Opportunities and challenges of data integration with focus on claw health and metabolism for decision support in herd management

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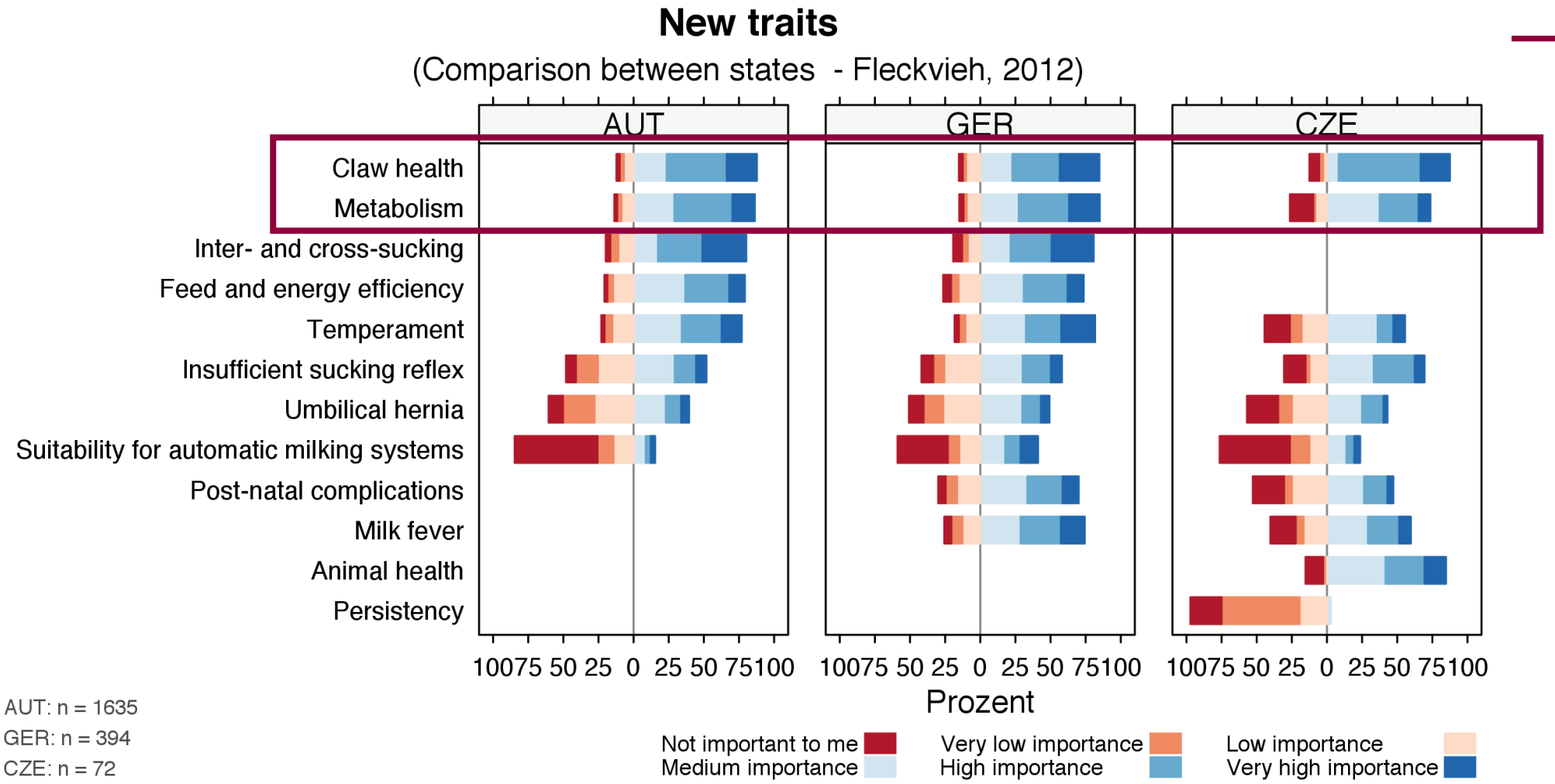
Feedback from practice…



AUT: n = 1635
GER: n = 394
CZE: n = 72

Steininger et al. 2013

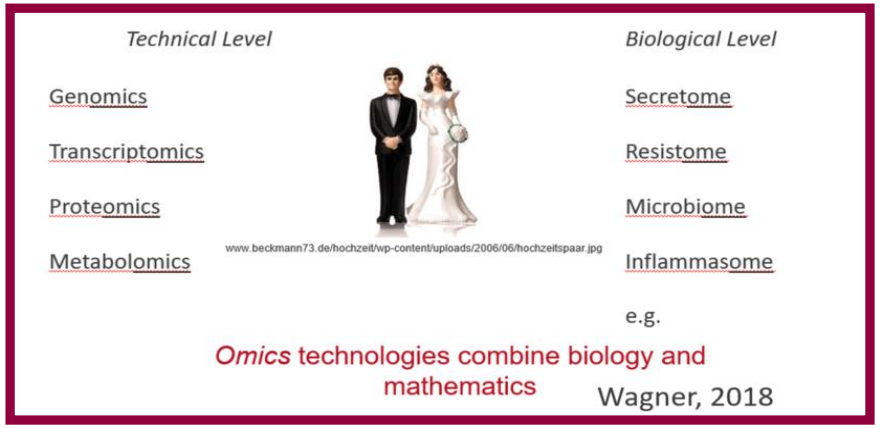
Claw health and metabolism of high importance!

