



D1.5 – Report on seminars and events, including the EAAP event

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1. Executive summary

The deliverable details the Sm@RT seminars and events in particular the EAAP events. It also highlights the links to other projects, and where common sessions were organised.

2. Sm@RT participation to several EAAP conferences and meetings

2.1 72nd Annual Meeting of the European Federation of Animal Science, Davos, 2021

During the first year of the Sm@RT project, Claire Morgan-Davies (SRUC) presented the project at the EAAP annual meeting in Davos (and online) in 2021. This initial abstract aimed to raise awareness of the project within the research community and facilitate connections with other related projects.

The presentation was given in *Session 14: 'The Sm@RT and TechCare Projects,'* a session organized in collaboration with the TechCare project.

Here is the submitted and accepted abstract below:

Sm@RT: small ruminant technology – PLF and digital technology for small ruminants

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Rural economies across Europe, and associated countries, heavily rely on small ruminant (SR) systems, particularly in areas unsuitable for other agriculture livestock production systems. Despite recent advances in precision livestock farming (PLF) and digital technologies (DT) to facilitate farm management, there is a slow rate of uptake by SR producers. This paper presents the project Sm@RT, which aims to improve the understanding, awareness and uptake of different technologies currently available to the SR sector, and further to facilitate 'solutions to needs' and identification of technology gaps. Sm@RT focus is on the use of PLF and DT across all types of sheep and goat management systems and environments, to develop a long-term, self-sustainable European/International network to encourage the use of PLF and DT across the sectors. Eight countries (UK, Ireland, Norway, Estonia, France, Italy, Hungary, Israel) are involved in Sm@rt. The paper presents the original project's approach: an interactive transdisciplinary and multi-actor approach relying on well-equipped demonstration farms ('digifarms') and innovative commercial farms to foster exchanges within the SR industry. It is an iterative step-by-step approach to engage relevant actors from all stakeholder groups at the appropriate level in the knowledge exchange process, crucial to boost dissemination in a trusting environment. Sm@RT will create opportunities to collect and exchange technical and practical knowledge, with information and guidelines on how to use PLF and DT to gain the best benefits for SR systems of production. This will increase efficiency and sustainability of SR farming systems in Europe and beyond.

At this meeting in Davos in 2021, 8 other abstracts were linked to the Sm@RT project, in particular as the technologies they presented were also solutions proposed later in Sm@RT. They also highlighted the links between the projects TechCare and OtoP 3D, and Sm@RT.

Six abstracts focused on the TechCare project:

- Update on TechCare: innovative technologies to improve small ruminant welfare management C. Morgan-Davies, C. Dwyer, J.M. Gautier, E. Gonzalez-Garcia, F. Kenyon, G. Molle, E. Sossidou, R. Carelli, I. Halachmi and E. Metuki
- Developing a welfare prioritization for small ruminants – the TechCare project C.M. Dwyer, G. Jorgensen, A. Aupiais, B. Fagot, L. Ciszter, J.M. Gautier, V. Giovanetti, I. Hansen, F. Kenyon, J.B. Menassol, C. Manca, M. Reeves, X. Such, E. Sossidou and C. Morgan-Davies





- A stakeholder co-design approach for improving small ruminant welfare: the TechCare Project E.N. Sossidou, C. Dwyer, E. González-García, I. Halachmi, J.M. Gautier, G. Caja, A. Rosati, A. Menet, S.I. Patsios, A. Barnes and C. Morgan-Davies
- State-of-the-art in precision livestock farming technologies for monitoring small ruminant welfare V. Giovanetti, G. Molle, M. Decandia, C. Manca, M. Acciaro, C. Morgan-Davies, M. Pollock, B. Fagot, J.M. Gautier, A. Elhadi, G. Caja, F. Kenyon, I. Halachmi, A. Bar Shamai, L. Grova, I. Llach, J.B. Menassol, N. Debus and E. González-García
- Animal-based indicators to improve small ruminant welfare using precision-livestock farming M.C. Reeves, F. Kenyon, E.M. Baxter, J.E. Martin and C.M. Dwyer
- Monitoring post-weaning behaviour in Merinos d'Arles ewelambs at grazing with a walk-over-weighing E. Leroux, I. Llach, G. Besche, J.-D. Guyonneau, O. Benoit, D. Montier, P.-M. Bouquet and E. González-García

