Horizon 2020 Programme

Report of the Final Seminar

Stirling, Scotland, UK

2-5 July 2024

Sm@RT

Sm@ll Ruminant Technologies

https://youtu.be/kESRGVSVEQY

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 101000471.

OBJECTIVES

The objectives for the final seminar were:

- To present the final Sm@RT project findings to a wide national and international audience
- To present some of the technological solutions identified by the consortium to answer farmers' needs
- To encourage exchanges between the partners' countries small ruminant sectors
- To meet face to face and continue creating links and cross-fertilisation
- To visit Scottish innovative farms and Digifarm and showcase UK innovative solutions

ORGANISATION AND ATTENDEES

The final seminar was the last face to face international meeting. It took place in Scotland in the UK, around Stirling, on 2-5 July 2024. The agenda of the meeting is detailed in the annex 1.

A total of 101 people participated to the final seminar workshop (49 farmers, 29 researchers and 23 consultants). Two of the advisory group members also participated (one from the UK, one from Hungary).

MONDAY 1ST JULY 2024

Arrival of delegations

- All delegations arrived by train at Stirling (Premier Inn Centre, Premier Inn South, Holiday Inn). Independent dinners in Stirling city centre by delegations.
The detailed agenda for the 3 days is in appendix 1.

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TUESDAY 2ND JULY – VISITS AT SRUC CT SCAN UNIT/MOREDUN RESEARCH INSTITUTE & FARM VISIT

The first day was dedicated to visits and presentations by the partners. A small interactive workshop was also organised by delegation.

We started with a bus trip to Penicuik, near Edinburgh, an hour drive from our hotels in Stirling. We visited SRUC's CT Scanning Unit, and to Moredun Research Institute, where each delegation also held an ADOPT session. Over lunch, we also had presentations from the Moredun partners, and from the Estonian and French delegations.

SRUC CT Scanning Unit:

Colleagues from SRUC presented the work done at the CT scanning unit. CT scanning makes use of a medical imaging technique using low dose X rays to produce images of the inside of an object or body. The technique is non-invasive and non-destructive and can be used on live animals and other objects without the risk of harm. Kirsty McLean presented their primary work, which is animal based; mostly working with sheep where they are involved in research trials but also provide a CT scanning service to pedigree terminal sire sheep breeders producing estimated breeding values on carcass traits that are used as a tool to select sires for improved lamb production.

John Gordon then showed the delegations the latest piece of equipment they use: Portable Accumulation Chambers for methane measurements. SRUC's GreenSheep facility allows quick and accurate measurement of methane emissions from sheep. Twelve portable accumulation chambers (PACs) are housed on a trailer that can be taken to the sheep to measure methane and CO_2 emissions on different diets (including at grazing). Each PAC is an aluminium box, approximately 1m long, that house individual sheep for short periods of time (50 minutes). Air samples are collected during this time and methane concentration can be analysed and emissions quantified.

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Moredun Research Institute:

The delegations then went to Moredun Research Institute, where they each performed an ADOPT session, to collect information on some the innovative tools highlighted in the project.

Country	Estonia	France	Hungary	Ireland	Italy	Israel	Norway	UK
Technology	Weather station outdoor or indoors	Portable SCC (milk) Feed ration planner (meat)	Post-dried hay technology	SheepIreland app	Portable NIRS	Aptimiz (labour app)	3D imaging tool	Automatic grass plate meter
Rate of adoption	25%	1% (milk) 86% (meat)	14%	6%	97%	93%	4%	90%
Years to peak adoption	18 years	9 years (milk) 11 years (meat)	11 years	16 years	10 years	12 years	17 years	11 years

Then, after lunch, Claire Morgan-Davies (SRUC, coordinator & hosting partner) and Fiona Kenyon (Moredun, hosting partner) welcomed formally the delegates, who were then introduced to the work undertaken by the Moredun institute. This was followed by the presentation of the Estonian delegation by Peep Piirsalu, and of the French delegation by Laurence Depuille.

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After lunch the group took buses to Hawick (~1.5 hour drive), to visit Southfield Farm, one of the UK innovative farms.

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Southfield Farm, Innovis. Farm manager: Hamish Macdonald

- 1,150 breeding ewes, 1620 lambs and 400 ewe hogg replacements.
- Wide range of performance recorded composite maternal and meat breeds.
- 20 Angus cows plus followers.
- 2,100 shearling rams sold each year. Bred at Southfield (nucleus) and 23 breeding partner flocks.
- 254 ha

Technology used:

- DNA parentage
- Tru-Test XR5000 weigh head + Pratley auto drafter
- Portable Accumulation Chamber (PAC)
- Feed Efficiency Bunkers
- Composite breeding programme

Hamish welcomed the delegates, who were then divided into 4 groups to see 4 stations in turn:

Station 1: farm tour. Delegates were taken by trailer to have an overview of the farm and the various fields and stocks.

Station 2: farm facts: Hamish Macdonald presented the farm and explained the husbandry and flock management, being one the nucleus flocks for the breeding company Innovis. He also explained the technology they used to record.

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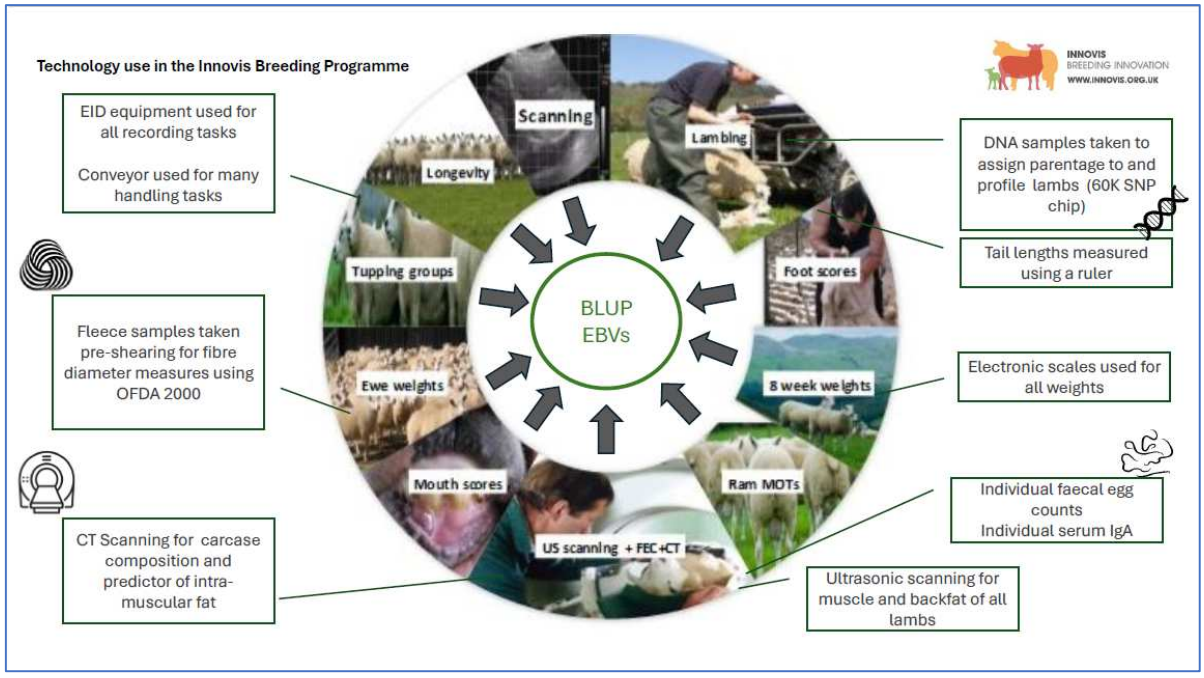
Station 3: Dewi Jones, the CEO of Innovis, explained how they developed their meat and maternal breeds to fit with the outdoor environment and farm conditions. Rams were also on display.

Station 4: Janet Roden, one of the geneticists working for Innovis, presented to the delegates how they use the various technologies and recorded information from Southfield to refine their breeding programmes.



The delegates thanked the team at Southfield and left for dinner in Peebles, on the way back to Stirling.

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Details on morning visits and Southfield farm are available in the handout (appendix 2).

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WEDNESDAY 3RD JULY – INNOVATIVE FARM VISIT & FINAL WORKSHOP

The second day was devoted to a visit to one of the UK innovative farms, followed by a common workshop in a nearby venue (Guardswell farm)

Incheoch Farm, Alyth, Perthshire

- 1,020 breeding ewes, 1600 lambs, 400 ewe hogg replacements and 120 yearling sale rams.
- Breed: Lleyn (900 ewes) and Texel (100 ewes) all performance recorded.
- 210 Luing, Simmental and Angus cows.
- 120 rams and 17 bulls are sold through on-farm 'Working Genes' ram and bull sales.
- 500 ha

Technology used:

- Agrident 600 Handheld data recorders
- Tru-Test XR5000 weigh head + FarmIT weigh crate or Ritchie Combi Clamp with EID reader
- Working Genes Ram Sale

More details in appendix 2.

Debbie and Neil McGowan welcomed us on their sheep and beef farms. The delegates were split in 3 groups to visit 3 different stations:

Station 1: farm tour. Delegates were taken by trailer to have an overview of the farm and the various fields and stocks.

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Station 2: Debbie showed how they use the various technologies to record information from the flock at lambing and how it informs their farm and grazing management. Delegates were able to try the combi-clamp with sheep.

Station 3: Neil explained the overall sheep year and how they select their rams for sale according to their own breeding programme and selection criteria adapted to their upland environment. Delegates were also able to see some of the selected rams and ask questions.

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After a BBQ lunch kindly organised by Neil & Debbie at Incheoch farm, the delegates went to Guardwell farm, a large venue where the Sm@RT workshop was being held.

Sm@RT final workshop – Guardswell farm

The workshop was held in 3 parts. We also had a zoom link for people who wanted to attend the workshop remotely. Lisa Hislop (NFUS) joined us.

The first part was a global presentation of the project. After a welcome by each of the Network Facilitators in their own language, Claire Morgan-Davies (SRUC coordinator) presented the project's results, with the help of the various workpackage leaders (Jean-Marc Gautier (Idele), Ilan Halachmi (ARO), Lise Grøva (NIBIO), Valeria Giovanetti

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(Agris), Ann McLaren (SRUC), Renata Klein (Unideb) and Fiona Kenyon (MRI)). This allowed the team to present the width of the work carried out during the project. The slides used are in appendix 3.

The second part was devoted to the presentations of the delegations and their farming systems (Hungary, Ireland, Israel, Italy, Norway and the UK). France and Estonia had done their presentation the day before.

The last part was a participatory exercise. The delegates were split in 5 groups (Group 1: France; Group 2: Italy; Group 3: UK & Norway; Group 4: Estonia & Ireland; Group 5: Israel & Hungary), which, in turn, had the opportunity to see 5 different stations (centred around the 5 themes of the project) where 2 tools were presented. At each station, delegates were shown 2 technologies (videos or PPT) that answered some of the farmers' needs identified, they had access to the guidelines prepared, the cost-benefit analyses and the results from the adoption workshops. Feedback from the various participants and discussion ensued.

Station 1: Feeding/Grazing.

The virtual fence and automatic milk feeder were presented by Laurence Depuille (France) and Peep Piirsalu (Estonia) to the delegates.

Station 2: Herd/Flock management.

The drone and flock management software were presented by Lise Grøva (Norway) and Assaf Godo (Israel).

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Station 3: Health & welfare.

The FEC pack and connected water meter were presented by Fiona Kenyon (UK) and Jean-Marc Gautier (France).

Station 4: Reproduction.

The pregnancy scanner and hand-held reader were presented by Renata Klein (Hungary) and Brid McClearn (Ireland).

Station 5. Fattening & Milking.

The EID weigh-crate and electronic milk meter were presented by Tim Keady (Ireland) and Valeria Giovanetti (Italy).

The information presented to the delegates is available in appendix 3.

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Each group had to pick their 2 preferred technologies after the discussions. Group 1 preferred the virtual fence and the FEC pack; group 2 preferred the FEC pack and flock management software; group 3 preferred the pregnancy scanner and the EID weighcrate and reader; group 4 preferred the FEC pack and pregnancy scanner, and group 5 preferred the flock management software and the EID weigh crate. Some of the reasons given were ease of management on pasture, surveillance of disease, biggest impacts on the flocks/herds, and most adaptable technologies.

The day concluded with a buffet meal with local produces and Scottish specialities, and opportunities for picturesque group photos. An evaluation questionnaire was also collected.

French Delegation

Hungarian delegation

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Irish delegation

Israeli delegation

Italian delegation

Norwegian delegation

UK delegation

Estonian delegation

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THURSDAY 4TH JULY – DIGIFARM VISIT

For the third and last day, the visit was dedicated to the UK digifarm, situated in the southern Scottish Highlands. Delegates left Stirling in the morning to drive to SRUC Hill & Mountain Research Centre, Auchtertyre & Kirkton farms (~1 hour away).

SRUC Hill & Mountain Research Centre, Kirkton & Auchtertyre farms. Sm@RT Digifarm.

- Covers land area of 2225 ha:
  - 1677 ha of mountain pasture (unimproved hill pasture).
  - 153 ha of semi-improved pasture; 67 ha improved pasture.
  - 307 ha native woodland and scrub.
- 1,300 breeding ewes (Scottish Blackface, Lleyns, Crossbred Blackface x Lleyn, Black Welsh Mountain) and 350 ewe hoggs (1 year old female replacements) in 4 different flocks:
  - 600 ewes in Kirkton Face (Scottish Blackface & Crossbred Blackface x Lleyn) – research flock
  - 500 ewes in Auchtertyre Glen (Scottish Blackface) & 150 ewes in the Corrie (Scottish Blackface & Black Welsh Mountain) – commercial hill flocks
  - 50 ewes in Auchtertyre Lleyn flock – commercial lowland flock
- 30 beef cows (Aberdeen Angus & Aberdeen Angus cross)

Technologies used:

- Sheep handling system:
  - Conveyor
  - EID stick reader, data logger and digital weigh-head
  - EID weigh crate and autodrafter
- Environmental sensors
  - Trail camera boxes for small mammal monitoring
  - AudioMoth (digital acoustic device) for monitoring birds and bats
  - Digitanimal GPS collars
  - Decentlab environmental sensors
- Sheep tracking and welfare monitoring
  - Ultra-High Frequency ear-tags and receiver:
  - Bluetooth beacons and receiver (Wearable Integrated Sensors Platform - WISP)
- Breeding for sustainable hill sheep
  - Automated feed intake recording equipment
  - CT scanning
  - Portable Accumulation Chambers (PAC) to measure methane emissions

More details of the technologies and projects are given in appendix 2.

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Professor Davy McCracken (SRUC, head of the Hill & Mountain Research Centre) welcomed the participants. After a coffee, they were split in 5 groups to visit 5 stations around the research farms.

Station 1:

Kirkton feed bins. Nicola Lambe (SRUC researcher) presented the results and approach of the ongoing research breeding programme on hill sheep.

Station 2: Environmental sensors and agroforestry trials. John Holland (SRUC researcher) and Milly Wade (SRUC technician) presented the sensors they use for the research on environmental benefits and biodiversity trials.

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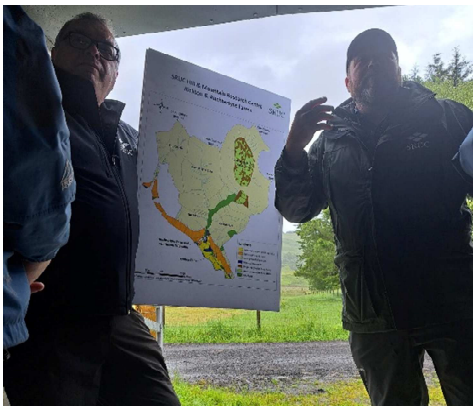
Station 3: Farm facts. Davy McCracken (SRUC) and Ewen Campbell (SRUC farm manager) presented the farm in general, and the sheep year and explained how the research and commercial hill flocks are managed.



Station 4: Handling systems. Ailsa Thomson (SRUC technician) and Fiona Livingstone (SRUC technician) presented the EID weighcrate and autosorter, and the conveyor, and how they are used for recording information on the research and commercial flocks.

Station 5:

Proximity trials. Claire Morgan-Davies (SRUC researcher) and Aimee Walker (SRUC PhD student) presented results from the TechCare project pilot trials that is testing UHF tags and Bluetooth beacons to measure animal proximity to a feed resource, and distance between ewe and lamb.

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The participants had a hot lunch (well appreciated as the Scottish wet weather had been in full force during the visit) before leaving back to Stirling.

The afternoon was devoted to a guided visit to the medieval Stirling castle, followed by a farewell dinner at the Stirling Highland Hotel.

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APPENDICES

Appendix 1: Detailed program
Appendix 2: Farm descriptions – handout
Appendix 3: Slides presented during the workshop
Appendix 4: Attendance sheets for the 3 days

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Appendix 1: Detailed program

Final Seminar – Stirling, Scotland, UK - Tuesday 2nd to 5th July 2024

AGENDA

Day 1 SRUC/Moredun & Southfield Farm

0800 – 0900: ***Buses (3) leave Stirling (from 3 hotels) to SRUC/MRI***

Bus 1 – Premier Inn South (M9) – FK7 8EX
Bus 2 – Premier Inn Centre – FK8 1QZ
Bus 3 – Holiday Inn Express – FK7 7XH ***(Then collect additional passengers at Premier Inn Centre)***

0900 – 1030: ***BUS 1:*** Visit to SRUC's CT Scanning Unit (EH26 0QE):
BUS 2: Visit to Moredun Research Institute (EH26 0PZ)
BUS 3: Goes to SRUC's CT Unit – Drop Hungarian delegation (n=10) & the 2 Israeli . The remaining French passengers go to Moredun.

1030 – 1200: ***BUS 1:*** Visit to Moredun Research Institute (EH26 0PZ)
BUS 2: Visit to SRUC's CT Scanning Unit (EH26 0QE):
BUS 3: Goes to SRUC's CT Unit: Drop French at CT Unit (collect Hungarians & 2 Israeli and take to Moredun).

1200 ***BUS 2*** *return to Moredun.*
BUS 3 *to collect French from CT and go back to Moredun*

1200 - 1300: ***Lunch – Moredun Research Institute***
(+ delegation presentations from UK, France, Estonia, Norway)

1300 – 1500: ***BUS 1, BUS 2 & BUS 3 - Travel to Southfield Farm, Hawick, (UK Innovative Farm)***

1500 – 1700: **Visit to Southfield Farm with Hamish Macdonald (Farm Manager)**

A (UK + Ireland) Fiona shepherd	B (Italy + Israel) Poppy shepherd	C (Norway + Hungary) Ann shepherd	D (France + Estonia) Claire shepherd
Farm tour	Tech	Farm facts	Rams
Rams	Farm tour	Tech	Farm facts
Farm facts	Rams	Farm tour	Tech
Tech	Farm facts	Rams	Farm tour

1715 – 1830: ***BUS 1, BUS 2 & BUS 3 - Travel to Peebles***

1830 – 2030: Evening meal – Peebles (The Green Tree)
(+ delegation presentations from Ireland, Israel, Italy & Hungary)

2030 – 2200: ***BUS 1, BUS 2 & BUS 3 - Return journey from Peebles to Stirling***
Bus 1 – Premier Inn South (M9) – FK7 8EX
Bus 2 – Premier Inn Centre – FK8 1QZ
Bus 3 – Holiday Inn Express – FK7 7XH ***(dropping additional passengers at Premier Inn Centre on the way)***

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Day 2 Incheoch Farm & Afternoon Workshop

0800 – 1000: ***Buses leave Stirling to travel to Incheoch Farm, Alyth (UK Innovative Farm)***
Bus 1 – Premier Inn South (M9) – FK7 8EX
Bus 2 – Premier Inn Centre – FK8 1QZ
Bus 3 – Holiday Inn Express – FK7 7XH (Then collect additional passengers at Premier Inn Centre)

1000 – 1200: **Visit to Incheoch Farm with Neil & Debbie MacGowan**

1a (France + Estonia) Claire shepherd	1b (Irish + Norway) Brid shepherd	2a (Italy + UK) Fiona shepherd	2b (Israel + Hungary) Lorna shepherd
Farm tour	Farm tour	Farm facts	Tech
Tech	Farm facts	Tech	Farm facts
Farm facts	Tech	Farm tour	Farm tour

1200 – 1300: **BBQ *LUNCH at Incheoch Farm***

1300 – 1400: ***BUS 1, BUS 2 & BUS 3 - Travel from Incheoch to Guardswell Farm, Kinnaird***

1400 – 1730: **Sm@RT workshop at Guardswell Farm**

Start at 2 pm
1400 – 1415 Introduction (Claire) + NF welcome in turn (15 min)
1415 - 1515 Presentation of the whole project (15 min per WP) - WP leaders/co-leaders
1515 - 1530 Break (15 min)
1530 - 1710 Session in groups (1 hour 40 min)
Groups of delegates rotate every 20 min between the 5 tables.

5 groups:

France (group 1)
Italy (group 2)
UK + Norway (group 3)
Ireland + Estonia (group 4)
Israel + Hungary (group 5)

Table	Topic	Presenters	Tech 1	Tech 2
1	Feeding/Grazing	Laurence/Peep	Virtual fence	Automatic milk feeder
2	Herd/Flock management	Lise/Assaf	Drone	Flock management software
3	Health/Welfare	Fiona/Jean-Marc	FEC pack	Connected water meter
4	Reproduction	Brid/Renata	Pregnancy scanner	Hand-held reader
5	Fattening/Milking	Tim/Valeria	EID weigh crate	Electronic milk meter

1710 - 1725 General conclusions (10-15 min) -> + one last survey

End of workshop

1730 – 2030: Free time followed by evening buffet at Guardswell Farm

2030 - 2130: ***BUS 1, BUS 2 & BUS 3 - Travel from Guardswell Farm back to Stirling***
Bus 1 – Premier Inn South (M9) – FK7 8EX
Bus 2 – Premier Inn Centre – FK8 1QZ
Bus 3 – Holiday Inn Express – FK7 7XH

Day 3 Digifarm and Stirling

0800 – 1000: ***Travel from Stirling to Auchtertyre Farm, Tyndrum (FK20 8RU)***
Bus 1 – Premier Inn South (M9) – FK7 8EX
Bus 2 - Holiday Inn Express – FK7 7XH THEN Premier Inn Centre – FK8 1QZ

1000 - 1045 ***Tea/coffee & welcome to Hill & Mountain Research Centre (Digifarm)***
5 stations

A (UK + EST) Eilidh shepherd	B (Italian) Fiona shepherd	C (French) Jean-Marc shepherd	D (HU + ISR) Renata shepherd	E (NO + IRE) Brid shepherd
Feed bins (Kirkton) - with trailer	Proximity sensors	Handling systems	Farm facts	Environmental sensors
Environmental sensors	Feed bins (Kirkton)	Proximity sensors	Handling systems	Farm facts
Farm facts	Environmental sensors	Feed bins (Kirkton)	Proximity sensors	Handling systems
Handling systems	Farm facts	Environmental sensors	Feed bins (Kirkton)	Proximity sensors
Proximity trials	Handling systems	Farm facts	Environmental sensors	Feed bins (Kirkton) & back with trailer

1300 – 1400: ***LUNCH at Auchtertyre Farm***
1400 – 1600: ***BUS 1 & BUS 2 - Travel from Auchtertyre Farm back to Stirling Castle***

1630 – 1800: ***Visit of Stirling Castle*** (guided visit)

1830 – 1900: ***Arrive at Stirling Highland Hotel***

1900 – 2200: ***Final dinner & farewell (delegations to make their own way back to their hotels)***

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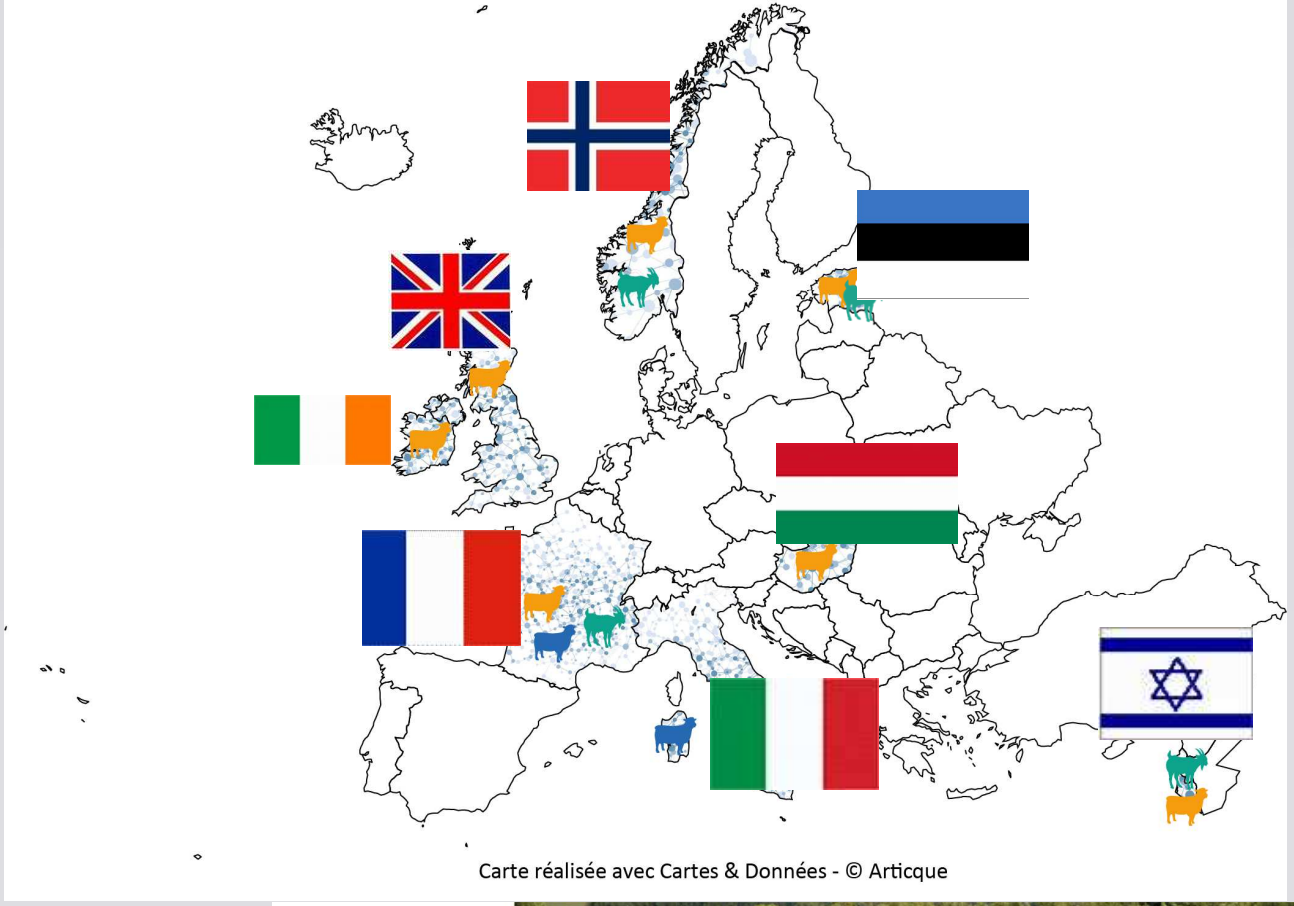
Sm@RT - Small Ruminant Technology

Final Seminar – Scotland, July 2024

Sm@RT
Sm@ll Ruminant Technologies



Carte réalisée avec Cartes & Données - © Articque

Welcome! *Tere tulemast!*

Bienvenue!

