D4Dairy
How digitalisation and data integration pave the way to dairy health improvement

Lameness detection and prevention in dairy cows

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FFG Promoting Innovation.
Federal Ministry Republic of Austria Digital and Economic Affairs
Federal Ministry Republic of Austria Transport, Innovation and Technology
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Lameness prediction as part of the D4Dairy project

Overall aim:

Transdisciplinary project with the overall aim of enhancing **animal health and welfare** as well as product quality by **integrating data driven information systems** for **dairy farm management**.

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Lameness detection & prediction:

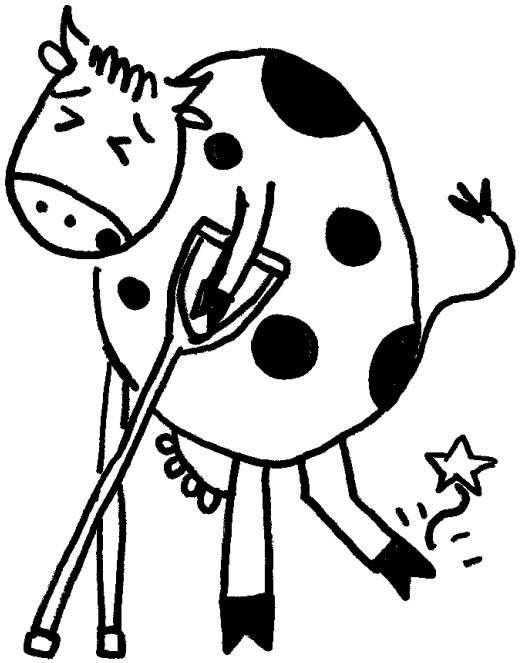
Integration of data from various farm areas

- … for **early lameness detection**
- … to provide a **decision support tool** for individual farms
- … to define **auxiliary traits** for the development of a claw health genetic evaluation

Lameness in dairy cows

- **Lameness in dairy cows** remains a widespread animal welfare and economic issue

- Lameness is caused by a **variety of factors**
  - Housing, feeding, management, …
- May be associated with changes in
  - **Milk performance**
  - **Behaviour**
  - **…**



Lameness detection

- **Early detection or prediction** of lameness could reduce negative effects, however:
  - **External assessment** by veterinarians or claw trimmers not possible on a regular basis
    ➔ early stage of lameness may be missed
  - **Weekly lameness scoring** is additional workload
    ➔ difficult for farmers to implement

- **Are there other indicators, which may be used to predict if a cow is at risk of developing lameness?**

Digitalisation in dairy farming

- Technical advances and **growing digitalisation**
  - … increased amount and quality of data …
  - … in various areas of dairy farming …
  - … supporting data-driven decision making.