And 2 focused on OtoP 3D project:

- Validation of a 3D imaging device to measure new morphological phenotype on ewes L. Depuille, L. Delattre, A. Delpeuch, M. Duval, T. Dechaux, T. Luginbuhl, E. Doutart, C. Valadier and J.M. Gautier
- Liveweight and condition score trajectories to parametrize self weighing scales in small ruminants D. Francois, T. Dechaux, E. Doutard, S. Parisot, C. Valadier, V. Lê, N. Ardjoune, C. Morgan-Davies, L. Depuille, A. Cheype, E. Gonzalèz-Garcia, T.W.J. Keady, J.P. Hanrahan and J.M. Gautier

2.2 *73rd Annual Meeting of the European Federation of Animal Science, Porto, 2022*

During the second year of the Sm@RT project, Ann McLaren (SRUC) presented the results of the project's survey at the EAAP annual meeting in Porto in 2022. This abstract aimed to communicate within the research community about farmer needs and equipment rates in Europe.

The presentation was given in *Session 36: Sensing animals and fields to improve pasture and rangeland management'*.

[Here is the submitted and accepted abstract below:](#)





Attitudes of European small ruminant farmers towards new digital technologies

A. McLaren¹, L. Depuille², N. Katzman³, A. Bar Shamai³, I. Halachmi³, L. Grøva⁴, T.W.J. Keady⁵, B. McClearn⁵, V. Giovanetti⁶, P. Piirsalu⁷, O. Nagy⁸, J.-M. Gautier², F. Kenyon⁹ and C. Morgan-Davies¹

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Despite continued advances in the application of precision livestock farming (PLF) tools and digital technologies associated with some livestock species, small ruminant production industries often still lag behind. Before attempting to improve the profitability of these production systems (both meat and dairy), through the increased uptake of PLF tools and digital technologies, it is necessary to assess the current needs and barriers of implementation. An online survey was launched in April 2021 across all countries (and languages) participating in the Sm@RT: Small Ruminant Technologies project (UK, Ireland, France, Norway, Hungary, Italy, Estonia and Israel). The aim was to assess the opinions and needs of sheep and goat farmers and other stakeholders regarding the use and uptake of PLF tools and digital technologies on farm and beyond the farm gate. After data quality checks, a total of 669 surveys were included in the analyses, 68% of which were completed by farmers, shepherds or farm workers across the meat sheep, dairy sheep and dairy goat sectors. The most popular tools already used on farms related to flock management (weigh crate, 40%; flock/herd management software, 35%). Virtual fences ranked highest on the list of those deemed to be the most beneficial tool to their system. More details will be covered in this paper. Overall, the data has provided an invaluable insight into the needs and priorities of various stakeholders within the sheep and goat industries across the participating countries. It has also provided important information on the current level of technology in use as well as identifying barriers to uptake. Although production type brought some differences, there were notable commonalities across all the different participants.

At the EAAP annual meeting in Davos in 2021, there were also 2 more abstracts which highlighted the links between Sm@RT and TechCare:

- Stakeholders' perceptions of precision livestock farming to improve small ruminant welfare E.N. Sossidou, E.G. Garcia, M.A. Karatzia, L.T. Csiszter, A. Elhadi, L. Riaguas, G. Caja, A. Barnes, J.M. Gautier, T. Keady, I. Halachmi, G. Molle, L. Grova and C. Morgan-Davies
- Romanian sheep farmers' welfare priorities and their knowledge on precision livestock farming L.T. Csiszter, C.M. Dwyer, S.O. Voia, E.N. Sossidou, S.E. Erina and C. Morgan-Davies

2.3 74th Annual Meeting of the European Federation of Animal Science, Lyon, 2023

During the third year of the Sm@RT project, a common session with Eurosheep, SoPerfect and Sm@RT project was organized at the EAAP annual meeting in Lyon in 2023. Five abstracts were presented and highlighted some results of the project to the research community about solutions identified, demonstrations and training sessions on digifarms and innovative farms and also on the lessons learned in New-Zealand.

