks) will need to be provided (consider special dietary requirements) and breaks arranged to fit with local timings.

3 Workshop methodology

Generally speaking, the field of *futures research* is the study of possible, probable and desirable futures, i.e., alternative future scenarios that can be imagined, desired or considered probable. Two main approaches to futures research can be identified (Vidal, 2006):

• first the 'critique' phase of the actual situation, followed by visioning of preferable future situations and identification of the pathways needed to move from the current states to the possible futures.

• Second, a representation of a/the future preferable situation(s), followed by the analysis of the actual situation and the necessary actions to move from the current situation to a/the preferable one(s).

The methodology chosen for use in this MIXED Task 1.2 workshop represents the future research methodology that belongs to the first category, starting from the critique of the current situation. The methodology is planned with reference to the concept of the Future Workshop (Jungk and Müller 1987; Vidal 2006), a methodology which facilitates participation by actors and stakeholders in ~~processes~~ addressing real-life situations. Participants will be able to recall, share, and jointly critique existing mixed farming systems and/or relevant alternatives. This strategy helps to raise participants' confidence in the ability to adopt new pathways and achieve a desirable future state.

The methodology proposed here will be broken down into the key stages suggested by Vidal (2006):

• **The preparation phase (Section 2 above):** Here the workshop programme (clear formulation of the aims and objectives, the invited participants, the methods, their rules and the timetable of the workshop) is devised by the organizers of the workshop and the facilitators. The room and local facilities for the workshop are identified.

• **The critique phase:** Here, current mixed farming systems are critically and thoroughly discussed and investigated. Brainstorming is the preferred creative technique follow up by a structuring and grouping of ideas in some main sub-themes.

• **The visioning phase:** Here the participants try to identify an ideal future. Brainstorming and other creative techniques will be used.

• **The operationalization and implementation phase**: Here, the ideal futures are checked and evaluated in term of their practicability. An action plan is elaborated.

• **The follow-up phase**: Here the action plan is monitored.

The preparation phase occurs prior to the workshop commencing whilst the critique, visioning, operationalization/implementation for the activities of the workshop itself. Some aspects of the follow-up phase are included in the summing up session of the workshop itself. Further activity occurs in the analysis and reporting of the workshops and subsequent further evaluation of pathways to implementation in other MIXED work packages.

4 Workshop Activities

4.1 Proposed timings

Table 2 below provides an example of how the workshop might be timed. This would comfortably fit in to a 10am to 4pm workshop (participants arriving and registering from 9:30am) which would allow participants to travel at the beginning and end of the day.

Table 2.

Time	Task	Who
	Refreshments on arrival and registration	
20 minutes 00:00-00:20	Welcome, project overview and objectives for the meeting	Meeting chair
60 minutes 00:20-01:20	**Critique Phase** - Description of existing challenges and future ideal states of mixed farming systems.	Breakout groups – facilitator, assistant and 4-6 stakeholders per group
15 minutes 01:20-01:35	Break	
60 minutes 01:35 -02:35	**Visioning Phase**: Elaboration of innovations and solutions to achieve ideal future states of mixed farming systems.	Breakout groups – facilitator, assistant and 4-6 stakeholdare we keepiers per group
40 minutes 02:35-03:15	Lunch	
60 minutes 03:15-04:15	**Implementation Phase**: what actions are needed to implement the innovations/solutions identified	Breakout groups – facilitator, assistant and 4-6 stakeholders per group
15 minutes 04:15-04:30	Break	
50 minutes 04:30-05:20	Group reporting back and next steps	Meeting chair
10 minutes 05:20-05:30	Thank you, evaluation and departure	Meeting chair

4.2 Welcome and introduction

The chair of the meeting will welcome the participants and give a presentation that introduces the project, the objectives of the workshop and the specific activities that are going to be conducted during the day and when breaks will occur. Allowing time for a round of participant introductions (name and organisation) is also valuable. Participants should then be allocated to their working groups for the day's activities.

4.3 Critique phase: Description of existing challenges of mixed farming systems (total 60 minutes)

The critique phase consists of two main activities, challenge identification and future ideal state envisioning.