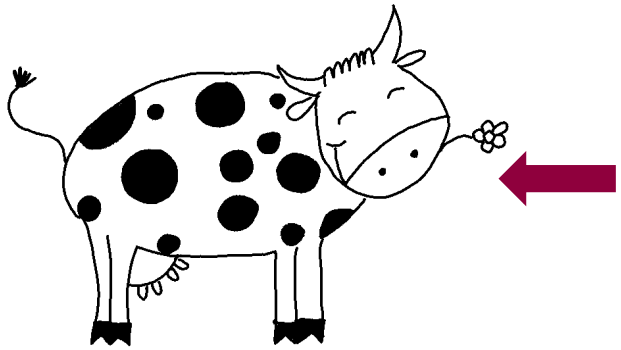
- Advances happened **incrementally**

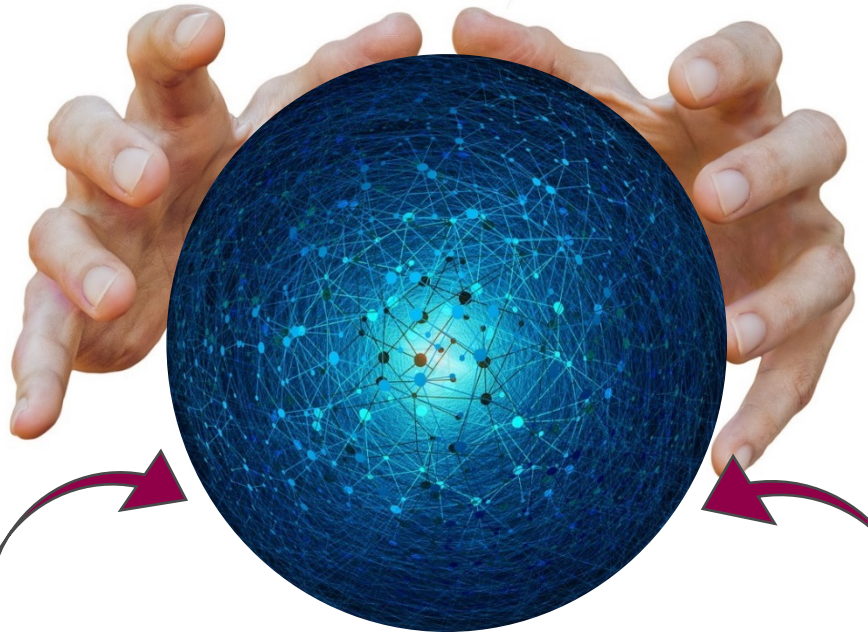
➔ Data from different **management areas and systems**
  - … available in different **formats**
  - … **different parameters** from different devices

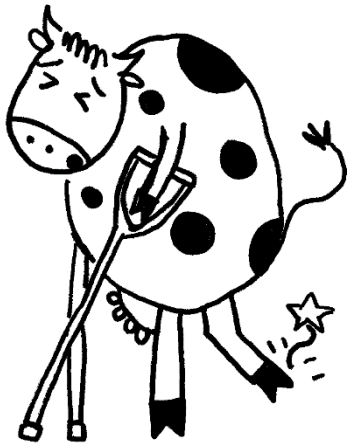
➔ making informed decisions in the **respective area**

Lameness prediction

Data integration to create a **decision support tool** to **predict lameness**



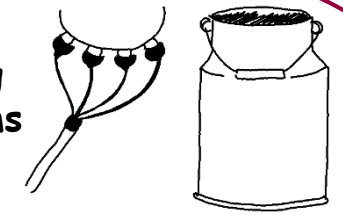




Relevant information from **other management areas**

Data, data, data…

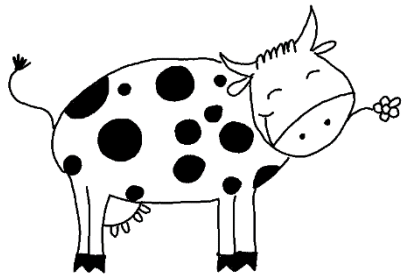
Milking systems



Veterinary records

National performance recordings

LKV AUSTRIA



smaXtec

SCR by Allflex
Make every cow count

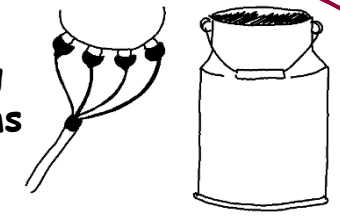
Sensordata

Farm records, operational structure

Claw trimmings, lameness scores

Data, data, data…

Milking systems



Veterinary records

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1,080 cows
19 farms

09/2019 – 06/2021

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Basic idea

- Lame cows may show **changes in performance and behaviour** - even before they show clinical signs of lameness or claw disorders

- Farms increasingly use **sensors** for monitoring cow health
  - Measure e.g. **activity, temperature or rumination**
  - **Continuous** data recording and provision
  - Indicator for **changes in cow behaviour**

The main challenges are…

Automatic data integration & data quality

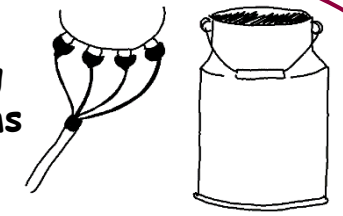
- Different data sets were **merged manually** using the statistical software programs  and **SAS® 9.4**
- Different **parameters, formats** and **time scales** were aligned
- Data cleaning: check for **duplicates, inconsistencies** and **implausible values**