The presentations were given in *Session 68: Small Ruminant Technologies (Sm@RT) and Thematic network EuroSheep*.

Below are the 5 abstracts:

Sm@RT: Identifying sheep and goats farmers' technological needs and potential solutions C. Morgan-Davies, L. Depuille, J.M. Gautier, A. McLaren, T.W.J. Keady, B. McClearn, L. Grova, P. Piirsalu, V. Giovanetti, I. Halachmi, A. Bar-Shamai, R. Klein, F. Kenyon and I. Llach-Martinez





Sm@RT: Identifying sheep and goats farmers' technological needs and potential solutions

C. Morgan-Davies¹, L. Depuille², J.M. Gautier², A. McLaren¹, T.W.J. Keady³, B. McClearn³, L. Grova⁴, P. Piirsalu⁵, V. Giovanetti⁶, I. Halachmi⁷, A. Bar-Shamai⁷, R. Klein⁸, F. Kenyon⁹ and I. Llach-Martinez¹⁰

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Small ruminant farming systems are important to the sustainability of many European rural communities. Despite recent advances in digital technologies to improve farm practices, uptake by small ruminant stakeholders has been low. Sm@RT (Sm@ll Ruminant Technology) is a Horizon 2020 funded project, involving 8 countries. Sm@RT established focus groups in each country to assess the technology/innovative tool needs of sheep and goats producers regarding 6 topics and proposed solutions. The main needs identified by topic were: (1) grazing/feeding: issues of forage/pasture quality, fencing; (2) for health and welfare: early detection of health issues and diseases and early diagnosis of mastitis; (3) for reproduction: how to optimise AI, animal selection and early pregnancy diagnosis; (4) for herd/flock management: issues of batch management; (5) for fattening: lamb weighing; and (6) for milking, milking machine maintenance. There were differences in the identified needs between countries and system of production (dairy sheep, dairy goats and meat sheep). The 8 Sm@RT countries identified 50 solutions that were subsequently voted by stakeholders during a transnational workshop. Some of the preferred solutions included EID weigh-crate and auto-sorter, milk feeders for kids/lambs, data recording system, automated grass measuring, and milk meters and milking management software. Sm@RT has identified farmers' needs, and identified many existing tools that could help them if adopted and will encourage uptake.

Sm@RT: Innovative technologies training for small ruminant producers L. Depuille, J.M. Gautier, A. McLaren, T.W.J. Keady, B. McClearn, L. Grøva, P. Piirsalu, V. Giovanetti, I. Halachmi, A. Bar Shamai, R. Klein, F. Kenyon, I. Llach and C. Morgan-Davies

Sm@RT: Innovative technologies training for small ruminant producers

L. Depuille¹, J.M. Gautier¹, A. McLaren², T.W.J. Keady³, B. McClearn³, L. Grøva⁴, P. Piirsalu⁵, V. Giovanetti⁶, I. Halachmi⁷, A. Bar Shamai⁷, R. Klein⁸, F. Kenyon⁹, I. Llach¹⁰ and C. Morgan-Davies²

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Across Europe, there is a low uptake of digital and precision livestock farming technologies and innovative solutions by small ruminant producers. The thematic network Sm@RT (Sm@ll Ruminant Technology), which involves 8 countries, aims to improve this level of uptake by farmers by identifying existing tools and technologies that can help farmers. To date, the network has selected 50 relevant tools. To encourage uptake, Sm@RT is organising training/demonstration days on digifarms (research/demonstration farms) and innovative commercial farms. During training days, stakeholders can work, and evaluate different tools and technologies in real situations. Farmers attending the events complete questionnaires before and after evaluating a technology, to gauge if their opinions change after the training. The tools vary from simple electronic identification (EID) stick readers to more complex milking machines and virtual fence collars. Demonstration days are held in a different context, relying on peer-to-peer exchanges between farmers. The innovative farmers show other farmers how they use tools or technologies, in practice, on their farm. The demonstration days allow for more discussion between farmers on the benefits and problems of using the tools. A series of online videos are also available showing how tools and technologies are used and can be accessed by those who did not attend the on-farm training days. These approaches will yield invaluable information regarding barriers and drivers to uptake of technologies on small ruminant farms.

