TECH CARE

Integrating innovative **TECH**nologies along the value Chain
to improve small ruminant welf**ARE** management

Newsletter - Issue 16

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The **TechCare** project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under grant agreement N°862050.

SUMMARY

TechCare - the final cut! - *by C. Morgan-Davies (SRUC)*

It has been nearly 5 years this month that we embarked on the TechCare project, and what a ride! The project started during Covid19, when everything was held online and lockdown was in force. The first project meetings had to be remote, and it is only in July 2022 that we managed to meet with some of the partners. Our full first annual meeting with everyone was only held in September 2022, in Glasgow, nearly 2 years after the official start!

But despite this, the consortium and partners made it. Let's reflect on these past years and outcomes.

TechCare – innovations and technologies for small ruminant welfare management

The project aimed to improve the welfare management of small ruminants through innovative and accessible technological solutions for farmers. The project, led by Scotland's Rural College, comprised 19 partners in 9 different countries. TechCare targeted sheep (milk and meat) and goat (milk) production sectors, taking into account the specificities of each type of production, from farming to transport.
Structured in five main steps, TechCare first planned to identify and prioritize animal welfare risk factors by country and sector. Subsequently, the consortium identified promising technologies to manage these risks, before testing them under real conditions in pilot farms. Effective technologies were then validated on a larger scale with willing commercial farmers. Finally, the project developed innovative alert systems enabling proactive management of animal welfare.
A key element of the project was the continuous involvement of farmers and stakeholders from the outset. The consortium organized national workshops from the beginning to present the objectives of TechCare, regularly gather feedback from stakeholders, and adapted the project's strategic choices to their real expectations and needs. This multi actor and collaborative approach ensured both the relevance of the proposed technologies and their impact on the ground.

Identification of welfare priorities in European farming

The project began with a thorough analysis of risk factors affecting the welfare of small ruminants, using the recognized Five Domains model of Mellor et al. (2020) - Nutrition, Health, Environment, Behaviour, Mental State. This step allowed for the identification of over

80 potential risks, covering different phases of production and development of sheep and goats.
This exhaustive list was then refined and prioritized by national expert committees, adapted to the local realities of production systems (intensive to extensive), the species farmed (sheep or goats), and the sectors (meat or milk). The project workshops held in all partners countries involved 260 stakeholders from the agricultural sector, allowing for the establishment of a list of common priorities by country and sector, which was considered particularly relevant for them. The **main priorities** identified at the consortium level were issues of **nutrition, mastitis, gastrointestinal and external parasites, lameness**, as well as **inadequate environmental conditions**.

Promising technologies to answer the welfare priorities

The project then focused on identifying and prioritizing digital technologies likely to concretely improve small ruminant welfare management on farms. An initial list of potential technological solutions was compiled, based on **three key criteria**: their ability to measure or monitor risks related to animal welfare, their ease of installation and use in real conditions, and their affordable cost.
Stakeholders were solicited again to discuss these potential technologies. Weather stations and environmental sensors to monitor environmental conditions, automatic weighing platforms, electronic milk and water meters, as well as RFID readers for animal identification, were amongst the innovations of most interest to the stakeholders. Accelerometers coupled with GPS, useful for tracking the movements and activity of animals, were also highly favoured.

Trials on farms

Given the priorities regarding issues and technologies, the consortium selected a list of technologies to test in experimental farms and pilot farms of partner organizations, and ultimately on commercial farms. The table below presents, for each of the technologies listed in the row, the category of the welfare indicator for which it can be used and the indicators to evaluate it.

	Technologies selected	Production	Level of data information	Relevant measure	Welfare Issues	Welfare indicators
	**EID tags (LF or UHF)**		Individual	Movement patterns, use of key resources Behavioural change, ewe-lamb relationships	• Lameness • Mastitis • Other illnesses	Behavioural change (BC)
	**Milk meter**		Individual	Individual changes in milk production	• Mastitis • Heat stress	Milk yield (MY)
	**Milk tank scale system**		Flock/batch	Flock-level changes in milk production		
	**Inside sensors (housing conditions)**		Flock	Environmental risks	• Heat stress • Environmental air quality, bedding quality • Respiratory diseases	Environment: (Evt)
	**Weather station (outside)**		Flock	Environmental risks	Outdoor environmental stress (temperature, rainfall, wind, etc.)	Environment (Evt)
	**Weigh crate** With an EID reader/antenna or stick		Individual	Changes in weight or condition	• Nutrition (Bad/under) • Lameness • Mastitis • Internal and external parasites • Other issues: conflicts with wildlife	Body state change (BWC)

These innovations have been tested on 56 commercial farms in 5 different partners countries (Ireland, France, Greece, Romania and Spain): weather station and indoor sensors for environmental risks; milk meter and milk tank scale to record the milk production; the RFID LF tags and readers to detect health issues during milking (milking order); EID weigh crate to collect and understand weight change data.