Automatic data integration & data quality

- Different data sets were **merged manually** using the statistical software programs  and **SAS® 9.4**
- Different **parameters, formats** and **time scales** were aligned
- Data cleaning: check for **duplicates, inconsistencies** and **implausible values**
- The information from this merging process has to be…
  - … **translated into an algorithm** to automate data reading and merging
  - … used to establish a **control mechanism** to guarantee for data quality

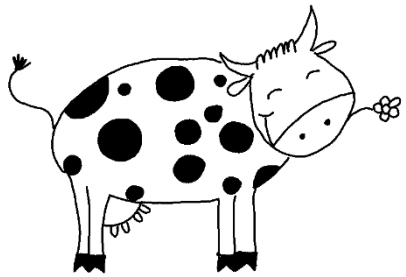
Fit a variety of farm conditions

Milking systems



Milking systems
- Automatic milking system
- Milking parlour

Husbandry systems
- Free stall
- Outdoor access
- Pasture



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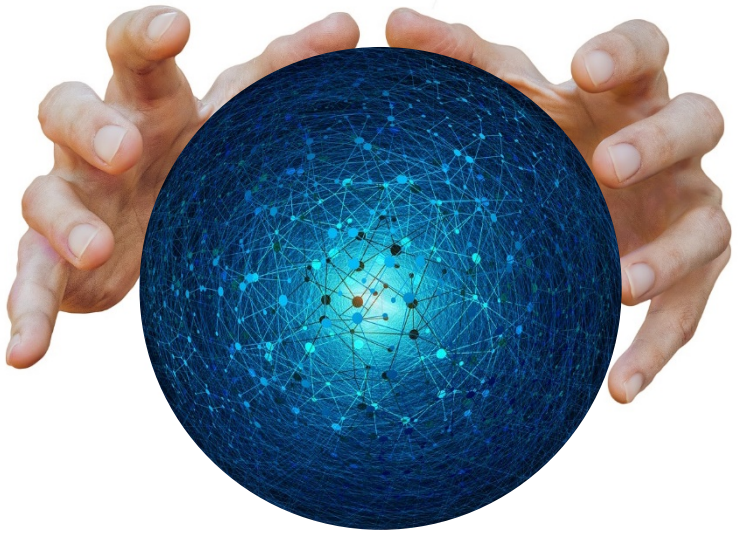
Farm records, operational structure

