EuroSheep

European Knowledge Exchange

European Network for interactive and innovative knowledge exchange on animal health and nutrition between the **sheep** industry actors and stakeholders

Report on research requirement: list of knowledge gaps

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 863056.

28/06/2023

Project Data		Deliverable Data	
Project	EuroSheep	Deliverable identifier	D2.4. Report on research requirement: list of knowledge gaps
Project	European Network for interactive and innovative knowledge exchange on animal health and nutrition between the sheep industry actors and stakeholders	Deliverable lead beneficiary	NEIKER
Grant Agreement N°	863056	Type of deliverable	R: Report
Start date of the project	01/01/2020	Due Date	31/05/2023
End date of the project	30/06/2024	Date of delivery	31/05/2023 updated the 21/06/2023
Duration	42 months	Classification	PU
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A. Executive summary

As a result of the different stages carried out throughout the development of the project (identification of needs by the main stakeholders, proposal of solutions, tips and tricks, implementation of the solutions, and evaluation of their impact in terms of cost-benefit and sustainability), it has been possible to discuss upon all the information gathered and to evaluate to what extent there are still unresolved needs and knowledge gaps. The majority of needs identified by stakeholders have been answered either with a solution proposed, or with a factsheet prepared by the consortium.

However, there were evident gaps, whenever no solution or factsheet could be proposed for some of the needs. The only case was for the need arisen in France regarding recommendations for the weaning management of the lambs (progressive, abrupt), considering the rusticity/robustness of the sheep breed.

At a second level, although solutions or factsheets were proposed for most of the needs collected, the level of satisfaction or acceptance was not always entirely satisfactory for some of them. For instance, the solution proposed by France to control contagious echtyma/orf did not solve completely the problem according to cost-benefit assessment surveys' analysis implemented.

Finally, as a complement, in each country an in-depth analysis of all the solutions which have not been tested even if they could have answer the needs of this country. This analysis was carried out within the corresponding national Scientific & Technical Working Group (STWG), to reflect on the choice of solutions, on why some solutions did not provide a completely satisfactory answer for certain needs, or which would require further adaptation to the specific conditions of sheep farming systems.

B. Identification of Gaps

According to the knowledge generated and collected throughout the project, 2 levels of gaps have been considered:

1) needs identified by the stakeholders, and for which neither a solution was proposed throughout the project, nor any factsheet was developed; and

2) needs for which some solution was proposed and tested, but the end user was not fully satisfied. However, the reasons for the level of satisfaction were not necessarily known.

Additionally, although many solutions were proposed for some of the needs, not all of them were afterwards put into practice and tested (in fact, 22 solutions from the 42 proposed for nutrition-related issues were not implemented, neither 22 of 46 for health).

Regarding the factsheets, they were developed to gather the existing technical and scientific knowledge and therefore to try to provide a solution to some of the initially detected needs, but they were not implemented afterwards.

1.- NEEDS WITHOUT A SOLUTION OR FACTSHEET

According to the initial set of needs identified, no solution was initially proposed to the following need, nor a factsheet could later be developed. Therefore, this need remains as a knowledge gap related to nutrition:

Need	Question
Weaning transition management	•How to tackle the rusticity/robustness of animals vs the weaning techniques (progressive, abrupt)? **(FR)**

2.- NEEDS WITHOUT A COMPLETELY VALID SOLUTION

Then, after an extensive proposal of solutions and the implementation of some of them, (ie. deliverable 2.3), 3 criteria have been considered to identify further gaps:

- Overall acceptance: in particular whenever the respondent considered that he/she was not satisfied or not satisfied at all by the solution tested,
- Recommendation: whenever the respondent wouldn´t recommend the implementation of the solution to other farmers.
- Existence of other solutions for the same need

From the total amount of 144 surveys gathered (68 health surveys corresponding to the assessment of 24 solutions and 76 nutrition surveys, assessing 22 solutions), we found 16 surveys corresponding to 12 solutions (7 for health and 5 for nutrition) that showed some level of dissatisfaction from the respondents with the overall acceptance. However, despite this dissatisfaction, in 4 of them, the respondent would recommend the solution (see table 1).

Table 1. Solutions tested but poor or not satisfactory for end users.

Topic	Need	Solution	N test poorly… /N test total	Overall acceptance	Recommend
Health	Scores and blisters on the lips, nose, ears and/or eyelids - e.g. Echtyma, Orf...	Better control of contagious ectima/orf **(FR)**	1/1	poorly	depending
Health	Internal parasitism	Mixed grazing for cattle¬sheep as a solution to limit parasite infestation **(FR)**	1/4	poorly	
Health	Internal parasites	Use of Targeted Selective Treatment (TST) for ewe lambs **(UK)**	1/2	poorly	yes
Health	Mastitis	Good machine-milking practices for	1/2	poorly	yes

		prevention of mastitis **(IT)**			
Health	Lameness	Guidelines to manage foot-bathing **(IT)**	4/5	2 poorly 2 not satisfied	no no/depending
Health	Lameness	Design and strategy of the hoof bath **(SP)**	1/9	poorly	depending
Health	Lameness	Targeted drainage system in the grassland **(TR)**	1/1	poorly	
Nutrition	Grassland and grazing management	HerbValo- knowing the valorisation of grass on your grassland **(FR)**	2/4	poorly	( )/yes
Nutrition	Artificial rearing	Artificial feeding for lambs **(GR)**	1/3	poorly	yes
Nutrition	Urea levels in milk - unbalanced energy /protein ratio in the diet	Guidelines for the interpretation of milk urea concentration in sheep milk **(IT)**	1/9	poorly	depending
Nutrition	Growth targets for 1st lambing at 1 year of age	Replacement management tool(software) **(SP)**	1/9	No satisfied at all	no
Nutrition	Grassland and grazing management	Guidelines for implementing rotational grazing / Rotational grazing systems (establishment and management) **(UK/IR)**	1/9	No satisfied	depending

3.- TOTAL LIST OF SOLUTIONS: TESTED AND NOT TESTED IN RELATION TO THE SPECIFIC NEEDS

There might also still be certain gaps related to solutions that were proposed but that have not been tested during the project: 22 of 42 from nutrition, and 22 of 46 from health. The reasons for the lack of implementation of the solutions can be multiple and depending on the particularities of the country, farming system, participants on the workshops, etc. The main reasons related to:

- Language barriers (for instance, software developed in a foreign language).
- Lack of availability of vaccines or treatments.
- High implementation costs.

- High labour requirement or lack of labour available at the farm.
- A long time to see effects (not compatible with the project timetable)
- Etc.

Due to the availability of partial knowledge for these situations or lack of certain other data, it was not possible to carry out a deeper analysis. Further discussions should be carried out at the national level.

Next, the solutions available have been grouped according to the topic (nutrition, health or management), type of animal (adult, lambs or ewe-lambs) and each particular need. It must be considered that some solutions can be used to meet more than one need (IN GREEN COLOUR). The number of surveys collected regarding the end-users acceptance for each solution are also presented in the following tables (Number of surveys). The factsheets developed for each need are also pointed out (IN BLUE COLOUR)

3.1 NUTRITION

3.1.1.- EWE (10 needs)

Need: Knowledge of nutrition requirement

Solution (Country of origin)	Number of surveys
Knowing the water requirements of dairy ewes (FR)	
Checking Diet Tool (SP)	
BCS as a tool for nutrition requirement of ewes (TR)	5
"Feeding the ewe" - feed planning (UK)	1

Forage: concentrate ratio in the diet

Factsheet: How to achieve a successful dietary transition when turning out at springtime (FR)

Protein concentration in the diet (concentrate + forage)

Factsheet: How to achieve a successful dietary transition when turning out at springtime (FR)

Factsheet: Amino-acid nutrition (SP)

Minerals and vitamins supplementation

Solution	Number of surveys
When and how to provide minerals? (FR)	
Methods to calculate vitamin and mineral content of feeds and pastures (GR)	
Cross comparison of feed catalogue value with animals' blood test (TR)	2

Urea levels in milk - unbalanced energy /protein ratio in the diet

Solution	Number of surveys
Sources of high milk urea and how to avoid excess protein content, links between protein intake and urea, modalities for checking milk urea (GR)	
Guidelines for the interpretation of milk urea concentration in sheep milk (IT)	9

Milk composition (fat and protein content)

Solution	Number of surveys
Strategic feeding protocol (TR)	

Factsheet: Management of fat and protein content of bulk tank sheep milk during the productive season (SP)

Factsheet: Genetics of fat and protein contents in sheep milk (IT)

Grassland and grazing management

Solution	Number of surveys
Rotational grazing systems (establishment and management) (IR)	8
Grazing: what is achievable and how? (IR)	
Sward measurement (IR)	
HerbValo - knowing the valorisation of grass on your grassland (FR)	4
Online history of grazing routes to remember and improve grazing routes in the next year (GR)	2
Wikiloc"- a free tool to record grazing activities (TR)	7
Sward stick and Platemeter (UK)	
Guidelines for implementing rotational grazing (UK)	8

Conserve forage production - hay, silage…

Solution	Number of surveys
How to produce high-quality grass-silage (IT)	4
Practical guide for conservation methods (TR)	

Forage crops - maize, sorghum, kale, rape, fodder beet, etc...