Sm@RT: main lessons from New Zealand on PLF uptake in small ruminants J.M. Gautier, C. Morgan-Davies, L. Depuille, A. McLaren, B. McClearn, L. Grøva, P. Piirsalu, V. Giovanetti, I. Halachmi, A. Bar-Shamai, R. Klein, F. Kenyon, E. Gonzalez-Garcia and T.W.J. Keady





Sm@RT: main lessons from New Zealand on PLF uptake in small ruminants

J.M. Gautier¹, C. Morgan-Davies², L. Depuille¹, A. McLaren², B. McClearn³, L. Grøva⁴, P. Piirsalu⁵, V. Giovanetti⁶, I. Halachmi⁷, A. Bar-Shamai⁷, R. Klein⁸, F. Kenyon⁹, E. Gonzalez-Garcia¹⁰ and T.W.J. Keady³

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Sm@RT (Sm@ll Ruminant Technology) is a thematic network, involving 8 countries, with the objective of improving the uptake of digital and precision livestock farming (PLF) technologies by sheep and goat producers, for labour efficiency and farm profitability. In 2023, representatives of the nine partners undertook a fact-finding tour to New Zealand (NZ) to study (1) the use and uptake of innovative PLF approaches; (2) barriers to PLF uptake; and (3) means to facilitate PLF uptake, for the small ruminant sectors. Similar barriers exist in NZ as in EU, namely cost, perceived lack of return on investment, lack of producer interest, additional management input, ease to use, lack of follow-up support, data interoperability and network coverage. A further issue identified in NZ is the absence of compulsory electronic identification (EID) in sheep. Simple tools instead are used at flock level (not at animal level), e.g. weight crate and manual drafting systems to sort lambs according to weight. As in EU, PLF uptake in NZ is higher in the dairy sector (sheep and goat) both for genetic and flock management. For the emerging dairy sheep sector, some companies propose a PLF package that includes digital tools, advice and training for uptake by their suppliers. Findings from the study tour suggest the following steps for PLF uptake: (1) identify issues at farm level; (2) determine if they can be solved without PLF; (3) if not, identify potential relevant PLF tools; (4) purchase and transfer the technology. The use of digital technologies by NZ researchers is important and can inspire EU researchers for digital, landscape management and agroecological studies.

Use of innovative and precision tools in research stations with small ruminants: the INRAE case Llach, H. Caillat, A. Fatet, S. Breton, T. Aguirre-Lavin, D. Dubreuil, A. Eymard, J. Boucherot, T. Fassier, D. Marcon, S. Parisot, C. Durand, G. Bonnafe, D. Portes, C. Morgan-Davies and E. González-García

Use of innovative and precision tools in research stations with small ruminants: the INRAE case

I. Llach¹, H. Caillat², A. Fatet², S. Breton³, T. Aguirre-Lavin⁴, D. Dubreuil⁴, A. Eymard⁵, J. Boucherot⁶, T. Fassier⁶, D. Marcon⁶, S. Parisot⁷, C. Durand⁷, G. Bonnafe⁷, D. Portes⁷, C. Morgan-Davies⁸ and E. González-García¹