Recorded parameters
- Inner temperature and activity
- Rumination and activity

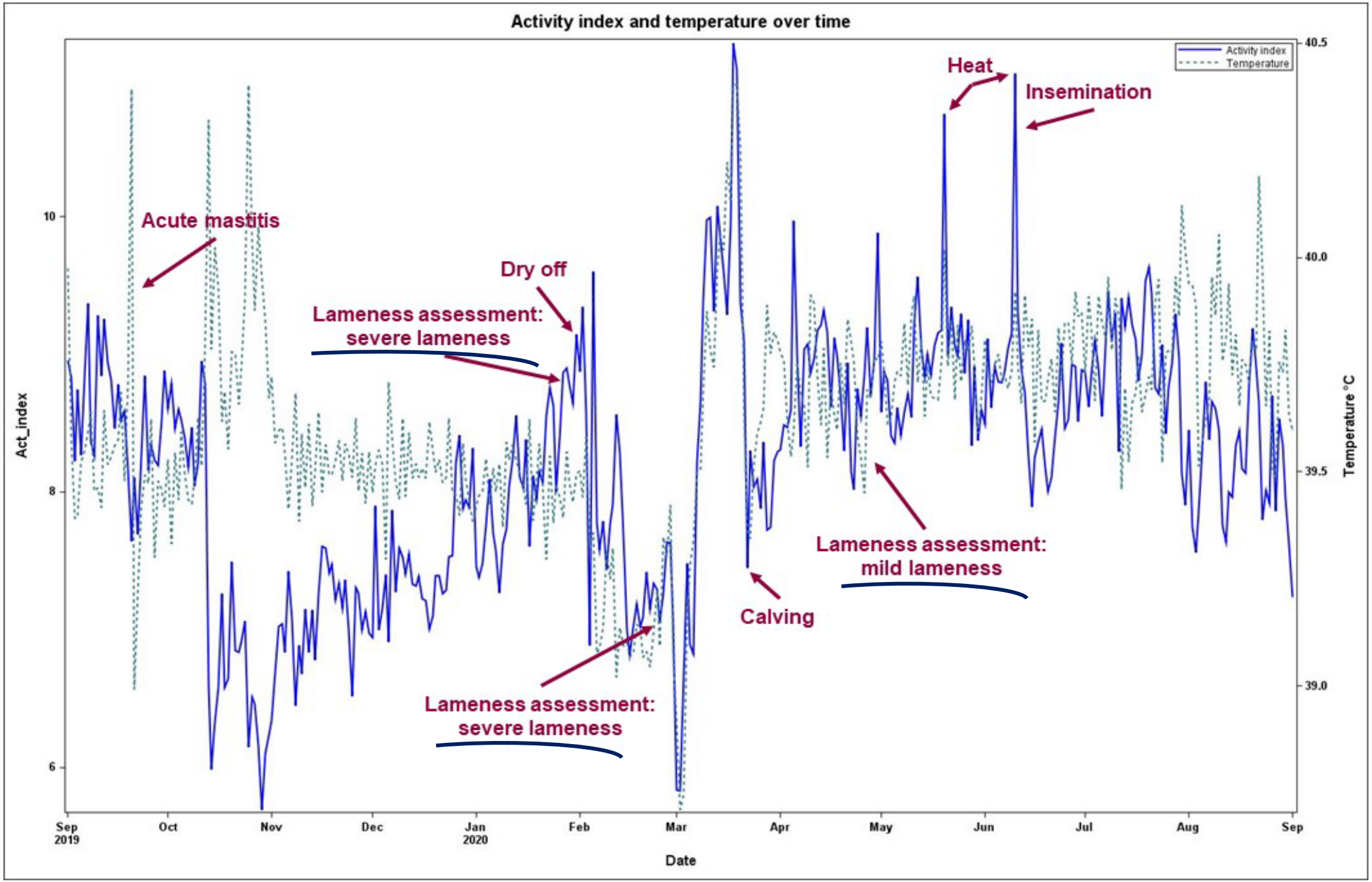
Approach

- Development of regression models using potential predictors from the different data sets to best **predict lameness events**

Detailed enough to produce the **best possible prediction** for the individual farm and animal

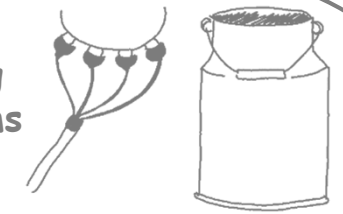


General enough to be **applied to a variety of dairy farms**


Activity index and temperature over time
Activity index
Temperature
Acute mastitis
Dry off
Lameness assessment:
severe lameness
Heat
Insemination
Lameness assessment:
mild lameness
Calving
Lameness assessment:
severe lameness
Act_index
Temperature °C
Date
Sep
2019
Oct
Nov
Dec
Jan
2020
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
10
8
6
40.5
40.0
39.5
39.0

Provide real-time decision support

Milking systems



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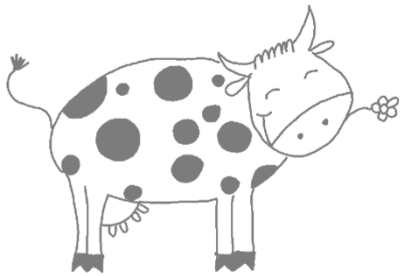