Solution	Number of surveys
Two successful combinations of legume/cereal winter forage crops (GR)	1
Inclusion and management of Sulla (Sulla coronaria (L.) medik.) in the forage systems (IT)	2

Forage feed value

Solution	Number of surveys
Producing high feed value grass silage (IR)	
Forage, nutritional value tool (SP)	
Use of portable NIR's to assess forage feed value (SP)	
Protocol for forage analysis (UK)	1

Factsheet: Quality on temporary pastures for dairy sheep (GR)

3.1.2.- LAMB (8 needs)

Knowledge of nutrition requirements

Solution	Number of surveys
Checking Diet Tool (SP)	

Factsheet: Theoretical approach: what are the energy and protein need of lambs post-weaning? (FR)

Factsheet: Feeding concentrate to lambs at pasture (IR)

Factsheet: Understanding nutritional requirements at key points in the ewe's production cycle (UK)

Lamb performance targets from birth to weaning

Solution	Number of surveys
Effect of birth and rearing type on lamb performance (IR)	
Lamb growth protocol for performance target (TR)	

Factsheet: In search of an ideal milk-replacer in small ruminants (SP)

Growth targets for fattening lambs: age and weight at slaughtering

Solution	Number of surveys
Effect of birth and rearing type on lamb performance (IR)	

Artificial rearing

Solution	Number of surveys
Practical advice on Artificial feeding in new-born lambs (GR)	3
Manual of good practices for the management of lambs on artificial rearing (SP)	

Factsheet: In search of an ideal milk-replacer in small ruminants (SP)

Post weaning management: adaptation to new feeding regime

Solution	Number of surveys
Gradual weaning protocol for lambs (TR)	2
Guidelines on milk/grass transition (UK)	5

Concentrate feed efficiency: weight gain / kg concentrate

Solution	Number of surveys
Ideal concentrates feed value for lambs finished in shed (FR)	

Ad libitum concentrate systems

Solution	Number of surveys
Ideal concentrates feed value for lambs finished in shed (FR)	

Grazing management

Solution	Number of surveys
Rotational grazing systems (establishment and management) (IR)	8
Grazing: what is achievable and how? (IR)	
Sward measurement (IR)	
HerbValo - knowing the valorisation of grass on your grassland (FR)	4

Online history of grazing routes to remember and improve grazing routes in the next year (GR)	2
Wikiloc"- a free tool to record grazing activities (TR)	7
Sward stick and Platemeter (UK)	
Guidelines for implementing rotational grazing (UK)	8

3.1.3.- REPLACEMENT (7 needs)

Knowledge of nutrition requirements in different stages of development

Solution	Number of surveys
Knowing the water requirements of dairy ewes (FR)	
Rationing ewe lambs for better udder development (FR)	5
When and how to provide minerals? (FR)	
Live weights at typical ages for ewe lambs (FR)	
Checking Diet Tool (SP)	
BCS as a tool for nutrition requirement of ewes (TR)	
"Feeding the ewe" - feed planning (UK)	

Factsheet: How to achieve a successful dietary transition when turning out at springtime (FR)

Weaning transition management

Solution	Number of surveys
Gradual weaning protocol for lambs (TR)	2
Guidelines on milk/grass transition (UK)	5

Factsheet: Managing the transition of breeding replacements (UK)

Growth targets for 1st lambing at 1 year of age

Solution	Number of surveys
Managing ewe replacements to lamb at 1 year old (IR)	1
Live weights at typical ages for ewe lambs (FR)	
Nutrition plan of lambs from weaning to mating (IT)	5
Guide for replacement nutrition at first lambing (TR)	1

Factsheet: Effect of age at first lambing on lifetime performance (IR)

Nutrition requirements for 1st lactation

Solution	Number of surveys
Replacement nutrition requirement for first lactation (HU)	

Suboptimal development of ewes that lambed young

Solution	Number of surveys
Development of ewes that lambed young (HU)	

Grazing management

Solution	Number of surveys
Rotational grazing systems (establishment and management) (IR)	8
Sward measurement (IR)	
HerbValo - knowing the valorisation of grass on your grassland (FR)	4
Online history of grazing routes to remember and improve grazing routes in the next year (GR)	2
Replacement management tool (SP)	9
"Wikiloc"- a free tool to record grazing activities (TR)	7
Sward stick and Platemeter (UK)	
Guidelines for implementing rotational grazing (UK)	8

Forage and grass availability-quality

Solution	Number of surveys
Producing high feed value grass silage (IR)	
Forage, nutritional value tool (SP)	
Use of portable NIR's to assess forage feed value (SP)	
Protocol for forage analysis (UK)	1

Factsheet: Quality on temporary pastures for dairy sheep (GR)

3.2. HEALTH

3.2.1.- EWE AND REPLACEMENT (10 needs)

Clostridial disease - e.g. pulpy kidney, braxy, blackleg

Solution	Number of surveys
Vaccinating against Clostridia and Pasteurella (IR)	1
Prevention strategies against Clostridial diseases (GR)	2
Enterotoxaemia from view of a sheep farmer (HU)	

Internal parasitism

Solution	Number of surveys
Reducing anthelmintic resistance (IR)	2
Nematodirus control - forecast and anthelmintic use (IR)	
Performing a coproscopic analysis after an antiparasite treatment (FR)	4
Mixed grazing for cattle & sheep as a solution to limit parasite infestation (FR)	4
Parasitism management in grazing animals (GR)	3
Gastrointestinal parasite infection in adult flock (HU)	
Guidelines for controlling gastro-intestinal nematodes by anthelmintic treatments (IT)	
The FAMACHA score assessment (TR)	
Use of Targeted Selective Treatment (TST) for ewe lambs (UK)	3
Guidelines on how to deal with anthelmintic resistance (UK)	

Factsheet: Genetics of gastrointestinal nematodes resistance (IT)

External parasitism

Solution	Number of surveys
Controlling external parasites (IR)	
Control plan of external parasites (SP)	

Respiratory disorders

Solution	Number of surveys
Vaccinating against Clostridia and Pasteurella (IR)	1
Well-ventilated buildings (FR)	2

Lameness

Solution	Number of surveys
Controlling lameness (IR)	3
Guidelines to manage foot-bathing (IT)	5
Bedding management and relative humidity references (SP)	1
Design and strategy of the hoof bath. (SP)	9
Targeted drainage system in the grassland (TR)	2
Booklet on how to recognise lameness (UK)	3

Mastitis

Solution	Number of surveys
Maintenance of the milking machine (video) (FR)	2
Udder evaluation grid for lactating sheep (conformation and udder health) (FR)	4
Mastitis (HU)	
Good machine-milking practices for prevention of mastitis (IT)	
Appraisal of udder morphology to prevent high somatic cell count and mastitis (IT)	4

Poor Body Condition

Solution	Number of surveys
Deworming program for sheep (SP)	4

Factsheet: Managing ewe condition score through the year (UK and IR))

Factsheet: Investigation of thin ewes to determine if poor body condition is due to an iceberg disease (GR)

Iceberg diseases

Solution	Number of surveys
Control of Ovine Progressive Pneumonia (Maedi Visna) at farm level (GR)	
Selective breeding for resistance to Maedi Visna Virus (MVV) (IT)	
Practical information on Iceberg diseases (UK)	
Best practice guidelines for biosecurity and iceberg diseases (UK)	2

Factsheet: Investigation of thin ewes to determine if poor body condition is due to an iceberg disease (GR)

Contagious agalactiae

Solution	Number of surveys
Prevention strategies against Contagious agalactia (GR)	1

Blue Tongue

Factsheet: Prevention and control of bluetongue disease (BT) (IT and SP)

3.2.2.- LAMB (7 needs)

Scores and blisters on the lips, nose, ears and/or eyelids - e.g. Echtyma, Orf...