Benvenuti!

Üdvözöljük!

Velkommen! ***שלום***

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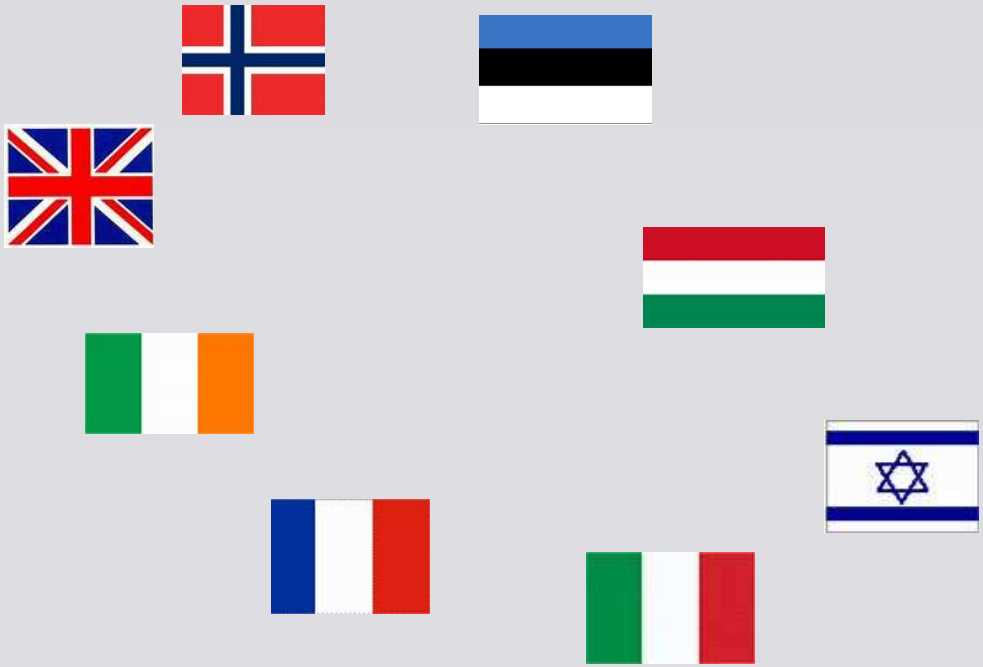
A warm welcome by our National Facilitators



Welcome! Tere tulemast!

Bienvenue!

Benvenuti!

Üdvözöljük!

Velkommen!

שלום

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Agenda for today:

2 – 2.15	**Welcome**
2.15 – 3.15	**Presentation of project by WP**
3.15 – 3.30	**Break**
3.30 – 5.10	**Group sessions**
5.10 – 5.30	**Conclusions**
5.30	***Bar opens***
6.00 – 8.30	***Evening buffet***

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Sm@RT – a reminder

Sm@RT: Small Ruminant Technology – PLF and Digital technologies for small ruminants

3 years + 9 months

Starting Jan 2021

Objectives :

- To create a European **network** around the **use of PLF and digital technologies** in small ruminants
- To encourage **knowledge exchange**, new technologies **adoption** and **communication** between farmers and stakeholders of the small ruminant sectors.

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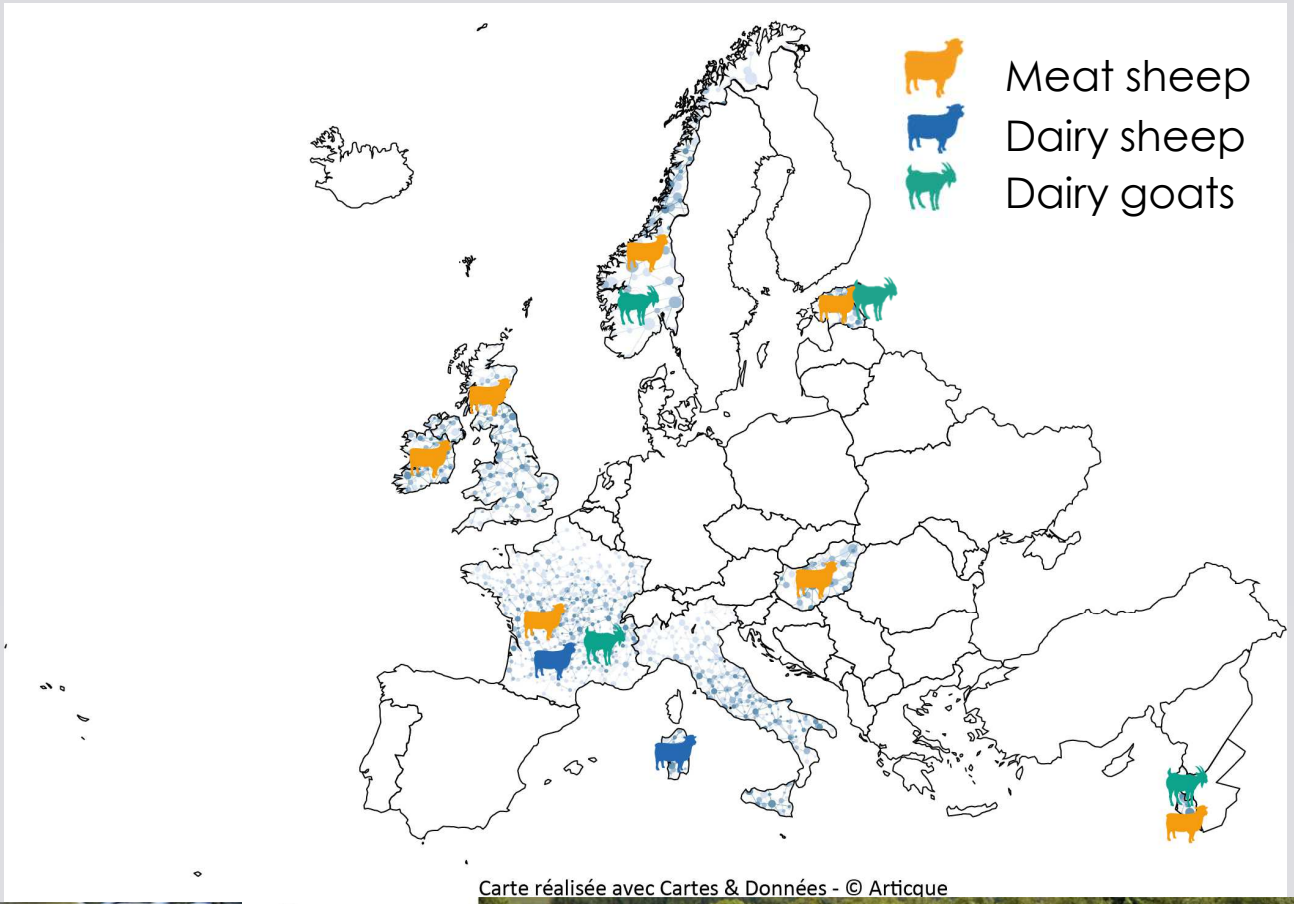
Partners & Countries:



Carte réalisée avec Cartes & Données - © Articque

UK
Ireland
Norway
France
Italy
Hungary
Estonia
Israel

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Network: 3 levels

Sm@RT
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Digifarm
1 per country & production

- Experimental or demonstration farm with PLF/DT
- Perfect place for exchange, demonstration and knowledge transfer.

Innovative farmers
3 per country and production type

- Commercial farms involved in the project, with some technologies, for peer-to-peer exchanges

Interested farmers

National workshops & transnational workshops

Farm demonstration days (on Innovative Farms)
Training events (on Digifarms)

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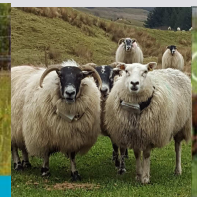
Multi-actor approach

National workshops
Every 6 months

PLF/Digital technologies demonstration/training
On the Digifarms and ‘Innovative Farms’ in 2022 / 2023

International workshops
Every 6 months
2 online in 2021/22
1 in France (July 2022)
1 in New Zealand (Feb 2023)
1 in Norway (June 2023)
1 online in 2024 (Jan)



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Sm@ll Ruminant Technologies

Step 1

- **1a:** Identification of farmers needs
- **1b**: Inventory of corresponding PLF/digital technologies

Step 2

- Selection of PLF/digital technologies suitable to the different contexts and countries
- Identification of methods and channels for knowledge transfer

Step 3

- Farmers and practitioners' barriers, testimonies and description of PLF/digital technologies adapted to local contexts

Step 4

- Assessment of farmers acceptance of the different PLF and digital technologies from the sessions, visits, and farm demo on Innovative Farms and Digifarms.

Step 5

- Definition of a European dissemination and uptake strategy for PLF and digital technologies in small ruminants systems

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Create a network

- NFs
- Farmers' groups
- AKIS
- Workshops organisation

Assessing farmers' needs

- Survey & inventory of tools on farms
- List of farmers' needs for technology

Finding solutions

- Identification
- Preference
- Guidelines
- Cost-Benefit analysis
- Videos

Evaluating the solutions

- Testimonies
- Farm demonstrations
- Training sessions
- ADOPT

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- NFs
- Farmers' groups
- AKIS
- Workshops organisation

Create a network

Setting-up a network of Digifarms in each country

Setting-up a network of Innovative farmers

18 **11** **8**

Setting-up the AKIS (Agricultural Knowledge & Innovation Systems)
➡ wider network

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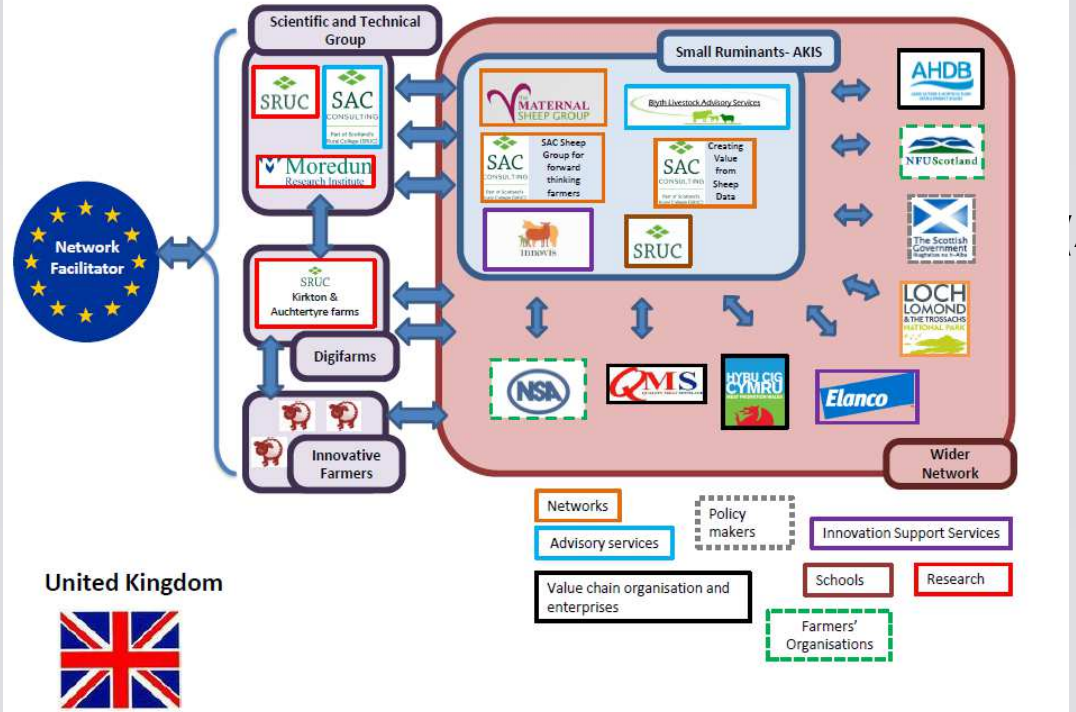
- NFs
- Farmers' groups
- AKIS
- Workshops

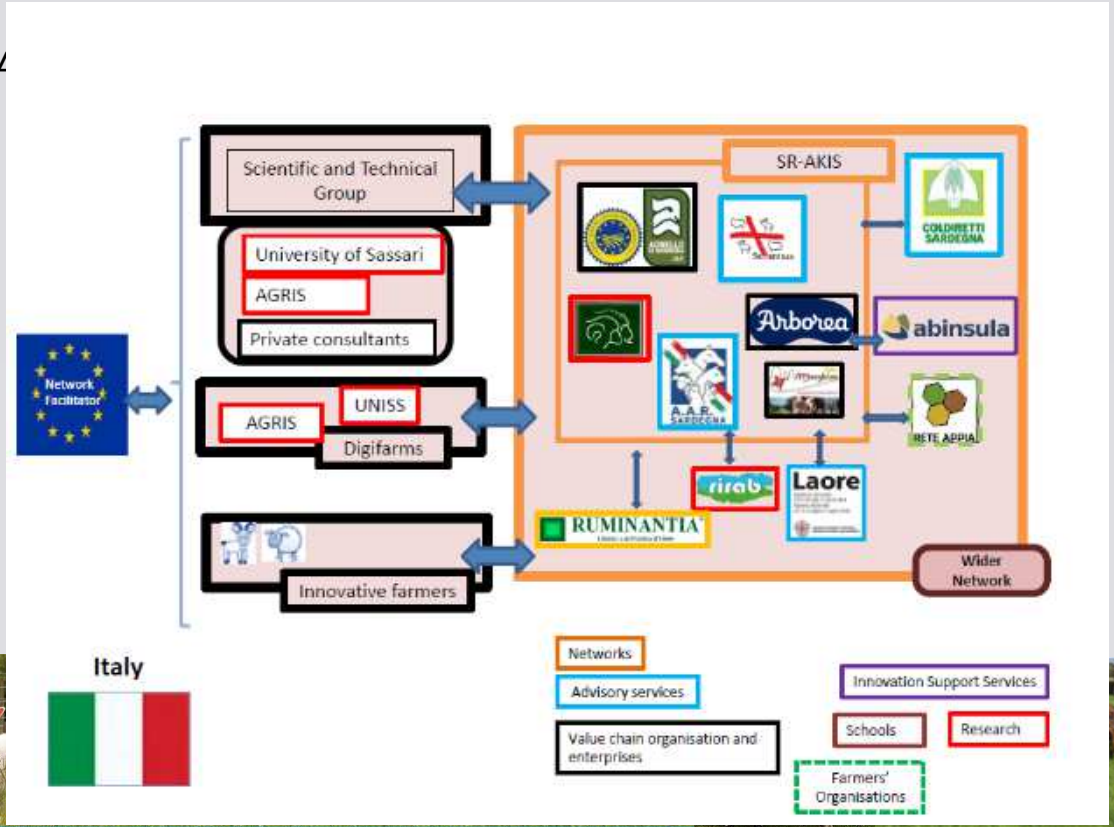
Setting-up a network of Digifarms in each country

Sm@ll Ruminant Technologies

k of Innovative farmers

11 8





Laurence/Jean-Marc

This project has received funding from the European Union's Horizon 2020 research and innovation programme, under grant agreement 101000471

- NFs
- Farmers' groups
- AKIS
- Workshops organisation

Create a network

Workshops organisation:

- 5 series of National workshops
- 5 transnational workshops
- 1 international visit

International workshops

Every 6 months

- 2 online in 2021/22
- 1 in France (July 2022)
- 1 in New Zealand (Feb 2023)
- 1 in Norway (June 2023)
- 1 online in 2024 (January)
- **Today!! Scotland, June 2024**

National workshops
56 in total
Every 6 months

Laurence/Jean-Marc

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Workshops organisation:

- NFs
- Farmers' groups
- AKIS
- Workshops organisation

Create a network

NWS1 & TNWS1 - ONLINE

Identification of farmers' needs

NWS2 & TNWS2 - ONLINE

Identification & selection of solutions

NWS3 &TNWS3 -France

Presentation & evaluation of solutions (farm demo)

International visit in New Zealand

Technologies used in another sheep country

NWS4 & TNWS4 – Norway

Assessment of solutions (training, tech speed dating)

NWS5 & TNWS5 – ONLINE

Last assessments & Identification of gaps

Liaising with other EU projects on small ruminants or on technology, e.g.

- EuroSheep
- TechCare
- R4D
- …

Laurence/Jean-Marc

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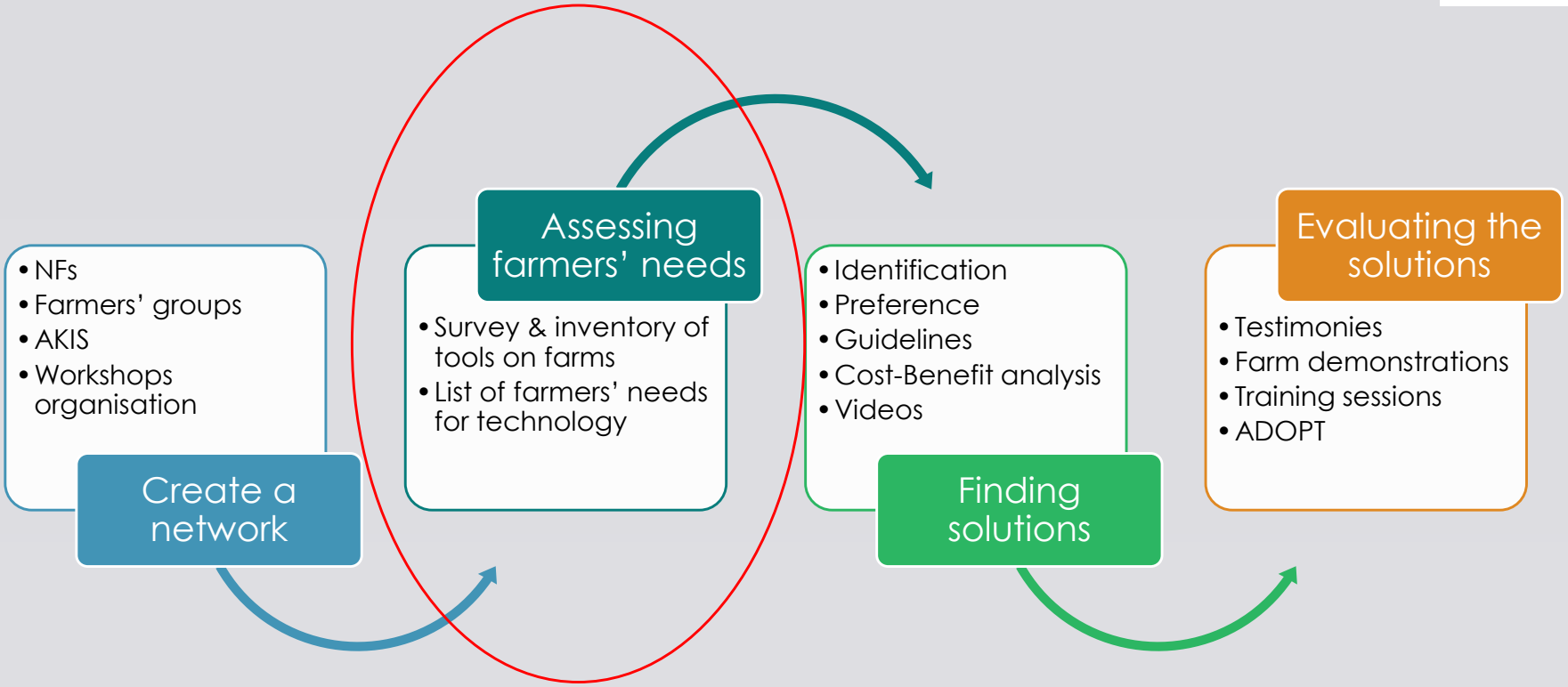
Sm@ll Ruminant Technologies



Sm@ll Ruminant Technologies

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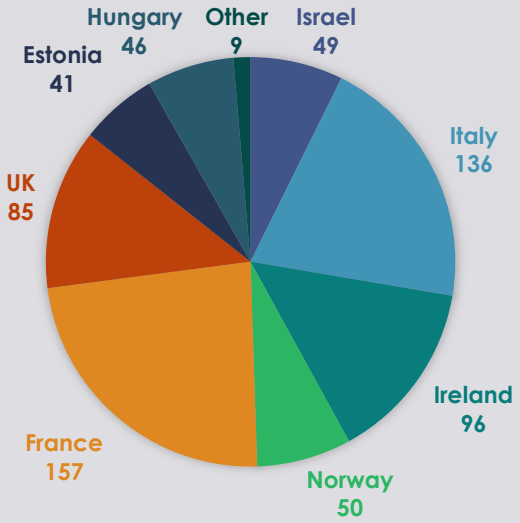
Assessing farmers' needs

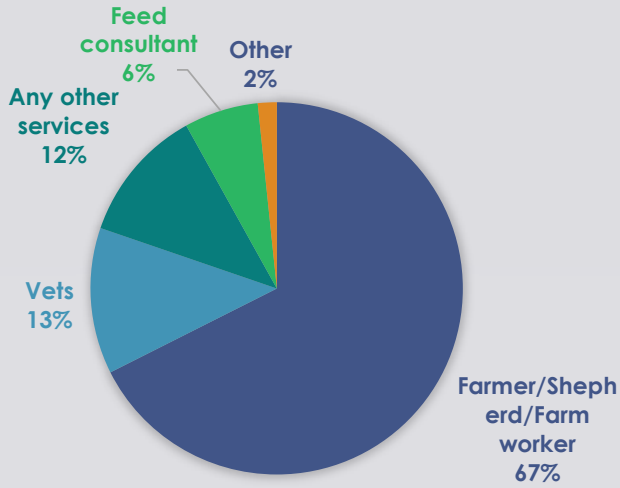
- Survey & inventory of tools on farms
- List of farmers' needs for technology

Online Survey

- Select the **technologies they have** on their farm
- Select which **technologies they would like** to use on their farm
- Rank the **5 technologies they deemed most beneficial** to their system

669 respondents





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Assessing farmers' needs

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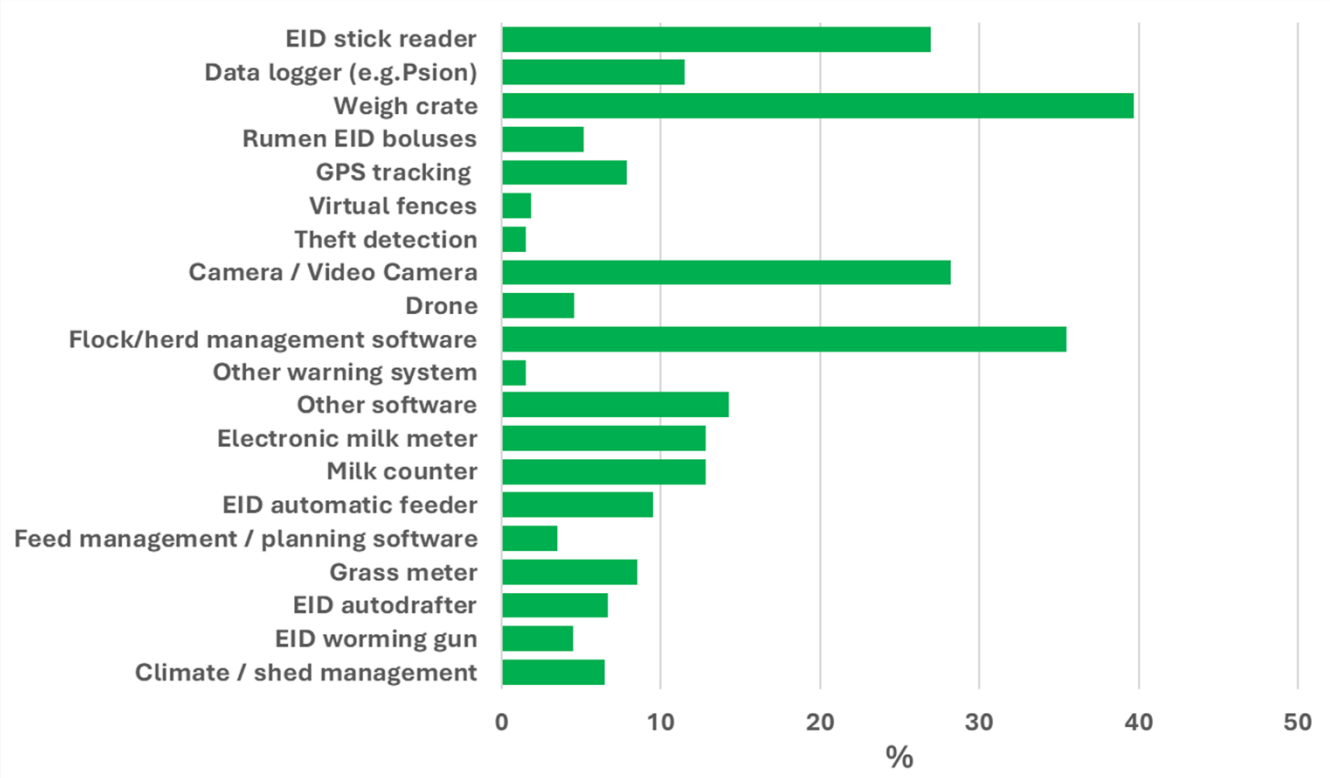
Technologies currently on farm:



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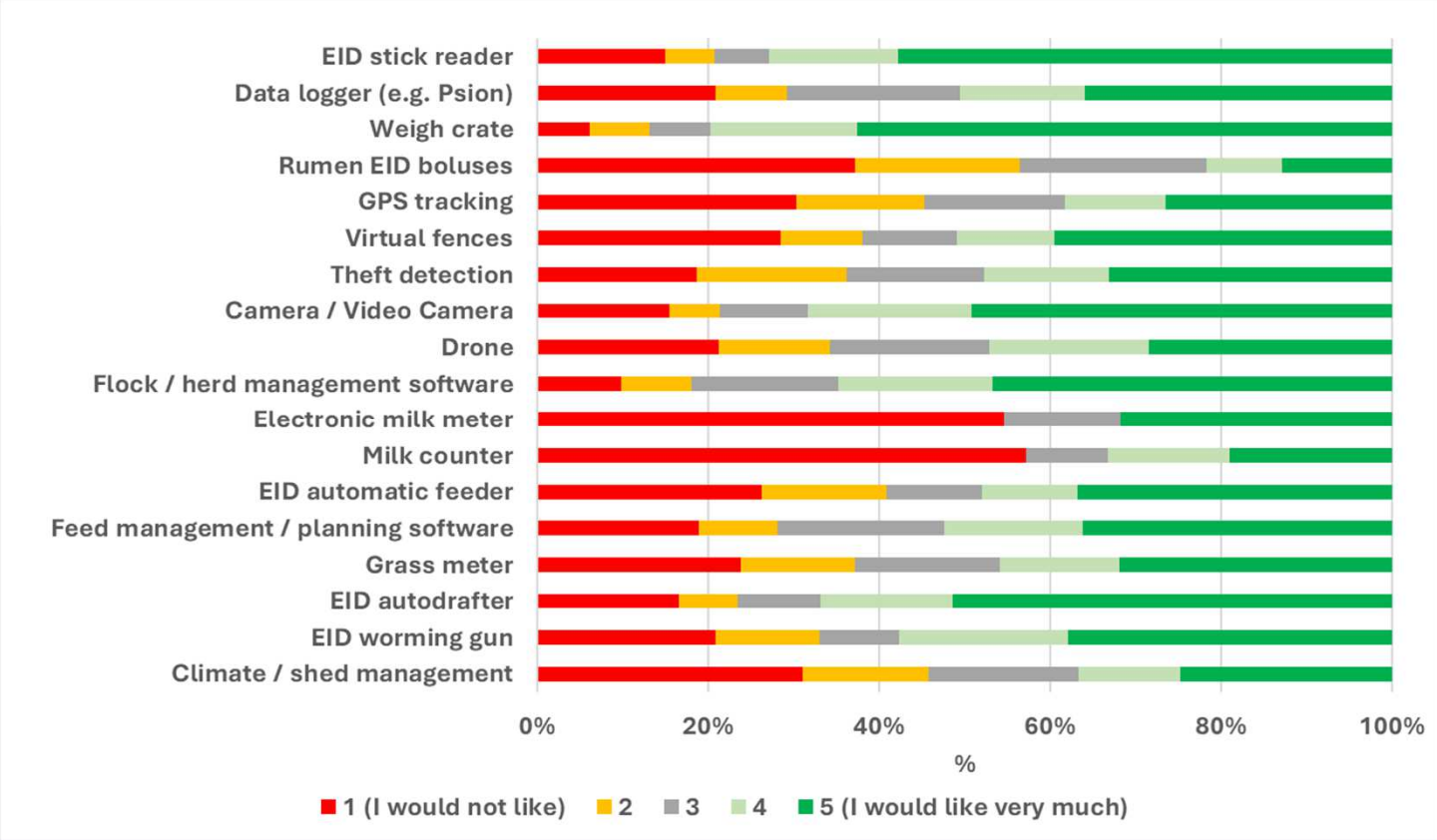
Assessing farmers' needs