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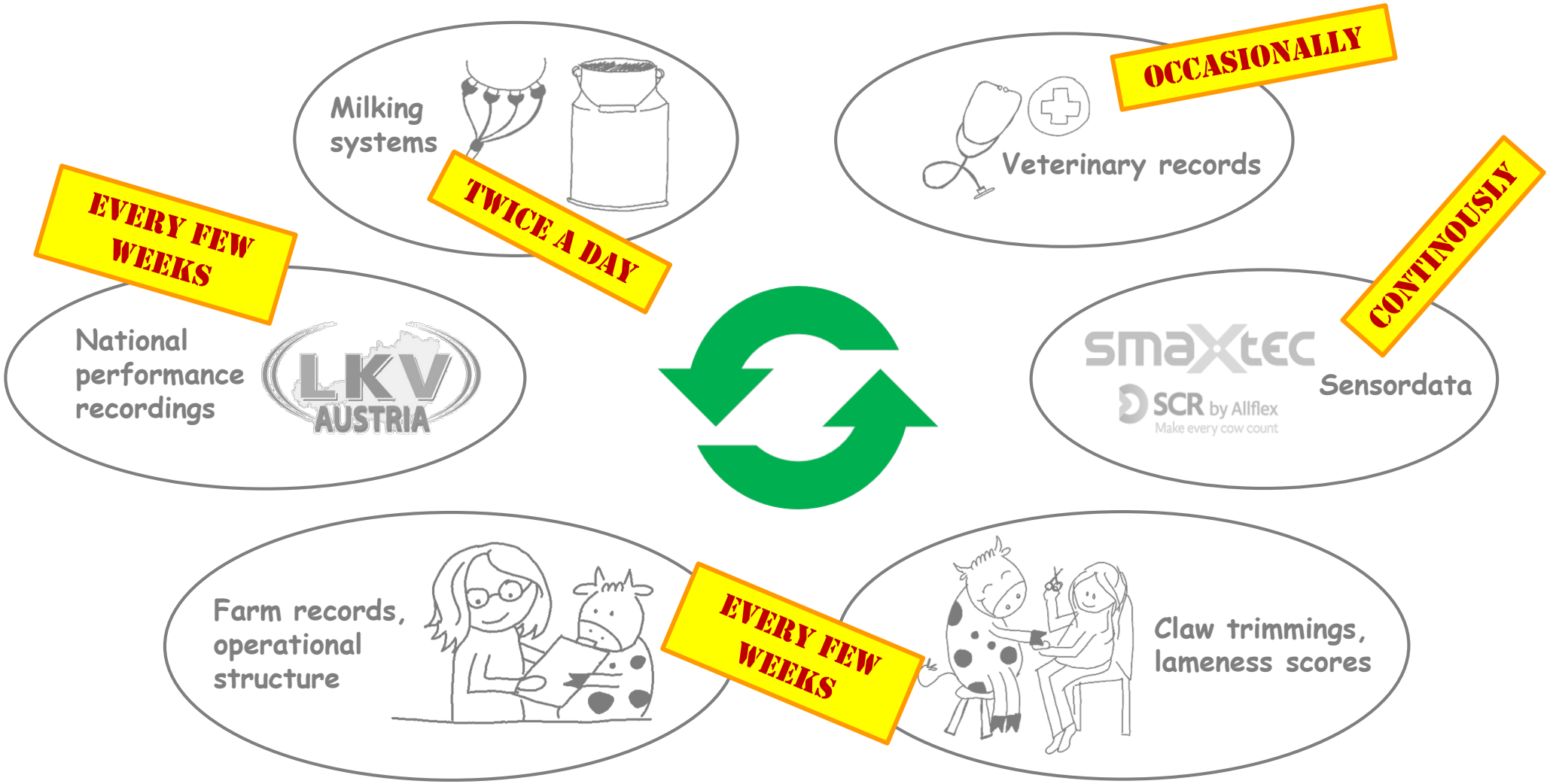

Outlook

- Development of systems for automatic **data integration**
- Finalise development and validation of the **lameness prediction model**
  - **Decision support tool** based on the predictive model using Machine Learning approaches
- Deduction of **auxiliary traits** for claw health
  - Prediction model as basis for phenotypic modelling
- **Genetic analysis** of the traits
- Establishment of conventional and genomic **breeding values**

D4Dairy – Progress through networking

Scientific partners:

Industry partners:

Cooperation partners:

Cow-Artwork by Johanna Schodl