Solution	Number of surveys
Better control of contagious ecthyma/orf (FR)	1

Coccidiosis

Factsheet: Coccidiosis (UK, TR and FR)

Other internal parasitism

Solution	Number of surveys
Reducing anthelmintic resistance (IR)	3
Nematodirus control - forecast and anthelmintic use (IR)	
Performing a coproscopic analysis after an antiparasite treatment (FR)	4
Parasitism management in grazing animals (GR)	3
Guidelines for controlling gastro-intestinal nematodes by anthelmintic treatments (IT)	

Use of Targeted Selective Treatment (TST) for ewe lambs (UK)	3
SCOPs information including the nematodirus forecast (UK)	

External parasitism

Solution	Number of surveys
Controlling external parasites (IR)	
Control plan of external parasites (SP)	

Acute death of lambs

Factsheet: Death of lambs (GR and TR)

Respiratory problems

Solution	Number of surveys
Vaccinating against Clostridia and Pasteurella (IR)	1
Well-ventilated buildings (FR)	2
From the view of a sheep farmer II: Respiratory issues of lambs (HU)	
Good management practices for fattening lambs. (SP)	

Lameness

Solution	Number of surveys
Controlling lameness (IR)	3
Lameness in lambs (HU)	
Bedding management and relative humidity references (SP)	1
Targeted drainage system in the grassland (TR)	2
Booklet on how to recognise lameness (UK)	3

3.3.- MANAGEMENT (9 needs)

Sheep shed management

Solution	Number of surveys
Well-ventilated buildings (FR)	2

Milking machine management

Solution	Number of surveys
Maintenance of the milking machine (video) (FR)	2
Record and review self-evaluation checklist for daily milking parlour maintenance inspection (GR)	
Good machine-milking practices for prevention of mastitis (IT)	2
Good milking practices (SP)	

Feeding/distribution management (eg concentrate + forages, TMR, etc.

Solution	Number of surveys
How to use molasses to homogenize feed ingredients and increase the lifespan of complete diets (unifeed) (IT)	

Factsheet: Managing triplet rearing ewes (IR)

Ration formulation - based on forage availability, quality

Factsheet: Finished store lamb from pasture, conserved forage or concentrate diets (IR)

Flock health plan

Solution	Number of surveys
Flock biosecurity – develop a health plan (IR)	4
Vaccinating against Clostridia and Pasteurella (IR)	1
Detailed data keeping for health management to organise farms' health plan / Use of smartphone or/and computer applications to get reminders (GR)	2
Flock Health Plan (SP)	
Scottish Animal Health Planning System (UK)	

Factsheet: Biosecurity for the Sheep Flock (UK)

Factsheet: Organising farm's health plan using google's workspace free online apps

Anthelmintic management

Solution	Number of surveys
Performing a coproscopic analysis after an antiparasite treatment (FR)	4
Mixed grazing for cattle & sheep as a solution to limit parasite infestation (FR)	4
Guidelines for controlling gastro-intestinal nematodes by anthelmintic treatments (IT)	

Biosecurity management

Solution	Number of surveys
Electricity/net fencing for communal rangeland issues (TR)	
Best practice guidelines for biosecurity and iceberg diseases (UK)	2

Factsheet: Biosecurity for the Sheep flock (UK)

Pest and predator control

Solution	Number of surveys
Electricity/net fencing for communal rangeland issues (TR)	

Lamb management

Solution	Number of surveys
Prevention of lamb diseases through proper new-born management (GR)	
Lamb management - Preparation of ewes for lambing & Lambing and rearing, organisation of manpower (HU)	

C. Assessment of knowledge gaps per Country

The Scientific and technical working groups of each country analysed the solutions which were not implemented during the project event if they could have answered the needs of their country, trying to identify why they haven't been implemented and if they could be interesting in the local context.

France

Regarding the French needs, the STWG discussed about the following solutions:

Nutrition

- Methods to calculate vitamin and mineral content of feeds and pastures (GR)
- Producing high feed value grass silage (IR)
- Effect of birth and rearing type on lamb performance (IR)
- Use of portable NIR's to assess forage feed value (SP)
- Sward measurement (IR)
- Grazing: what is achievable and how? (IR)
- Forage, nutritional value tool (SP)
- Checking Diet Tool (SP)
- Practical guide for conservation methods (TR)
- Guide for replacement nutrition at first lambing (TR)
- Protocol for forage analysis (UK)
- Sward stick and Platemeter (UK)

Health

- Controlling external parasites (IR)
- Cross comparison of feed catalogue value with animals' blood test (TR)
- Prevention of lamb diseases through proper new-born management (GR)
- Record and review self-evaluation checklist for daily milking parlour maintenance inspection (GR)
- Nematodirus control - forecast and anthelmintic use *(IR)*
- Guidelines for controlling gastro-intestinal nematodes by anthelmintic treatments (IT)*)*
- Flock Health Plan (SP)
- Scottish Animal Health Planning System (UK)
- Control plan of external parasites (SP)
- The FAMACHA score assessment (TR)
- Guidelines on how to deal with anthelmintic resistance (UK)
- SCOPs information including the nematodirus forecast (UK)
- Replacement nutrition requirement for first lactation (HU)

For the following solutions, they are either known in France and can answer the needs identified by French stakeholder, or may need more dissemination.

- For the solution "Grazing: what is achievable and how? (IR)", the general indicators are known and the specific part on lambs fattening on grass is not adapted in France because we have less and less farmers who finish lambs on pasture due to grass availability.
- The solutions "Sward stick and Platemeter (UK)" and "Sward measurement (IR)" are close and known in France, even if very few farmers use those kinds of tools due to the time needed.
- The solutions "Practical guide for conservation methods (TR)", "Producing high feed value grass silage (IR)", "Protocol for forage analysis (UK)" are known and used in France.

- The solution “Prevention of lamb diseases through proper new-born management (GR)” is known and used in France.
- The solution “Controlling external parasites (IR)” is known and used in France where it is possible. But it’s a solution with big constraints and not easy to implement.
- “Control plan of external parasites (SP)” is known but should be more disseminated.
- “Guidelines for controlling gastro-intestinal nematodes by anthelmintic treatments (IT)” and “Nematodirus control - forecast and anthelmintic use *(IR)”* are close and used in France.
- “Record and review self-evaluation checklist for daily milking parlour maintenance inspection (GR)” is close to the solution proposed by France and already known. The part describing the self-evaluation checklist can be interesting though if several people are milking the ewes and it changes every day.

The following solutions are not adapted to the French context.

- Two solutions have not been implemented because they need translation of the tool, which represent time we were not able to spend: “Scottish Animal Health Planning System (UK)” and “Checking Diet Tool (SP)”
- The solution “Forage, nutritional value tool (SP)” is useless in France because laboratories who make analyses give those results.
- The “FAMACHA score assessment (TR)” is known but not used in France because it’s time consuming and not easy to implement.
- The “Cross comparison of feed catalogue value with animals’ blood test (TR)” hasn’t been implemented because veterinarians estimate that animal blood test is enough and don’t need an analyse of the feeds. Also, when supplied together, some micronutrients can have antagonistic effects on some others, making the correlation between both concentration in feed and blood unreliable.
- The “Methods to calculate vitamin and mineral content of feeds and pastures (GR)” has not been implemented because it’s expensive and the variability along the year would necessitate a lot of analyses. Also, for a lot of micronutrients, concentrations in the feeds are available in the INRA tables and can perfectly be used to equilibrate rations.
- The “Flock Health Plan (SP)” has been judged not adapted, especially due to the conception of the shed in France which implies to limit over disinfection. The other advice of this solution is adapted and already used in France.