- Survey & inventory of tools on farms
- List of farmers' needs for technology

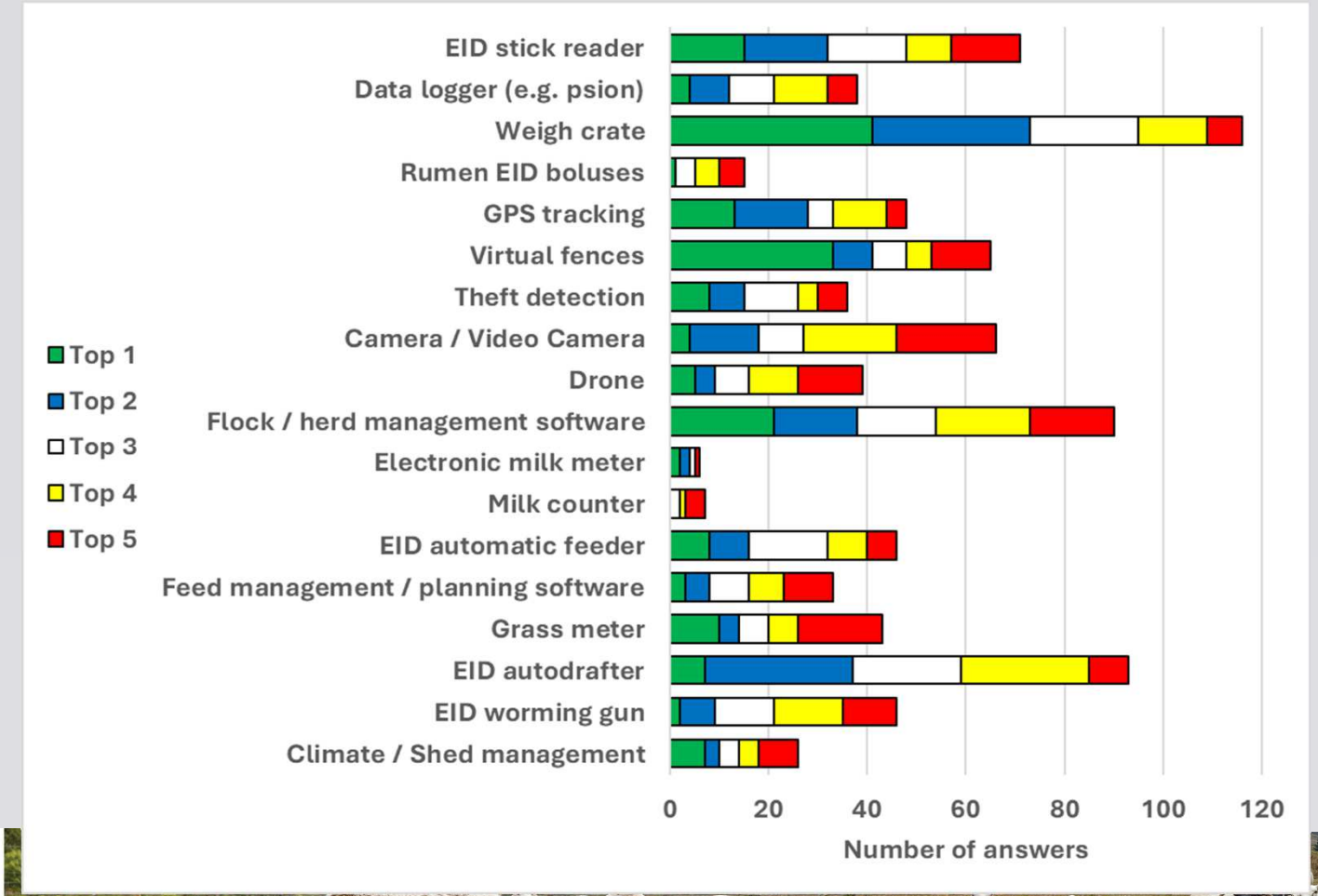
Technologies farmers would like to have:



Assessing farmers' needs

- Survey & inventory of tools on farms
- List of farmers' needs for technology

5 technologies most beneficial:



Ilan/Ann

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Assessing farmers' needs

- Survey & inventory of tools on farms
- List of farmers' needs for technology

Farmers' needs for technology for:

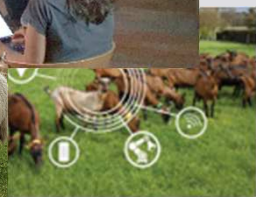
- Feeding/Grazing
- Health & Welfare
- Reproduction
- Flock/Herd management
- Fattening
- Milking

NWS1 & TNWS1

166 needs identified

Themes	Dairy goats	Dairy sheep	Meat sheep
Feeding/Grazing	13	5	17
Health & Welfare	13	10	17
Flock/herd monitoring	10	8	11
Reproduction	9	5	15
Milking/Fattening	8	9	16

Ilan/Ann



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Sm@ll Ruminant Technologies

Create a network

- NFs
- Farmers' groups
- AKIS
- Workshops organisation

Assessing farmers' needs

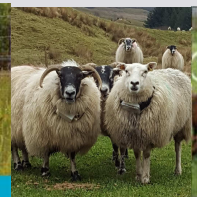
- Survey & inventory of tools on farms
- List of farmers' needs for technology

Finding solutions

- Identification
- Preference
- Guidelines
- Cost-Benefit analysis
- Videos

Evaluating the solutions

- Testimonies
- Farm demonstrations
- Training sessions
- ADOPT



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- Identification
- Preference
- Guidelines
- Cost-Benefit analysis
- Videos

Finding solutions

Proposed by all

30 innovative solutions

Preferred

NWS2 & TNWS2

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Feeding/Grazing

SmartFence/Virtual fence

EID weighcrate + autosorter

Grazing management app

PastureBase IRELAND

Automated grass measurement

Pregnancy scanning

Ration/Feeding Software

Drone

Portable NIR

Milkmeter

Automatic feeder

Connected Fence

GPS collars

Postdried hay technology

HappyGrass

Happy GRASS PRAIRIE

Drone with thermal camera

GPS collars with behaviour

Lise

Health/Welfare/Reproduction

EID hand-held wand/data loggers

Data recording system/ Flock recording app

EID weigh crate and autosorter

FEC software (FecPak G2)

Pregnancy scanning

Parentage test

Worming /vaccinating gun

Sheep conveyor

Happy Factor algorithm

Camera

Somatic Cell counter

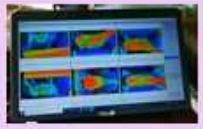
Weather/ environmental station

Water meter

Automatic *feeder*

Alpha detector

3D imaging



Ultra High Frequency

Walk Over Weigh

Environmental enrichment

EID-enabled water trough

GPS & proximity ear-tags

Guard dog & high tensile fence

Milk feeders for kids/lambs

GPS collars & behaviour information

Lise

Flock/Herd monitoring

EID hand-held wand

Worming/Vaccinating guns

EID weigh crate and autosorter

Milking parlour with EID

Aptimiz

Environmental station + cooler

Automatic feeder

Camera

Milk meter

EID-enabled water trough

Data recording system

Lise

Fattening

EID hand-held wand/data loggers

Walk Over Weigh

EID weigh crate and autosc

FEC software

EID tags

Electronic weather station

Automated grass measures

Happy Factor algorithm

EID-enabled weighing trough

Flock recording app (Sheeplreland)

Lise

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Milking/Transformation

Milk tank weighing	Milk meter + milking management software	Somatic Cell Count	

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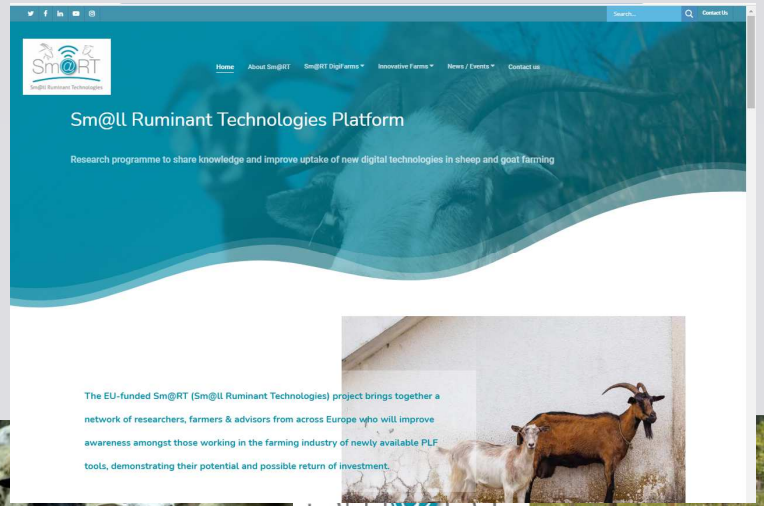
- Identification
- Preference
- Guidelines
- Cost-Benefit analysis
- Videos

Finding solutions

Solutions guidelines created



Lise

- Identification
- Preference
- Guidelines
- Cost-Benefit analysis
- Videos

Finding solutions

Cost-benefit analysis

- Costs:
  - Initial set up
  - Running costs
  - Training requirements
- Benefits:
  - Management
  - Animal
  - Technical
  - Other
- Overall summary:
  - Ease of use (1 – 10)
  - Value for money (Y/N/Maybe)
  - Recommendation (Y/N/Maybe)

Horizon 2020 Programme

Costs

Initial set-up

- Capital costs (Large items e.g. a weigh crate, auto-drafter, etc.):
  €1 - €500 ☐ €501- €1,000 ☐ €1,001-€2,500 ☐ €2,501-€5,000 ☐ €5,001-€15,000 ☐ > €15,000 ☐
- Individual costs (Smaller items e.g. per tag, per sample, per collar):
  €1 - €20 ☒ €21- €50 ☐ €51-€200 ☐ €201-€500 ☐ > €500 ☐
- Equipment leasing costs (if not purchased):
  Annual ☐ Monthly ☐ Weekly ☐ €1 - €50 ☐ €51-€200 ☐ €201-€500 ☐ > €500 ☐
- Lifetime of the technology (approximately how long will it last before needing replaced)?
  1 – 4 weeks ☐ 1-6 months ☐ 6 – 12 months ☐ 1-2 years ☐ 2-5 years ☐ > 5 years ☒
- Farm infrastructure requirements: Decrease ☐ Increase ☐ No change ☒
- Percentage of animals within the flock/herd that use/are equipped/take advantage of the technology? 100 %

Running costs

- Power source requirements (tick all that apply):
  Not required ☒ | Mains ☐ | Battery ☐ | Solar ☐ | Other ☐
- Subscription fee – Needed? Yes / No
  - If yes

Per flock / herd ☐	Per individual animal ☐	Per unit ☐	
Annual ☐	Monthly ☐	Weekly ☐	
€1 - €50 ☐	€51 - €200 ☐	€201 - €500 ☐	Over €500 ☐

- Additional licences or permits required? No / Yes – Annual / Yes – Monthly / Yes - Weekly
  If yes, cost: €1 - €50 ☐ | €51 - €200 ☐ | €201 - €500 ☐ | Over €500 ☐
- Maintenance cost – included in the subscription? Yes / No / Not applicable
  If no, cost per month: €1 - €50 ☐ €51 - €200 ☐ €201 - €500 ☐ Over €500 ☐
- Maintenance / replacement parts:
  Easy to obtain ☒ Difficult to obtain ☐ Not obtainable ☐ Don't know ☐
- Technical / mechanical support provided on farm, after purchase? Yes / No

Training requirements

- Training required to install / use? Yes / No
  If yes, time range? Up to an hour ☒ Half day ☐ Full day ☐ More ☐
- Additional technical advice required (e.g. advisor time)? Yes / No
- Are there additional costs associated with training and/or technical advice? Yes / No

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Lise

Sm@RT Sm@ll Ruminant Technologies

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- Identification
- Preference
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- Cost-Benefit analysis
- Videos

Finding solutions

Cost-benefit analysis

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Lise

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Horizon 2020 Programme

Benefits (tick all that apply)

Management

☒Labour / time saving.
☐Accuracy of records (health, management, movements etc.).
☒Management decisions for animal groupings.
☒Better individual animal management.
☐Improved medicine use.
☐Better nutrition / meeting requirements better.
☐Improved use of feed resource (grazing, concentrates, etc.).
☐Product quality improvements (e.g. hay, carcass, growth, milk, etc.).
☒Increased information on production system.
☐Opportunity for sharing / moving device (more than one location).

Animal

☐Reduced stress to the animal(s).
☐Improved welfare of the animals(s).
☒Additional information on animal behaviour.
☐Information on water intake / water availability.
☐Information on food intake / food availability.

Technical

☐Compatibility with other devices.
☐Ease of data transfer to other software.
☒Easy to use once installed.

Other

☒Reduced stress to farmer / staff.
☒Environmental benefits (e.g. reduced wastage, improved biodiversity, etc.)
☒Helps to attract new entrants into the small ruminant industries.

Page 92/129

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- Identification
- Preference
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Finding solutions

Cost-benefit analysis

- Costs:
  - Initial set up
  - Running costs
  - Training requirements
- Benefits:
  - Management
  - Animal
  - Technical
  - Other
- Overall summary:
  - Ease of use (1 – 10)
  - Value for money (Y/N/Maybe)
  - Recommendation (Y/N/Maybe)

Horizon 2020 Programme

Another benefit not listed? Please give details:

Helps to assess ewe, ram & lamb performance.

Ability to collect data for genetic improvement programmes.

Allows the use of multi-sire mating groups (rather than single sire groups / artificial insemination)

Less labour required at lambing time for recording.

Overall summary:

- **Ease of use?** *Scale 1 (Complicated) – 10 (Simple)*

  1 2 3 4 5 6 7 8 **(9)** 10

- **Value for money (*for this type of benchmark farm*)?** Yes ~~/ No / Maybe~~
- **Recommend this tool/technology for use on other types of farm?**

  Yes ~~/ No / Maybe~~

- **Additional comments?**

  Large initial cost of sampling every animal in the flock, but yearly costs thereafter only include lambs born each year and any new animals joining the flock.

  Only useful if the data (pedigree information) is going to be used.

Lise

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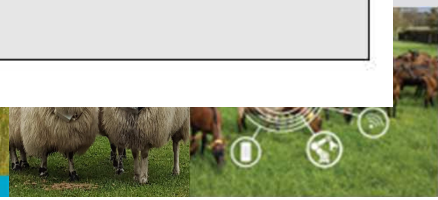


- Identification
- Preference
- Guidelines
- Cost-Benefit analysis
- Videos

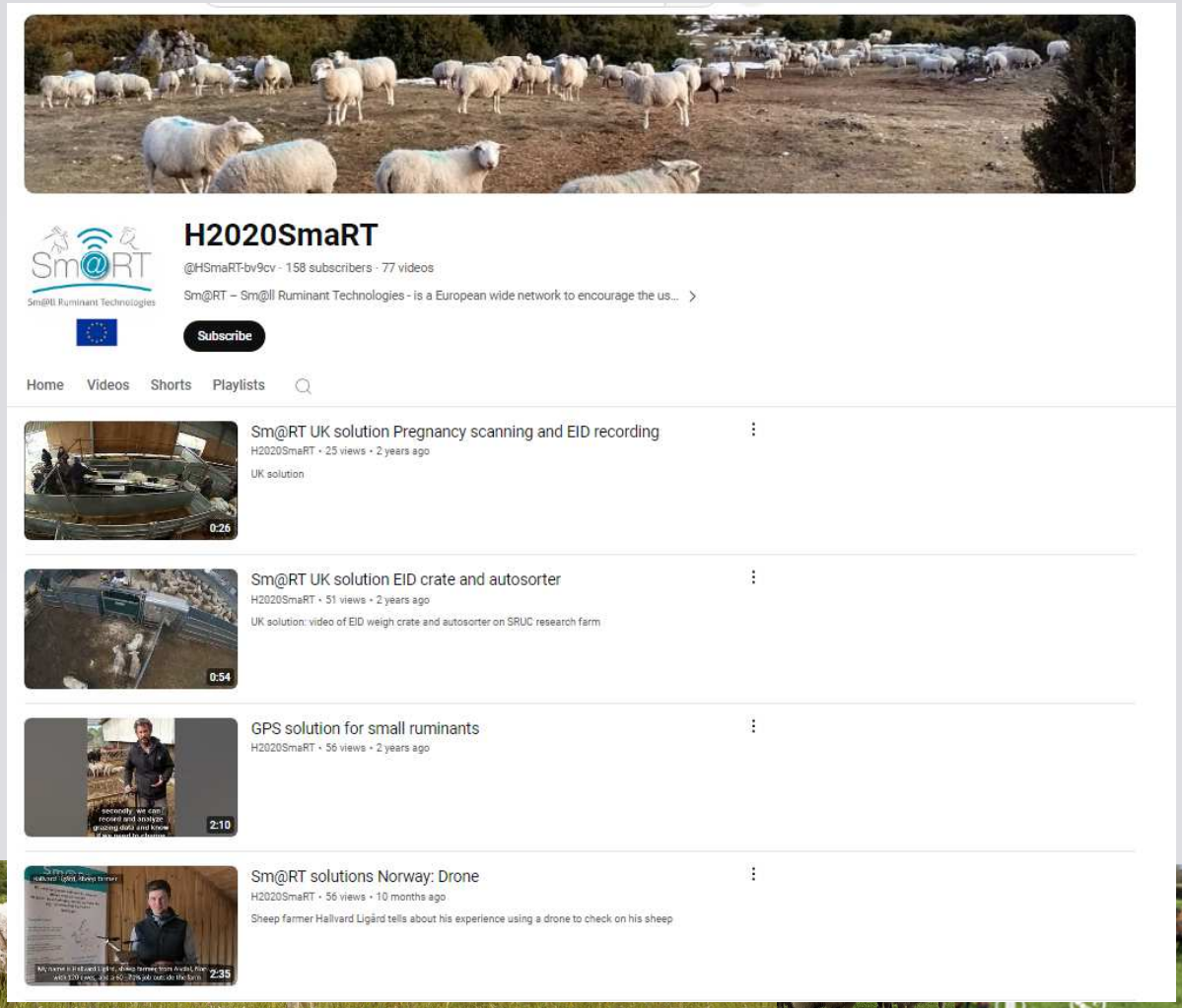
Finding solutions

Videos of the tools

- PLF tools description

Sm@RT YouTube channel

➔ over 20 tool videos



Lise

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Sm@ll Ruminant Technologies

Create a network

- NFs
- Farmers' groups
- AKIS
- Workshops organisation

Assessing farmers' needs

- Survey & inventory of tools on farms
- List of farmers' needs for technology

Finding solutions

- Identification
- Preference
- Guidelines
- Cost-Benefit analysis
- Videos

Evaluating the solutions

- Testimonies
- Farm demonstrations
- Training sessions
- ADOPT

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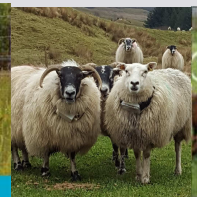

- Testimonies
- Farm demonstrations
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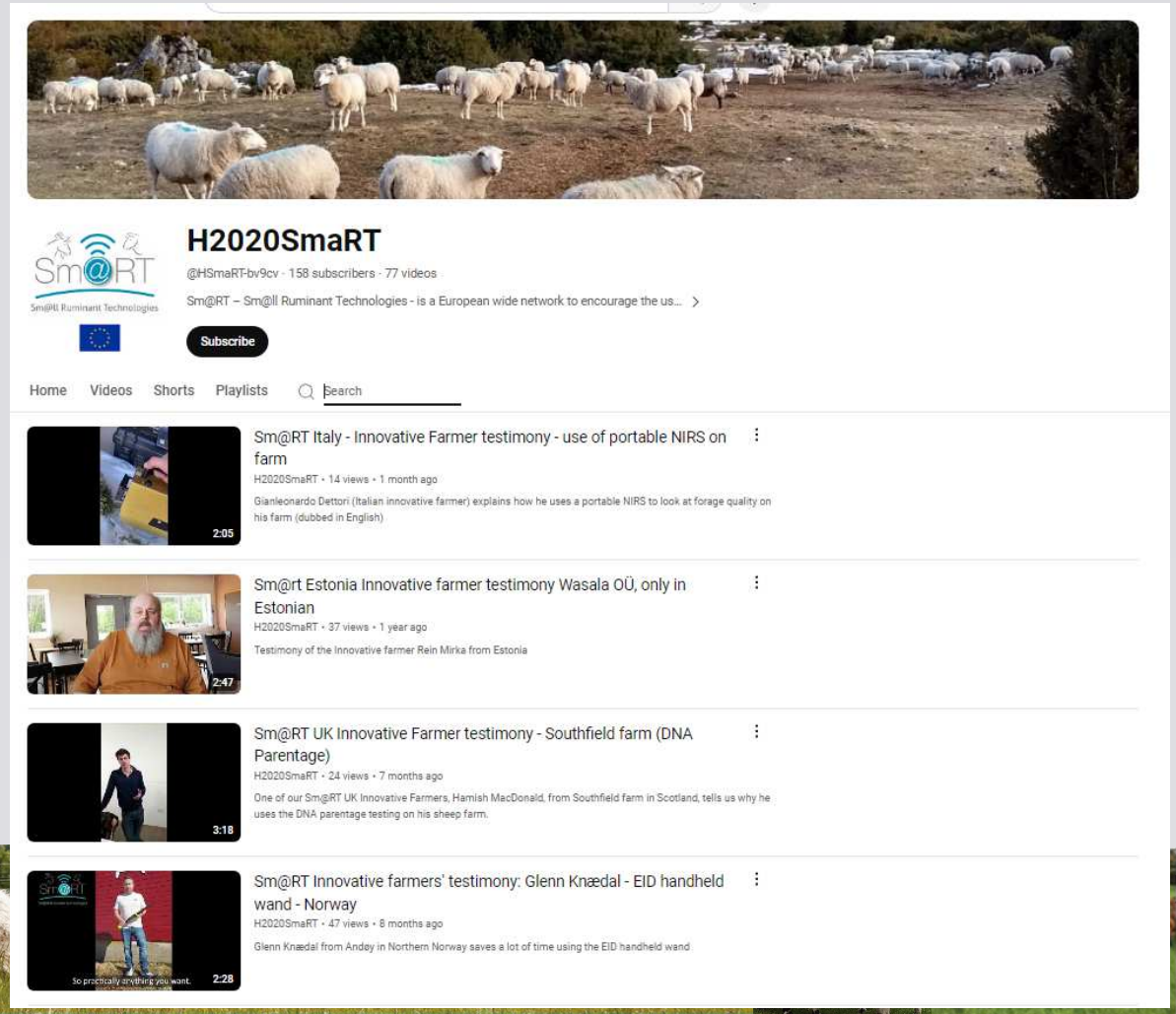
Evaluating the solutions

Testimonies

Testimonies from innovative farmers who use the tools -> **Peer to peer**

Sm@RT YouTube channel

➔23 testimony videos



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- Testimonies
- Farm demonstrations
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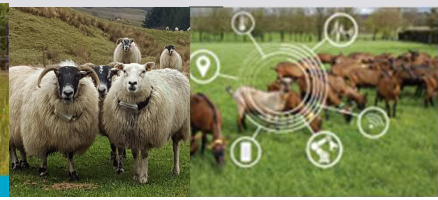
- ADOPT

Evaluating the solutions

Farm demonstrations & Training sessions

NWS3 & TNWS3

Country	Estonia	France	Hungary	Ireland	Italy	Israel	Norway	UK
Number of sessions	3	4	1	3	4	2	1	3



Evaluating the solutions

- Testimonies
- Farm demonstrations
- Training sessions
- ADOPT

Farm demonstrations & Training sessions

Before/after questions

Training sessions

Please tick your answer	Maybe	No	Yes
BEFORE - what do you think of this technology?	19%	18%	63%
BEFORE - would you put it on your farm?	9%	26%	66%
AFTER - what do you think of this technology?	2%	24%	51%
AFTER - would you put it on your farm?	9%	28%	62%

Evaluating the solutions

- Testimonies
- Farm demonstrations
- Training sessions
- ADOPT

Farm demonstrations

Before/after questions

Farm Demonstrations

Name of PLF tool tested :			
Please tick your answer	1 (Not)	2 (Not sure)	3 (Yes)
BEFORE - Do you have this tool ?			
BEFORE - Do you think it is worth investing in it?			
BEFORE - Would you like to implement it on your farm?			
BEFORE - Level of practicality (1=low; 4=high)			
AFTER - Do you think it is worth investing in it?			
AFTER - Would you like to implement it on your farm?			
AFTER - Level of practicality (1=low; 4=high)			

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Evaluating the solutions

- Testimonies
- Farm demonstrations
- Training sessions
- ADOPT

Farm demonstrations

Example of Norway

Ann/Valeria

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- Testimonies
- Farm demonstrations
- Training sessions
- ADOPT

Evaluating the solutions

Assessing level of adoption & peak uptake

NWS4 & TNWS4

ADOPT tool
(Adoption & Diffusion Outcomes Prediction Tool)

- 22 questions asked around 4 aspects of adoption
  1) characteristics of the tool/technology
  2) characteristics of the farming population
  3) advantage of using the tool/technology
  4) Learnability

