SmartCow

an integrated infrastructure for increased research capability and innovation in the European cattle sector

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Newsletter – Issue 5

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Summary

Editorial

Despite the Covid-19 epidemic currently raging in Europe, the SmartCow project made significant progress in the last months in networking and joint research activities, as well as in the transnational access to research infrastructures. All public deliverables of the project are now available on the SmartCow website.

Twenty-three transnational access projects selected after the first three calls are now implemented in SmartCow research infrastructures. Some delays and postponements of experimental work had to occur, but we hope that the projects will be completed before end of 2021. We ran a fourth call in autumn 2020 and nine projects are currently under evaluation. Results of this last call will be published in January 2021.

All teams are working hard on the book of methods entitled "Methods in cattle physiology and behaviour research – Recommendations from the SmartCow consortium" that has started to be published in full Open Access as a living handbook on the Publisso platform.

Of course, all meetings and participation to congresses had to be turned online since March 2020. SmartCow participated to the EAAP 2020 on line meeting with an invited conference. Dr. Gonzalo Cantaladapiedra-Hijar (INRAE) presented the first results on proxies to predict feed efficiency. The title of his conference was "Natural ^{15}N abundance of animal proteins: a promising biomarker of feed efficiency in beef cattle". SmartCow was also invited to participate to the International FAIR Convergence Symposium and to present and discuss the work we are conducting on data management in SmartCow towards FAIR (Findable, Accessible, Interoperable, Reusable) principles. It was the opportunity to highlight the development of the could-based data platform by Agrimetrics (UK) and of a common vocabulary using Livestock Ontologies.

In this difficult period that all the countries of the world are going through, I wish all of you to stay safe and healthy, and hope to meet you again face to face next year

A Merry Christmas and a very good year 2021!

René Baumont (INRAE)
SmartCow coordinator


Second SmartCow Annual Meeting, 13th – 15th October 2020

Due to Covid-19 crisis, we had to cancel the annual meeting initially planned at FBN-Leibniz in Dummerstorf (Germany) and to hold an online meeting spread out over three half-days. The participation was good with more than 30 attendees to each part of the meeting. The meeting aimed to take stock of the work done during the last 18 months, discuss the results obtained and plan the actions to be carried out for the coming year.

After two and half years of the project, following progress beyond the state-of-art can be mention:

- The networking of cattle research infrastructures developed for the first time at European scale, through mapping activities
- A wider, simplified, and more efficient access to the best research infrastructures through successful transnational access calls (23 experimental projects selected after 3 calls)
- An improved and harmonised services with more ethics in experimentation through networking of research infrastructures, a cloud-based data platform for sharing and linking data and guidelines for methods
- A reinforced academic–industry partnership through stakeholders engagement and important industry participation to transnational access projects
- A significant involvement in the education of a new generation of researchers through attractive training courses and involvement of young scientists in transnational access projects
- Cross-disciplinary fertilizations and a wider sharing of information through the building of large databases and new collaborations in joint research activities with external research institutes to the consortium and with the global research alliance - feed and nutrition network (GRA-FNN)
- A better consideration of ethics and animal welfare in cattle experimentations through the activity of the Ethical board of the project and the implementation of 3R (Replace, Reduce, Refine) principles.

During the meeting, sessions were held to discuss the next steps and the development of project activities with a particular focus on:

- The first feedbacks and monitoring of Transnational Projects;
- The valuation of the mapping of cattle research infrastructures in Europe;
- The utilisation of the Cloud-based data platform and of the Animal Trait Ontology for Livestock;
- The publication of a book of methods in cattle physiology and behaviour;
- The involvement of the stakeholders and the organisation of the training activities proposed by SmartCow;
- The ethical issues in the management of fistulated cow in cattle research and the implementation of 3R principles;
- The progress in the Joint Research Activities of SmartCow aimed at refining reference methods and developing proxies for measuring feed efficiency and emissions in cattle, and developing new phenotyping capabilities from activity sensor data.

We highly appreciated the participation of two TNA beneficiaries, Joël Bérard previously from ETH Zürich (Switzerland) and Lalhou Bahloul (Adisseo, France) that gave us an interesting feedback on their experiences at INRAE Herbipôle (France) and Aarhus University (Denmark), respectively. We also highly appreciated the participation of members of the Scientific Advisory Board during the meeting, and in particular, of Dr. Karen Beauchemin (AgriFood, Canada), Pr. James Reecy (Iowa State University, USA) and Pr. Sven Dänicke (FLI-Animal Nutrition, Braunschweig, Germany) who gave a positive feedback and made interesting suggestions to improve

some aspects of the project. Finally, we start to discuss the possible future of SmartCow after its ending in January 2022.
We thank warmly Vincent Troillard and Cassandra Togna (INRAE Transfert) for the perfect organisation of the on-line meeting using the Go-To-Meeting platform and the Klaxoon tool to stimulate participation and interactions among attendees.