4.3.1 Challenge identification

Main objectives: Individual writing (10 min) to describe the challenges of mixed farming systems in relation to competitiveness, innovation and sustainability.

The facilitators ask the following questions to stimulate thought:

• What are the main problems of mixed farming systems?

• What could be improved to enhance competitiveness and sustainability?

• What hampers competitiveness?

• What is not sustainable?

In silence, participants each write three to five main challenges on pink A5 Post-it notes (one challenge to one Post-it). The group facilitator then places completed Post-it notes on the left side of a large paper sheet (4 flip chart sheets sellotaped side by side to the wall is ideal) in front of the whole group. If there is a similar challenge on two or more Post-it notes, the group facilitator should put them on top of each other and give them a common title.

After the individual writing the participants present their challenges to the rest of the group (20 min). Facilitators can ask expanding questions such as:

• What is the scope/scale (farm-level/processing/distribution) of the problem?

• What are the main reasons for the problem?

- Consider the impact of resolving the problem – only positive impacts or other negative impacts. This may assist in deciding the idea future and appropriate pathway to get there.

4.3.2 Future state envisioning

After presenting all the challenges, the facilitator works with the group to come up with agreed ideal futures for each of the identified challenges (30 min). Each corresponding ideal future should be written on a green Post-it note and displayed on the wall as in Figure 1 with a line drawn from the challenge to the ideal future.

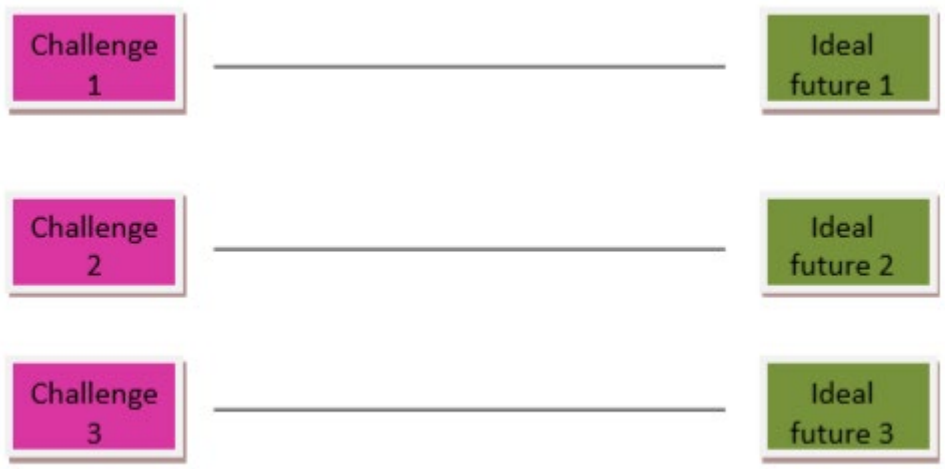


Figure 1. Illustration of the critique phases to identify challenges and envisioning of possible ideal future states.

4.4 Visioning phase: Elaboration of innovations and solutions to achieve ideal future states of mixed farming systems (total 60 minutes)

Main objectives: In the visioning phase, the participants create optimal solutions and innovations to achieve the desired ideal future. There are two main activities in this envisioning phase, assessment of the current situation and identification of possible innovations/solutions to achieving the ideal futures.

4.4.1 Where are we now?

With reference to the challenges identified, each group first defines the current situation (where they think things are at present in terms of achieving the idea and how far they thought the situation could progress towards the ideal in the next 5 to 10 years (15 minutes). The findings should be placed on a construct line continuum as EXISTING (red sticker) and IDEAL FUTURE (green sticker) situations.

• The group facilitator asks the group to ponder on "Where are we now" and put a red sticker on the line continuum. This is to be done for every challenge.

• The group facilitator asks the group to ponder on "Where could we be in 5 to 10 years" and put a green sticker on the line. This is also done for every challenge.