- % level of adoption
- Number of years until peak adoption

-> 45 sessions covering 24 tools

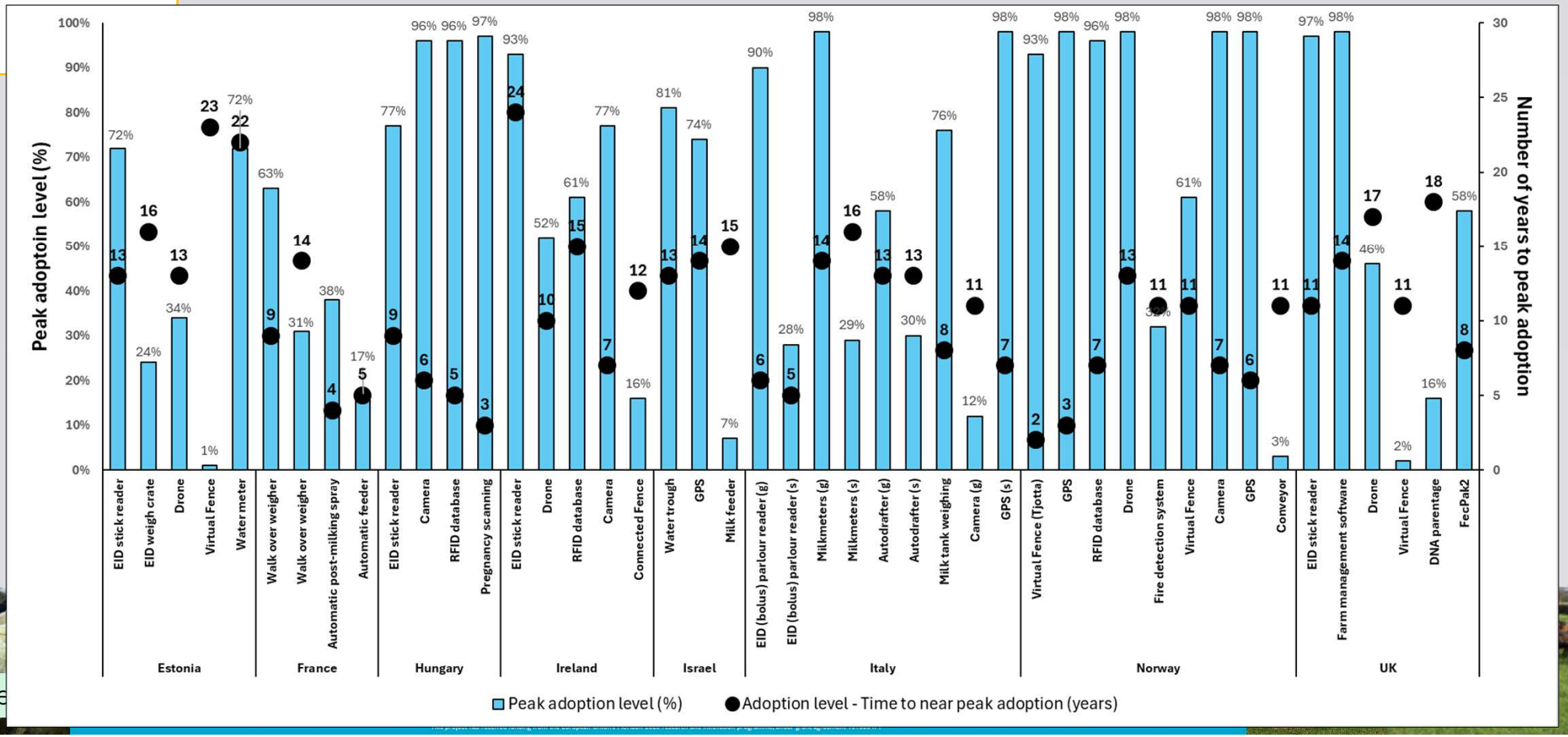
Evaluating the solutions

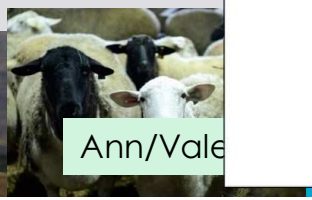
- Testimonies
- Farm demonstrations
- Training sessions
- ADOPT

Assessing level of adoption & peak uptake

ADOPT tool

(Adoption & Diffusion Outcomes Prediction Tool)





Ann/Vale

- Testimonies
- Farm demonstrations
- Training sessions
- ADOPT

Evaluating the solutions

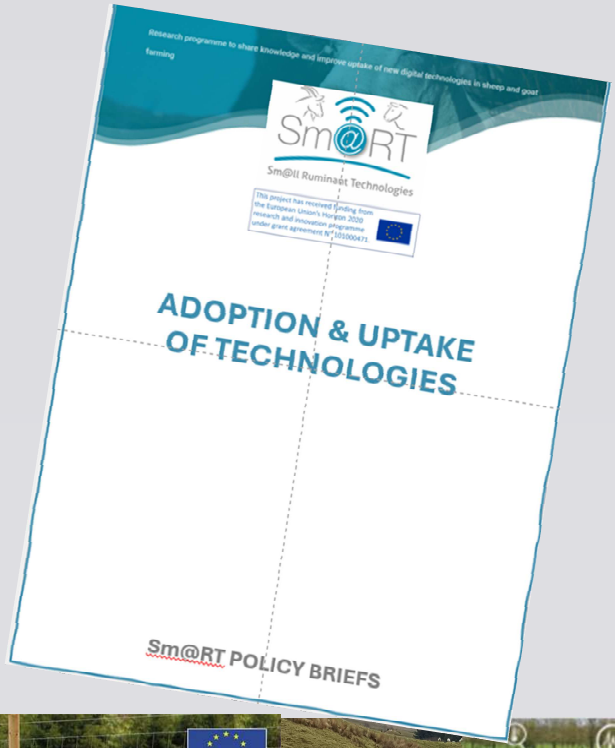
Assessing level of adoption & peak uptake

ADOPT tool
(Adoption & Diffusion Outcomes Prediction Tool)

Peak adoption level – sensitive to:

- Scale of the sheep/goat enterprise
- Potential profit benefit during the years that the technology were used

- **Length of time** to peak adoption – sensitive to:
  - Need to develop substantial new skills and knowledge to use the technology
  - Learnability characteristics of the technology



Evaluating the solutions

- Testimonies
- Farm demonstrations
- Training sessions
- ADOPT

Assessing level of adoption & peak uptake

ADOPT tool

From yesterday

Tool	Peak adoption	% adoption
Portable SCC (French)	9 years	1%
Feed ration planner (French)	11 years	86%
Automatic Grass plate meter (UK)	11 years	90%
3D imaging tool (Norway)	17 years	4%
SheepIreland app (Ireland)	16 years	6%
Post-dried hay technology (Hungary)	11 years	14%
Aptimiz (Israel)	12 years	93%
Portable NIRS (Italy)	10 years	97%
Weather station / Environmental sensor (cooler) (Estonia)	18 years	25%

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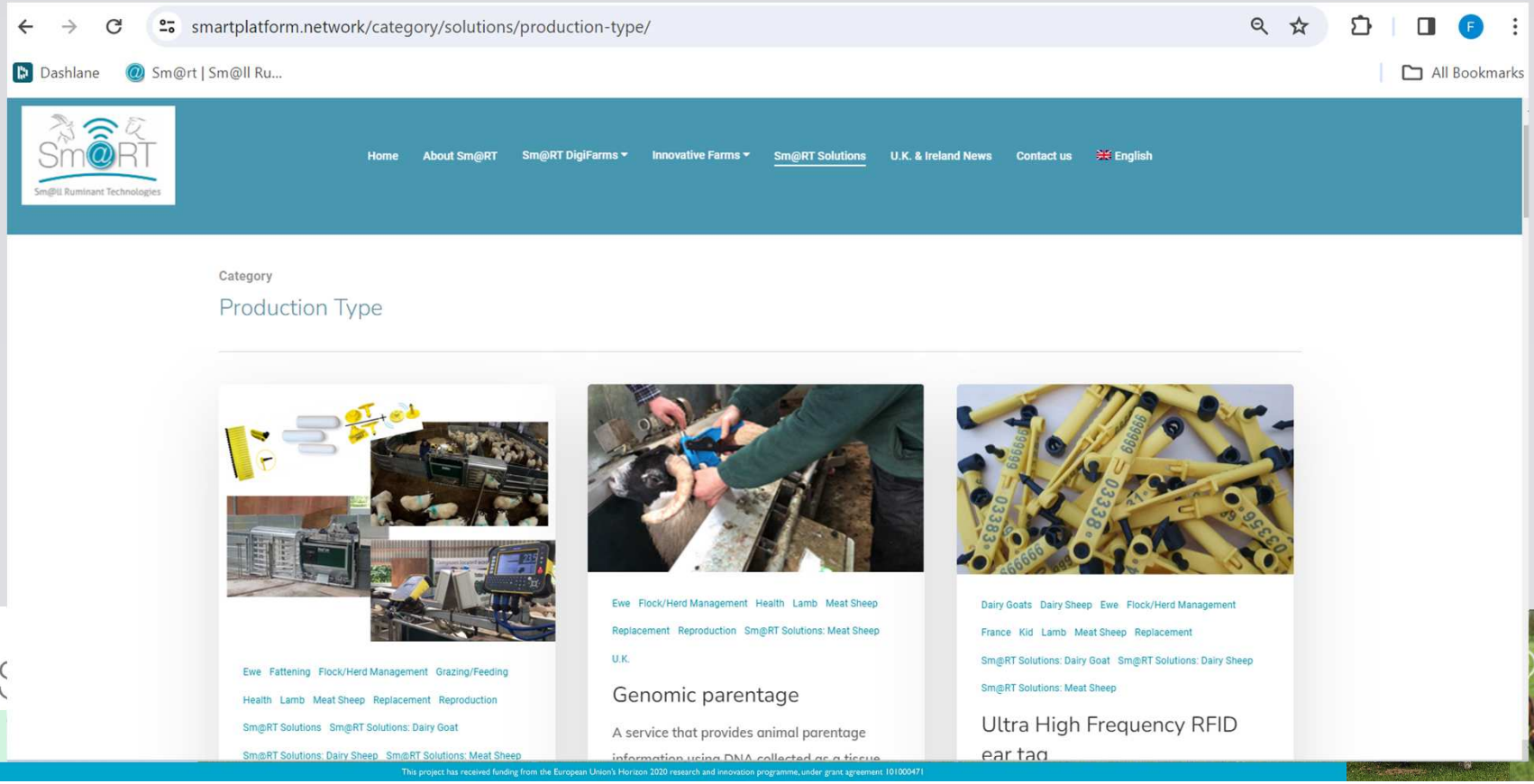
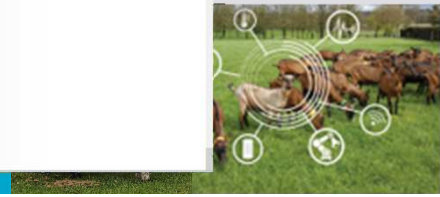
Communication & Dissemination

Website in 8 languages

www.smartplatform.network



Fiona/Renata



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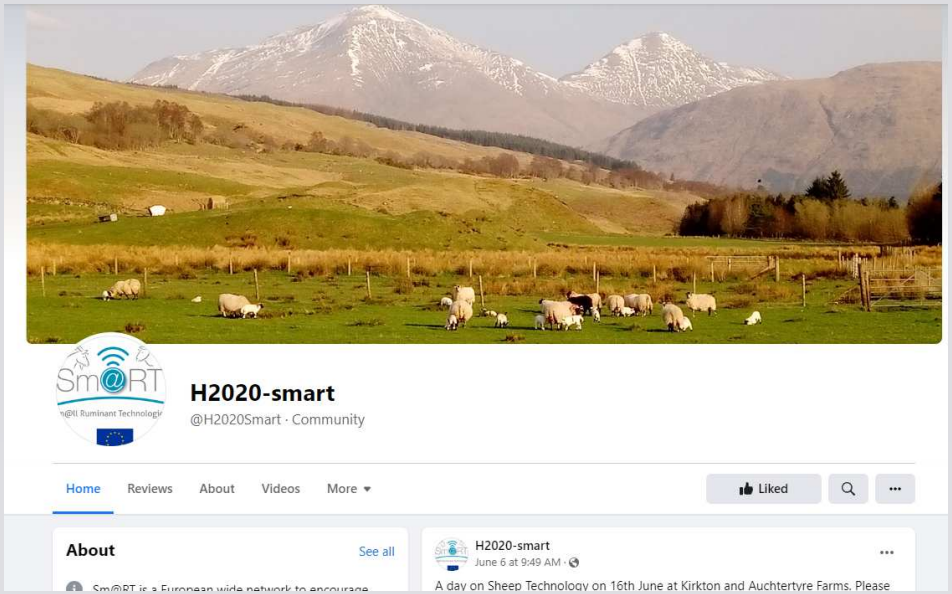
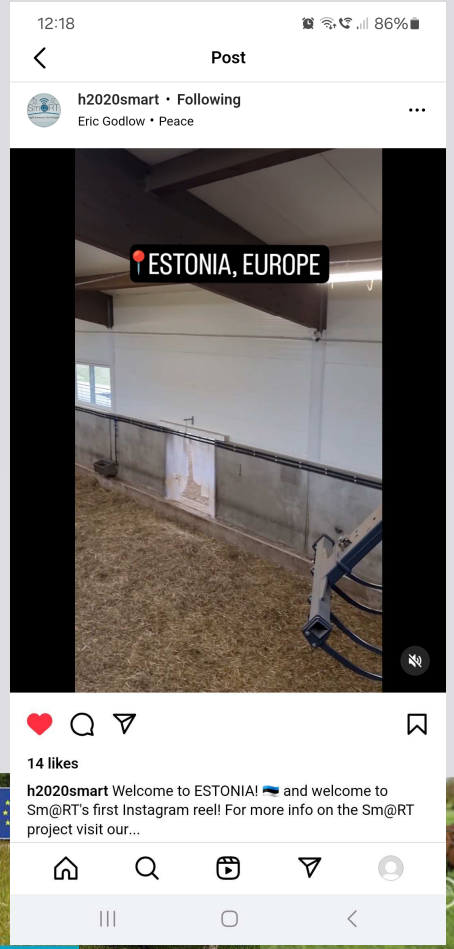
Communication & Dissemination

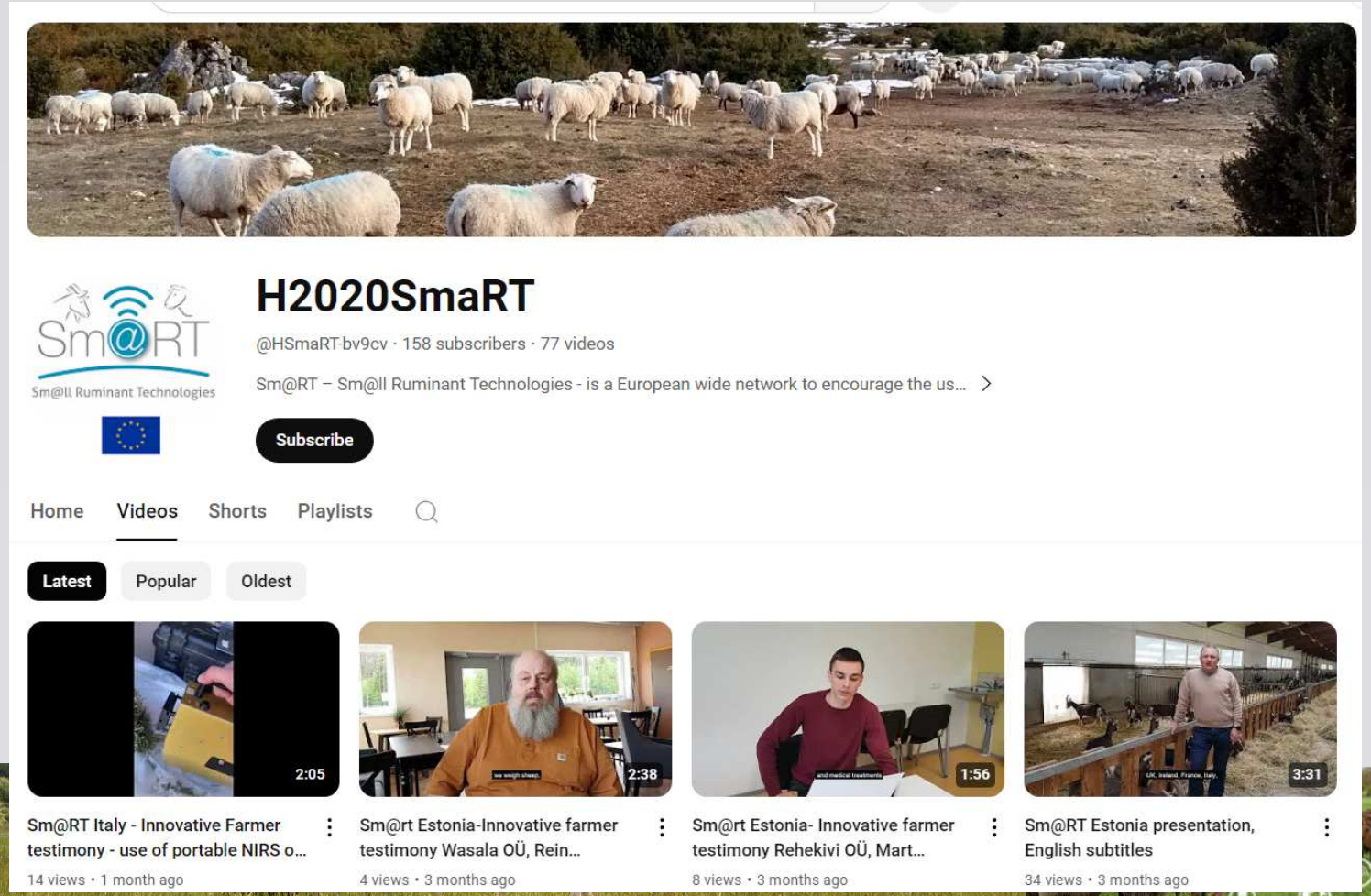
Twitter (X), Facebook & Instagram





Communication & Dissemination

YouYube Channel



Fiona/Renata

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Communication & Dissemination

Newsletter

linktr.ee/h2020smart

Communication & Dissemination

Project leaflets, Survey results, Sm@RT in numbers, policy briefs, Practice abstracts

Fiona/Renata

It’s time to follow us!

www.smartplatform.network

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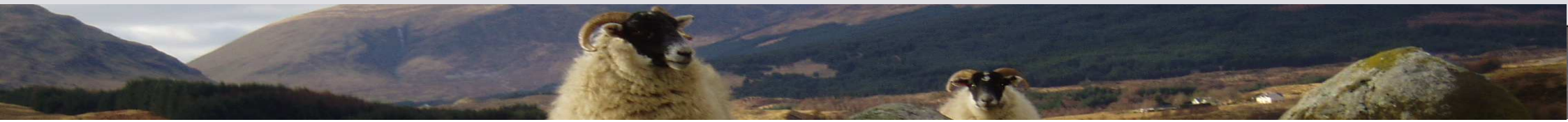

Presentation of the delegations



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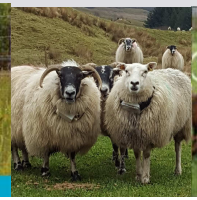


Estonia

SM@RT

Estonia

- Estonia is a country by the Baltic Sea in Northern Europe with population of 1,35 millions. Estonia shares a common boundary with Latvia and Russia and sea boundary with Finland and Sweden
- The territory of Estonia consists of the mainland and islands of Saaremaa and Hiiumaa, covering a total area of 45 thousand km^2
- The ground is flat (no mountains) and soils are productive. Forest land covers around 51,3 % of Estonia territory, so forestry is very important.
- Estonia has four seasons (spring, summer, autumn, winter) of near-equal length
- The average precipitation is over 800 mm
- Summers are moderately warm (the mean temperature in July is 16 - 17°C and winters are moderately cold (the mean temperature in February is between -2.5 and -7°C, up to the -25 or lower).

Livestock production in Estonia

- Rural economy relies on **grain production, dairy cattle milk production and forestry.**
- The annual milk yield per cow (of 85000 cows) for the whole state was **10053 kg** in 2020 (highest in EU in 2020) surpassing by 25 kg Denmark
- The number of small ruminants is low: around **60 thousand** meat sheep **(1500 farms**) of which around 60-63 % are farmed in organic farms
- 4 thousand dairy goats **(400 farms**) of what 28-29% are farmed in organic farms.

Sheep breeds. 3 local Estonian sheep breeds : the Estonian Blackface, the Estonian Whiteface sheep breeds (both are syntetic breeds), Kihnu Native Sheep



- The main purpose of sheep breeding in Estonia is **sheep meat production**
- The list of other breeds are quiet wide: **Suffolk, Texel (inc Beltex), Norwegian Whiteface, Dorset, Lleyn, Dorper, Gotland and other breeds (in total 33 breeds in 2024)**

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Estonian delegation

5 Farmers:

Priit Jõesalu, Hillar Kalda, Mirjam Pikkmets, Marwin Virkus, Annemari Polikarpus

2 Researchers: Ph.D. -Maria Soonberg

Ph.D. (NF Estonia)- Peep Piirsalu

Estonian delegation sheep farms
FIE Hillar Kalda, organic farm

- Total 240 Estonian White Face ewes + 7 rams (Texel, Norwegian White)
- Organic farms, year round outside, in winter sheep have free access to the shelter, grazing on pastures at other times

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Estonian delegation sheep farms
OY Oruküla, Priit Jõesalu

Raise 300 **Ileyn** ewes for meat, indoor in winter, grazing rest of the time

EID stick reader, weighing crate, weighing indicator

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Viinamärdi Talu OÜ, milk sheep farm, hostess Annemari Polikarpus

150 Lacaune milk sheep + agroturism (https://www.viinamarditalu.ee/agroturism)
Indoor year round system, syncronizing ewes

Milking parlour with individual milk quantity measurements (Panazoo - Italy)

Italian style cheeses (Ricotta Fresca, Pecorello and etc), icecream

Lamb milk feeder

Smartphone app -pedigree recording

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Estonian delegation sheep farms
Aaduni Farm OY, Mirjam Pikkmets, manager of the Estonian Sheep and Goat Union

Newly established farm in 2016

175 gotland sheep, 110 milking cows

Raise sheep for meat, skin and wool

Guard dogs (East Asian shepherd)

Wolf free high tensile fence

Grazing on semi-natural pastures and on wooded meadows

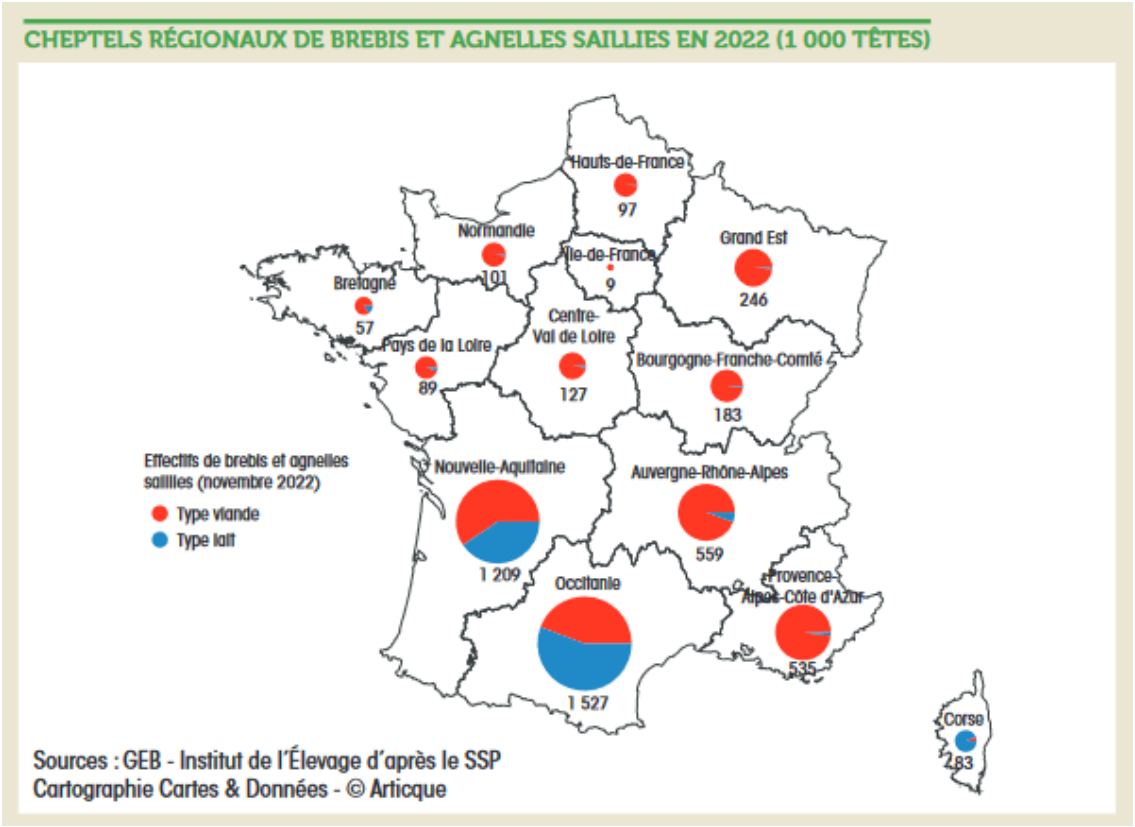
Mäeoja Talu OÜ
Marwin Virkus

- 50 Estonian White Face sheep
- Sheep are year round outside, in winter sheep have an access to the shelter, grazing on pastures at other times

- MS student at the Estonian University of Life Sciences (thesis title- Digital Technologies)

France

French Sheep industry



French Female breeding flock (2021) – MEET SHEEP	Holdings	Livestock
1 to 49 breeding sheep	49 842	494 579
50 to 149	7 855	672 183
150 to 299	3 830	814 311
300 to 499	2 230	847 949
500 to 999	1 222	799 674
1 000 and over	271	396 509
Total	**65 250**	**4 025 205**

French Female breeding flock (2021) – DAIRY SHEEP	Holdings	Livestock
1 to 49 breeding sheep	1 603	18 852
50 to 149	731	68 844
150 to 299	1 100	252 502
300 to 499	1 580	608 369
500 and over	821	606 644
Total	**5 835**	**1 555 211**

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French Goat industry

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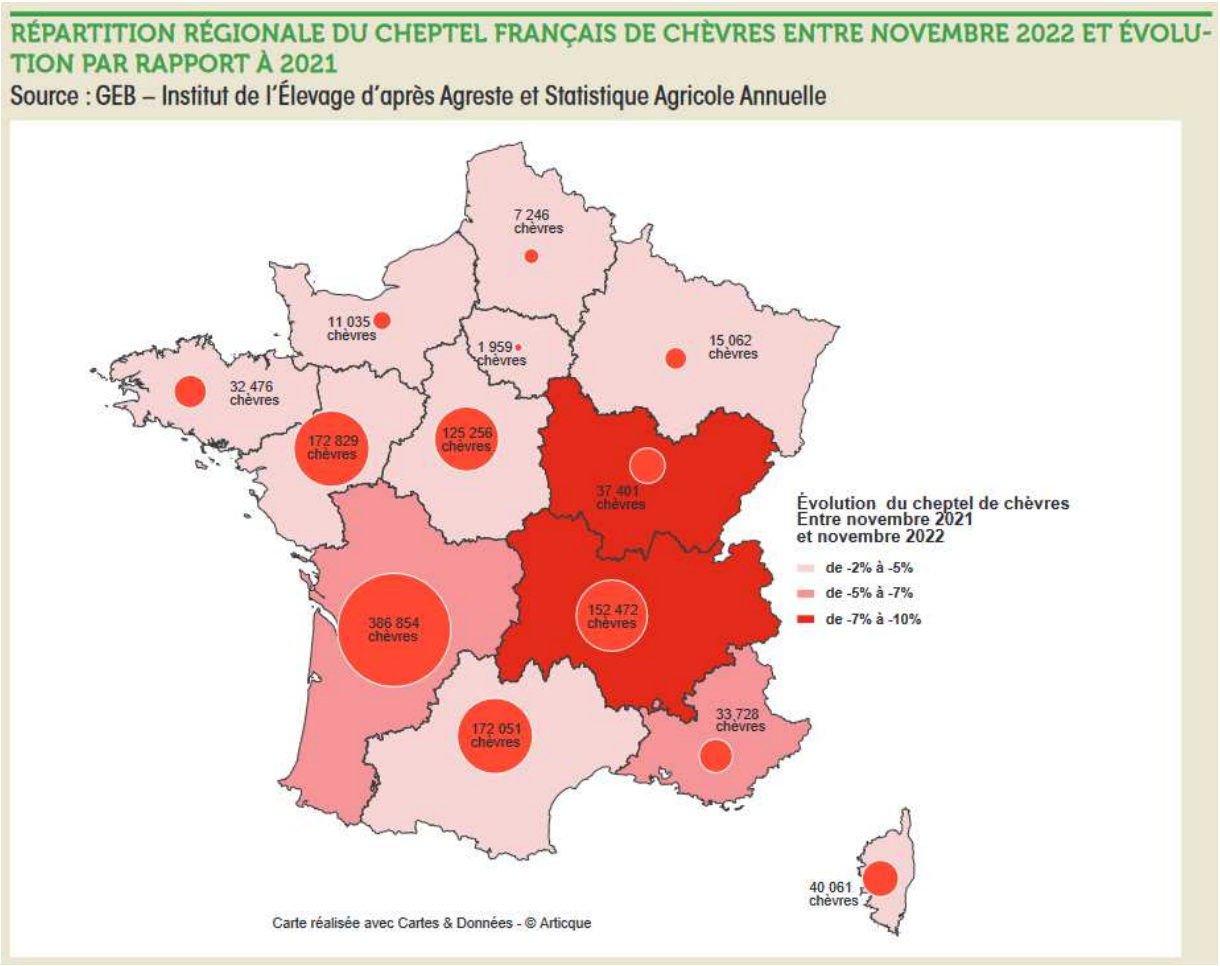