The following solutions has not been selected by stakeholders during the project but could be interesting to try and to adapt.

- The two next solutions from UK, “SCOPs information including the nematodirus forecast (UK)”, “Guidelines on how to deal with anthelmintic resistance (UK)” have been updated through the duration of the project and the new online content is interesting and will be studied by veterinarians. It could be implemented in France after translation and adaptation.
- The “Effect of birth and rearing type on lamb performance (IR)” is interesting but need adaptation and specific development to be integrated in the tools of the farmers if we want to use it.

The following solutions have been selected but we missed time to implement.

- The “Use of portable NIR's to assess forage feed value (SP)” was selected by our stakeholders but it was difficult to find the material. We succeeded in having de demonstration of the tool but we didn’t have had enough time to implement in farms.

The following solutions are not enough complete to answer the needs of the farmers.

- The 2 solutions “Replacement nutrition requirement for first lactation (HU)” and “Guide for replacement nutrition at first lambing (TR)” don’t give the practical information needed by farmers to manage the first lactation of ewes which had their first lambing at 1 year of age. **It appears for the French STWG that there is still a gap in the knowledge of nutrition requirements for first lactation (and end of gestation).**

GREECE

In relation to the needs expressed by Greek stakeholders at the start of the project, the STWG discussed why the following solutions were not retained:

Nutrition

1. "Feeding the ewe" - feed planning (UK)
2. BCS as a tool for nutrition requirement of ewes (TR)
3. Checking Diet Tool (SP)
4. Cross comparison of feed catalogue value with animals' blood test (TR)
5. Development of ewes that lambed young (HU)
6. Effect of birth and rearing type on lamb performance (IR)
7. Forage, nutritional value tool (SP)
8. Guide for replacement nutrition at first lambing (TR)
9. Guidelines on milk/grass transition (UK)
10. Knowing the water requirements of dairy ewes (FR)
11. Lamb growth protocol for performance target (TR)
12. Live weights at typical ages for ewe lambs (FR)
13. Managing ewe replacements to lamb at 1 year old (IR)
14. Nutrition plan of lambs from weaning to mating (IT)
15. Protocol for forage analysis (UK)
16. Rationing ewe lambs for better udder development (FR)
17. Replacement nutrition requirement for first lactation (HU)
18. Use of portable NIR's to assess forage feed value (SP)
19. When and how to provide minerals? (FR)
20. How to use molasses to homogenize feed ingredients and increase the lifespan of complete diets (unifeed) (IT)

Health

1. Appraisal of udder morphology to prevent high somatic cell count and mastitis (IT)
2. Controlling lameness (IR)
3. From the view of a sheep farmer II: Respiratory issues of lambs (HU)
4. Good management practices for fattening lambs. (SP)
5. Guidelines to manage foot-bathing (IT)
6. Maintenance of the milking machine (video) (FR)
7. Mastitis (HU)
8. Targeted drainage system in the grassland (TR)
9. Udder evaluation grid for lactating sheep (conformation and udder health) (FR)
10. Well-ventilated buildings (FR)
11. Record and review self-evaluation checklist for daily milking parlour maintenance inspection (GR)
12. Flock biosecurity – develop a health plan (IR)
13. Flock Health Plan (SP)

Regarding those solutions, the following are known in Greece and, can answer the needs identified by stakeholder, and may need more dissemination.

- The general guidelines presented in the solution "BCS as a tool for nutrition requirement of ewes (TR)" are methods known by Greek farmers and vet/advisors but not necessarily accepted by farmers, since they are time-consuming and there is a need to handle animals individually.
- The solution "Guidelines on milk/grass transition (UK)" consists of general guidelines and a leaflet not translated into Greek. Similar guidelines exist in Greek language and could be completed by analytical information after translation of the additional material of the UK solution.
- The solution "Rationing ewe lambs for better udder development (FR)" is an interesting solution, though most dairy farmers in Greece are aware of the solution and implement it.
- The same comment can be made for the general guidelines given in the solution "When and how to provide minerals? (FR)".

The following solutions were like other solutions implemented.

- "Record and review self-evaluation checklist for daily milking parlour maintenance inspection (GR)" and "Maintenance of the milking machine (video) (FR)" are similar with the solutions proposed by Italy (Good machine-milking practices for prevention of mastitis) and Spain (Good milking practices) which were selected for implementation.
- A similar solution to "Flock biosecurity – develop a health plan (IR)" and "Flock Health Plan (SP)" was selected for implementation (UK solution on flock health plan).
- "Controlling lameness (IR)" and "Guidelines to manage foot-bathing (IT)" are similar with the solutions proposed by UK (Booklet on how to recognise lameness) and Spain (Design and strategy of the hoof bath) which were selected for implementation.

The following solutions are not adapted to the Greek context:

- The solutions "Feeding the ewe" - feed planning (UK), Lamb growth protocol for performance target (TR), Good management practices for fattening lambs (SP), Udder evaluation grid for lactating sheep (conformation and udder health) (FR) and Guide for replacement nutrition at first lambing (TR) are targeted for meat sheep and less interesting for milk production. Moreover, information included in leaflet/software is in English and need translation.
- Likewise, the solution "Effect of birth and rearing type on lamb performance (IR)" is not adapted to Greek sheep production systems which are dairy sheep production systems.
- The Cross comparison of feed catalogue value with animals' blood test (TR) is a costly method; in routine conditions farmers supplement in vitamins and minerals according to technical references, and quantity and nature of supplementation is prescribed by vet or advisor.
- The solution Knowing the water requirements of dairy ewes (FR) was considered of limited information for global application.
- The solution Live weights at typical ages for ewe lambs (FR) is based on specific references for weight: in dairy sheep systems in Greece, there is no equipment for routine weighing of sheep, so the solution is not applicable.
- Likewise, the solution Managing ewe replacements to lamb at 1 year old (IR) mentions general guidelines and the ram effect, which is a known method in Greece, whereas protocol with weighing of lambs is not practical in most Greek dairy sheep systems.
- Concerning the Nutrition plan of lambs from weaning to mating (IT), several constraints appear for implementation: it is not necessary adapted to Greek production systems (a prerequisite is to weigh at target ages), and it is not easy to modify diet composition in the timeframe of the project (need to formulate corresponding diet with the food available to the farmer and to apply transition period).
- Although there was a need for information on feeding/distribution management, no stakeholder expressed interest for implementation of the specific issue of How to use molasses to homogenize feed ingredients and increase the lifespan of complete diets (unifeed) (IT).

- Similarly, no stakeholder expressed problems with lameness due to wet grasslands so the solution Targeted drainage system in the grassland (TR) was not selected.

The following solutions has not been selected by stakeholders during the project but could be interesting to try and to adapt.

- The solutions Checking Diet Tool (SP) and Forage, nutritional value tool (SP) are based on a Software, which was not translated to Greek. Similar guidelines exist in Greek language, and it could be interesting to get inputs from the Spanish software after translation and adaptation.
- The Protocol for forage analysis (UK) is interesting but was not selected for implementation due to cost. The main information of the solution is included in video and technical leaflet that is in English and could be translated to Greek for application in another context.
- The solution Appraisal of udder morphology to prevent high somatic cell count and mastitis (IT) was not selected as its implementation would go beyond the timeframe of the project.
- Same comment for the solution Well-ventilated buildings (FR), not feasible in the timeframe of the project.

The following solutions did not have enough details to answer the needs of the farmers.

The following solutions were not developed enough for practical application: Development of ewes that lambed young (HU), Replacement nutrition requirement for first lactation (HU), From the view of a sheep farmer II: Respiratory issues of lambs (HU), Mastitis (HU).