4.4.2 Moving towards the possible future ideal

The participants are encouraged (individually or in pairs) to imagine which novel solutions/innovations could be deployed to move from the existing to the ideal (45 minutes). The participants write innovations on yellow Post-it notes (one idea to one Post-it) and position them on the line corresponding to the related challenge. It is important to note if one suggested strategy or innovation answers several challenges. The group discuss the innovations/solutions and the moderator consolidates ideas on new yellow Post-it notes and positions them on the line correspondent to the related challenge. There may be multiple ideas for specific challenges but try to keep it to a maximum of 2-3 per challenge.

4.5 Implementation phase (total 60 minutes)

Main objective: In the implementation phase, the actions that could be used to achieve the future states are developed with the focus being on their feasibility. The phase is again split into two activities, prioritising of possible solutions/innovation to achieve ideal futures and identification of actions for facilitating implementation and their perceived transferability to other geographical regions.

4.5.1 Prioritising solutions/innovations

Solutions/innovations derived 4.4.2 above are voted on in terms of their perceived practicality and supply chain acceptability (10 minutes). Each participant is given ten votes (ten black stickers), with which they could vote for one solution/innovation, or split between several (e.g., strategy X got one vote and strategy Y got four votes and so on).

4.5.2 Actions for facilitating implementation of solutions/innovations

The 3 - 5 most voted for solutions/innovations (no. depending on time availability) are discussed in terms of actions needed for implementation (50 mins). Discussion is stimulated using the following questions:

• What further steps are needed to implement the suggested innovations/solutions?

• What policy would be recommended?

• What are the roles of the actors and stakeholders in the supply chain?

The participants write their ideas on orange Post-it notes (one idea to one Post-it) and put them on the wall next to the innovation/solution being discussed. The group then discuss proposals, the facilitator consolidates similar concepts. Actions should be rated according to their perceived transferability to other geographical regions by clearly writing one of the following letters on the relevant orange post-it note (E – easily transferable; P – possible with some local adaptation; N – not transferable). For those categorised as P, a few words on the back of the post-it elaborating the required adaptation would be useful.

At the end of the day, each group's wall should look like the picture in Figure 2 below.

Figure 2. Each group should finish the day with a wall looking similar to this: Challenges on the left (pink), ideal futures on the right (green), solutions/innovations in the middle (yellow), actions for implementation of most voted solutions/innovations next to them (orange).

4.6 Final Plenary Session (60 minutes)

The final session is an opportunity for each group to report back to the other groups (time allocated per group depends on the number of groups). The session chair can note differences/similarities between the groups in terms of challenges and future ideals identified, most voted for

solutions/innovations to achieving the future ideals, and what are common themes for implementation.

The chair will wrap up the session by stating that the outcomes of this workshop, and similar workshops taking place across Europe, will inform a publication characterising mixed farming systems in Europe and solutions innovations identified will go forward into other work in MIXED for scenario testing and development of decision support tools.

Participants should be asked to complete an evaluation form to aid in future workshop planning.

5 Reporting

5.1 Mixed farming system context

Please describe the type of mixed farming that was the focus of discussion in the workshop and provide some context of the extent of this type of mixed farming in your region/country.

5.2 Methodology

Describe the methodology used. There may be adaptations required due to local COVID rules and /or to adapt to local working conditions. Please be specific about approach to recruitment, the timeline for the day, etc.