French Female breeding flock (2021) – GOAT	Holdings	Livestock
25 to 49 breeding goat	972	35 768
50 to 149	2 026	175 505
150 to 499	1 866	516 566
500 to 999	365	238 957
1 000 and over	51	70 112
Total	**5 280**	**1 036 908**

French Sheep and goat industry

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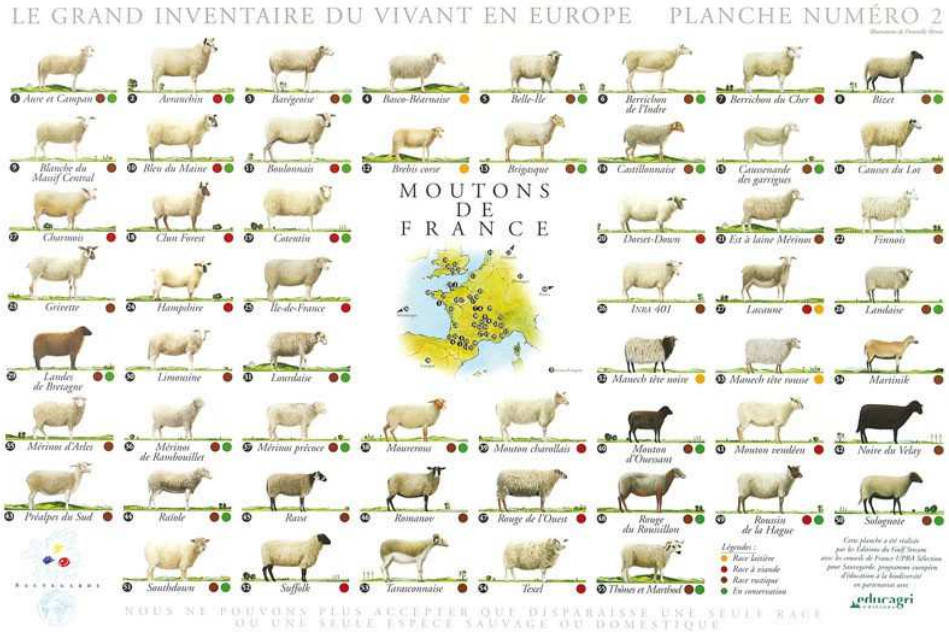

French Sheep and goat industry

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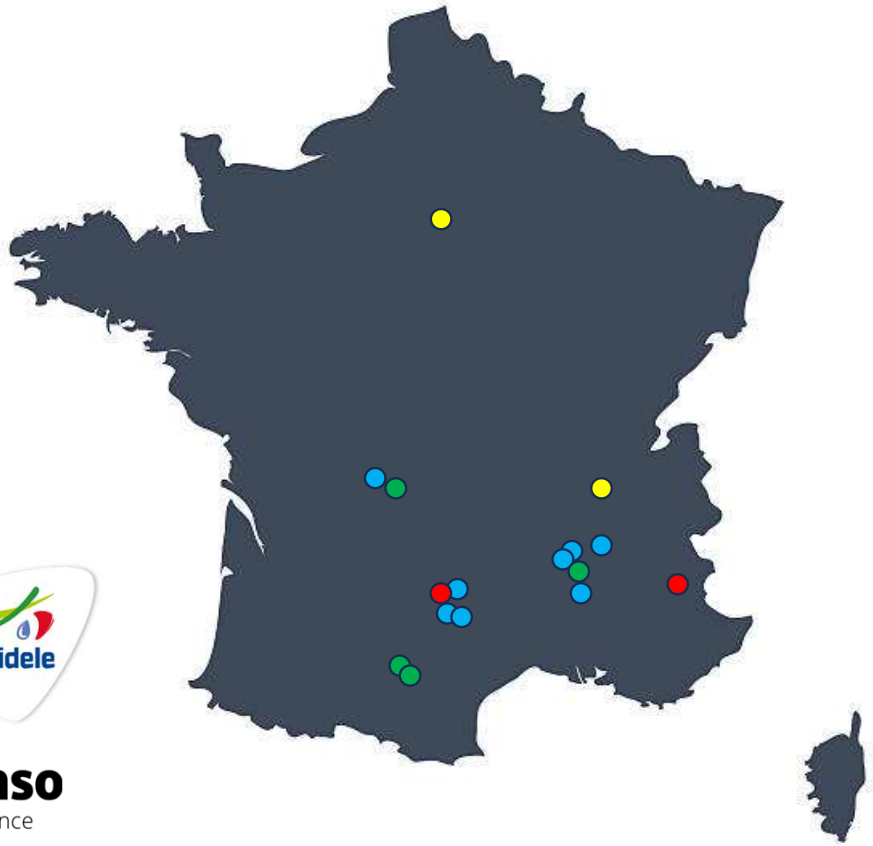
French delegation

- Farmers
  - Thierry Deygas – Drôme
  - Marie-Hélène and Laurent Poulet – Ardèche
  - Patrick Ribes - Ardèche
  - Guillaume Metz – Haute-Vienne
  - Vanessa Barthelemy and Alexia Tete – Aveyron
  - Véronique Molinier – Aveyron

- Research & Industry
  - Laurence Depuille & Jean-Marc Gautier
  - Philippe Thorey & Denis Gautier
  - Béatrice Weirich
  - Margaux Faure & Louisiane Lemaitre
  - Marie Desestrets



INSTITUT DE L'ELEVAGE idele

APLBR

In Extenso
Innovation Croissance

Farmer info

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Farmer	Farm Size	Ewes	Other	Production
Thierry	130 ha	400 goats (Saanen)		
Marie-Hélène and Laurent	36 ha	180 goats and 100 replacement		
Patrick	20 ha	180 goats (Alpine & Saanen)		
Philippe	40 ha	230 goats (Alpine)	DIGIFERMES	
Guillaume	150 ha	500 ewes	35 cows (Aubrac)	
Denis	95 ha	740 ewes (Mouton Vendéen, Ile de France x Romanov)	DIGIFERMES	
Vanessa and Alexia	160 ha	550 ewes (Lacaune)		
Véronique	100 ha	450 ewes (Lacaune)		

Hungary

Hungarian sheep production

Area	93 036 km^2
Population	9 604 000 person
Registered sheep breeder	7 200
Grazing field	771 300 ha (8,3%)
Number of sheep (2023)	907 000
Ewes	694 000
Sheep meat consumption	0,2 kg

→ export

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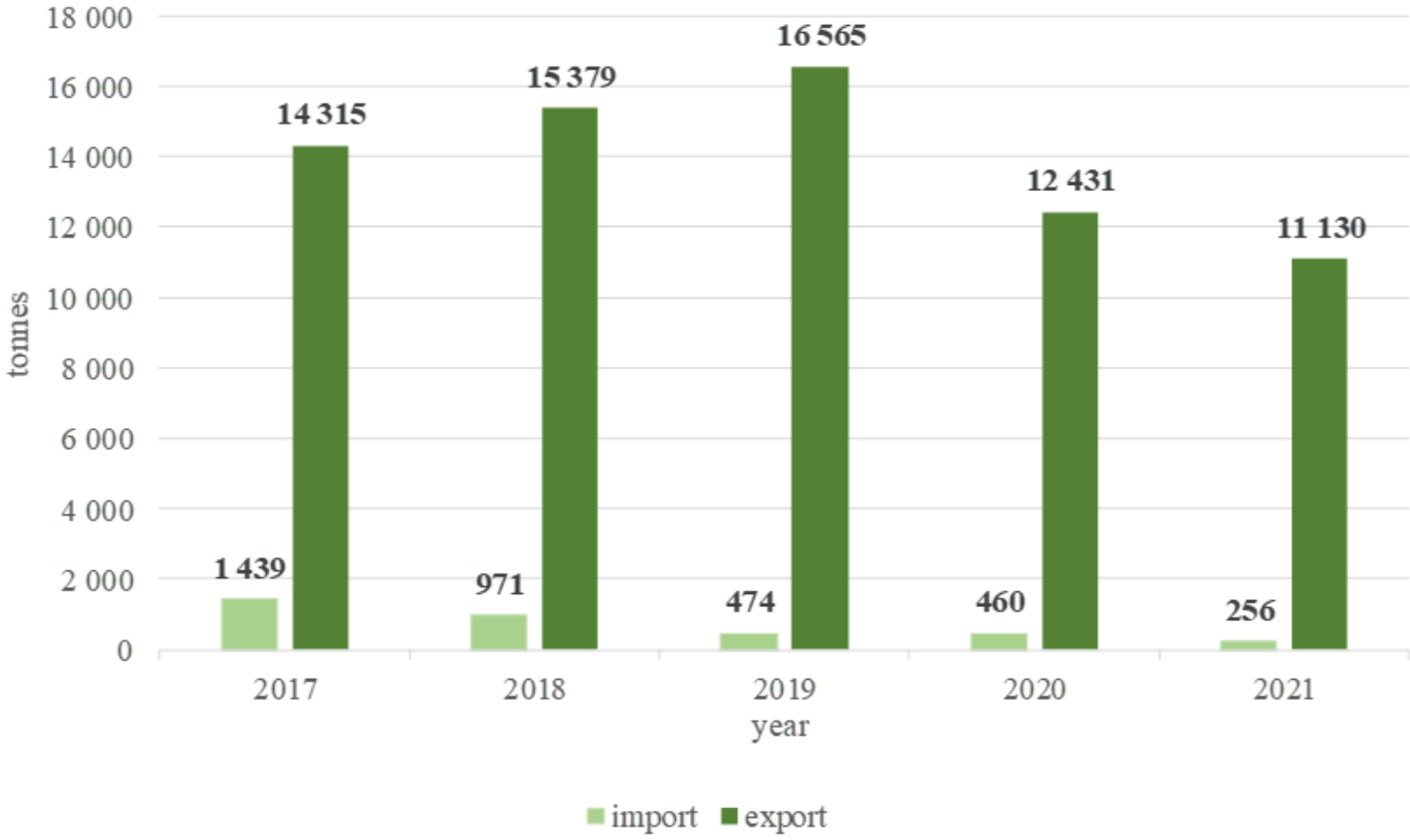
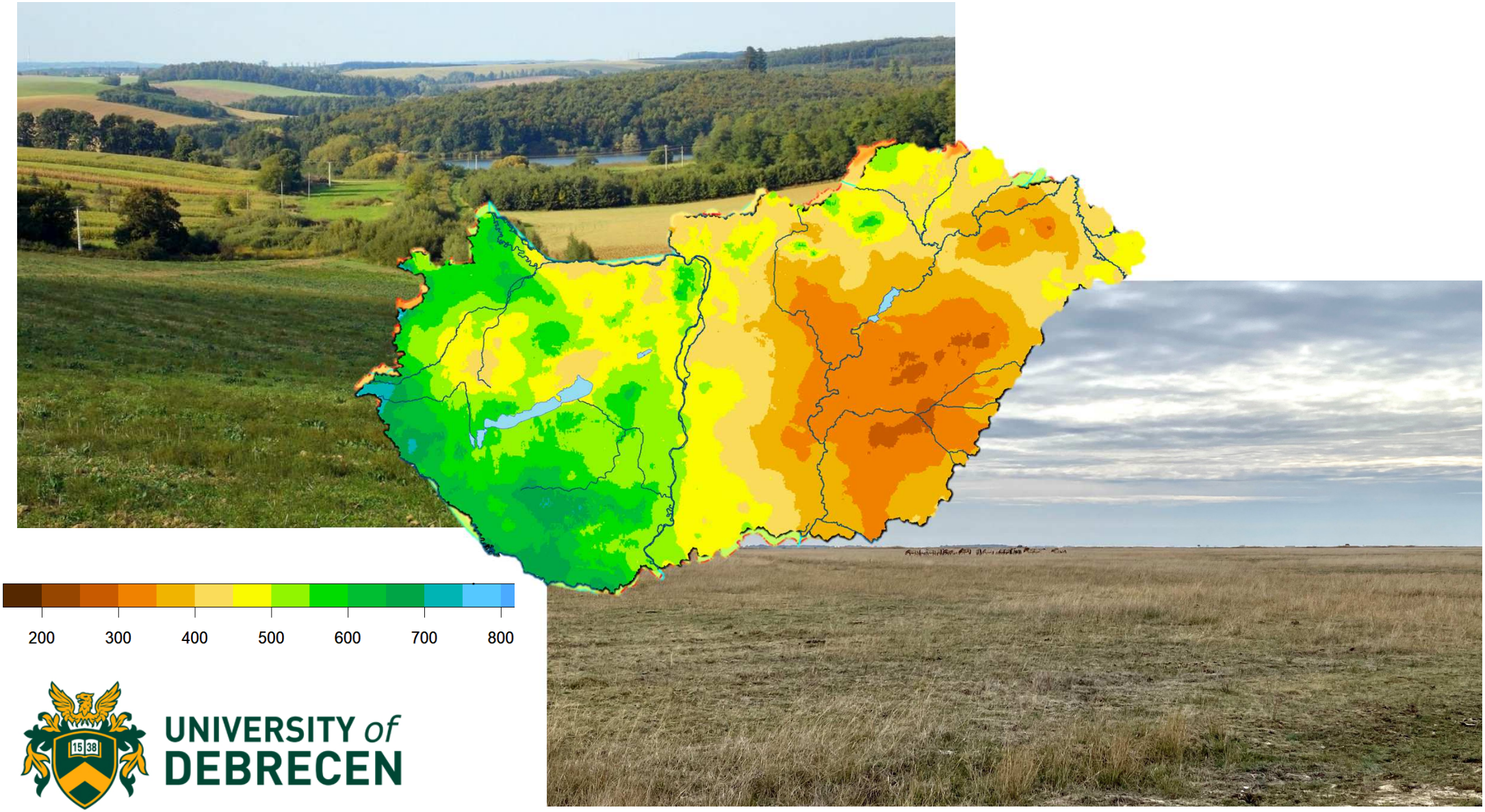
External trade [tonnes]





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Breeds

32 breeds HSGA authorization

- Indigenous breeds:
  (max. 30-35000)
  - Hungarian Racka
    (black/white)
  - Tsigai
  - Cikta
- Foreign breeds:
  - Berrichon Du Cher
  - Île-de-France
  - Blanc du Massif Central
  - German Mutton
  - English Suffolk
  - White Suffolk
  - Dorper
  - White dorper

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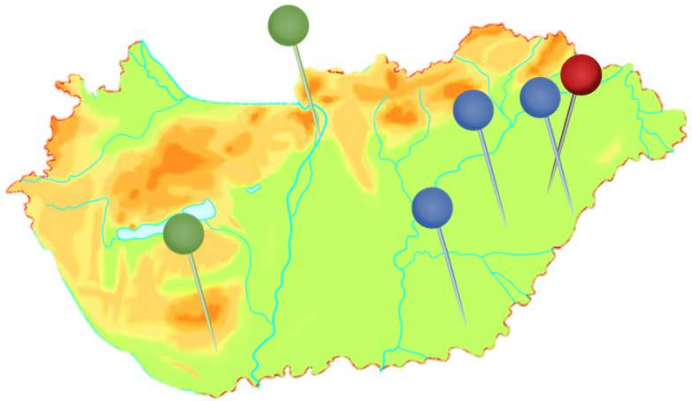
Delegation

Renáta Klein
(PhD, NF)

János Oláh
(PhD, HSGA Board)



Eszter Bácsi
(PhD student)

Nóra Pálfyné Vass
(PhD, DVM)

Boglárka Vincze
(PhD, DVM)

Tímea Milisits-Németh
(PhD, IO Board, AB)

Ferenc Czina
(PhD student)

István B. Csák

László Perge
(HSGA Board)

Kristóf Kormányos

My delegation

Farmer	Flock size	Breed	Production
István	450, 150	BMC, Hungarian Merino	
Kristóf	115	Dorper	
Ferenc	40	Île-de-France	
László	200	Hungarian Racka	
János (UD)	300	Tsigai, Dorper, White Dorper	
Tímea	15	Hungarian Plain Goat	

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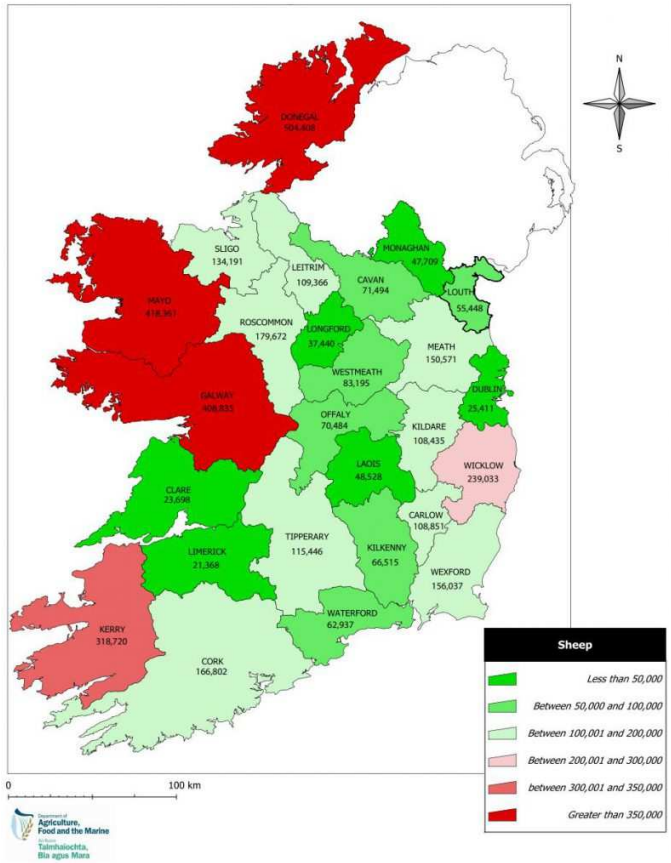
Ireland

Irish sheep production – export orientated

- Ireland - 4th largest sheep meat exporter in world
  - largest net exporter in Europe
  - export 77,000 tonnes sheep meat (€475 million)
  - main markets: France, Germany, UK, Sweden, Belgium
- Ewe flock (2.66m) in decline (48% decrease since 1992)
- Grass based systems - lowland and hill
- Mean carcass weight = 20.4 kg
- Main breeds - Suffolk, Texel, Belclare, Charollais
  - Black face mountain, Cheviot



Irish delegation

- Farmers
  - Tomas O'Toole - Innovative farmer, Galway
  - Shane Moore - Innovative farmer, Roscommon
  - Margaret Stevenson - Sheep and beef, Donegal
  - Simon Byrne - Sheep and tillage, Wexford
  - John Brooks - Sheep and beef, Roscommon
  - John Curley - Sheep and beef, Roscommon
- Research & Industry
  - Tim Keady - Researcher Sm@rt and TechCare, Teagasc
  - Bríd McClearn - Technologist Sm@rt and TechCare, Teagasc
  - Noel Claffey - Farm manager digifarm, Teagasc
  - Eoin Dunne - Technologist sustainable sheep systems, Teagasc
  - Frank Campion - Researcher hill sheep and flock health, Teagasc
  - Ciaran Lynch - Sheep specialist, Teagasc
  - Seamus Fagan - Veterinary research officer, DAFM
  - Lauren Nolan - Irish Country Meats

Israel

Israel sheep & goats production

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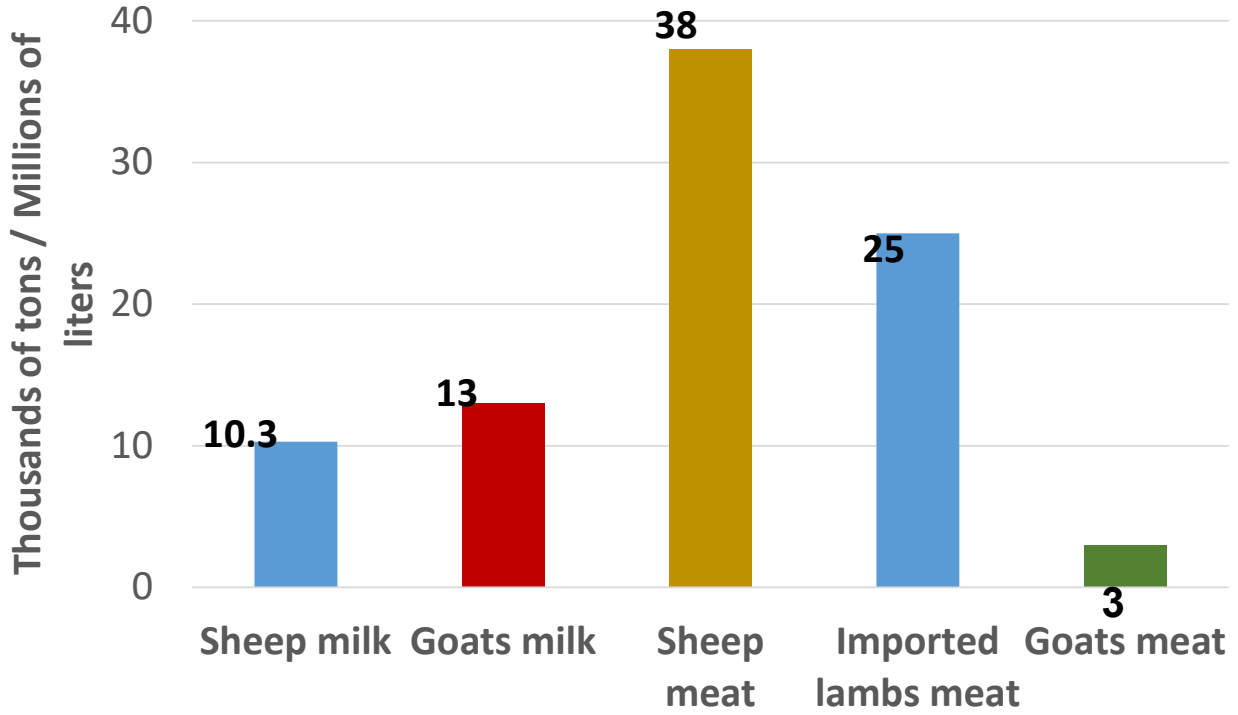
Sm@ll Ruminant Technologies

300,000 ewes
Prolificacy: 1.78

50,000 does
Prolificacy: 1.91

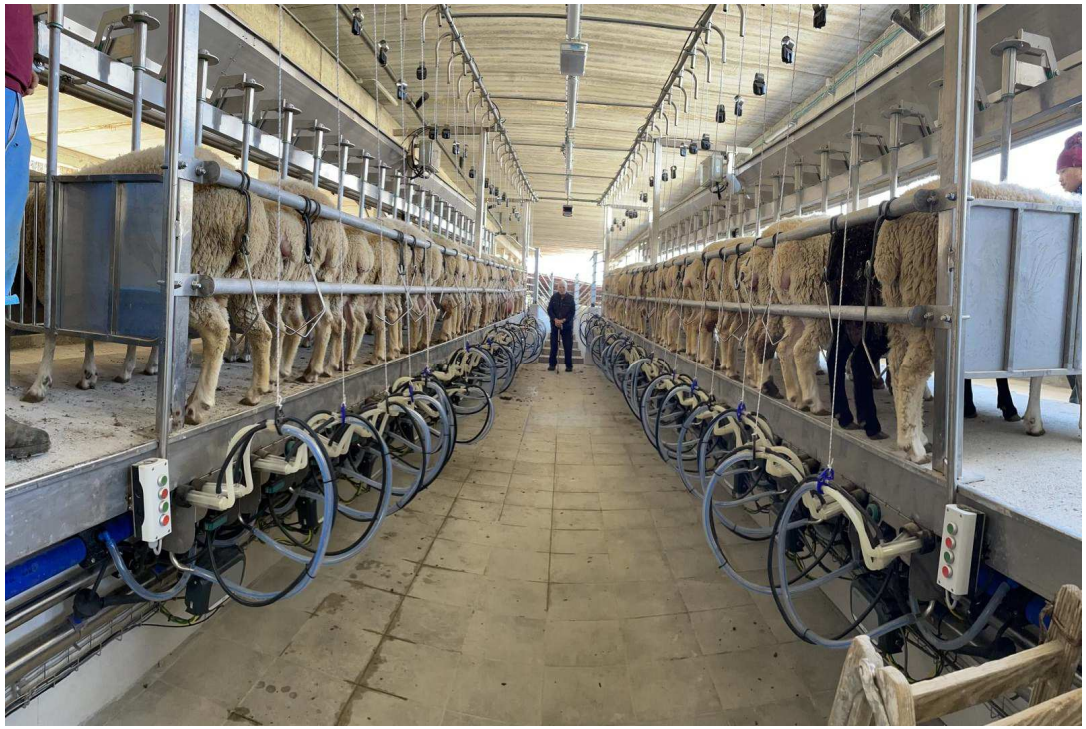


- **15% decrease in flocks numbers – 3,900 farms in 2022, 3,300 in 2023.**
- **Additional 406,000 live lambs/year (40% of total consumption)**

Characteristics

Sm@RT
Sm@ll Ruminant Technologies

- **Shift to very intensive, highly productive farming**
- **Open sheds, served dry forage, synchronized lambings**
- **Automatic milk replacer feeder, slatted floors**
- **Automatic milking systems (Afimilk, S.C.R)**



Israel delegation

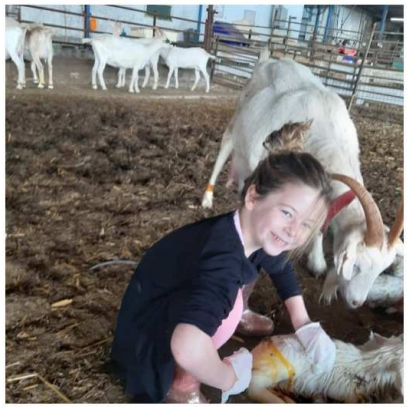
Sm@ll Ruminant Technologies

	Name	Farm Type & Size	Ewes/Does
	**Prof. Ilan Halachmi**	**Precision Livestock Farming (PLF) Lab**	Agricultural Research Organization • Volcani Center •
	Eng. Assaf Godo		
	Joseph Lepar		
 	**Samir Kaadan**	**SHAHAM -** The Center for Applied Solutions for Israeli Agriculture	SHAHAM
	Michal Milger		