HUNGARY

Based on the Hungarian needs, the STWG discussed about the interest to have the following solutions adapted:

Nutrition

1. Nutrition plan of lambs from weaning to mating (IT)
2. Lamb growth protocol for performance target (TR)
3. Rationing ewe lambs for better udder development (FR)
4. Methods to calculate vitamin and mineral content of feeds and pastures (GR)
5. How to produce high-quality grass-silage (IT)
6. BCS as a tool for nutrition requirement of ewes (TR)
7. Grazing; what is achievable and how? (IRE)
8. Protocol for forage analysis (UK)
9. Gradual weaning protocol for lambs (TR)
10. Sward measurement (IR)
11. Producing high feed value grass silage (IR)
12. Parasitism management in grazing animals (GR)
13. Checking Diet Tool (SP)
14. Herbvalo - knowing the valorisation of grass on your grassland (FR)
15. Use of portable NIR's to assess forage feed value (SP)

Health

1. Controlling lameness (IR)
2. When and how to provide minerals? (FR)
3. Guidelines to manage foot-bathing (IT)
4. Booklet on how to recognise lameness (UK)
5. Guidelines on how to deal with anthelmintic resistance (UK)
6. Controlling external parasites (IR)
7. Design and strategy of the hoof bath (SP)
8. Well-ventilated buildings (FR)
9. The FAMACHA score assessment (TR)
10. Effect of birth and rearing type on lamb performance (IR)
11. Cross comparison of feed catalogue value with animals' blood test (TR)
12. Mixed grazing for cattle & sheep as a solution to limit parasite infestation (FR)
13. Targeted drainage system in the grassland (TR)
14. Reducing anthelmintic resistance (IR)
15. Better control of contagious ecthyma/orf (FR)

For the following solutions, they are either known in Hungary and can answer the needs identified by Hungarian stakeholders or may need more dissemination.

- The solutions "Nutrition plan of lambs from weaning to mating (IT)", "How to produce high-quality grass-silage" are known and used in Hungary. "Lamb growth protocol for performance target (TR)", "Gradual weaning protocol for lambs" are known in Hungary but need more dissemination.
- **"**BCS as a tool for nutrition requirement of ewes (TR)" has been using for a long time in the industry. "Grazing; what is achievable and how? (IRE)" is already well known in Hungary and used by farmers. "Protocol for forage analysis" is a costly method but is known in Hungarian.
- "Parasitism management in grazing animals" is well known in Hungary, but farmers can use many other solutions.

- “Producing high feed value grass silage (IR)” and “Sward measurement (IR)” is also known by Hungarian farmers.
- “Controlling lameness (IR)” and “Guidelines to manage foot-bathing (IT)” are similar with the solutions. “When and how to provide minerals? (FR)”, “Guidelines on how to deal with anthelmintic resistance” are used in Hungary. The solution “Rationing ewe lambs for better udder development (FR)” is an interesting solution, though most dairy farmers in Hungary are aware of the solution and implement it. The solution “Controlling external parasites (IR)” is known and used in Hungary where it is possible. “Design and strategy of the hoof bath (SP)” is known in the country.
- “The FAMACHA score assessment (TR)” is used in Hungary but sometimes farmers haven’t got time for this in the everyday routine. The “Effect of birth and rearing type on lamb performance (IR)” is interesting but need adaptation and specific development to be integrated in the tools of the farmers if we want to use it.

The following solutions are not adapted to the Hungarian context for financial reasons:

- The “Methods to calculate vitamin and mineral content of feeds and pastures (GR)” has not been implemented because it is expensive and labour intensive.
- “Well-ventilated shed (FR)” is costly. The “Cross comparison of feed catalogue value with animals’ blood test (TR)” hasn’t been implemented because vets estimate that animal blood test is enough. “Use of portable NIR's to assess forage feed value (SP)” this method is expensive if the farmer does not have the equipment. Targeted drainage system in the grassland (TR) this solution is not adapted in Hungary because we don’t have wet type grazing fields. Because of the climate change we will have more and more dry field in the future.
- “Better control of contagious ecthyma/orf (FR)” is good but the vaccine Ecthybel is not available in Hungary and the Hungarian vets and farmers use other vaccines.

There were language barriers for the implementation of the following solutions:

- “Booklet on how to recognise lameness (UK)” needs translation of the proposed material.
- “Checking Diet Tool (SP)” sounds an interesting solution, but unfortunately is available only in Spanish.
- Herbvalo - knowing the valorisation of grass on your grassland (FR), there were problems with translation of the tool and understanding how it works.

The following solutions has not been selected by stakeholders during the project but could be interesting to try and to adapt.

- Hungarian farmers did not select this method “Mixed grazing for cattle & sheep as a solution to limit parasite infestation (FR)” because they usually do not keep cattle and sheep together. The solution “Reducing anthelmintic resistance (IR)” was not chosen because Hungarian farmers need more knowledge about that.

IRELAND

Regarding the Irish needs, the Irish STWG discussed the following solutions and decided they were not relevant to Ireland mainly due to being associated with dairy sheep production or related to a disease/issue which is not relevant to Ireland.

Nutrition

- Knowing the water requirements of dairy ewes (FR)
- Sources of high milk urea and how to avoid excess protein content, links between protein intake and urea, modalities for checking milk urea (GR)
- Guidelines for the interpretation of milk urea concentration in sheep milk (IT)
- Strategic feeding protocol (dairy) (TR)
- Electricity/net fencing for communal rangeland issues (TR)

Health

- Maintenance of the milking machine (FR)
- Prevention strategies against Contagious agalactia (GR)
- Control of Ovine Progressive Pneumonia (Maedi Visna) at farm level (GR)
- Record and review checklist for daily milking parlour maintenance inspection (GR)
- Good machine-milking practices for prevention of mastitis (IT)
- Selective breeding for resistance to Maedi Visna Virus (MVV) (IT)
- Good milking practices (SP)
- Targeted drainage system in the grassland (TR)

The following solutions are similar to those produced by Ireland, and while relevant may require adapting to Irish conditions.

Nutrition

- Key references for the conservation of fermented forages (FR)
- Live weights at typical ages for ewe lambs (FR)
- How to produce high-quality grass-silage (IT)
- Practical guide for conservation methods (TR)
- Sward stick and platemeter (UK)
- Guidelines for implementing rotational grazing (UK)

Health

- Parasitism management in grazing animals (GR)
- Prevention strategies against clostridial diseases (GR)
- Enterotoxaemia from view of a sheep farmer (HU)
- Internal parasites (HU)
- Lameness in lambs (HU)
- Guidelines for controlling gastro-intestinal nematodes by anthelmintic treatments (IT)
- Guidelines to manage foot-bathing (IT)
- Control plan of external parasites (SP)
- Deworming program for sheep (SP)
- Booklet on how to recognise lameness (UK)
- SCOPs information including the nematodirus forecast (UK)
- Best practice guidelines for biosecurity and iceberg diseases (UK)
- Guidelines on how to deal with anthelmintic resistance (UK)

The following solutions have not been implemented because they needed translation of a tool or manual:

- Checking Diet Tool (SP)
- Forage, nutritional value tool (SP),
- Manual of good practices for the management of lambs on artificial rearing (SP) and
- Good management practices for fattening lambs (SP).

And the following solutions were not implemented as they were not suited to the climate in Ireland:

- Two successful combinations of legume/cereal winter forage crops (GR) and
- Inclusion and management of Sulla in the forage systems (IT).

Solutions where large quantities of concentrate are offered to lambs or replacements or deemed not relevant to Irish grass-based systems of prime lamb production were also not implemented including rationing ewe lambs for better udder development (FR), nutrition plan of lambs from weaning to mating (IT), gradual weaning protocol for lambs (TR) and lamb growth protocol for performance target (TR).

Some solutions were not possible to implement including: better control of contagious ecthyma/orf (FR), as the vaccine isn't available in Ireland, online history of grazing routes to remember and improve grazing routes in the next year (GR) and "Wikiloc"- a free tool to record grazing activities (TR) as shepherded systems aren't practised in Ireland, and joint ill in lambs (HU) as we don't have the equipment mentioned in Ireland, how to use molasses to homogenize feed ingredients and increase the lifespan of complete diets (IT) as it is an extreme exception for sheep to be offered total mixed rations in Ireland, the FAMACHA score assessment (TR), as haemonchosis is not prevalent in Ireland, and finally Scottish Animal Health Planning System (UK) as we were not able to register for this service in Ireland.
The following solutions were selected as being possibly useful and relevant but there was not enough time to implement, the solutions on well ventilated buildings (FR), and bedding management and relative humidity references (SP) as they required a winter housing period to be evaluated. Udder evaluation grid for lactating sheep (FR) and appraisal of udder morphology to prevent high somatic cell count and mastitis (IT) as they are very time consuming for farmers.