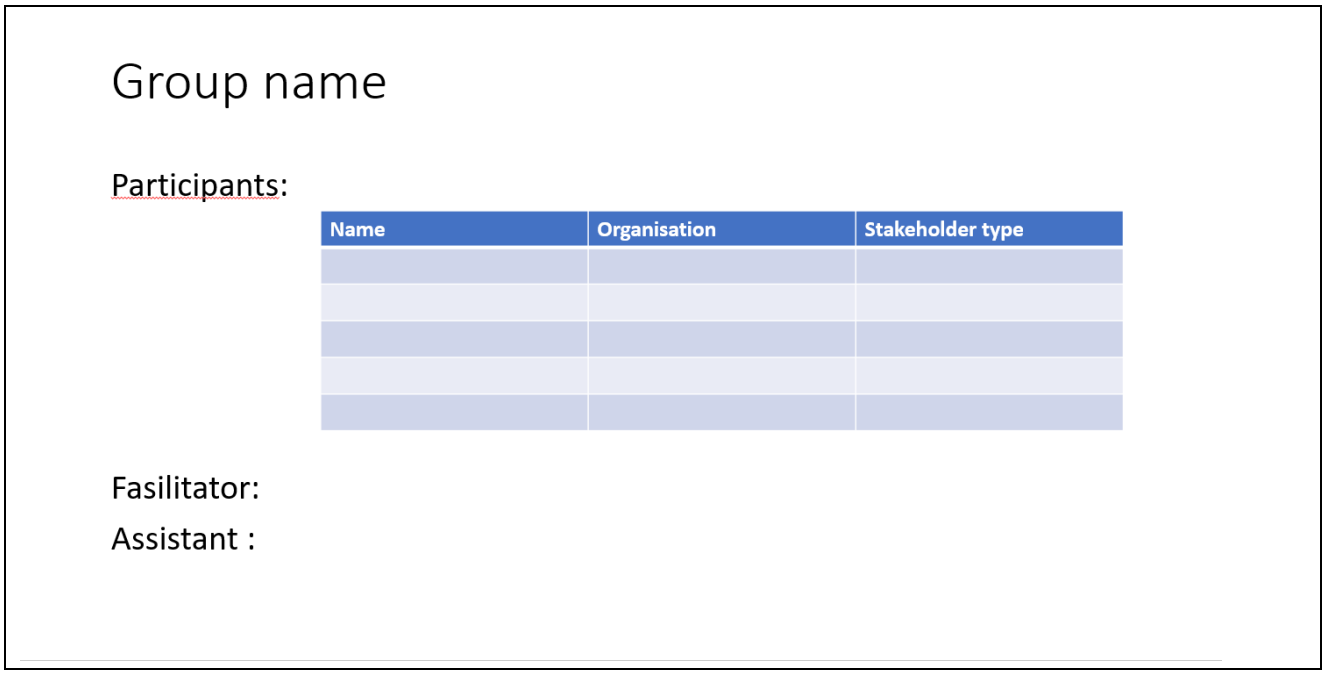
5.3 Observations

How did the group interact? Were some groups or stakeholder individuals more vocal than others? etc.