Farmers info

	Farmer	Farm Type & Size	Ewes/Does	Inovation	Products
	Hanoch Ben-Zvi	40 Ha	600 ewes (Merinolandschaf & american suffolk)	Mobile spray pen	
	Benjamin Talyah	30 Ha	500 ewes (Merino-Dorper)	Mixed species grazing	
	Dr. Edna Eyal Koren	Open shed + Milking system	1,450 ewes (Assaf)	Two floors sheep shed	
	Rotem Boker Michaeli	Open shed + Milking system	400 does (Zanen)	Feeding conveyor	
	Muhammad Habarat	Open shed	1,400 ewes (Merino – Assaf-Dorset – Suffolk – INRA 401)	Underfloor heating	

Thank you



Italy

Small ruminant dairy farming in Italy

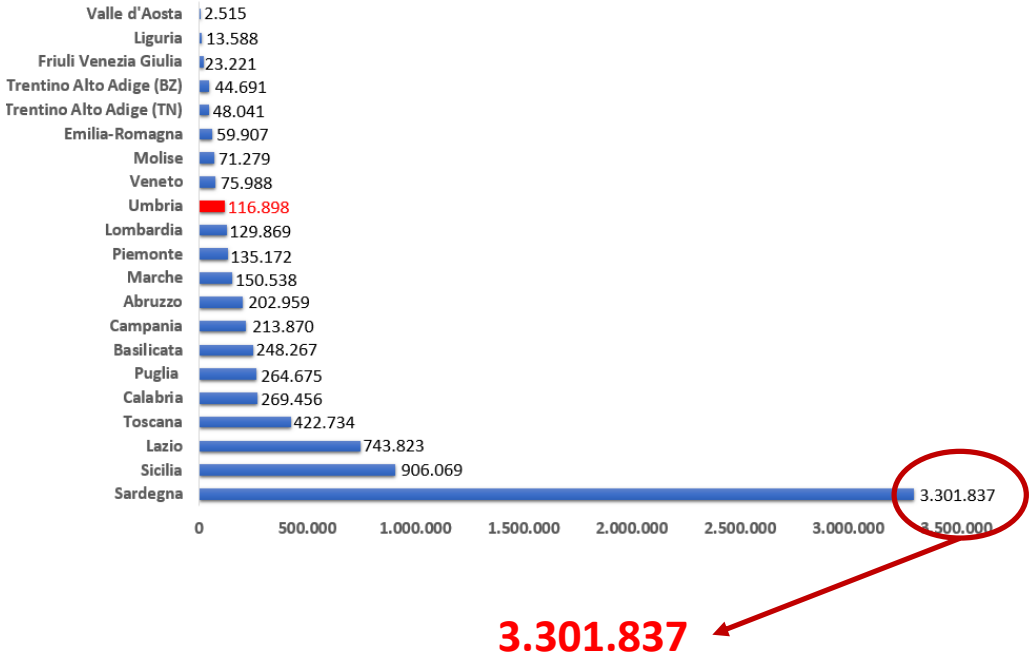
	N° sheep	Tons of milk	Kg milk/head
Italy	6.567.546	449.674	68
Sardinia	3.074.452	309.631	100

	N° goats	Tons of milk	Kg of milk/head
Italy	1.010.143	42.862	42
Sardinia	292.149	25.255	86

Sarda dairy sheep industry

Italy produces
16.2% of European sheep's milk and
Sardinia 69% of Italian sheep milk

Italy produces
1.2% of European goat's milk and
Sardinia 58% of Italian sheep milk



3.301.837

n° heads	% Sheep Farms	% Livestock
1-20	19.8	0.6
21 - 50	8.8	1.5
51 - 100	10.3	3.8
101 - 200	19.8	14.4
201 - 300	16.6	20.2
301 - 400	10.7	18
401 - 500	6	13.1
> 500	8	28.4

With about **3 million sheep**, i.e. 45% of the national sheep population (ISTAT, 2020) and about 4% of the European Union one (EU28, EUROSTAT, 2020), and a milk production of about **300,000 t** per year (ISTAT, 2020), Sardinia is the main European region for sheep milk production, representing more than 13% of the total European production (EUROSTAT, 2020).

Inventory of dairy sheep farms in Sardinia and Italy (ISTAT 2015-2021)

	Sardinia (total)	Sardinia (% of Italy)	Italy
Total sheep farms (n.)	12,699	24,6	51,096
Total sheep (n. heads)	3.074.452	46.8	6.567.546
Total ewes (n. heads)	2.896.905	47.4	6.110.114
Average flock size (n. heads)	236		133
Total sheep milk (t)	309.631	68.8	449.634

IT delegation

- Farmers
  - Giuseppe Diana
  - Caterina Motzo
  - Giuseppe Ena
  - Matteo Melis
  - Pietro Scanu
  - Mario Morittu

Research & Industry

- Valeria Giovanetti, Maria Sitzia,Marco Acciaro & Stefano Picconi
- Antonello Cannas, Maria Angela Porcu
- Emanuela Rossi, Giorgia Serra, Gianleonardo Dettori

Farmer info

Sm@RT
Sm@ll Ruminant Technologies

Farmer	Farm Size	Ewes	Other	Production
Pietro Scanu	300 ha	400 dairy ewes (Sarda)	900 dairy goats (Saanen)	
Caterina Motzo	80 ha		180 dairy goats (Murciana)	
Giuseppe Ena	80 ha	250 dairy ewes (Sarda)	350 dairy goats (Saanen)	
Giuseppe Diana	150 ha	920 dairy ewes (Sarda)	310 goats (Murciana)	
Matteo Melis	35 ha		200 dairy goats (Murciana)	

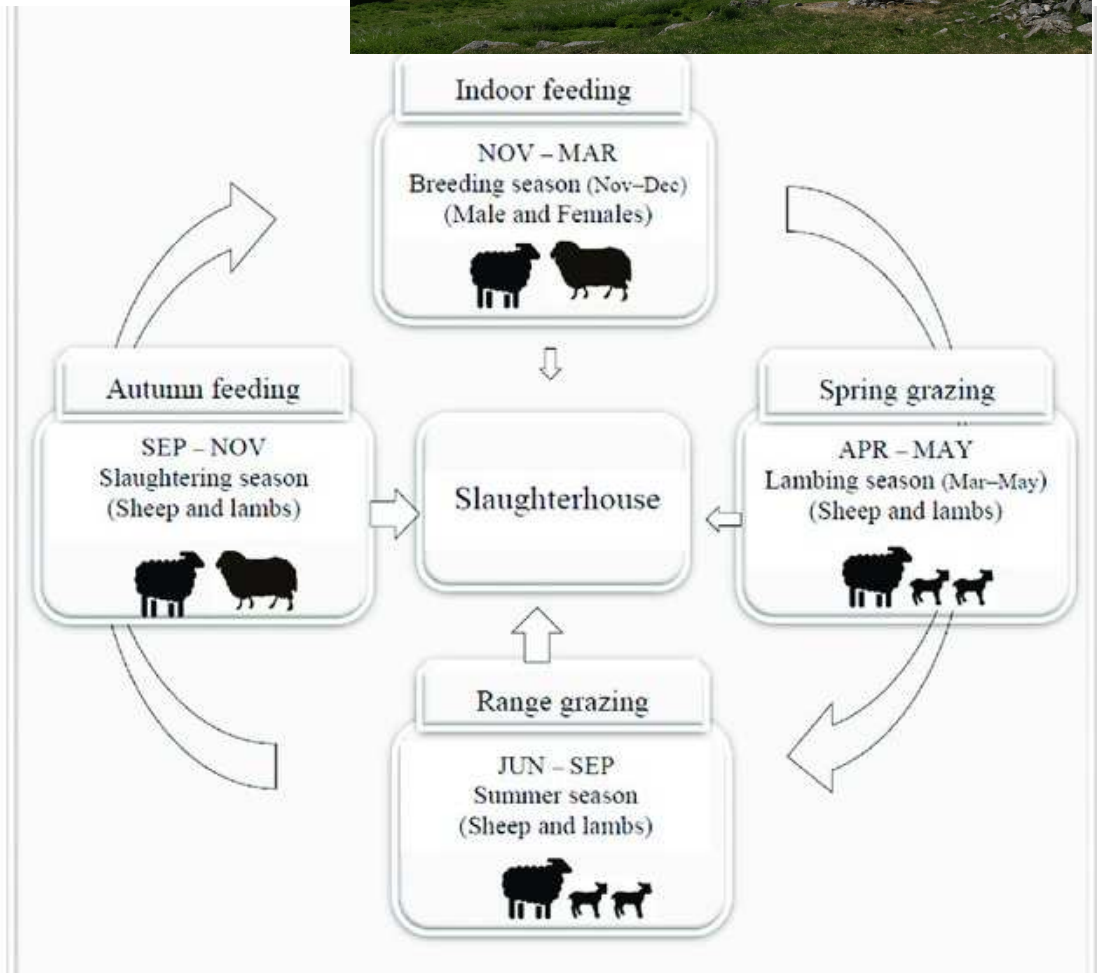
Norway

Norwegian Sheep Industry

2024: 889 615 sheep on 12 930 farms

Average farm size:	69 adult sheep/farm
	(11% of farms > 150 sheep)
Slaughtered lambs + sheep:	1 161 947 – only meat sheep
Average slaughter weight:	20,1 kg (18,4 kg lambs)
Total tonn meat:	22 370
Total tonn wool:	3 371

- Norwegians eat an average of 5.4 kg of sheep meat per person per year.
- Norway is the largest sheep meat producer among Nordic countries.
- Export only 38 tonn sheep in 2023.
- Import 1063 tonn sheep in 2023.



Norwegian Goat Industry

2024: 33 938 dairy goats on 251 farms

Average farm size: 126 goats / farm

25 % > 170 goats

Total goat milk production:	21 349 737 l
Meat (goat and kid), tonn:	340 tonn

Main breed: Norwegian Dairy Goat

Other Norwegians:

NIBIO Norwegian Institute of Bioeconomy Research

Lise Grøva
Scientist
Sm@RT network facilitator

Shelemia Nyamuryekung'e
Scientist

Anne de Boer
Technician

United Kingdom

UK Sheep industry

This project has received funding from the European Union's Horizon 2020 research and innovation programme, under grant agreement 101000471

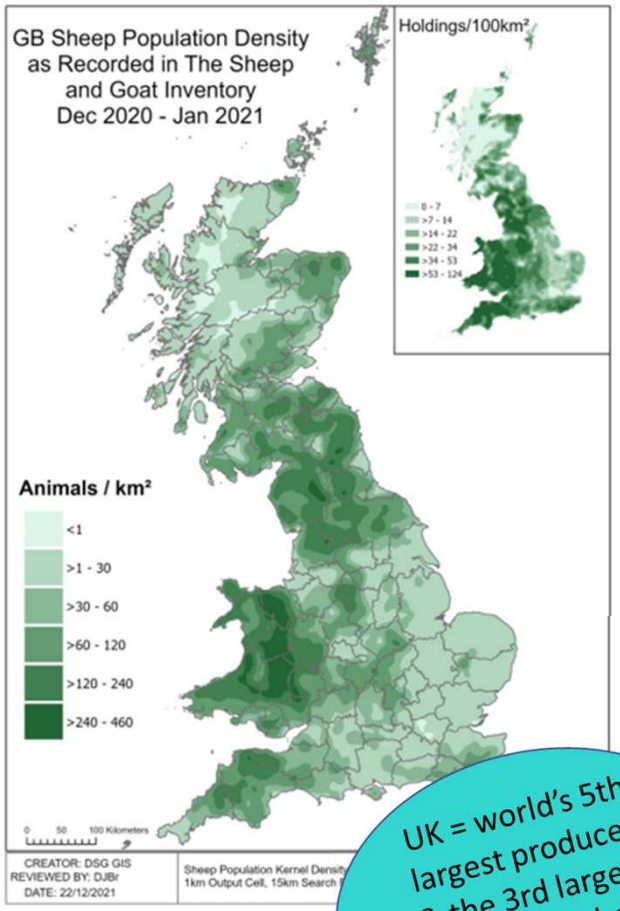


Figure 1 Sheep population density in GB (Sheep ar

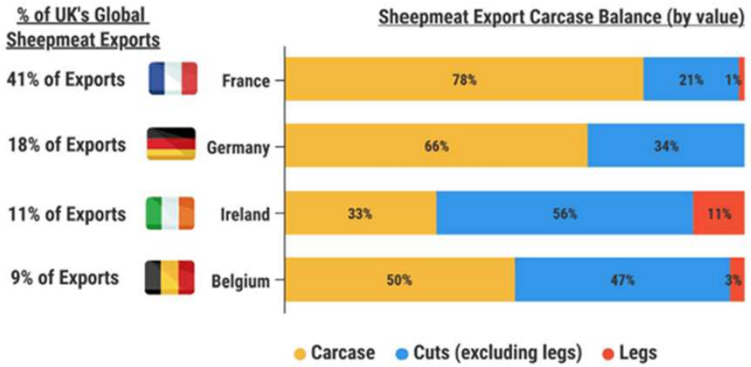
Published 2021

UK Female breeding flock (2021)	Holdings	Livestock
1 to 19 breeding sheep	13,855	139,298
20 to 49	13,970	451,810
50 to 124	14,507	1,178,880
125 to 499	19,210	4,911,440
500 to 999	5,821	4,036,279
1 000 and over	3,005	4,906,525
Total	**70,368**	**15,624,233**

UK = world's 5th largest producer & the 3rd largest exporter of sheep meat.

~ 300,000 tonnes of lamb & mutton produced annually, we export 88,000 tonnes of sheep meat.

Over 90 different breeds of sheep in 2020 survey



UK delegation

- Farmers
  - Neil & Debbie McGowan – Alyth, Perthshire
  - Hamish MacDonald – Hawick, Scottish Borders
  - Lawrence Martin – Kelty, Fife
  - Robert & Diane Hall – Moniaive, Dumfries & Galloway
  - John Gray – Morpeth, Northumberland

- Research & Industry
  - Claire Morgan-Davies & Ann McLaren SRUC
  - Fiona Kenyon, Millie Scott & Eilidh Geddes Moredun
  - Daniel Stout, Poppy Frater & Lorna Shaw SAC CONSULTING
  - Nicola Noble (National Sheep Association) NSA

Farmer info

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Farmer	Farm Size	Ewes	Other	Production
Neil & Debbie	500 ha	900 Lleyn & 100 Texel ewes	200 beef cows	
Hamish	254 ha	1,150 ewes (range of breeds)	20 beef cows	
Lawrence	65 ha	200 Lleyn ewes	20 beef cows	
Robert & Diane	1000 ha	1,500 NCC ewes	90 beef cows	
John	156 ha	950 Easicare & 35 Texel ewes		

Break!


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Tables sessions – needs & solutions

5 groups
20 min per table

France (group 1)

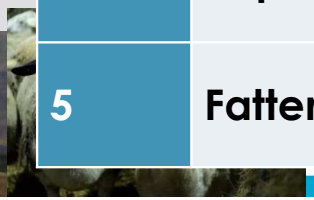
Italy (group 2)

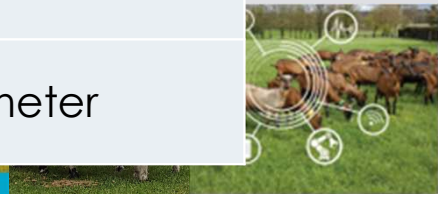
UK + Norway (group 3)

Ireland + Estonia (group 4)

Israel + Hungary (group 5)

Table	Topic	Presenters	Tech 1	Tech 2
1	**Feeding/Grazing**	Laurence/Peep	Virtual fence	Automatic milk feeder
2	**Herd/Flock management**	Lise/Assaf	Drone	Flock management software
3	**Health/Welfare**	Fiona/Jean-Marc	FEC pack	Connected water meter
4	**Reproduction**	Brid/Renata	Pregnancy scanner	Hand-held reader
5	**Fattening/Milking**	Tim/Valeria	EID weigh crate	Electronic milk meter





This project has received funding from the European Union's Horizon 2020 research and innovation programme, under grant agreement 101000471

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Sm@RT Final Seminar Scotland

Workshop activities

FEEDING/GRAZING NEEDS & SOLUTIONS

What have we done?

Online survey
(May –July 2021)
(669 answers)

Workshops
(Sept – Oct 2021)

List of farmers' needs for tools to help them at:

1. **Feeding/Grazing**
2. **Health/Welfare**
3. **Reproduction**
4. **Flock/Herd management**
5. **Fattening/Milking**

Feeding/Grazing needs for tools

- Moving electric fences/lack of fence on hill
- Measuring grass height
- Identification of sick animal, move animals in big lots
- Link between the state of the animals, feeding and distribution
- Establish paddocks
- Gather the sheep from mountain pastures
- Lamb/animal surveillance on pasture
- Distribute concentrates

- Reliability/Repeatability of quality/quantity of measurements of the forage availability and composition
- Link between feeding and production
- Feeding transition between pasture and barn

- Evaluation of forage quality and comparison to references/chemical analysis of feedstuff on farm
- Fences monitoring
- Concentrate distribution at milking or in the box
- Recording of forage distributed/forage distribution in trough

Examples of 2 solutions

1. Virtual fence

[Goats grazing at the Nofence boundary (youtube.com)]

Virtual fence – ADOPTION BY FARMERS

Tried in Estonia, Norway & UK

Adoption rate: 1 -2 % (UK & Estonia) but 61% in Norway

Peak time? 11 years (Norway & UK) or 23 years (Estonia)

Sm@RT solutions Norway - virtual fence (youtube.com)

What do you think??
Have you tried it?

Examples of 2 solutions

Sm@ll Ruminant Technologies

2. Automatic milk feeder for kids

https://www.youtube.com/watch?v=ve5gvDqdbuo

Automatic milk feeder – ADOPTION BY FARMERS

Sm@RT
Sm@ll Ruminant Technologies

Tried in Israel

Adoption rate: 7 %

Peak time? 15 years

What do you think??
Have you tried it?

Virtual Fence – Cost-benefit analysis

English

Estonia

Francais

Hungary

Italian

Hebrew

Norwegian

Milk feeders for kids - Cost-benefit analysis

English

Estonia

Francais

Hungary

Italian

Hebrew

Norwegian

This project has received funding from the European Union's Horizon 2020 research and innovation programme, under grant agreement 101000471

Sm@RT Final Seminar Scotland

Workshop activities

HERD/FLOCK MANAGEMENT NEEDS & SOLUTIONS

What have we done?

Online survey
(May –July 2021)
(669 answers)

Workshops
(Sept – Oct 2021)

List of farmers' needs for tools to help them at:

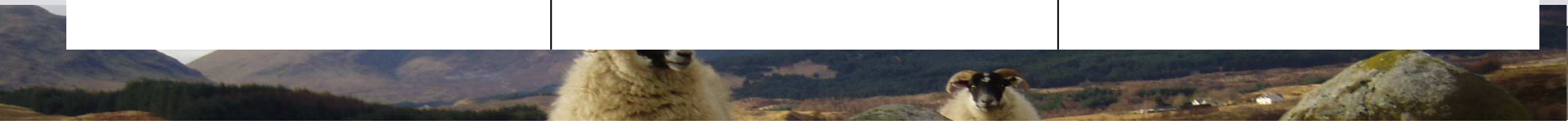
1. Feeding/Grazing
2. Health/Welfare
3. Reproduction
4. **Flock/Herd management**
5. Fattening/Milking

Herd/Flock management needs for tools

- Recognising your sheep automatically
- Weighing your sheep automatically
- Managing sheep on pasture
- Individual recording system

- Targeted rationing
- Identification of ewes for lambing
- Grouping the animals

- Adding value to EID
- Management software
- Controlling shed environment
- Management of homogeneous groups



Examples of 2 solutions

1. Drone

[Sm@RT solutions Norway: Drone (youtube.com)]

Drone – ADOPTION BY FARMERS

Sm@RT
Sm@ll Ruminant Technologies

Tried in Estonia, Ireland, Norway and the UK

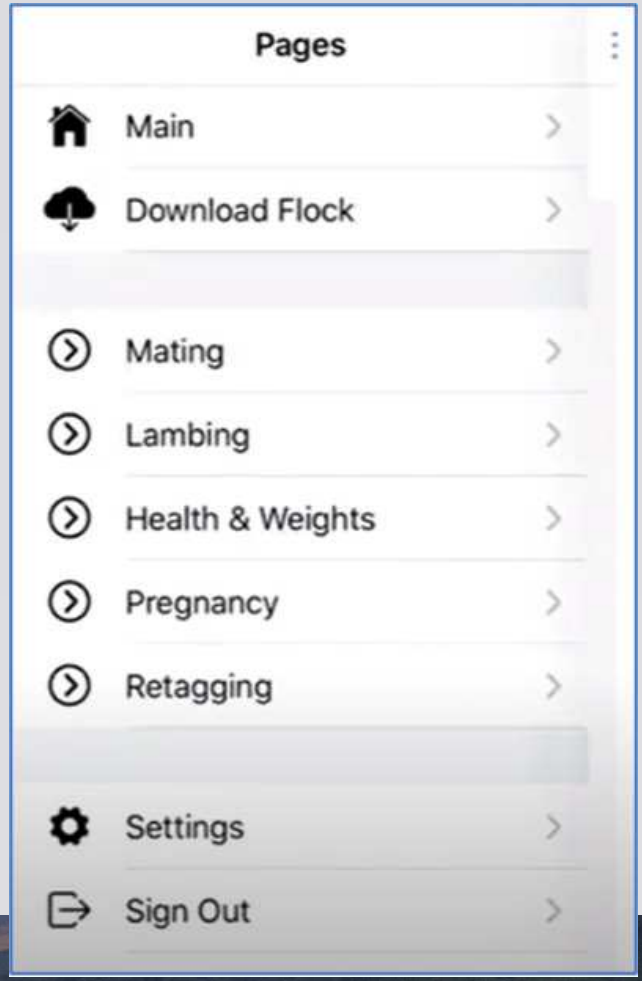
Adoption rate: btw 34% & 98%

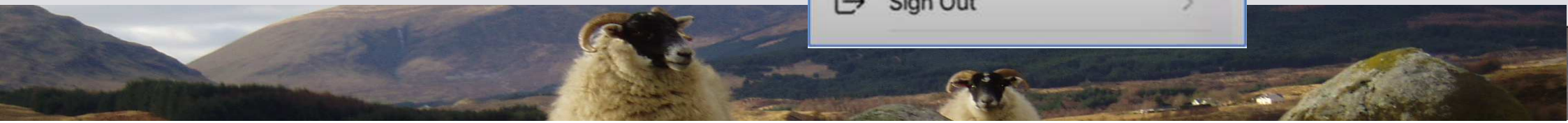
Peak time? Between 10 & 17 years

What do you think??
Have you tried it?

Examples of 2 solutions

2. Farm management software/app





Farm management software – ADOPTION BY FARMERS

Tried in the UK

Adoption rate: 98 %

Peak time? 14 years

What do you think??
Have you tried it?

Drone – Cost-benefit analysis

English

Estonia

Francais

Hungary

Italian

Hebrew

Norwegian

Flock Management app - Cost-benefit analysis

English

Estonia

Francais

Hungary

Italian

Hebrew

Norwegian

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Sm@RT Final Seminar Scotland

Workshop activities

HEALTH/WELFARE NEEDS & SOLUTIONS

What have we done?

Online survey
(May –July 2021)
(669 answers)

Workshops
(Sept – Oct 2021)

List of farmers' needs for tools to help them at:

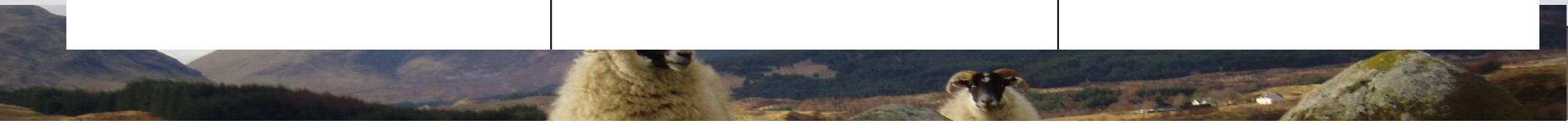
1. Feeding/Grazing
2. Health/Welfare
3. Reproduction
4. Flock/Herd management
5. Fattening/Milking

Health/Welfare needs for tools

- Detection of common parasites
- Identification of sick animals
- Combining health data with other data
- Recording & analysing health data quickly
- Early detection of health issues
- Dosing/vaccinating

- Early detection of issues
- Prevention/early detection of mastitis
- Monitor environmental conditions
- References on water consumption

- Observation of changing behaviour
- Early detection of health/parasite troubles
- Management of social interactions



Examples of 2 solutions

1. FEC pack

FECPAKG2 technology for easy and accurate Faecal Egg Count testing. (youtube.com)

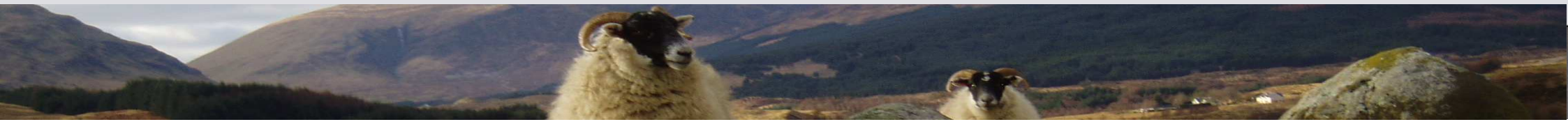
FEC Pack– ADOPTION BY FARMERS

Tried in the UK

Adoption rate: 58 %

Peak time? 8 years

What do you think??
Have you tried it?



Examples of 2 solutions

Sm@RT
Sm@ll Ruminant Technologies

2. Connected water meter

Connected water meter – ADOPTION BY FARMERS

Sm@RT
Sm@ll Ruminant Technologies

Tried in Estonia

Adoption rate: 72 %

Peak time? 22 years

What do you think??
Have you tried it?

FEC Pack – Cost-benefit analysis

English

Estonia

Francais

Hungary

Italian

Hebrew

Norwegian

Water meter - Cost-benefit analysis

English

Estonia

Francais

Hungary

Italian

Hebrew

Norwegian

This project has received funding from the European Union's Horizon 2020 research and innovation programme, under grant agreement 101000471

Sm@RT Final Seminar Scotland

Workshop activities

REPRODUCTION NEEDS & SOLUTIONS

What have we done?