ITALY

Regarding the needs expressed by Italian stakeholders (NW2), the national group identified initially 22 solutions for the nutrition related needs and 30 solutions for health issues that could be of interest to be tested in Italy. Among them, only 10 solutions were retained to be tested (NW3). The Italian STWG discussed which solutions should have been tested but have not been and the reason for that by summarising comments received by farmers involved in the national group.

Tested solutions

<u>Nutrition</u>

- Herbvalo - knowing the valorisation of grass on your grassland (FR)
- Online history of grazing routes to remember and improve grazing routes in the next year. (GR)
- Producing high feed value silage (IR)
- Rotational grazing systems (Establishment and management) (IR)
- Cross comparison of feed catalogue value with animals' blood test (TR)

Health

- Design and strategy of the hoof bath. (SP)
- Deworming program for sheep (SP)
- Targeted drainage system in the grassland (TR)
- Best practice guidelines for biosecurity and iceberg diseases (UK)
- Use of Targeted Selected Treatment (TST) for ewe lambs (UK)

Not tested solutions

In the tables below we present the list of solutions taken into consideration but not tested in Italy and the main reason:

Nutrition

	Name of solution	**Reason for not testing**
1	Two successful combinations of legume/cereal winter forage crops (GR)	Already applied with species more adapted to the Italian context
2	Methods to calculate vitamin and mineral content of feeds and pastures (GR)	It needs adaptation since costs of analyses and sampling were estimated too high
3	"Wikiloc"- a free tool to record grazing activities (TR)	It is similar to another tested solution
4	Guidelines for implementing rotational grazing (UK)	It is similar to another tested solution
5	Improving the development of ewes that lambed young (HU)	It needs adaptation to the Italian context
6	Forage, Nutritional value tool (SP)	It needs adaptation to the Italian context
7	Replacement management tool (SP)	It needs adaptation to the Italian context
8	Checking diet tool (SP)	It needs adaptation to the Italian context
9	Protocol for forage analysis (UK)	It needs translation of the proposed material
10	Sward stick and platemeter (UK)	Similar to practices used in Italy
11	Knowing the water requirements of dairy ewes (FR)	Similar to practices used in Italy with different parameters
12	Live weights at typical ages for ewe lambs (FR)	Similar to practices used in Italy with slight differences due to breed requirements
13	Rationing ewe lambs for good udder development (FR)	Similar to practices used in Italy with some adaptations to the Italian context
14	when and how to bring minerals? (FR)	Similar to practices used in Italy with some adaptations to the Italian context
15	Managing ewe lamb replacements to lamb as 1 year old (IRE)	Similar to practices used in Italy with some adaptations to the Italian context
16	Sward measurement (IRE)	Similar to practices used in Italy with some adaptations to the Italian context
17	Guide for replacement nutrition at first lambing (TR)	Similar to practices used in Italy with some adaptations to the Italian context

Health

	Name of solution	**Reason for not testing**
1	Maedi Visna prevention strategies (GR)	It is considered too laborious and costly. Farmers oriented toward genetic strategy
2	Coprology control after antiparasite treatment (FR)	It needs more dissemination since Italian farmers are not aware of anthelmintic resistance
3	Reducing anthelmintic resistance (IR)	It needs more dissemination since Italian farmers are not aware of anthelmintic resistance
4	How to deal with anthelmintic resistance (UK)	It needs more dissemination since Italian farmers are not aware of anthelmintic resistance
5	Better control of contagious ecthyma (FR)	It needs more dissemination since Italian farmers are not used with vaccination for ecthyma

6	Identifying and controlling Lameness (IR)	It needs more dissemination since Italian farmers are not used with all the proposed practices
7	Bedding management and relative humidity references (SP)	It needs more dissemination since the use of these tools are not spread in Italy
8	Well ventilated shed (FR)	It needs more dissemination to check the proposed parameters
9	Electricity/net fencing for communal rangeland issues (TR)	Communal rangeland is rare in Italian context
10	Mixed grazing of cattle and sheep to limit parasite infestation (FR)	Mixed farms are difficult to find in Italian context
11	Parasitism management in grazing animals (GR)	It is similar to another tested solution
12	Flock Biosecurity (IR)	It needs more dissemination to show the feasibility of the protocol
13	Flock health plan (SP)	It needs more dissemination to show the feasibility of the protocol
14	Control plan of external parasites (SP)	It needs more dissemination to show the feasibility of the protocol
15	Detailed data keeping for health management to organize farms health plan. / Use of smartphone or/and computer applications to get reminders (GR)	It needs the development of the application
16	Scottish Animal Health Planning System (web-based) (UK)	It needs the development of the digital platform
17	Booklet on how to recognize lameness (UK)	It needs translation of the proposed material
18	Practical information on iceberg diseases (UK)	Partially applied. Some practices are considered too laborious
19	Milking machine maintenance (FR)	Similar to practices used in Italy
20	Record and review self-evaluation checklist for daily milking parlour maintenance inspection (GR)	Similar to practices used in Italy
21	Prevention strategies against Clostridial diseases (GR)	Similar to practices used in Italy
22	Prevention strategies against Contagious agalactia (GR)	Similar to practices used in Italy
23	Respiratory problems in the shed (HU)	Similar to practices used in Italy
24	Clostridial and Pasteurella vaccination (IR)	Similar to practices used in Italy
25	Good milking practices (SP)	Similar to practices used in Italy

In summary, the main reasons for not testing some solutions are:

Nutrition

- Already applied even if with some adaptation to the Italian context (9)
- They need some important adaptations to be applied in Italy (5)
- Similar to already tested solutions (2)
- It needs the translation of the proposed material (1)

Health

- Already applied even if with some adaptations to the Italian context (8)
- More dissemination to show the feasibility of the protocol (4)
- Farmers not aware of the issue (3)
- Farmers not used with the tools (3)
- Need for the development of a digital platform or software (2)
- The issue is not common in Italy (2)
- It needs the translation of the proposed material (1)
- Similar to already tested solutions (1)
- Too costly (1)

SPAIN

Based on the needs expressed by stakeholders in the sector, and the battery of available solutions, at the 2nd NWS the participating stakeholders pre-selected 23 nutrition and 20 health solutions that could be interesting to test in the national context. Finally, in the the 3rd NWS, 11 solutions were considered feasible to test and work on, 7 related to nutrition and 4 to health. The Spanish STWG has made an analysis of the main reasons that have prevented the testing of the rest of the solutions.

Tested Solutions

Nutrition

- Guidelines for the interpretation of milk urea concentration in sheep milk (IT)
- Nutrition plan of lambs from weaning to mating (IT)/ Rationing ewe lambs for better udder development (FR)
- BCS as a tool for nutrition requirement of ewes (TK)
- "Feeding the ewe"- feed planning (UK)
- Guidelines for implementing rotational grazing (UK) / Rotational grazing systems (establishment and management) (IR)

Health

- Maintenance of the milking machine (video) (FR)
- Well-ventilated buildings (FR)
- Parasitism management in grazing animals (GR)
- Appraisal of udder morphology to prevent high somatic cell count and mastitis (IT)

Not tested solutions

Nutrition

Solution	**Reason for not testing**
Herbvalo - knowing the valorisation of grass on your grassland (FR)	It needs time and resources to parameterise the tool to each farm´s conditions; more dissemination to show the feasibility
Knowing the water requirements of dairy ewes (FR)	It is theoretical knowledge: needs to be further communicated to farmers to acknowledge the real consumption
When and how to bring minerals? (FR)	Like practices already used in Spain
Two successful combinations of legume/cereal winter forage crops (GR)	Like practices already used in Spain
Methods to calculate vitamin and mineral content of feeds and pastures (GR)	Difficult to implement due to analysis requirements and economic cost.
Sources of high milk urea and how to avoid excess protein content, links between protein intake and urea, modalities for checking milk urea (GR)	Similar to already tested solution
Development of ewes that lambed young (HU)	Like practices used in Spain
Replacement nutrition requirement for first lactation (HU)	Like practices used in Spain

Sward measurement (IR)	Like practices used in Spain
Producing high feed value grass silage (IR)	Like practices used in Spain; it needs more dissemination to show the feasibility
Effect of birth and rearing type on lamb performance (IR)	Requires adaptation to the extensive sheep production system in Spain.
How to produce high-quality grass silage (IT)	Like practices used in Spain; It needs more dissemination and training on good forage production and conservation practices.
Practical guide for conservation methods (TR)	Like practices used in Spain; It needs more dissemination and training on good forage production and conservation practices.
Gradual weaning protocol for lambs (TR)	Like practices used in Spain
Electricity/net fencing for communal rangeland issues (TR)	Similar practices already implemented in Spain in paddocks; not viable for communal rangelands due to regulatory limitations.
Guidelines on how to manage transition between milk & grass (UK)	Like practices used in Spain
Protocol for forage analysis (UK)	Available in Spain, but farmers are usually reluctant to face this economic cost.