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An extensive survey was carried out in experimental units (EU) of INRAE using small ruminants (SR), to get insights in current and historical uses of innovative technologies in their facilities, and staff viewpoints. Ten EU use SR in INRAE (in France and overseas); 6 were visited in 2022 (addresses in the abstract; 3 with sheep -2 meat, 2 both meat and dairy-; and 3 with dairy goats). A detailed questionnaire was prepared. A total of 78 technologies were inventoried. From that, ~10% are invented or co-produced by INRAE, from which 7 are appreciated i.e. automate weighing device (Baléa); sorting gates (3 exits); DH20 (water consumption monitoring and weighing indoor); DAC (automatic distributor of concentrate); DAF (automatic distributor of forage); Gély test tube (individual milk yield monitoring); and Walk-over-Weighing (WoW). Five tools are used by 100% of EU i.e. EID for individual identification; Baléa for weighing; PDA (Personal Digital Assistant); temperature and humidity sensors (mandatory); and sorting gates. Interviewed staff are favourable to techs' use, but mostly for research purposes and they unanimously agreed in positive effects to alleviate workload and routine. Internet connectivity was revealed however as a serious constraint in certain areas. Four techs are recommended for farmers, recognising price may limit adoption: conveyor belt for feeding supply indoor; mixer (with tractor) for preparing total mixed rations; milk tank weighing; Combi clamp (to ease handling). The P3R EU is the best example of phenotyping EU with promising and effective techs for both research and management purposes. Information will be completed, with further upcoming visits to 100% of EUs.





FEC check: development of an online tool to aid farmer understanding of roundworm faecal egg counts
E. Geddes, A. Duncan, K. Lamont, J. Duncan, F. Kenyon and L. Melville

FEC check: development of an online tool to aid farmer understanding of roundworm faecal egg counts

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Faecal egg counts (FECs) are a simple, inexpensive, and accessible tool for sheep producers to monitor the gastrointestinal nematode (GIN) challenge facing their livestock. GINs are the cause of significant production losses to the industry, and now with increasing anthelmintic resistance and pressure to reach environmental goals, sustainable and effective control is key. FECs are being increasingly utilised by producers to guide treatment timings, estimate pasture contamination and test anthelmintic efficacy. However, interpretation can be challenging. To support the effective interpretation of FEC results, a free web-based application ('FEC Check') was co-designed with stakeholders. A prototype tool was developed using R Shiny which provides farmers with a visual representation of the clinical importance of their FEC results. This is accompanied by guidance to support effective decision-making. Subsequently, to ensure the app is tailored to stakeholder needs, the prototype was trialled by farmers, veterinary clinicians, and animal health advisors in four focus groups across two geographically distinct locations in Scotland. The app was trialled by 33 stakeholders, composed of 17 farmers, and 16 vets/advisors. Most farmers (87%) currently used FECs on their farm, however agreed that the level of interpretation and clinical guidance provided with the results varied substantially between test providers. Upon introduction to the app, both the farmers and advisors liked the simplicity of the design. They also highlighted the benefits of being able to download the results to build a picture of the parasite challenge and anthelmintic efficacy over time, information which could be used for future health planning and breeding stock selection. With further development to optimise the app for smartphones and the ability to handle longitudinal data, all participants agreed that this tool could improve utilisation and understanding of FEC results within the industry.

The other presentations of the session 68, on Eurosheep and SoPerfect project, were:

- EuroSheep: increasing flock profitability through improved sheep health and nutrition management P.G. Grisot, B. Faça, A. Carta, S. Salaris, C. Morgan-Davies, I. Beltran De Heredia, R. Ruiz, S. Ocaç Yetisign, T.W.J. Keady, B. McClearn, R. Klein, D. Tsiokos and C. Ligda
- EuroSheep: end-users assessments of flock health and nutrition best practices P.G. Grisot, B. Faça, A. Carta, S. Salaris, C. Morgan-Davies, I. Beltran De Heredia, R. Ruiz, S. Ocaç yetisign, T.W.G. Keady, B. McClearn, R. Klein, L. Perucho and C. Ligda
- French regional project SO-PERFECTS: project methodology C. Douine, L. Sagot, A.S. Thudor, M. Miquel, M. Bernard, M. Goyenetche and D. Gautier
- French regional project SO-PERFECTS: trial results M. Bernard, L. Sagot, A.S. Thudor, C. Douine, M. Miquel, M. Goyenetche and D. Gautier

At the EAAP annual meeting in Lyon in 2023, 3 other abstracts were also linked with the Sm@RT project by the link between TechCare and Sm@RT:

- TechCare: exploring the use of precision livestock farming for small ruminant welfare management C. Morgan-Davies, G. Tesniere, C. Dwyer, G. Jorgensen, E. Gonzalez-Garcia and J.M. Gautier
- Monitoring water trough attendance in shed: a potential indicator of sheep health or welfare issues? G. Tesnière, U. Jean-Louis, E. Doutart, S. Duroy, C. Douine, M. Rinn, D. Gautier, A. Hardy, A. Aupiais, F. Guimbert, J.-M. Gautier and C. Morgan-Davies