Online survey
(May –July 2021)
(669 answers)

Workshops
(Sept – Oct 2021)

List of farmers' needs for tools to help them at:

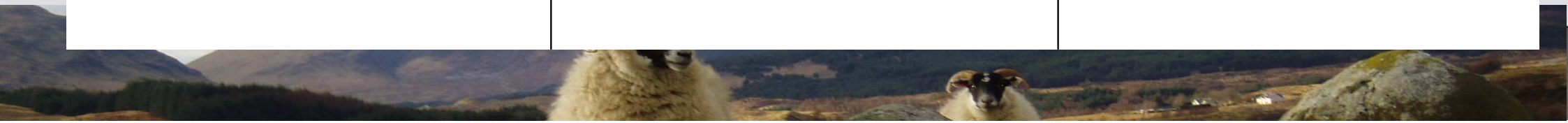
1. Feeding/Grazing
2. Health/Welfare
3. **Reproduction**
4. Flock/Herd management
5. Fattening/Milking

Reproduction needs for tools

- Scanning & dividing ewes for appropriate nutrition
- Managing mating groups
- Lambing records/ewe performance
- Selecting ewes/rams for replacement
- Identification of ewe lambs

- Cycle & heat identification
- Availability of scanning services

- Heat detection
- Automatic estimation of body condition score
- Optimisation of AI



Examples of 2 solutions

1. Pregnancy scanning

https://www.youtube.com/watch?v=ActZdYMIlfk

Pregnancy scanning – ADOPTION BY FARMERS

Sm@RT
Sm@ll Ruminant Technologies

Tried in Hungary

Adoption rate: 93%

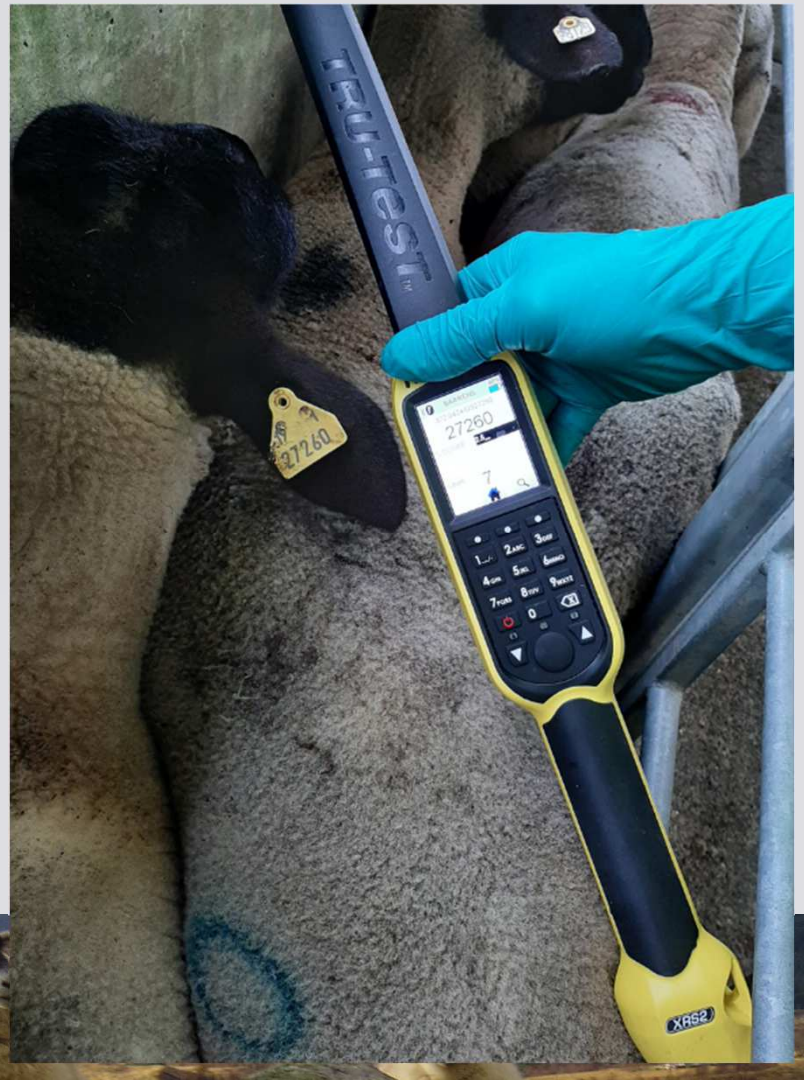
Peak time? 3 years

What do you think??
Have you tried it?

Examples of 2 solutions

2. EID hand-held reader

Ireland Sm@rt video: EID Handheld wand (youtube.com)



EID hand-held reader – ADOPTION BY FARMERS

Tried in Estonia, Hungary, Ireland and the UK

Adoption rate: 85 % (72% to 97%)

Peak time? 14 years

What do you think??
Have you tried it?

Pregnancy Scanning – Cost-benefit analysis

English

Estonia

Francais

Hungary

Italian

Hebrew

Norwegian

EID handheld reader – Cost-benefit analysis

English

Estonia

Francais

Hungary

Italian

Hebrew

Norwegian

This project has received funding from the European Union's Horizon 2020 research and innovation programme, under grant agreement 101000471

Sm@RT Final Seminar Scotland

Workshop activities

FATTENING/MILKING NEEDS & SOLUTIONS

What have we done?

Online survey
(May –July 2021)
(669 answers)

Workshops
(Sept – Oct 2021)

List of farmers' needs for tools to help them at:

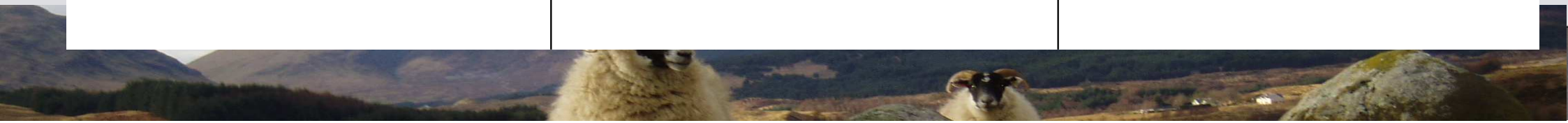
1. Feeding/Grazing
2. Health/Welfare
3. Reproduction
4. Flock/Herd management
5. Fattening/Milking

Fattening & Milking needs for tools

- Lamb weighing
- Animal sorting
- Knowing when lambs are ready for slaughter
- Timely weaning
- Parasite detection
- Monitoring outdoor conditions
- Performance recording

- Different milking requirements
- Identification & separation of animals with problems
- Monitoring of udder health

- Monitoring of automatic cleaning
- Individual milk production
- Improvement/prediction of lactation curve length



Examples of 2 solutions

1. EID weigh crate

[Ireland Sm@rt video: EID Weighcrate and Autosorter (youtube.com)]

EID weigh crate – ADOPTION BY FARMERS

Tried in Estonia

Adoption rate: 24%

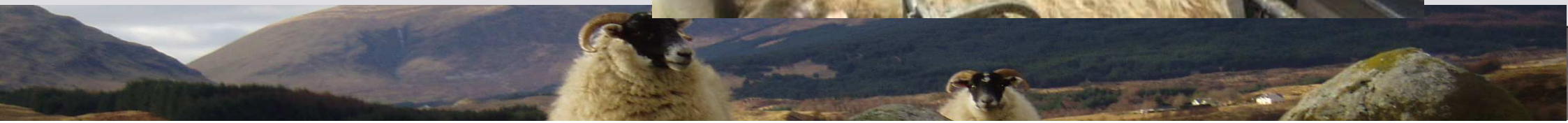
Peak time? 16 years

What do you think??
Have you tried it?

Examples of 2 solutions

2. Milk meters

[Italian solution_Milk meters AGRIS (youtube.com)]



Milk meters – ADOPTION BY FARMERS

Tried in Italy (different groups)

Adoption rate: 64 % (29% to 98%)

Peak time? 15 years

What do you think??
Have you tried it?

EID weigh-crate – Cost-benefit analysis

English

Estonia

Francais

Hungary

Italian

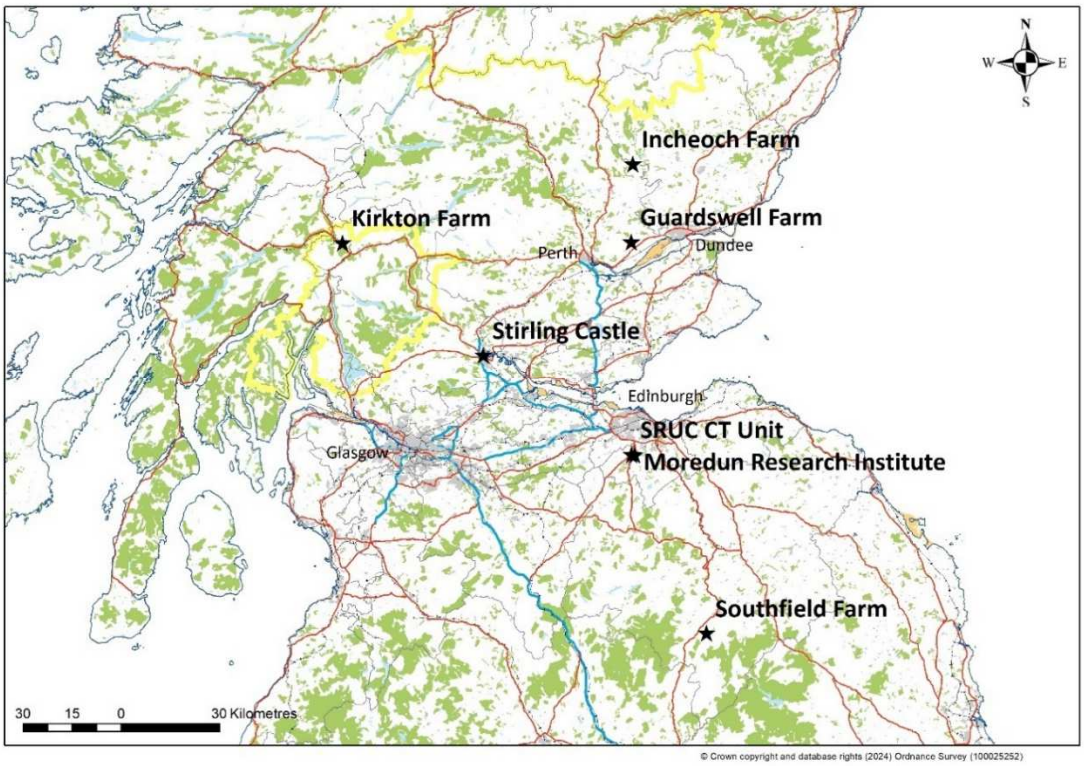
Hebrew

Norwegian

Sm@RT
Sm@ll Ruminant Technologies

Final Seminar

Scotland July 2024



SRUC Moredun Research Institute SAC CONSULTING Part of Scotland's Rural College (SRUC)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 101000471.

Day 1 – Tuesday 2nd July 2024

Moredun Research Institute

Team:

Fiona Kenyon, Heather McDougall, Jade Duncan, Adam Hayward, Leigh Andrews, Phoebe Beal, Gillian Mitchell, Rebecca Ross, Eilidh Geddes, Aidan Petrie, Michelle Reeves, Cameron Cunnea, Rhodri Evans, Lynsey Melville, Cassie McGregor & Millie Scott

History of Moredun

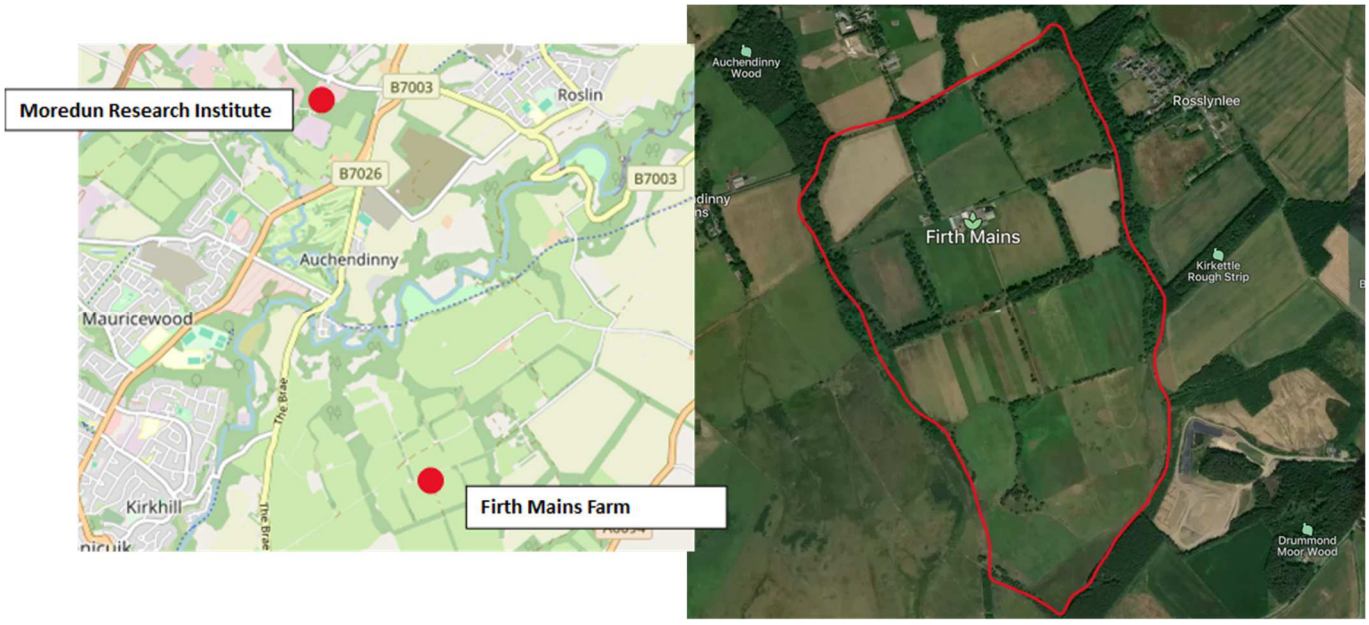
Moredun was founded by farmers, for farmers in 1920 with the aim of improving the health of livestock, especially sheep. This was because of a significant rise in the value and demand of livestock following World War 1 which saw the need for research into livestock disease. Within six years the founding members had raised enough funds to buy a plot of land and build the Moredun Research Institute. Within ten years of the Research Institute opening, Moredun scientists had discovered the cause and developed vaccines and treatment strategies for Braxy and lamb dysentery which, at the time, were a huge concern for farmers. Over the years Moredun has continued to work closely with farmers and vets, as they strive to improve livestock health and support sustainable agriculture through the development of diagnostic tests and the creation of novel vaccines to combat infectious disease.

Firth Mains Farm

The Moredun Research Institute's farm at Firth mains, just outside Penicuik, Midlothian, is a lowland livestock farm, compromising approximately 115 Ha in the shadow of the Pentland hills. Firth Mains is a working farm, which can run 600 breeding sheep. The main focus of the research work at Firth Mains is on the sustainable control of parasitic worms in sheep.

Set-up

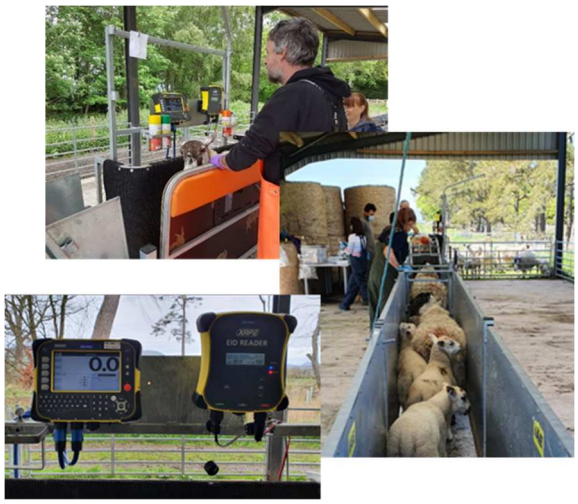
- Semi-extensive lowland sheep farm
- Mule Texel cross breed used, common breed in the Scottish lowlands / uplands.



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 101000471.

Targeted Selective Treatment (TST) as a PLF tool

- Happy Factor minimum weight prediction provides a pen-side decision support system.
- Treatment of individual underperforming lambs.
- Slow development of anthelmintic resistance.
- Optimise wormer use.
- Reduce labour & treatment costs.



Pre-existing PLF technologies

Sheep handling system

- Ritchie Combi-clamp weigh crate
- Tru-test XR-5000 weigh head
- Tru-test EID reader
- Demonstrated during Sm@RT training sessions in 2022 & 2023

Innovative PLF technologies

TechCare trial: Ewes and lambs facing natural Gastrointestinal parasite infection on pasture while wearing PLF technology

Animals wore innovative low-cost Bluetooth beacons. Readers (WISPs) were either on-animal or on fence posts. Accelerometers and GNSS used to ground truth results. Data collection also included: BCS, live weight, mastitis score, feacal soiling score plus direct feacal & venal blood samples. FECs performed within 48 hours at Moredun Research Institute.

Early life trial: Livestock face many challenges in early life – how does this affect future productivity

Livestock face many challenges in early life – disease, nutritional, environmental etc. However, minimal understanding of how these events affect long term productivity. Animal data collected using pre-existing and innovative technologies.

- 100 ewe lambs closely monitored during first grazing season and on until they give birth at 2 years old.

GreenGrass trial: To understand the impact of pasture improvement and grazing strategies on livestock productivity and health in Scotland.

Involves a combination of rotational grazing and TST, using the Ritchie combi-clamp, Tru-Test XR-5000 weigh head & Tru-Test EID reader.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 101000471.

SRUC's CT Unit.

Team: Kirsty McLean & John Gordon

CT scanning

CT scanning makes use of a medical imaging technique using low dose X rays to produce images of the inside of an object or body. The technique is non-invasive and non-destructive and can be used on live animals and other objects without the risk of harm. Images are produced using the attenuation of X rays passing through the body, enabling tissues of different density to be identified. The images produced show tissues of different density as different shades of grey: for example, bone is shown as white, muscle as light grey, fat as dark grey and gas or air as black. We use software that allows images to be segmented and measured in numerous ways and produces measurements of linear dimensions, areas, volumes, average densities and standard deviations of tissues.

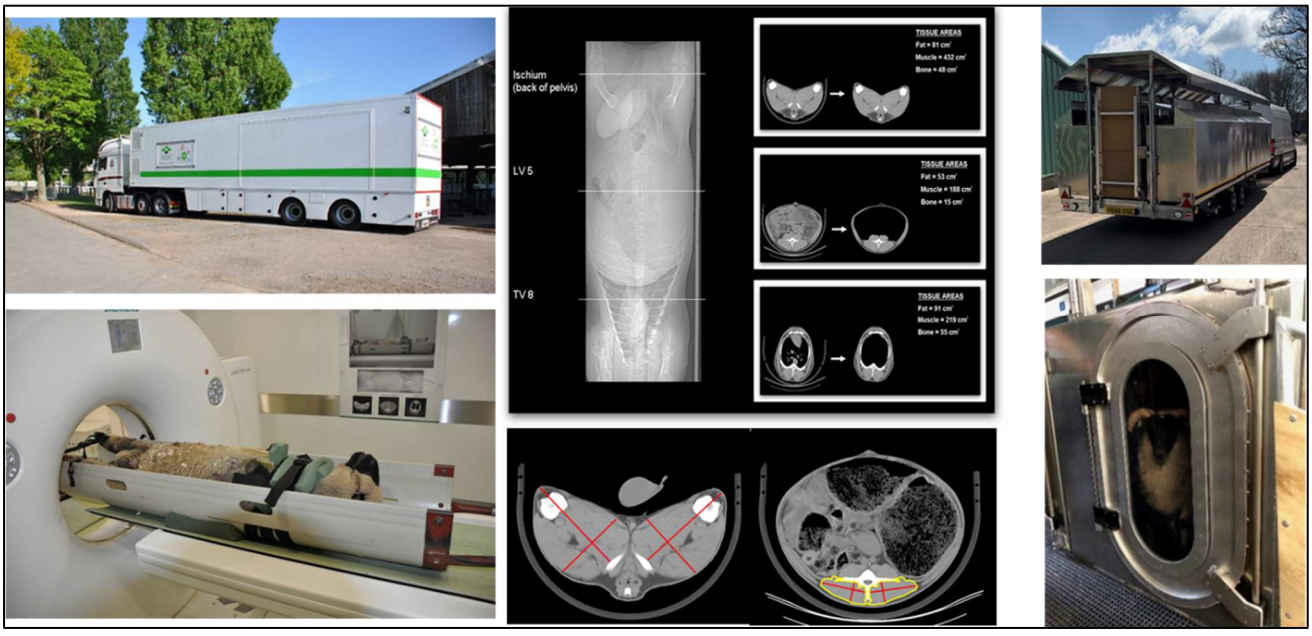
Our primary work is animal based; mostly working with sheep where we are involved in research trials but we also provide a CT scanning service to pedigree terminal sire sheep breeders producing estimated breeding values on carcass traits that are used as a tool to select sires for improved lamb production.

We also scan pigs, chickens and fish as live animals producing information on carcass traits that can be used in breeding programs and for research purposes. Carcasses and primal joints are scanned to assess non-destructively, levels of fat and muscle as a whole and in prime cuts of meat.

Portable Accumulation Chambers (PAC) to measure methane emissions

SRUC's GreenSheep facility allows quick and accurate measurement of methane emissions from sheep. Twelve portable accumulation chambers (PACs) are housed on a trailer that can be taken to the sheep to measure methane and CO_2 emissions on different diets (including at grazing). Each PAC is an aluminium box, approximately 1m long, that house individual sheep for short periods of time (50 minutes). Air samples are collected during this time and methane concentration can be analysed and emissions quantified.

PAC measurements are being taken on thousands of UK sheep as part of on-going research projects



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 101000471.

Southfield Farm, Hawick

Farm Manager: Hamish Macdonald

Maternal breed ewes

Meat breed ewes

1,150 breeding ewes, 1620 lambs and 400 ewe hogg replacements.

Wide range of performance recorded composite maternal and meat breeds.

20 Angus cows plus followers.

2,100 shearling rams sold each year. Bred at Southfield (nucleus) and 23 breeding partner flocks.

Innovis combine extensive performance recording, in-house genetic evaluation (EBVs), composite breeding (stabilised cross breeds) and heavy selection pressure on a forage based system to breed functional high performance sheep that suit low input outdoor lambing systems.

Sheep year

- *Breeding season*: 20th November.
- *Mating*: Bred pure for 1 cycle (20 days) then mobbed up and bred to Primera rams for the 2nd cycle. AI and embryo transfer used within the wider breeding programme.
- *Lambing season*: Outdoors from 15th April. DNA parentage assignment is used with foetal aging at pregnancy scanning providing an estimated birth date within approximately 1 week. This avoids the need to tag at birth and allows mob mating. Lambs are colour marked by week of birth at lambing.
- *Lamb nutrition and weaning*: Grass and mothers milk. No creep feed. Weaning at 9-12 weeks depending on grass supply, around mid-July.
- *Lamb finishing*: 320 ram lambs retained for breeding sales which are sent to a growing unit in October. All lambs surplus to breeding are finished on grass and kale.
- *Ewe wintering*: Ewes are bred on pasture for the 20 days then put on the hill to graze deferred pasture and silage for the 2nd cycle. The flock is pregnancy scanned on the 10th February with singles put back to the hill and fed silage. Twins graze swedes and silage until 3 weeks pre-lambing when they are put back to grass. Triplets are housed, fed high quality silage (11.3 ME, 17% protein) and concentrates.
- *Ewe hogg wintering*: Grazed on kale from 1st October to mid-January then swedes until mid-March.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 101000471.

Performance

- Scanning: 1.83 lambs per ewe to the ram (1.6 – 2.1 depending on breed).
- Rearing: 1.45 lambs per ewe to the ram.
- Slaughter weight: 18.5kg dwt, R and U grade carcasses (range between breeds).

The farm:

254ha of which:

- 206ha pasture including 20ha reseeded each year
- 8ha swedes
- 12ha kale
- 28ha woodland and scrub

Farm labour: Working farm manager and one full time worker.

Technology

DNA Parentage

Lambs are ear tagged and tissue sampled at marking (4-6 weeks of age). Each tissue sample has a unique barcode which is read using a bar code scanner linked to the Tru-test XR5000. This in turn is linked to the lamb's ear tag, read using a Tru-test stick reader. The sample is then sent away to a lab to provide parentage for sire and dam, which have already been DNA sampled.

Tru-Test XR5000 weigh head + Pratley auto drafter

The Tru-XR5000 is used extensively for date collection and selection including:

- Weighing lambs at 8 weeks and weaning. Then monthly including at ultrasound scanning.
- Weighing and recording BCS of ewes four times per year.
- Trait scoring including mouth and tail scoring in ewes and tail length and breech scoring in lambs.
- Parentage assignment.
- To look up EBVs of sale rams.

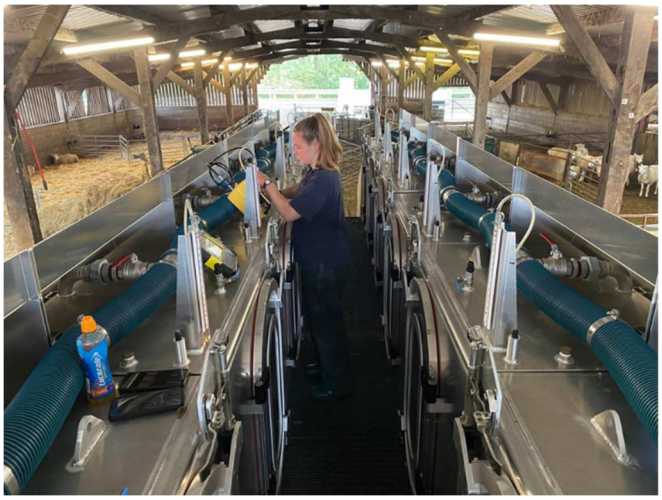
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 101000471.

The Pratley auto-drafter has made life much easier allowing rapid drafting into groups including mating groups, by BCS for differential feeding and randomisation groups for trials.

XR5000 being used to look up ram information and EBVs

Foot scoring for structure and footrot

Portable Accumulation Chamber (PAC)



Innovis is currently leading the Breed for Ch4NGE project which over three years aims to measure methane emissions using the PAC on 13,500 sheep over 45 flocks. At Southfield, 160 ram lambs and 160 ewe lambs are to be measured annually. The project will facilitate identification and breeding selection, through EBVs, for animals that genetically produce less methane to breed lower carbon footprint flocks.

Feed Efficiency Bunkers

Feed efficiency bunkers have been installed at Southfield to measure individual animal feed intake (grass pellets). Lambs are acclimatised to the feed and system for two weeks prior to the start of the trail. Each trial last 6 weeks with lambs weighed weekly thoughout the trial. This provides individual animal data on growth rates and feed intakes to allow genetic selection for feed efficiency. This is also combined with ultrasound of backfat and muscle and CT scanning.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 101000471.

Composite breeding programme

Alongside detailed performance recording and selection on an outdoor lambing forage-based system, composite breeding is a key part of the Innovis breeding strategy. Breeds with complementary characteristics have been crossed and the resulting crossbred offspring bred together to stabilise each new breed.

Meat breeds

		
Abermax	**Aberblack**	**Primera**
Texel x Charolais	Suffolk x Charolais	NZ composite of meat breeds

Maternal breeds

		
Aberfield	**Aberfield SR**	**Abertex**
Texel x Bluefaced Leicester	Aberfield x Lleyn	UK & NZ Texel

		
Highlander	**Cheviot (pure)**	**Aberdale**
NZ composite: Romney x Texel x Finn	North and South Country Cheviots	Abertex line with Inverdale prolificacy gene.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 101000471.

Day 2 – Wednesday 3rd July 2024

Incheoch Farm, Alyth, Perthshire

Farmers: Neil and Debbie McGowan

Lleyn sale rams

1,020 breeding ewes, 1600 lambs, 400 ewe hogg replacements and 120 yearling sale rams.

Breed: Lleyn (900 ewes) and Texel (100 ewes) all performance recorded.

210 Luing, Simmental and Angus cows.

120 rams and 17 bulls are sold through on-farm 'Working Genes' ram and bull sales.