Health

Solution	**Reason for not testing**
Udder evaluation grid (conformation and mammary health) for meat sheep (FR)	Already implemented in dairy systems in Spain with an adapted scale
Coprology control after antiparasite treatment (FR)	It needs more dissemination since Spanish farmers are still not aware of anthelmintic resistance issues.
Mixed grazing of cattle and sheep to limit parasite infestation (FR)	In the Spanish systems considered, either they only have one species (sheep) or cattle and sheep usually do not graze on the same pastures.
Detailed data keeping for health management to organise farms health plan / Use of smartphone or/and computer applications to get reminders (GR)	Requires the development of the application/software.
Record and review self-evaluation checklist for daily milking parlour maintenance inspection (GR)	Similar to already tested solution
Enterotoxaemia from view of a sheep farmer (HU)	Like practices used in Spain
From the view of a sheep farmer II: Respiratory issues of lambs (HU)	Like practices used in Spain
Nematodirus control - forecast and anthelmintic use (IRE)	Requires the development of the application/software.
Controlling lameness (IRE)	Like practices used in Spain
Flock biosecurity – develop a health plan (IR)	Like practices used in Spain
Selective breeding for resistance to Maedi Visna Virus (MVV) (IT)	Like practices used in Spain
Targeted drainage system in the grassland (TR)	Difficult to apply in mechanized pastures, sloping pastures or in communal areas.
Scottish Animal Health Planning System (web-based) (UK)	Requires the development of the application/software.

SCOPS forecast for nematodirus (website) (UK)	Requires the development of the application/software.
Booklet on how to recognise lameness (UK)	The proposed material must be translated; in addition, a similar booklet is already in preparation by the Univ. of Zaragoza

TURKEY

Regarding the Turkish needs, the Turkish STWG discussed the following solutions and were not retained mainly due to being associated with high costs, dairy sheep production or related health and disease issues which were irrelevant to Turkey, or they were already known and/or not applicable by the stakeholders.

Nutrition

- Rationing ewe lambs for good udder development (FR)
- Knowing the water requirements of dairy ewes (FR)
- Key references for the conservation of fermented forages (FR)
- Herbvalo - knowing the valorisation of grass on your grassland (FR)
- Sources of high milk urea and how to avoid excess protein content, links between protein intake and urea, modalities for checking milk urea (GR)
- Online history of grazing routes to remember and improve grazing routes in the next year (GR)
- Two successful combinations of legume/cereal winter forage crops (GR)
- Managing ewe lamb replacements to lamb as 1 year old (IR)
- How to use molasses to homogenize feed ingredients and increase the lifespan of complete diets (IT)
- Inclusion and management of Sulla (Sulla coronaria (L.) medik.) in the forage systems (IT)
- Use of portable NIR's to assess forage feed value (SP)
- Forage, Nutritional value tool (SP)
- Manual of good practices for the management of lambs on artificial rearing (SP)
- Good management practices for fattening lambs (SP).
- Sward stick and platemeter (UK)
- Guidelines for implementing rotational grazing (UK)

Health

- Coprology control after antiparasite treatment (FR)
- Milking machine maintenance (FR)
- Better control of contagious ecthyma (FR)
- Mixed grazing of cattle and sheep to limit parasite infestation (FR)
- Well-ventilated shed (FR)
- Udder evaluation grid (conformation and mammary health) for meat sheep (FR)
- Prevention strategies against Clostridial diseases (GR)
- Disease prevention through correct management of newborn lambs (GR)
- Detailed data keeping for health management to organize farms health plan / Use of smartphone or/and computer applications to get reminders (GR)
- Mastitis, how to avoid it (HU)

- Lamb management - Preparation of ewes for lambing & Lambing and rearing, organization of manpower (HU)
- Lambs joint ill problems (HU)
- Treatments and protection against internal parasitism (HU)
- Controlling external parasites (IR)
- Clostridial and Pasteurella vaccination (IR)
- Flock Biosecurity (IR)
- Good machine-milking practices for prevention of mastitis (IT)
- Appraisal of udder morphology to prevent high somatic cell count and mastitis (IT)
- Selective breeding for resistance to Maedi Visna Virus (MVV)(IT)
- Control plan of external parasites (SP)
- Good milking practices (SP)
- Scottish Animal Health Planning System (web-based) (UK)
- SCOPS forecast for nematodirus (website)(UK)
- Use of Targeted Selected Treatment (TST) for ewe lambs (UK)

Regarding the following solutions, either they are already known and similar in Turkey or some may need further modifications at farm-based conditions:

- The solutions "Key references for the conservation of fermented forages (FR)", "Online history of grazing routes to remember and improve grazing routes in the next year (GR)", "Two successful combinations of legume/cereal winter forage crops (GR)" and "How to use molasses to homogenize feed ingredients and increase the lifespan of complete diets (IT)," "Good management practices for fattening lambs (SP)" and "Milking machine maintenance (FR)" were already known in Turkey but could have been worked on for a better dissemination across the sheep farmers.
- The solution to record "Online history of grazing routes to remember and improve grazing routes in the next year (GR)" was similar to Turkish solution the "Wikiloc", therefore it was not retained.

The following solutions have not been implemented because they needed translation of a manual/tool, and there were also issues with understanding the configuration:

- Use of portable NIR's to assess forage feed value (SP)
- Forage, Nutritional value tool (SP)
- Herbvalo - knowing the valorization of grass on your grassland (FR)
- Manual of good practices for the management of lambs on artificial rearing (SP)
- Good management practices for fattening lambs (SP).
- Scottish Animal Health Planning System (web-based) (UK), for Turkey is not possible to register in this system.

Solutions "Rationing ewe lambs for good udder development (FR)", "Knowing the water requirements of dairy ewes (FR)", "Sources of high milk urea and how to avoid excess protein content, links between protein intake and urea, modalities for checking milk urea (GR) ", Mastitis, how to avoid it (HU), Good machine-milking practices for prevention of mastitis (IT), Appraisal of udder morphology to prevent high somatic cell count and mastitis and "Good milking practices (SP)" are not selected or adapted to the Turkish context because dairy industry in Turkey relies on cattle production. There are very few dairy sheep farmers and most of them are practicing in the traditional way with few animals. Similarly for the Sward stick and palameter (UK)" and "Guidelines for implementing rotational

grazing (UK)" was not relevant for Turkey since we have real dryland conditions during the spring and summer times in many of the regions.

Some of the solutions were too costly to be implemented, such as:

- "Selective breeding for resistance to Maedi Visna Virus (MVV)(IT"), since it is associated with DNA analyses and
- "Well ventilated shed (FR)", which requires too much work and high cost to modify the barns.
- "Coprology control after entoparasite treatment (FR)", that is time consuming including lab costs.

Other solutions could not be implemented:

- "Better control of contagious ecthyma (FR)", as the vaccine is not available in Turkey but there are other vaccines and protocol that farmers use.
- "Inclusion and management of Sulla (Sulla coronaria (L.) medik.) in the forage systems (IT)", as there were not many farmers that own land to do mixed farming.
- "Mixed grazing of cattle and sheep to limit parasite infestation (FR)" was not implemented because farmers had opposite opinion on this solution: A viral disease caused by Coryza Gangrenosa Bovum – CGB in sheep would make a lot of losses in cattle if they are grazed together.

The following solutions are already routinely applied by farmers in Turkey: "Prevention strategies against Clostridial diseases (GR)", "Disease prevention through correct management of newborn lambs (GR)", "Detailed data keeping for health management to organise farms health plan / Use of smartphone or/and computer applications to get reminders (GR)", "Controlling external parasites (IR)", "Clostridial and Pasteurella vaccination (IR)", "Flock Biosecurity (IR)" Mastitis, how to avoid it (HU), "Lamb management - Preparation of ewes for lambing & Lambing and rearing, organization of manpower (HU)", "Lambs joint ill problems (HU)", "Treatments and protection against internal parasitism(HU)".