- TechCare UK pilots – integrated sheep system studies using technologies for welfare monitoring A. McLaren, A. Waterhouse, F. Kenyon, H. MacDougall, S. Beechener, A. Walker, M. Reeves, N. Lambe, J. Holland, A. Thomson, J. Duncan, A. Barnes, C. Dwyer, F. Gimbert, J.M. Gautier, G. Tesniere and C. Morgan-Davies

2.4 75th Annual Meeting of the European Federation of Animal Science, Florence, 2024

During the last year of the Sm@RT project, 3 abstracts were submitted and accepted for the EAAP annual meeting in Florence in 2024. The abstracts presented results of the Sm@RT project to the research community about gaps between small ruminants farmers and existing technologies, uptake of digital tools and, demonstrations and training sessions in Irish digifarms and innovative farms.

The presentations were given in *Session 14 : Integration of PLF and context data to improve decision making* and *Session 96: Optimization of technical, economic, and environmental efficiency in sheep and goat production systems*.

Here are the submitted and accepted abstracts below:

Digital and precision livestock farming (PLF) technologies: gaps between sheep and goat farmers' needs and existing solutions C. Morgan-Davies, A. McLaren, L. Grova, V. Giovanetti, L. Depuille, T. W. J. Keady, B. Mcclearn, R. Klein, A. Godo, I. Halachmi, P. Piirsalu, I. Llach, J. M. Gautier, F. Kenyon

Digital and precision livestock farming (PLF) technologies: gaps between sheep and goat farmers' needs and existing solutions

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Sm@RT is an EU Horizon 2020 funded project, involving Estonia, France, Hungary, Ireland, Israel, Italy, Norway and UK, to encourage uptake of digital and PLF technologies by sheep and goat farmers. In a series of national and international workshops in the 8 countries, 166 different needs and challenges regarding technology use were identified by sheep and goat farmers. Sixty potential solutions were collated by the project partners, with some solutions addressing more than one need and production type (meat sheep, dairy sheep and dairy goats). In total, 18 needs were not addressed as follows: 3 for reproduction, 4 for health/welfare, 3 for herd monitoring, 2 for feeding/grazing, 4 for milking, and 2 for fattening. During a final international workshop, additional solutions were identified by over 80 stakeholders to address those gaps although not all were available on the market or directly adapted. Only two gaps relating to milking were not addressed. Between existing technologies and upcoming prototypes, most sheep and goats farmers' needs for technology use on farms can be answered. However, barriers to uptake and cost-benefit analysis, amongst others, should also be considered.





Assessing the future uptake of digital tools and technologies by sheep and goat farmers in the meat and dairy industries A. McLaren, L. Grøva, A. De Boer, T. W. Keady, B. McClearn, G. Valeria, M. Acciaro, L. Depuille, R. Klein, A. Godo, P. Piirsalu, F. Kenyon, I. Halachmi, I. Llach, C. Morgan-Davies

Assessing the future uptake of digital tools and technologies by sheep and goat farmers in the meat and dairy industries

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Sm@RT, an EU Horizon 2020 funded project, aims to improve the understanding, awareness and uptake of digital tools and technologies available to small ruminant farmers. To assess factors influencing the rate and peak level of uptake, stakeholder groups in the 8 Sm@RT countries (Estonia, France, Hungary, Ireland, Israel, Italy, Norway, UK) used the Adoption and Diffusions Outcome Prediction Tool (ADOPT) (<https://adopt.csiro.au/home.aspx>). Questions were in 4 categories; characteristics of the tool/technology; characteristics of the farming population; advantage of using the tool/technology; and learnability. To date, sessions have been completed on 20 different tools/technologies presented by the project as possible solutions to needs identified previously. For example, predicted rate and peak level of uptake for an EID stick reader (across 4 different countries) ranged from 9-24 years and 72-97% of the population. Overall results indicate that answers given relating to what proportion of the population will need new skills/knowledge, and the proportion of farms that could benefit from the tool/technology, are influential in terms of rate and peak level of uptake respectively.