Promising innovations

As well as those 'ready to buy' innovations tested on commercial farms, the project consortium also tested technologies that were only prototypes or not yet developed for small ruminants:

- **A walk over weigh (WoW):** an automatic weighing scale prototype that allows to monitor the weights of animals in extensive conditions or on pastures. This scale takes the form of a corridor equipped with weighing bars, an RFID reader for individual identification, and a display to show the weight. Strategically placed with an attraction area (water trough, mineral salts), the device naturally encourages animals to regularly cross the platform, allowing for automatic, stress-free weighing.
- **Bluetooth (BLE) beacons** to study ewe-lamb proximity in grazing conditions: Compared to other options such as GPS, BLE could offer a non-invasive and low-cost alternative. A BLE reader prototype that records data every five minutes has been developed, transmitting information in real-time via a LoRa network, a long-range and low-power radio communication technology. The reader can be used both in static mode and worn by the animal. Trials showed that BLE technology could reveal significant differences in animal behaviour based on their breed or the age of the lambs. Furthermore, the BLE reader used as a fixed point, for example on a fence post, could allow for an approximate location of the sheep with an accuracy of about 22 meters.
- **Ultra-high frequency (UHF) RFID** identification eartags to monitor the behaviour of animals in pastures or shelters. Unlike low frequency (LF) RFID, UHF technology offers the potential for detection at greater distances (up to nine meters) and the simultaneous reading of multiple eartags. A device was developed by the consortium, consisting of RFID readers, several reading antennas, and a platform for consulting and sorting data nearly in real-time. This system has been tested to monitor the attendance of animals at strategic points such as feed troughs, water troughs, or key passages to pastures.

Promising applications as early warning system for the farmer

Four different tools have been developed by the project:

1. **THICare** – an application to follow in real time the shed environment. The app allows farmers to consult, via their smartphone, the outdoor and indoor thermal stress index (THI), measured using sensors installed in their farm. A first reference for alert thresholds concerning thermal stress for small ruminants has been developed, and this classification allows the farmer to quickly identify comfort or discomfort levels in each area of the building, using a color-coded visual system.

2. **TechCare UHF platform** – to monitor the animals and their behaviour. This system, consisting of RFID readers integrated into a 'suitcase' and controlled by a microcomputer, allows for remote detection of the UHF eartags worn by animals. The collected data is accessible through a web interface that enables real-time monitoring of the presence or absence of the animals near the antennas, as well as the detection of potential changes in behaviour. The platform offers several types of alerts, such as network disconnection, antenna malfunction, or the absence of detection of an animal for a certain period.
3. **Abinsula platform** – a system dedicated to exploit sensors data from experimental farms. A cutting-edge digital tool designed for real-time monitoring of small ruminants on an experimental farm in Sardinia. Installed in a dairy sheep farm, it primarily aims to enhance animal welfare by enabling the early detection of risky situations.
4. **Breedr app** – a function of the app to record welfare indicators on farms. Breedr app itself is a versatile digital tool, designed to record farm data via a mobile interface, but also accessible in a web version. The latter not only allows for downloading or direct uploading of data but also provides a detailed view of the animals present in the farm. As part of the TechCare project, the application has integrated specific features for sheep and goats, allowing for real-time recording of animal welfare assessments. All the indicators selected in the project, along with their scoring grids, are available in the tool. An 'evaluator/technician' account can combine several profiles, each corresponding to a different farm, which facilitates multi-site tracking.

Alerts using collected data

As well as the platforms and applications developed, algorithms have been created to predict issues based on the data collected from the trial farms. For instance:

- Milking order and udder health. Results from Italy, Spain and France showed that ewes with a poorer udder condition (e.g. infection) tended to shift their position (order) entering the milking parlour.
- Weight change in lambs and parasite burden. Results from Ireland showed that lambs weight change can be an indicator of welfare issue.

TechCare - last stand at the EAAP:

Some of the partners of the TechCare consortium met one last time at the EAAP conference in Innbruck, Austria. Presentations about animal welfare gold standards, the latest trials in Scotland on proximity, results from Spain on THI, and on the large-scale results from France, were part of the programme. It was nice to liaise again with colleagues one last time to discuss the project and its outcomes.

Photo from Left to Right: Ann McLaren (SRUC), Nicola Lambe (SRUC), Riccardo Carelli (EAAP), Tim Keady (Teagasc), Claire Morgan-Davies (SRUC), Ali El-Hadi (UAB), Eliel Gonzalez-Garcia (INRAE), Gilles Lagriffoul (IDELE), Cathy Dwyer (SRUC), Jean-Marc Gautier (IDELE)

This is only a snapshot of all the work carried out during those 5 years. It is impossible in a newsletter to detail all the efforts and activities. To name a few, business models have been also developed, focusing on the data produced by the farms/farmers, as potential source of revenue for them. Consumer surveys have also been undertaken, to understand how the wider society view the welfare in small ruminant systems. Stakeholders' engagement has also been a key part of this project.