Third meeting of the European Stakeholder Platform

The third meeting of the European Stakeholder Platform was held on June 30th morning, with the participation of almost all WP leaders and 9 members of the platform upon 14, including representatives from: Eurogenomics, EFFAB-Fabre TP, FEFAC (Federation of European Animal Feeding Organisations, Natural Resources Institute Finland (Luke), Biores KU Leuven, GenTORE EU-funded project, UECBV European Livestock And Meat Trading Union, Allflex, Animal Task Force (ATF). René Baumont (INRA, coordinator) and Florence Macherez (Idele, partner, task leader 4.2) chaired the meeting.
The aim was to update stakeholders on latest activities and present first results from: several WPs, as well as feedbacks from the first and second TNA calls (2018, 2019) and next steps (training and study tours programmes, towards a "SmartCow 2" proposal for an Advanced Community).
The reinforce the relevance of the European Platform, some stakeholders suggested involving possibly local NGOs, not only from the animal welfare side, but also environmental NGOs, with the possibility to have separate meetings. They expressed a strong interest in the first results: the interactive map, the book of methods, the online platform for data sharing and ontologies, JRAs, TNAs, and a shown willingness to promote trainings/TNAs in their network.
Finally, they offered their support towards the building of a SmartCow 2 project in enlarging the network among their members and in involving organisations outside EU, connecting to other EU projects (Smarter, small ruminants). There has been a discussion around involving people working on small ruminants.
Due to confinement measures, most of the national stakeholder workshops could not be held physically in 2020 and had to be postponed to 2021 on a remote + when possible physical basis. The list will be regularly updated on the SmartCow website.

Update on Transnational Access projects and Fourth TNA call!

The Transnational Access (TNA) programme of SmartCow makes available cattle research facilities of SmartCow partners for research by academic or industry colleagues from other (mainly EU) countries. Successful bidders receive funding to cover the operating costs of facilities.

We have now completed three application rounds, with the following numbers of applications and success rates:

Call	Number of full applications	Number selected for support
1 (2018)	13*	11*
2 (2019)	16	7
3 (2020)	9	5

*One of these studies was a multi-site study requesting TNA at 3 sites

Projects selected for support in round 3 include work on diet components for methane mitigation; amelioration of heat stress; mineral nutrition of cows; methane measurement techniques; and technological properties of milk from grazing dairy cows.

Covid-19 restrictions meant that we received fewer applications in 2020 and so we have launched an additional call. The fourth call closed on 16th November and applications are under review with decisions expected in January 2021.

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Book "Methods in cattle physiology and behaviour research" - First Chapter open access available

One major task in the SmartCow project is the collation of existing protocols related to animal experimentation. The first guideline on the measurement of "Bodyweight, body condition and anatomy" is now published in the book "Methods in cattle physiology and behaviour research".
Open access to additional 19 guidelines will be available soon. The advantage the way the book is published is that further chapters can be added beyond the end of SmartCow. The so-called "living handbook" receives financial support by the Leibniz Institute for Farm Animal Physiology and the Leibniz Association.

An impressing and unique cattle research centre at AU Foulum

The new Danish Cattle Research Centre is now reality. It is an impressing barn complex completed with brand new and unique research facilities. Three new cattle barns have been built, the forage barn has been expanded, and the staff facilities have been modernised. The new cattle facilities have already been put into service, and the research projects are running.

The new buildings are placed behind the original Danish Cattle Research Centre. At the far right, you will see the new cattle barn, in the middle, the flexible barn, and to the far left, the intensive barn. Photo: Linda S. Sørensen.

The building and renovation of the new Danish Cattle Research Centre (DKC) has finally reached the end. At first sight, DKC is just the same as ever when driving down the gravel road. But when walking to the end of the old cattle barn, a "whole new world" opens with a big courtyard and an impressing barn complex. It is a construction easy to spot as three completely new barns have been erected at the centre. Previously, DKC was divided between two locations, but now all cattle and staff have been gathered at Burrehøjvej, while the agreement on rental of the old research facilities at Blichers Allé at AU Foulum has been terminated.

"We are very satisfied with the result. It has been a long-standing and intensive process to come this far. However, it was necessary because of an essential reduction of rent, important optimisations and in order to modernise

and to adapt our cattle research facilities for future requirements. I am very delighted that we have now reached our goal, and I am proud and happy to be able to present research-focused settings this modern to the cattle research, which we have now built," says Klaus Lønne Ingvartsen, head of department at Department of Animal Science, Aarhus University.