Digital tools and technologies: Irish sheep stakeholder opinions before and after training B. McClearn, T. W. Keady, C. Morgan-Davies, A. McLaren, L. Grova, A. De Boer, V. Giovanetti, M. Acciaro, L. Depuille, R. Klein, A. Godo, P. Piirsalu, F. Kenyon, I. Llach

Digital tools and technologies: Irish sheep stakeholder opinions before and after training

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Sm@RT, an EU Horizon 2020 funded project, aims to improve the understanding, awareness and uptake of digital tools and technologies available to small ruminant farmers. To facilitate this, each of the 8 participating countries (Estonia, France, Hungary, Ireland, Israel, Italy, Norway, UK) hosted training days on farms. Training days consisted of workshops where stakeholders had a demonstration and opportunity to use digital tools/technologies. In Ireland, 3 training days were held where stakeholders were able to evaluate and use a variety of tools including Electronic Identification (EID) readers, EID weighcrate with autosorter, flock managements apps, sheep conveyor, lambing cameras and weather stations. Prior to and after each individual demonstration, stakeholders completed a short survey on their opinion of the tool or technology. After training, some of the stakeholders' opinions changed due to a better understanding of how to use the tool and learning about the potential benefits for their farms. Training days provided an opportunity for stakeholders to have hands-on experience and improve their understanding of the potential benefits of technologies/tools available to small ruminant farmers.





At the EAAP annual meeting in Florence in 2024, 3 other abstracts were also linked to the Sm@RT project by the link between TechCare and Sm@RT project:

- TechCare: Technologies to manage the welfare of sheep and goats – from pilots to large-scale studies C. Morgan-Davies, G. Tesniere, C. M. Dwyer, G. Jorgensen, E. Gonzalez-Garcia, J. M. Gautier, L. Grova, M. Decandia, F. Kenyon, G. Caja Lopez, I. Halachmi, A. Godo, E. Sossidou, S. Patsios, L. T. Czyszter, T. W. Keady, B. Mcclern, G. Lagriffoul, N. Litalien, L. Riaguas
- TechCare: Monitoring semi-intensive meat sheep welfare through EID and weight F. Kenyon, J. Duncan, G. Mitchell, L. Andrews, C. M. Dwyer, M. Reeves, H. Mcdougall, A. Hayward, A. McLaren, A. Thomson, S. Beechener, C. Morgan-Davies
- Tracking sheep indoors or on pasture using Bluetooth and UHF RFID for welfare management: feedback from trials conducted in Scotland and France G. Tesnière, C. Morgan-Davies, F. Kenyon, A. McLaren, T. Waterhouse, S. Duroy, U. Jean-Louis, C. Dwyer, A. Walker, M. Reeves, J. Duncan, J. M. Gautier

2.5 3rd Mountain Livestock Farming Systems Meeting of the European Federation of Animal Science, Clermont-Ferrand, 2024

During the last year of the Sm@RT project, 3 abstracts were accepted for the EAAP regional meeting on mountain farming in Clermont-Ferrand (France) in 2024. The abstracts presented results of the Sm@RT project to the research community about GPS collars in Norway, cost-benefit analysis of digital tools and, evaluation of innovative technologies.

The presentations were given in *Session 8: New technologies for mountain livestock*.

Below are the presented abstracts:

GPS collar data from free ranging sheep in Norway: New knowledge for farmers, authorities and researchers L. Grøva, M. Angeloff, O. Kaasa

GPS collar data from free ranging sheep in Norway: New knowledge for farmers, authorities and researchers