It has been 5 years, but quite a journey!

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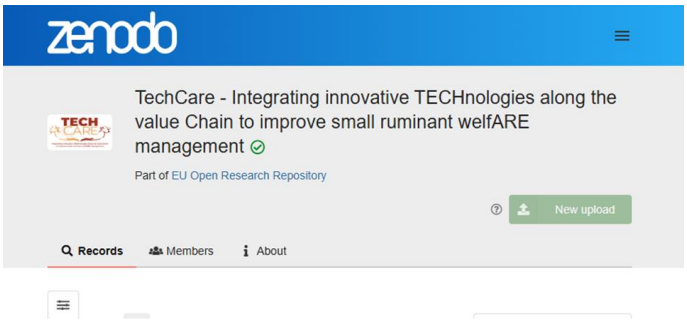
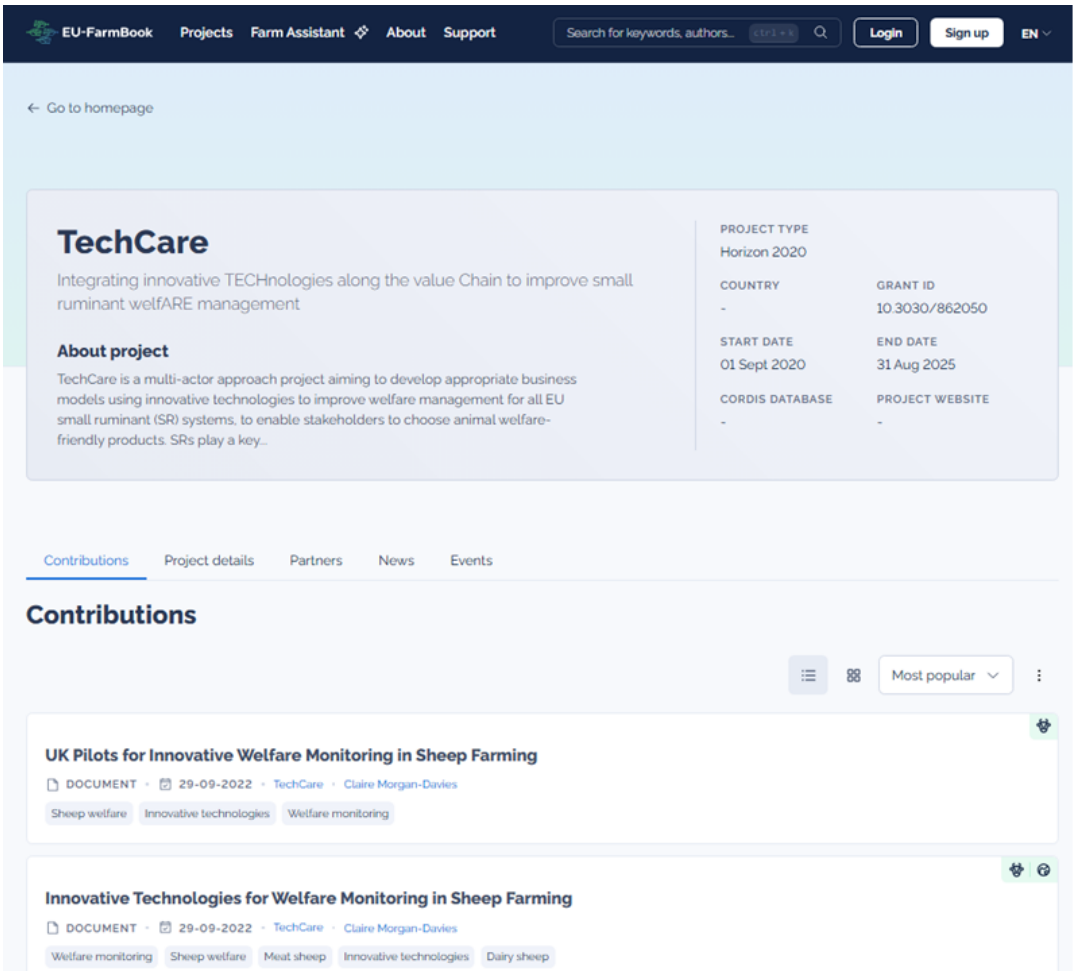
TechCare – where to find us - *by C. Morgan-Davies (SRUC)*

During the course of the project, the consortium has created much information that we want to share. Of course, our website is the first port of call. However, we have also uploaded much information on other plarforms:

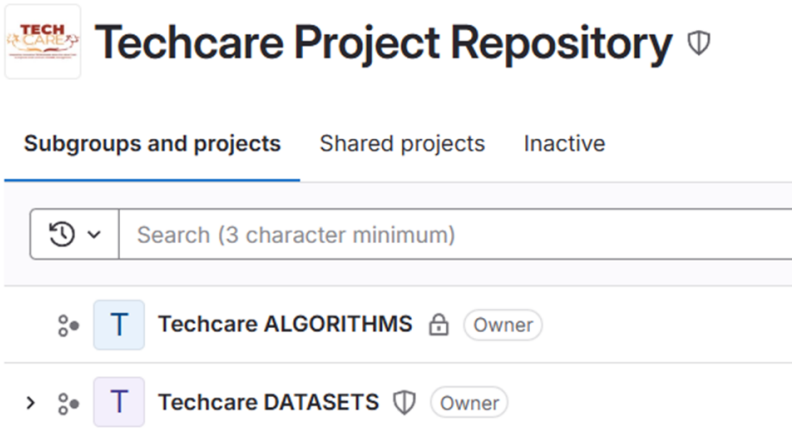
Zenodo: https://zenodo.org/communities/techcare/records This platform is open access, and many of our outputs are available on it. For instance, the welfare assessment protocols developed are there, as are the conference abstracts and papers written during the project. More will be added at the end of the project.



EU Farmbook: Welcome | EU-FarmBook. This platform contains a lot of the outputs from recent and ongoing EU funded projects. TechCare has its own space, and we have uploaded most of the practice abstracts created during the project on it.



GitLab: Sign in · GitLab. This platform has been used to create a repository for the algorithms and datasets created by the project during the 5 years. It will become live after August 2025. Check this space!



THICare gold medals! – *by L. Cziszter (BUAS)*

Ludovic Czizster (Romanian partner) prepared a poster with Gerardo Caja and Abdelali El Hadi (Spanish partner UAB) showcasing the THICare application that UAB developed with the Spanish company Sosein SA. The poster explained how the application uses the sensors data installed in the TechCare large-scale farms and presents them on a dashboard with threshold alerts for the farmers. The poster was presented in Timisoara Ziua Câmpului (Romania) in May 2025, and then in another innovative field day in Chișinău, Republic of Moldova, in June 2025. Both times, the poster got awarded Gold Medal! Well done to the partners involved!

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TechCare Partner Team: MRI

Moredun Research Institute (MRI) was founded in Scotland 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 outside Edinburgh. 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.

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. This lowland farm is one of the TechCare pilot farms in the UK (together with the SRUC upland farm in the West Highlands). Both farms represent the spectrum of sheep farms conditions in Scotland and the UK.

Within Techcare, MRI is involved in WP5 – pilot trials. The trials conducted on the pilot farm at Firth mains constituted of ewes and lambs facing natural Gastrointestinal parasite infection on pasture while wearing PLF technology.


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Animals wore innovative low-cost Bluetooth beacons. Readers (WISPs) were either on-animal or on fence posts. Accelerometers and GNSS were used to ground truth the results. Data collection also included: BCS, live weight, mastitis score, faecal soiling score plus direct feacal & venal blood samples. FECs (faecal egg counts) was performed within 48 hours at MRI. MRI is also part of the Ethics management group within TechCare.

Short profile of the team involved in the TechCare project:

Fiona Kenyon: Fiona is a senior researcher at the Moredun Research Institute, who specialises in the sustainable control of roundworm parasites in livestock. She is focused on 4 main topics, such as the optimisation of wormer use by targeting wormer to only those animals who will benefit (targeted selective treatments, TST), the impact of regenerative grazing approaches on animal health and welfare, impacts of disease in young female lambs on their future productivity and the use of technology to act as an early warning system for welfare issues or disease. Fiona is the main partner in TechCare, leading the MRI team in the project.

Jade Duncan: Jade is a graduate from the University of Glasgow, with an MSc in Aquatic Pathobiology from the University of Stirling. Jade joined MRI as a research assistant at the end of 2021 working within the parasitology department. One of her activities is to work on the TechCare project alongside Fiona.

TechCare in the news

List of past and upcoming events with TechCare partners attendance.

Event	Date	Location	Partner
←			
ISAE 58th Congress of the International Society for Applied Ethology	4 – 8 August 2025	Utrecht, The Netherlands	SRUC
→			
76th EAAP Annual Meeting	25 -29 August 2025	Innsbruck, Austria	SRUC, IDELE, UAB, CNBL, UNOTEC, Service Elevage de Confédération Générale de Roquefort
Tech-Ovin IDELE, CNBL and CIIRPO will have a stand to communicate about technologies and an oral presentation during conference: "Individual production data and heat stress: exploring new indicators for managing dairy sheep flocks?"	3 – 4 September 2025	Bellac, France	IDELE, CNBL, CIIRPO

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For more information visit our website:

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