Big and bright cubicle barn and a brand new milking system

The biggest of the three new barns is the new cattle barn with cubicles and room for 96 cows. The barn is designed so that it can be divided into 8 groups of 12 cows each. Compared to earlier, this solution provides the researchers with better opportunities for experimental designs. In the big cubicle barn, electronic feeding troughs have been installed as far as the eye can see — one feeding trough per cow. *"Our computerised feeding troughs are very central here at the research centre. They generate a huge pool of data with information on each cow's feed uptake and eating behaviour. The troughs are of the same type as the ones used at DKC for many years. Therefore, we have significant experience in using and maintaining them,"* says Operations Manager Allan Mikkelsen.

The new cattle barn with the many electronic feeding troughs. Photo: Linda S. Sørensen.

The new milking system

At the end of the cattle barn, we find the pick-up place adjacent to the milking parlour. The new milking parlour contains a 2×12 side-by-side system from SAC. Here, it is possible to milk 12 cows at a time, which exactly fits an experimental group. *"In the new milking system, we can milk via three different strings: either all cows at once, one side at a time, or we can segregate all the milk. This gives a good flexibility in relation to collecting data on the cows and the milk, which is a very important aspect in relation to the many experiments we run,"* says Head of Centre Jens Bech Andersen.

The new milking system during the very first milking. Photo: Linda S. Sørensen.

After milking, the cows are weighed on their way out when passing through the driving aisle before re-entering the cubicle barn. Weighing data on each cow are also an important parameter in many of the research projects. Under the milking parlour, there is a technique basement from which it is possible to draw milk samples and to collect data on the milking. It is possible to send the milk samples to the floor level with a lift. In connection to the technique basement, you also have access to an office, a laboratory and to various technical equipment used for the many different experiments.

The milking basement from which milk samples can be drawn. Photo: Linda S. Sørensen.

Intensive barn with methane chambers and unique boxes

The next barn we enter in the new barn complex is the intensive barn which is divided into different units. One of these units is designed with four new respiration chambers. Here, the researchers can collect the cows' exhalation air and for example measure their emission of methane. This may be relevant in experiments where you look at the effect of different feeding initiatives or feeding strategies of which the purpose is to reduce the methane emission from cattle.

Two of the four new methane chambers in the intensive barn. Photo: Linda S. Sørensen.

The remaining part of the new intensive barn is designed with 20 unique boxes for individual animals. Here, the first place in the world, we are dealing with boxes that are customised for experimental cows with so-called fistulas. These provide the researchers with the opportunity to draw analytical samples directly from the cows' digestive system without the cows feeling anything. The new boxes give the animals the opportunity to move freely in the box in which they have previously been tied in order not to damage the fistulas.

Cow in one of the 20 new customised boxes for cows with fistulas. Photo: Ester Bjerregaard.

The flexible barn

The third new barn system is a so-called flexible barn. As the name implies, it is a barn in which the design is flexible. The biggest part of the barn is an uninsulated section while a smaller part of the barn is insulated. The big uninsulated part can be designed in different ways by means of a network of holes in the floor. This barn will for example be suitable for behavioural studies which often demand an alternative barn design and sometimes a test arena. The insulated part of the barn can be heated to a minimum of 10 degrees Celsius and thus be used for special experiments during winter.

On this photo, the flexible barn is designed for a feeding experiment with calves. Photo: Linda S. Sørensen.

Expanded forage barn and updated staff building

Apart from the new-built barns, the forage barn has been expanded; it has now doubled its size. This gives the opportunity to handle the larger amounts of and the many more kinds of the necessary feed mixtures. Furthermore, there is now room for a cooler-freezer compartment for storage of for example feed samples. Finally, the staff building has been updated with new locker rooms and bathing facilities.

"We look forward to taking advantage of the modern, new settings for our cattle research. By means of the modernisation and by gathering the cattle facilities in one location we have gained a considerably higher efficiency in the form of better use of time, staff, animals and facilities. Furthermore, we have ensured that the research centre is well prepared for satisfying future research demands within the cattle area," concludes Head of Centre Jens Bech Andersen.

More information

The building and modernisation of DKC are primarily funded by AU's equity capital.

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SmartCow video

SmartCow project has realised an interesting video targeting public audience! SmartCow integrates key European cattle research infrastructures to promote their coordinated use and development and thereby help the European cattle sector face the challenge of sustainable production. Explore the video here!

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For more information visit our website: www.smartcow.eu

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