Finally, although the following solutions were not selected by stakeholders during the project, it could be interesting to try and to adapt them:

- Udder evaluation grid (conformation and mammary health) for meat sheep (FR)",
- "Use of Targeted Selected Treatment (TST) for ewe lambs (UK)" and
- Appraisal of udder morphology to prevent high somatic cell count and mastitis (IT) for the few commercial farms

UK

Regarding the UK needs, the UK STWG discussed why the following solutions were not retained:

<u>Nutrition</u>

1. Live weights at typical ages for ewe lambs (FR)
2. Rationing ewe lambs for good udder development (FR)
3. Producing high feed value silage (IRE)
4. How to use molasses to homogenize feed ingredients and increase the lifespan of complete diets (unifeed) (IT)
5. Nutrition plan of ewe-lambs from weaning to mating (IT)
6. Use of portable NIR's to assess forage feed value (SP)

7. Forage, Nutritional value tool (SP)
8. Checking diet tool (SP)
9. Gradual weaning protocol for lambs (TR)
10. Herbvalo - knowing the valorisation of grass on your grassland (FR)
11. Methods to calculate vitamin and mineral content of feeds and pastures (GR)
12. Grazing techniques (HU)
13. Good management practices for fattening lambs (SP)
14. Manual of good practices for the management of lamb on artificial rearing.(SP)
15. Lamb growth protocol for performance target (TR)
16. Knowing the water requirements of dairy ewes (FR)
17. Online history of grazing routes to remember and improve grazing routes in the next year (GR)
18. BCS as a tool for nutrition requirement of ewes (TR)
19. Guide for replacement nutrition at first lambing (TR)
20. Rotational grazing systems (Establishment and management) (IRE)
21. Sward measurement (IRE)
22. Grazing; what is achievable and how? (IRE)

<u>Health</u>

1. Udder evaluation grid (conformation and mammary health) for meat sheep (FR)
2. Treatments and protection against internal parasitism (HU)
3. Clostridial and Pasteurella vaccination (IRE)
4. Parasitism management in grazing animals (GR)
5. Maedi Visna prevention strategies (GR)
6. Disease prevention through correct management of newborn lambs (GR)
7. Lambs joint ill problems (HU)
8. Possibilities for the development and treatment of lameness (HU)
9. Selective breeding for resistance to Maedi Visna Virus (MVV) (IT)
10. Guidelines to manage foot-bathing (IT)
11. Control plan of external parasites (SP)
12. The FAMACHA score assessment (TR)
13. Nematodirus control - forecast and anthelmintic use (IRE)
14. Reducing anthelmintic resistance (IRE)
15. Guidelines for controlling gastro-intestinal nematodes by anthelmintic treatments (IT)
16. Bedding management and relative humidity references (SP)
17. Flock health plan (SP)
18. Design and strategy of the hoof bath (SP)

Regarding those solutions, the following are known in the UK, can answer the needs identified by the UK stakeholder, and may need more dissemination.

- For the solutions *Producing high feed value silage (IRE)*, and *How to use molasses to homogenize feed ingredients and increase the lifespan of complete diets (unifeed) (IT),* the facts are already known in the UK but could be disseminated more. Could be a future article written for the UK farmers by advisors.
- For the solution *Use of portable NIR's to assess forage feed value (SP),* the tool is already known in the UK, but the accuracy of it can be an issue. For this solution, some calibration/controls would be needed, but it is a great idea in principle.
- For the solution *Udder evaluation grid (conformation and mammary health) for meat sheep (FR),* this is already known as we use the same grid used in the UK, but more dissemination is needed. Developing an app with pictures for selection/recording at culling/stockdraw time would be useful. Useful for breeding programs but also for commercial farmers

- For the solution *Treatments and protection against internal parasitism (HU),* the information is already known in the UK, but maybe more dissemination is needed. There were similar solutions proposed by partners, so this one was not retained.
- The three solutions proposed by Ireland on grazing management: *Rotational grazing systems (Establishment and management) (IRE), Sward measurement (IRE)* and *Grazing; what is achievable and how? (IRE)* are already well known in the UK and used by farmers. Likewise for the solution *BCS as a tool for nutrition requirement of ewes (TR) and Guide for replacement nutrition at first lambing (TR*), the latter being based on UK guidelines.
- The solution *Online history of grazing routes to remember and improve grazing routes in the next year (GR)* was similar to another solution proposed for the Turkish partner and was not retained.
- For the solution *Clostridial and Pasteurella vaccination (IRE),* this is already routinely done in the UK. For the solution *Parasitism management in grazing animals (GR),* there were similar solutions proposed by the other partners, so it was not retained. Maybe more research is needed to really understand all the different factors affecting these issues.
- For the solutions *Disease prevention through correct management of new-born lambs (GR)* and *Control plan of external parasites (SP),* these solutions are already known in the UK, so were not retained by the team. The solution for *Lambs joint ill problems (HU)* was also deemed not new to what farmers are already doing. Likewise for the solutions *Guidelines to manage foot-bathing (IT),* and *Design and strategy of the hoof bath (SP).* These solutions are already known in the UK and farmers tend to use a 5 point plan for lameness.
- It was the same for the solutions *Nematodirus control - forecast and anthelmintic use (IRE), Reducing anthelmintic resistance (IRE), Guidelines for controlling gastro-intestinal nematodes by anthelmintic treatments (IT), Flock health plan (SP),* which were solutions similar to those proposed by the UK team.

The following solutions are not adapted to the UK context:

- For the solution *Live weights at typical ages for ewe lambs (FR)* -the targets proposed are too low for the UK. The solution *Rationing ewe lambs for good udder development (FR)* is for a concentrates based system which is unlike our UK forage based systems. It is also for dairy sheep, not meat sheep. Similarly, the solution *Knowing the water requirements of dairy ewes (FR)* is targeted at dairy animals, not meat ewes. Likewise for the solution *Grazing techniques (HU),* it was not appropriate for the UK as we don't have dry summer. Similarly, for the *FAMACHA score assessment (TR)*, it is not relevant for Scotland, but maybe could be for some farmers down South. However, Haemoncus is not a major issue in the UK. Likewise, the solution *Bedding management and relative humidity references (SP)* is for indoors systems, which are not very common in the UK.
- Some solutions were not retained as there were some issues of translation. The solution *Forage, Nutritional value tool (SP)* is only in Spanish and uses different systems of calculations, with no UK equivalent available. Likewise for *Herbvalo - knowing the valorisation of grass on your grassland* (*FR)*, there were issues with translation of the tool and understanding how it works. Both solutions *Good management practices for fattening lambs (SP)* and *Manual of good practices for the management of lamb on artificial rearing (SP)* were considered as potentially very good solutions for the UK if they were translated from Spanish.
- Although the solution *Nutrition plan of ewe-lambs from weaning to mating (IT)* was targeted at dairy systems, it was felt that some was known, and some lessons could be learnt.
- The solution *Maedi Visna prevention strategies (GR)* had issue of practicality to implement in the UK. Likewise, the solution *Selective breeding for resistance to Maedi Visna Virus (IT)* was found expensive and would require access to a DNA test to implement.

The following solutions has not been selected by stakeholders during the project but could be interesting to try and to adapt.

Two solutions were deemed interesting:

- The solution *Checking diet tool (SP)* could be nice to use to improve our existing UK tool – and see how it could help. The question was if it was only available in Spanish. It would be nice to see how their mechanism work (what equation/method they use).
- The other solution on *Gradual weaning protocol for lambs (TR)* could be interesting for our UK systems in a dry year. We tend not to creep feed before weaning but that may change. More information on weaning age would be useful to compare.

The following solutions did not have enough details to answer the needs of the farmers.

Three solutions fell in that category: *Methods to calculate vitamin and mineral content of feeds and pastures (GR)* and *Possibilities for the development and treatment of lameness (HU)* did not provide enough information. The solution *Lamb growth protocol for performance target (TR)* did not have enough details and is already known in the UK.