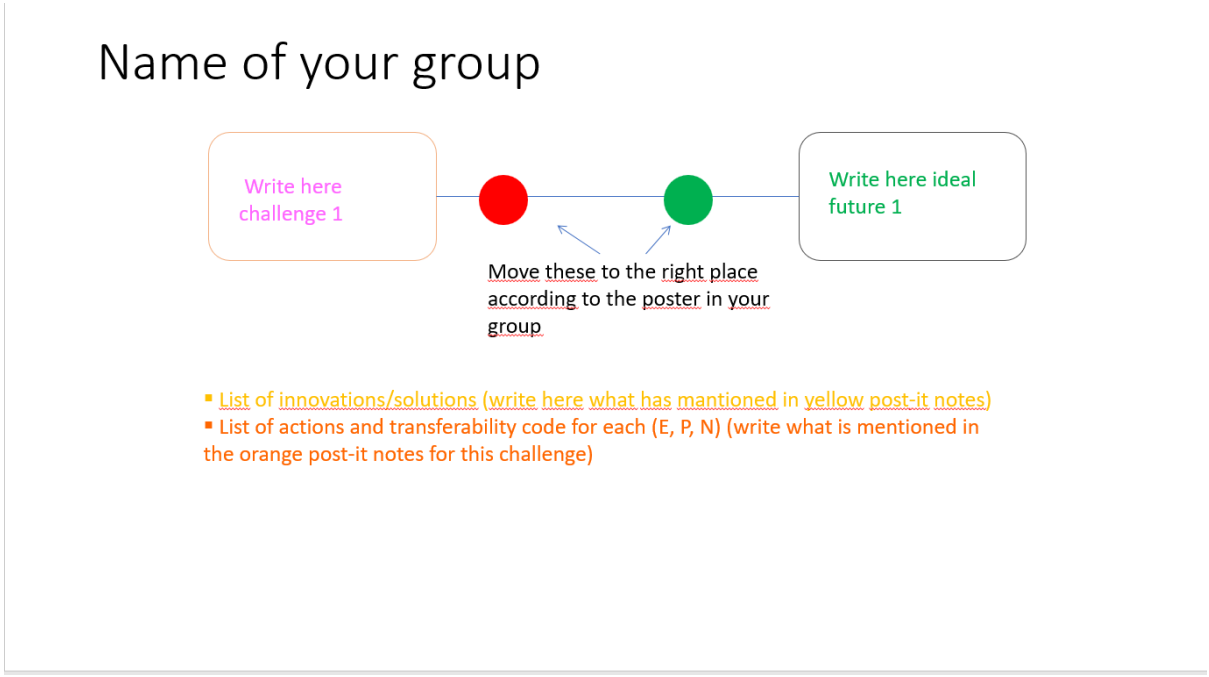
5.4 Data summarising

The assistants and facilitators play an important role in recording information throughout the day (taking notes and photos) but also in transferring the information discussed to electronic form.

Immediately after the session is completed, the facilitator and assistant for each group need to enter the information, **in English please**, from the Post-it notes for their group onto the following templates:



The form below needs to be completed for **every challenge** identified in each group. Only the challenges prioritised in step 4.5.1 will have actions and transferability codes listed (orange Post-its).



5.5 Evaluation

This section is to include a summary of the participant evaluation forms but also an evaluation of the process by the organisers. Aspects to consider include: what worked, what didn't, what changes would the organisers and participants have liked to see, how would participants like to be kept up to date with future work etc. Would participants be willing to participate in other MIXED activities?

6 References

Vidal, R.V.V. 2006. The Future Workshop: Democratic Problem Solving. Atlantic Review of Economics. Vol 5, No 4.

Terhi Latvala, Maurizio Sajeva, Phillipa Nicholas, Susanne Padel, Raffaele Zanoli (2015) D5.4 Scenarios and Optimal Supply Chain Management (SCM) Strategies. Project no. 266367, Project acronym: SOLID, Project title: Sustainable Organic and Low Input Dairying, Collaborative Project SEVENTH FRAMEWORK PROGRAMME KBBE.2010.1.2-02 Sustainable organic and low-input dairy production.

7 Appendices

Detailed documents not included here but are available on request to the authors.

Invitation and information template

Participant consent form template

Introduction presentation

Participant evaluation form template

Reporting template

8 Online version of the back casting workshop

If an in-person meeting is impossible due to local covid-19-related restrictions the aims of the back casting workshop can be achieved using a suitable online platform (e.g., Zoom, MS Teams). Many of our prospective workshop participants – representatives of farming unions, farming cooperatives, supply chain, NGO's (environment, wildlife etc), policy makers, researchers *et al.* – will be familiar with virtual meetings by now. Of course, hosting an online workshop demands that the meeting coordinator(s) has the necessary ICT (information communication technology) skills and that participants have access to the required computer equipment as well as basic ICT skills of their own. If you foresee problems in this regard please communicate with your Network Coordinator, who will seek potential solutions with the wider national team and/or the WP1 leader and MIXED Project Steering Committee. Moreover, Zoom's 'Basic Plan' brings one key constraint – a 40-minute limit for meetings with more than three participants – and the free version of MS Teams does not allow meetings to be recorded. It may be that the Network Coordinator's organisation has access to an enhanced version of Zoom or MS Teams that can overcome these constraints.

In the case of a need to move the workshop online the main body of this document should still be followed (e.g., the workshop phases, general structure, and need for reporting) – and you should apply your own discretion and autonomy to how you will execute specific aspects of the workshop – but below is a list of the "big picture" adjustments that will need to be made to the methodology:

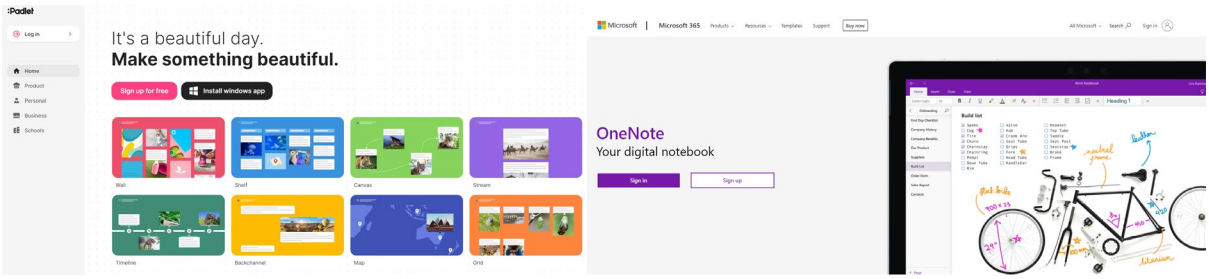
1. **Preparation for the workshop**: As with an in-person meeting, on agreement of attendance participants should be issued with information outlining the day's activities, schedule, and meeting details (including instructions on how to join the virtual meeting and how to use any

supplementary software, e.g., padlet [see below]). The participant should also be issued with a consent form to be completed prior to commencement of the workshop (i.e., that participants consent to photos being taken, the information they provide during the meeting being used for project purposes – anonymously of course, and the sessions they are involved in being recorded to help with subsequent reporting processes). Hence, pre-meeting information and the consent form will need to reflect the adjustments made to accommodate a move online. The consent form will need to be collected from participants electronically or by post in advance of the meeting (please provide appropriate guidance in the pre-meeting information for participants). Participants' email addresses should be requested so that they can be invited to the virtual meeting.

2. **Timings**: The suggested workshop timings (section 4.1) *could* be extended to account for technical issues that may arise during the day. Presumably, time that will be saved because participants will not need to travel to the workshop venue can be used for this instead.
    a. As with an in-person meeting, the suggested timetable can be adapted somewhat to meet local stakeholder expectations in terms of start and finish time and break lengths, however, each of the key activities (critique, visioning and implementation phases) will require the specified time as a minimum to allow for sufficient discussion and data collection.
3. **Facilitating group work in a virtual meeting**: As per section 2 in the main body of this document: "*prior to the meeting, participants who have agreed to attend should be allocated to working groups for the workshop. Participants will spend the bulk of the day working in these small pre-defined groups under the leadership of group facilitators and with the help of an assistant.*" To this end, Zoom offers a "breakout rooms" function that allow for multiple working groups to be convened within a single call (NB. Microsoft have also added this feature to MS Teams yet they are experiencing delays in rolling it out; hopefully it will be available before the end of 2020); use technical support provided by the organisations themselves to ensure accuracy in your use of this feature (e.g., https://support.zoom.us/hc/en-us/articles/206476093-Enabling-breakout-rooms).
    a. If the breakout room feature *within the organised call* is unavailable to you for any of the above reasons, it is also possible to have each working group facilitator convene a series of independent calls with those participants who would otherwise be in their breakout room. Participants can exit the main call and the facilitator will call the members of their working group in a separate call to carry out the workshop activities. The host can re-convene the main meeting at an agreed time for whole-group discussion. (Good advice here: https://www.contentandcode.com/blog/faqs-collaborate-external-users-microsoft-teams/)
4. **Work that participants do individually and in small groups and the written output they produce**: In a virtual meeting we would like to simulate as closely as we can, the tried and tested methods we all use in traditional workshops/meetings. For example, in the 'Challenge Identification' phase (section 8.1.1) of an in-person back casting workshop participants "*each write three to five main challenges on pink A5 Post-it notes (one challenge to one Post-it). The group facilitator then places completed Post-it notes on the left side of a large paper sheet (4 flip chart sheets sellotaped side by side to the wall is ideal) in front of the whole group. If there is a similar challenge on two or more Post-it notes, the group facilitator should put them on top of each other and give them a common title. After the individual writing the participants present their challenges to the rest of the group (20 min)*." All subsequent phases of the workshop require similar written output from each working group. Three approaches can be taken to

adjust the methodology for a virtual meeting (although you may think of other valid approaches, of which there must be many!), and please remember to take screenshots throughout the day in the same way that you would use a camera during an in-person workshop:

a. Whilst in a Zoom or Teams "breakout" call the facilitator can prompt participants to use supplementary software to make <u>private</u> notes on the topics to be discussed, such as Padlet (https://padlet.com/) or Microsoft OneNote (https://www.onenote.com/; Google also offers various such solutions). With regards to Padlet in particular: this privacy in the initial stage of brainstorming should encourage comfort and honesty because the participant is in control of whether or not to share a given note with the working group. Once workshop participants have had time to note down their thoughts they can share them to the facilitator's padlet when prompted. Thus, the notes made in private are *allowed* into the public domain one-by-one, and all participants can observe the facilitator's padlet and explain and discuss their ideas in an organised manner. Categorisation (thematic grouping) of these ideas thus happens simultaneously with their "release" into the group's shared padlet. Once all notes have been shared, discussed, and categorised a volunteer can prepare to summarise this collaborative work with the entire workshop when the main call is re-convened. The beauty of Padlet is that it is very visual and nicely reflects the in-person practice of writing Post-it notes and placing them on a notice board or flip chart.
    i. To save time and ensure smooth running on the day of the workshop, the coordinator should invite participants to a 'padlet' in advance, *by group*. (They might have to create an account which they didn't previously have, to keep the work within a password-protected space); it also means that participants will have multiple windows open simultaneously (with associated bandwidth demands). The host can demonstrate how it will work in the workshop's opening session. Meeting coordinators and facilitators will need to be sure to save the work that is produced on these platforms for subsequent reporting purposes. The facilitators' padlets can be set up prior to the workshop to smoothly handle the categorisation task. A member of WP1 will share such a template in the MIXED online document repository for your convenience.



b. Alternatively, stick as closely as possible to what is suggested for in-person meetings – with one facilitator/assistant acting as a "scribe" who types up (in whatever programme they prefer) or writes up the participants' ideas in real-time and shares their screen to physically display these collated notes with fellow group members and the wider group when appropriate. If notes are typed-up please ensure that the word processing or note-taking software has "auto-save" turned on so that data is not lost. Participants may prefer how this method feels fairly close to an in-person meeting,

with them writing notes on paper in private, followed by the verbal sharing of ideas and **one person** taking group-level notes. This method also has the benefit of not bringing additional bandwidth requirements for participants, and each facilitator can use the gratis version of their preferred note-taking software because there will only be a single user. However, this method will place a large burden on the facilitator of each working group to keep up their note-taking with the speaker.

c. Alternatively, an MS Team could be established in advance so that its collaborative workspace can be used (cf. https://support.microsoft.com/en-us/office/join-a-team-as-a-guest-928d1eef-61e2-49ec-b754-c2fe86b34824). Workshop participants can join the Team in their browser or in the app. Within the Team, "channels" (i.e., groups) can be created in advance, participants allocated to each group in a pre-planned manner, and there they can share ideas. However, until MS Teams has a functioning "breakout room" facility with a true collaborative workspace available to each group *during the call*, this option might not be the optimal solution.

5. **Recording the virtual meetings**: With an organisational licence (but not the *gratis* version) MS Teams allows you to record the meeting to help you capture the whole-group discussions; Zoom allows you to record both the whole group and breakout room discussions, but remember the 40-min caveat on Zoom's basic plan. The host will need to allow recording before opening the breakout rooms (cf. https://support.zoom.us/hc/en-us/articles/115005769646-Participating-in-breakout-rooms). Consent will need to be acquired in advance if you are to record the meetings (see point number 1, above).
6. **"Staffing" required to host a virtual back casting workshop**: The workshop should include around 12 participants (section 2.1): the host will require assistance in a virtual workshop just as they would in an in-person workshop. Specifically, each working group (breakout) will require facilitation from a non-participant, i.e., a colleague from the host's organisation or academic partner organisation rather than a stakeholder-participant; the more working groups, the more assistance is needed.

In conclusion, it is advised that the workshop organising team devotes plenty of time prior to the workshop to thoroughly familiarise themselves with the technology they will use. There is no substitute for hands-on experience, and a pilot test is strongly recommended. Experienced facilitators will probably be able to adapt more quickly during a session, but even these individuals may have no experience with this *particular* workshop methodology.