Breeding stock at Incheoch are a great example of data driven selection (EBVs) using technology combined with detailed knowledge of pedigree, type and selection pressure within a commercial forage-based system.

Sheep year:

- *Breeding season*: End November / December
- *Mating:* Natural service (no AI) single sire mating, apart from 365 Lleyn ewes which are mob mated with Texel rams.
- *Lambing season*: Texels indoors at night and outdoors during the day from 27th March, Lleyns outdoors from 26th April. All lambs tagged at birth including crosses bred lambs.
- *Lamb nutrition and weaning*: Grass and mothers milk. No creep feed. Wean at 100 days in August.
- *Lamb finishing:* All lambs finished on farm. 62% finished by end November on red clover leys. Then on to forage crops with 94% finished by Christmas.
- *Winter feeding*:
    - Texel ewes wintered on grass and supplemented with concentrates pre lambing.
    - Lleyn ewes wintered on turnips to scanning. Singles then put onto silage outdoors, twins back on to the turnips until 3 weeks pre-lambing. Triplets on grass and ewe rolls. All ewes set stock on grass one week pre-lambing.
    - Ram lambs for sale are wintered on red clover bale grazing on a last year red clover year.
    - Ewe hoggs wintered off farm on kale/stubble turnips.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 101000471.

Lleyn ewe with twin lambs

Texel ewes with twin lambs

Performance:

- Scanning: 1.82 lambs per ewe
- Rearing: 1.51 lambs per ewe
- Slaughter weight: 21.8kg dtw, R and U grade carcasses (EUROP confirmation)

The farm

500ha of which:

- 125ha arable land including grass leys (42ha), cereals (45ha), red clover leys (20ha) and forage crops (18ha)
- 325ha grassland including permanent pasture and reseeds.
- 50ha rough grazing

Farm labour: Family plus 2 full time workers.

Technology

Agrident 600 Handheld data recorders (x 2)

Neil recording lambing data using Agrident 600

Use: Record ewe and lamb tags for parentage assignment, lamb birth weight, lambing ease, lamb vigour and ewe mothering ability. Likes: Small, compact, waterproof and easy to use. Change: More complex data entry options and cloud back up.

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Tru-Test XR5000 weigh head + FarmIT weigh crate or Ritchie Combi Clamp with EID reader

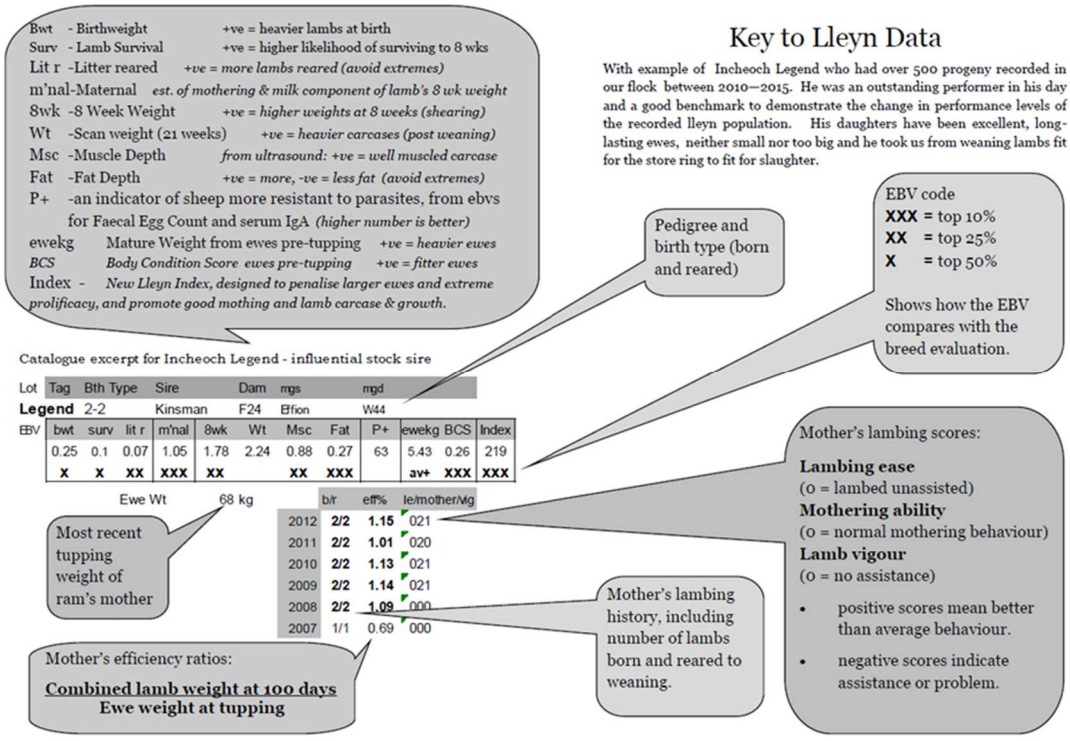
- XR5000: Record weights, ewe BCS and ewe pregnancy data. Tupping groups are uploaded for drafting.
- FarmIT weigh crate is used for weighing lambs at 8-weeks, weaning and ultrasound scanning.
- Combi-clamp with weigh bars is preferred for weighing and drafting finishing lambs and ewes at tupping group allocation as it allows the user to handle and assess each animal easily.

Debbie weighing lambs using XR5000 and FarmIT weigh crate

Debbie taking DNA samples of ewe hogg replacements as part of methane project using PAC

Working Genes Ram Sale

2023 ram sales catalogue can be seen online: Working Genes - Incheoch Breeding Stock Blairgowrie Scotland (incheochfarm.co.uk) The below infographic taken from the sale catalogue explains the detailed data and EBVs provided for selection of Lleyn rams.



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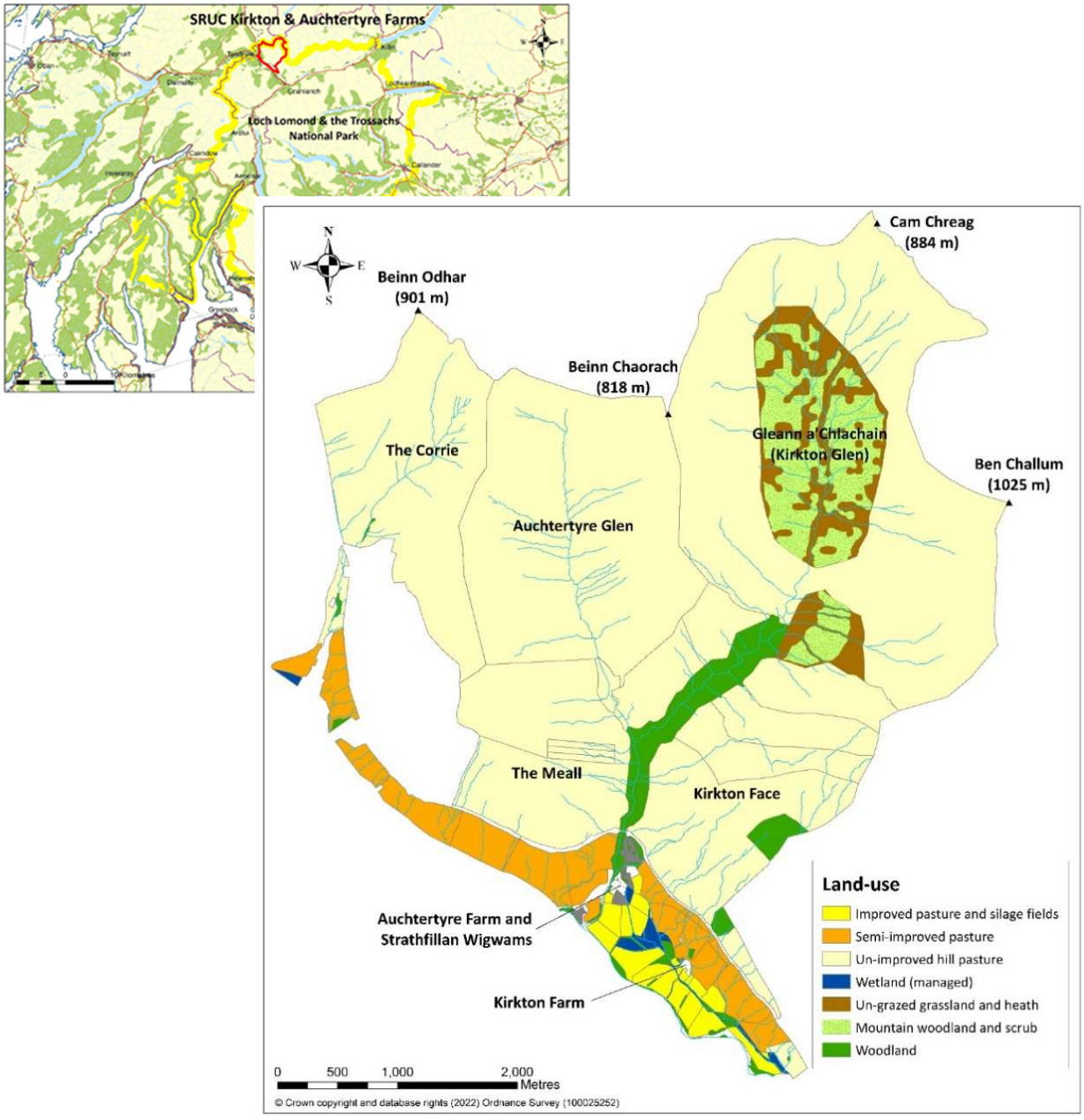
Day 3 – Thursday 4th July 2024

SRUC Hill & Mountain Research Centre, Kirkton & Auchtertyre farms. Sm@RT Digifarm.

Team:

Prof. Davy McCracken (head of centre); Ewen Campbell (farm manager); Dr John Holland, Dr Nicola Lambe, Dr Ann McLaren, Dr Claire Morgan-Davies & Dr Meg Pollock (researchers); Ailsa Thomson, Fiona Livingstone, Milly Wade (technicians); Johnny Redmond & Nicole MacDonald (shepherds).

Farm map:



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Farm statistics:

Covers land area of 2225 ha:

- 1677 ha of mountain pasture (unimproved hill pasture).
- 153 ha of semi-improved pasture; 67 ha improved pasture.
- 307 ha native woodland and scrub.

1,300 breeding ewes (Scottish Blackface, Lleyns, Crossbred Blackface x Lleyn, Black Welsh Mountain) and 350 ewe hoggs (1 year old female replacements) in 4 different flocks:

- 600 ewes in Kirkton Face (Scottish Blackface & Crossbred Blackface x Lleyn) – research flock
- 500 ewes in Auchtertyre Glen (Scottish Blackface) & 150 ewes in the Corrie (Scottish Blackface & Black Welsh Mountain) – commercial hill flocks
- 50 ewes in Auchtertyre Lleyn flock – commercial lowland flock

30 beef cows (Aberdeen Angus & Aberdeen Angus cross)

Environmental schemes (agroforestry, small scale tree planting, wetland management, protection of water margins, species-rich grassland management, moorland management, summer hill cattle grazing)

Low Power Wide Area Network (LoRaWan) covering most of the farm

Sheep year:

Ewes are outside all year.
Mating season: November/December
Lambing season: 20 April – 15 May
Weaning: Mid-Late August
Sales September/October

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PERFORMANCE COMMERCIAL HILL FLOCKS:

~1.13 lambs/ewe at scanning

Note. If weather bad, not all ewes are gathered in at scanning.

0.91 lamb/ewe to the ram at weaning

Store weight: ~30 kg

Surplus lambs are sold store.

PERFORMANCE RECORDED HILL FLOCK:

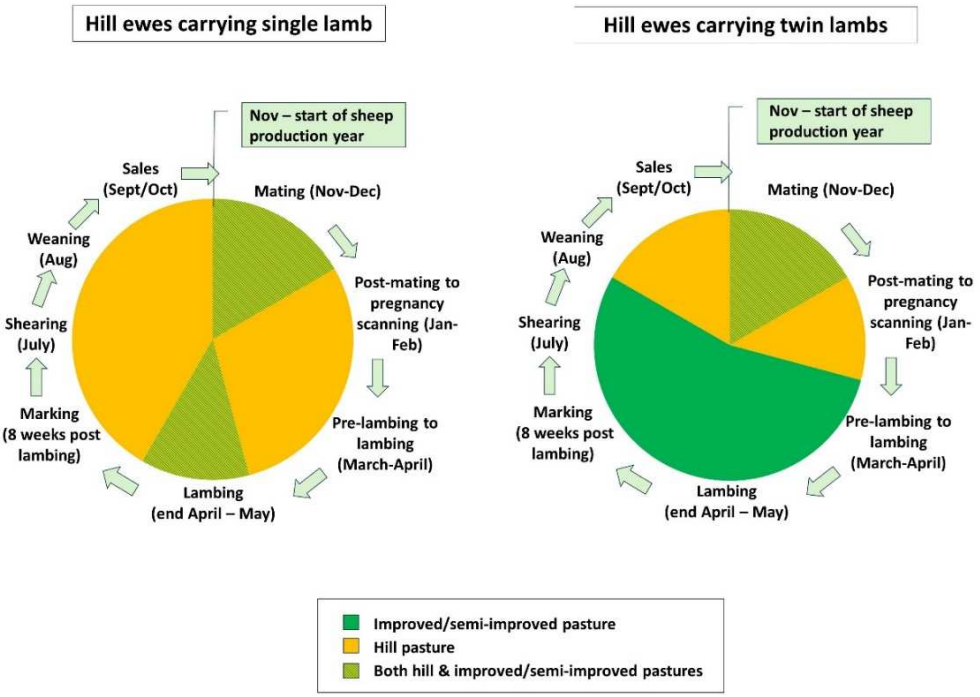
1.42 lambs/ewe to the ram at scanning

1.21 lamb/ewe to the ram at weaning

Slaughter live weight: ≥ 37 kg

EUROP (carcass confirmation): Mainly R – 2 & 3L

AREA and GRAZING:



BREEDING:

COMMERCIAL HILL FLOCKS:

- 3 rams per 100 ewes
- Multiple sire mating groups

Rams bought (from market) + own replacements from research flock

20% replacement rate – ewe lambs mated at 18 months

Ewe sold on after 4 crops (5.5 years old)

Lambs EID tagged at marking (June)

RESEARCH FLOCK:

- 1 ram per 50 ewes
- Single sire mating

Rams bought privately with index figures + own replacements

20% replacement rate – ewe lambs mated at 18 months

Ewe sold on after 4 crops (5.5 years old)

Lambs EID tagged at birth (within 24 hours old)

ECONOMY:

Income outside sheep farming: Cattle

Number of permanent workers: 2.5

Number of seasonal workers: 1 during lambing

Additional contractors: shearers, pregnancy scanner, sheep dipper etc.

PRODUCE:

Lambs slaughtered at local abattoir near Stirling

- Some finished off grass and concentrates
- Remaining lambs housed early October and finished on straw and concentrate diet

Cull ewes, store lambs and some finishing lambs

- Sold through live auction market

Wool is sold via British Wool Marketing Board

- but worth very little (main use = carpets)

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FEEDING & HEALTH TREATMENTS

Winter feeding up to pregnancy scanning

- High energy feed blocks (plus hay when snow cover)

After pregnancy scanning

- Ewes carrying twins: hay, blocks & concentrates
- Ewes carrying singles/barren: High energy feed blocks (plus hay when snow cover)

Health treatments:

Animals treated for fluke and worms throughout the year when required. When possible, regular FECs are taken, and treatment decisions based on these. Most lambs are wormed according to the TST protocol.

Heptavac-P Plus booster – March

All animals dipped in Organophosphate dip in Autumn (using a mobile dipping service).

Pour-ons used to protect animals from flystrike & ticks during the summer.

GRAZING MANAGEMENT:

Fertiliser only on 46 ha of improved pasture

Programme of reseeding started in 2012 after a period of 30 years without reseeding

Lime applied to improved and semi-improved pasture (5 tonnes/ha), where pH below 5.9

No lime or fertiliser on hill ground

Silage (1 cut – June/July): mainly for cattle.
Only 1 cut of silage taken from 17ha of improved pasture (~20 bales/ha)

CATTLE

30 cows & 5 heifers

2 bulls (1 Traditional Angus, 1 Native Angus)

Aim = a 600kg cow, weaning a 300kg calf

Spring calving in shed

Calves sold at 8 months

Housed from November (depending on weather) to April.

Summer grazing on hill

- NoFence collars used at certain times of year

Fed silage from farm (and from other SRUC farms)

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Technologies- Sheep handling system:

Conveyor

Conveyor is used for many different management tasks (vaccinations, dosing, tagging, foot trimming, udder & teeth checks, etc.).

Pregnancy scanner sets up his scanning crate at the end of the conveyor. As does the mobile sheep dipper.

Back-fat scanner scans research flock lambs while they are on the conveyor.

EID stick reader, data logger and digital weigh-head

Handhelds (EID stick reader & Psion) used to record:

- IDs of animals arriving / leaving the farm
- IDs of animals receiving health treatments

Digital weigh-head (Tru-Test XR5000) - Stores information for each individual animal on the farm:

- Includes ID, breed, sex, age, flock/management group, plus any additional information of interest etc.
- Stores data collected at each event (live weights, body condition scores, any comments etc.)

EID weigh crate and autodrafter:

EID weigh crate: 1 person can weigh and sort 500 sheep in 1 hour

EID weigh crate used:

- for targeted selective treatment (TST) worming
- at mating to sort animals in their mating groups
- to select which lambs are ready for slaughter (based on weight)
- to record all information of the animals automatically

Past research projects have shown that:

- Allocating ewes into their feeding groups in winter takes half of the time (using weight change) compared to doing it manually
- Worming lambs based on their weight change (using the Happy Factor algorithm) saves 40 % time and 35% of product.
- Using EID weigh crate during the whole sheep year saves up to 40% labour.

These tools were those demonstrated during the Sm@RT training sessions in 2022 and 2023.

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TECH: Environmental sensors

Trail camera boxes for small mammal monitoring

AudioMoth (digital acoustic device) for monitoring birds and bats

Digitanimal GPS collars

Decentlab environmental sensors

- Air temperature and relative humidity sensors
- Soil temperature, moisture and electrical conductivity sensors
- Soil moisture and temperature profile sensors
- Water level sensors
- Tipping bucket rain gauges
- All-in-one weather station with 12 sensors

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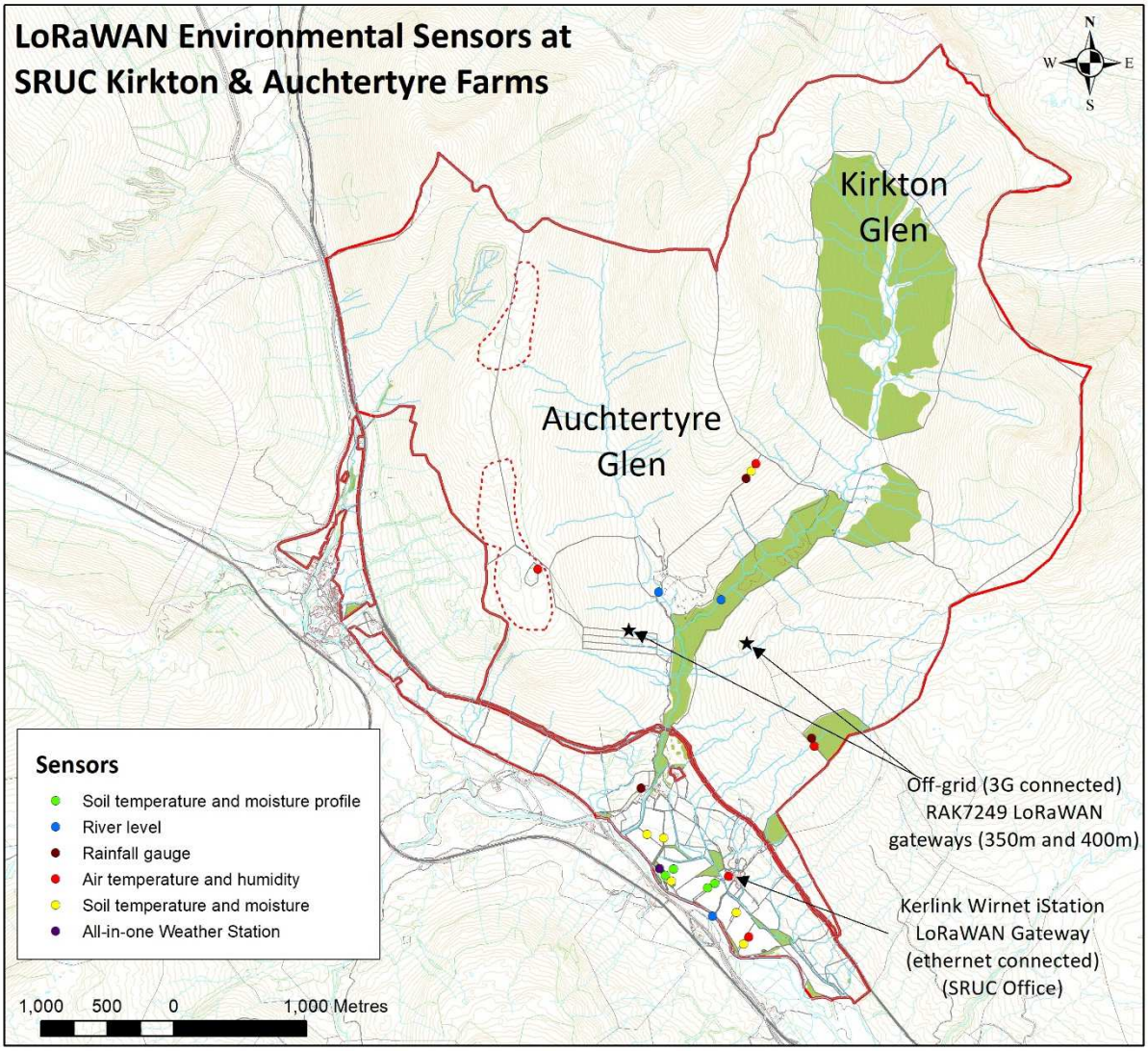

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Sheep tracking and welfare monitoring

This project is another EU funded project called TechCare (innovative technologies to improve small ruminant welfare management) - www.techcare-project.eu

On farm: testing of innovative technologies to see if they can be used as a welfare alert to farmers.

Ultra-High Frequency ear-tags and receiver:

UHF tags can be read at the same time (multiple animals with 1 antenna), and reading distance is higher than LF tags. Reading range can be adapted/changed. Works with 4G or with flashcard. LoraWan connection + power source.

Study: UHF antennas above the feeder during outdoor winter feeding of ewes. Tracking which ewe comes to the feeder. Coupled with regular welfare measurement observations. Any ewe that stops 'coming' to the feed may have an issue.

Study: UHF antennas at gates:

- Tracking ewes – ewe order, or order change may indicate a welfare issue (e.g. lameness)
- Tracking ewe/lamb association for pedigree

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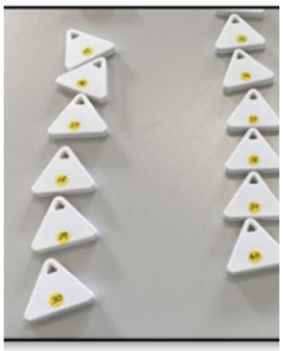
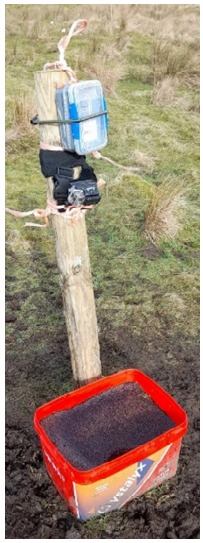
Bluetooth beacons and receiver (Wearable Integrated Sensors Platform- WISP)

Bluetooth beacons and receiver – prototype (Aimee Walker PhD). Connection via LoraWan and on flashcard. 1 receiver can 'read' up to 16 nearest beacons. 1 read every 5 minutes. Allows to know which animals are near a resource or near another animal.



Study 1: Proximity to a resource (winter feeding)



Study 2: Ewe-lamb proximity (maternal bond)

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TECH: Breeding for sustainable hill sheep

A large-scale, Scottish Government funded, research project at SRUC Hill and Mountain Research Centre is focussing on breeding sustainable hill sheep. The aim is to use scientific advances and technologies to produce productive and efficient genetics and management strategies to adapt to future challenges, promoting resilience to climate change and biodiversity.

Experimental plan:

- **High genetic index Scottish Blackface (SBF) ewes n = 200**
- **Crossing SBF x Lleyn ewes as comparison n = 400**
- Genetic selection for:
  - Production
  - Health and welfare
  - Resilience
  - Efficiency
  - Reduced environmental impact
- Monitor:
  - Grazing resource
  - Animal location
  - Biodiversity
  - Environmental parameters (sensors)

Automated feed intake recording equipment

Portable feed intake recording equipment for sheep:

- Works with RFID ear tags to record individual animal intakes of forage, concentrates and water in an open pen. Number, timings and duration of each meal per lamb recorded.
- Access to different feed types and amount can be set on an individual animal basis.
- SRUC owns 3 modules, each containing:
  - 16 forage bins
  - 4 concentrate feeder crates
  - 4 water crates with weigh platforms
  - 1 control room trailer
  - space for ~140 sheep
- Funded by the Centre for Innovation Excellence in Livestock (CIEL)

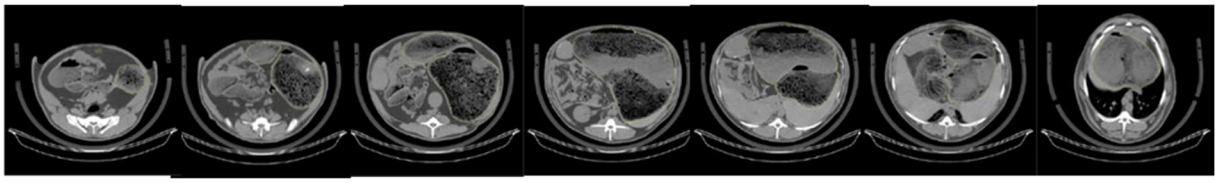
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 101000471.




These feeders are being used with a representative sample of hill lambs each year to measure individual feed intake during the finishing period. Data will be used to look at genetic control of feed intake and feed efficiency and genetic relationships with other traits.

CT scanning

X-ray computed tomography (CT) scanning of sheep provides detailed carcass trait measurements without slaughter. Since the late 1990s SRUC has owned a CT scanner and has provided measurement of total carcass muscle and fat weights and muscularity that feed into UK national breeding programmes. Research has expanded the number of traits that are routinely measured to include spine traits and predictors of meat quality, methane emissions (rumen volume), and lambing ease (pelvic, hip and shoulder skeletal dimensions).



The hill lambs at SRUC Hill and Mountain research centre are being CT scanned to measure rumen volume and body composition, to enable investigations of relationships with feed efficiency, methane emissions, productivity and sustainability traits.

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Portable Accumulation Chambers (PAC) to measure methane emissions

Hill lambs were measured at SRUC's Hill and Mountain Research Centre in 2023 and will be for the following 3 years as part of a Green-ERA Hub funded project (Sustain Sheep), which will bring together PAC methane data from 6 international partners and allow recommendations of how to incorporate these measurements into breeding programmes.


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Acknowledgements

Many thanks to the Sm@RT Innovative farmers Hamish, Debbie & Neil, for welcoming us on to their farms.

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Incheoch
BREEDING STOCK

Also to Shearwell for their help providing the delegate's name badges.

Shearwell Data
Livestock Systems

And to the Scottish Government

Scottish Government
Riaghaltas na h-Alba
gov.scot

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