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About 45% of the land area of Norway can provide feed resources for grazing domestic ruminants and can be described as unfenced rangeland forest and mountain land. They provide summer grazing feed and it is estimated that this feed has a value of some NOK 1000 million annually. In general, these systems are considered to provide high levels of animal welfare as animals can express natural behaviour in. However, this is compromised by losses to predators as well as disease and accidents. A main challenge for sheep farmers is the supervision and guarding of these animals. This challenge is the background for the extensive implementation of GPS collars on grazing livestock in Norway in order to track animals during the grazing season. It is estimated that currently some 150 000 GPS collars are on sheep in Norway and they are gathering about 100 million positions every year; with number of collars as well as quality and quantity data improving every year. The farm grazing group of Meråker beitelag consists of 25 farmers that graze some 2000 ewes with lambs every year. All ewes have GPS tracking collars and since 2019 position data are gathered every 4th hour throughout the grazing season. A large proportion of the farmers also use the Norwegian Sheep Recording System (NSRS) for farm management, where performance, pedigree and health data is recorded. Merging GPS data with performance data from NSRS allows the study of numerous factors in the development of Early Warning Systems (EWS) related sheep health and welfare (i.e. surveillance of mastitis, other disease, predators, climate, vegetation etc). Also, land use knowledge is important in a future of increasing multi interest conflicts from the society in these areas (i.e. cabins, hiking, hunting, windmills etc.).





Cost-benefit analysis of digital and precision livestock farming technologies for sheep and goat farms
A. McLaren, L. Grova, V. Giovanetti, M. Acciaro, L. Depuille, T. W. Keady, B. McClearn, R. Klein, A. Godo, P. Piirsalu, F. Kenyon, C. Morgan-Davies

Cost-benefit analysis of digital and precision livestock farming technologies for sheep and goat farms

A. McLaren¹, L. Grova², V. Giovanetti³, M. Acciaro³, L. Depuille⁴, T. W. Keady⁵, B. McClearn⁵, R. Klein⁶, A. Godo⁷, P. Piirsalu⁸, F. Kenyon⁹, C. Morgan-Davies¹

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Sm@RT is a EU Horizon 2020 funded project, involving 8 countries, which aims to encourage technology uptake by sheep and goats farmers. In a series of national and international workshops, farmers identified 166 different needs and challenges regarding technology use on their farms. Sixty potential solutions were collated and proposed to farmers, who voted to retain 30 different technologies across the sheep (meat and dairy) and goat (dairy) industries; each subsequently had a cost-benefit analysis (CBA) undertaken. For context, each CBA was based on a benchmark farm. Information on initial set-up and running costs of each technology, training requirements and potential benefits were collated. An overall summary included an ease-of-use scale, information on value for money, and a recommendation for different types of sheep and goat farms. These CBAs enable farmers to assess objectively whether a technology is appropriate for their farm needs, system and budget. The impact of using each technology is highlighted by the range of potential benefits associated with social, environmental and welfare topics. Benefits relating to flock management, labour efficiency and animal welfare were evident for many of the solutions proposed.

Sm@rt project: Update on evaluation of innovative technologies by sheep and goat farmers V. Giovanetti, M. Acciaro, A. McLaren, L. Grøva, T. Keady, B. McClearn, L. Depuille, R. Klein, A. Godo, P. Piirsalu, C. Morgan-Davies

Sm@rt project: Update on evaluation of innovative technologies by sheep and goat farmers

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Sm@RT (Sm@ll Ruminant Technology) is a EU Horizon 2020 funded thematic network, involving 8 countries, aiming at encouraging the uptake of technology on small ruminant farms. The best innovative technologies were selected in each country and evaluated by sheep and goat farmers at 2 different levels: Training sessions (Digifarms, research center), from researchers to farmers, and Demonstration days (Innovative Farms, commercial farms), from farmer to farmer, in order to provide tangible knowhow on practice and to allow the farmers to see, experience and understand in practice how the different technologies work on farms. Farmers attending the events completed questionnaires before and after evaluating a technology, to gauge if their opinions changed after the sessions. During these events, the cost benefit analysis of technologies was also presented. The results and feedback of farmers' evaluations were summarized for each country. For some technology, farmer's opinion changed after the training. For most of the technologies evaluated, farmers thought that was worth investing and implementing them on their farms, probably for the moderate to high levels of practicality and economic value detected. Knowledge sharing from farmer to farmer in commercial farms has been a success. Digifarms remain a reference point for farmers who need to improve their knowledge of a specific technology