Affecting welfare, sustainability and economics

Technological advances

Genomics
(VanRaden, 2019)

Country	2009	1/2019
US and Canada	22,344	3,020,00
France	8,500	550,000
Germany	3,000	785,000



OMICS
technologies

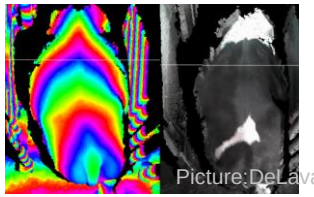
Robotics and **Artificial Intelligence**

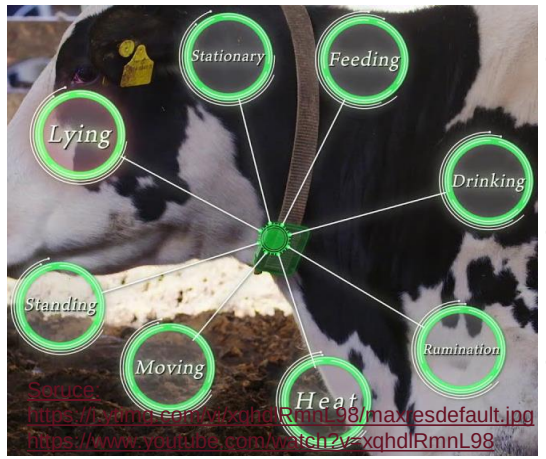
automatic milking systems

automatic feeding systems

3D Cameras to detect e.g. BCS

others





- Large variety of miniatualized low-power smart sensors
- Low-power wireless communication
- Embedded data analytics

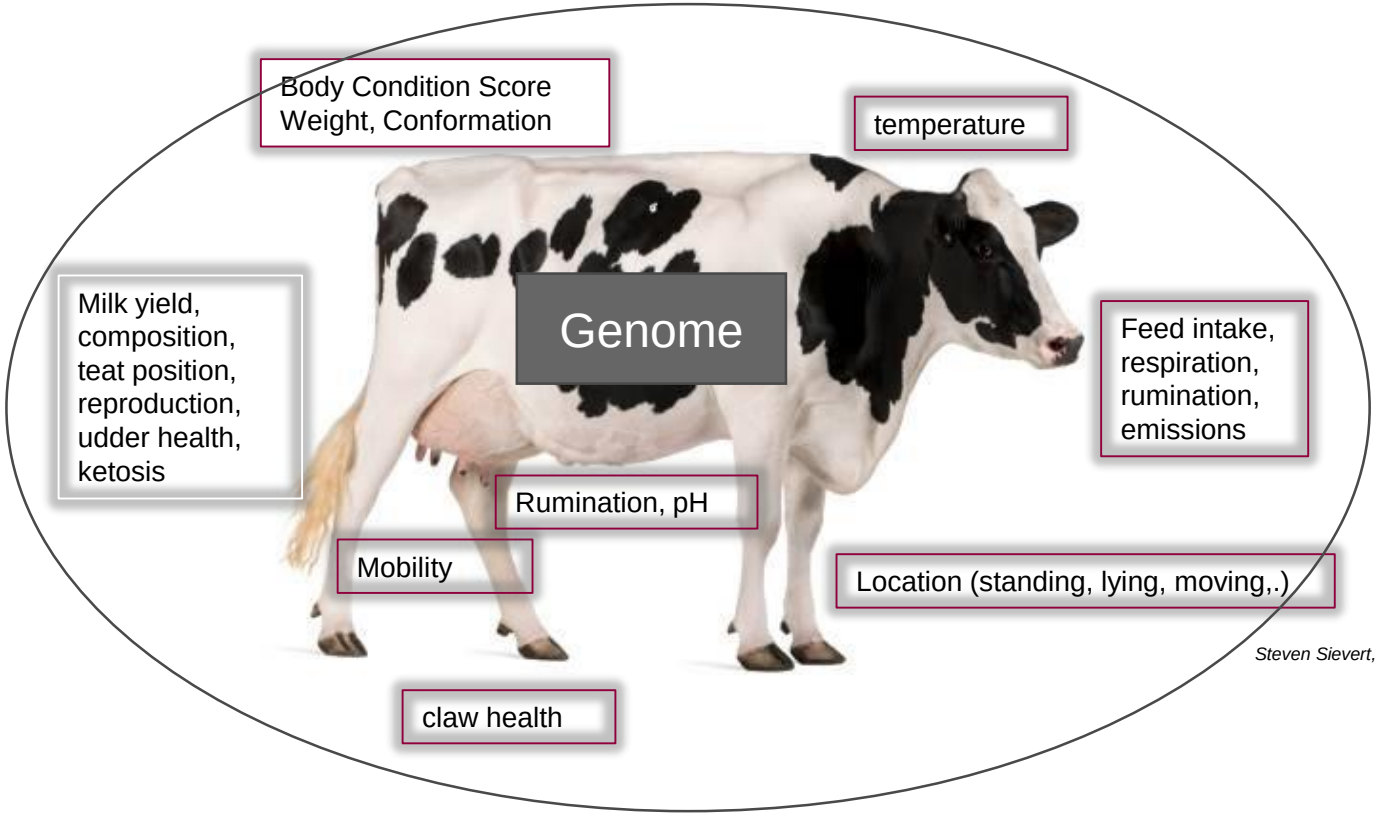
Information technology

New technique brings many new phenotypes

Many data
(5 Vs – Volume, Velocity, Variety, Veracity, Value)

Algorithms to derive parameters!

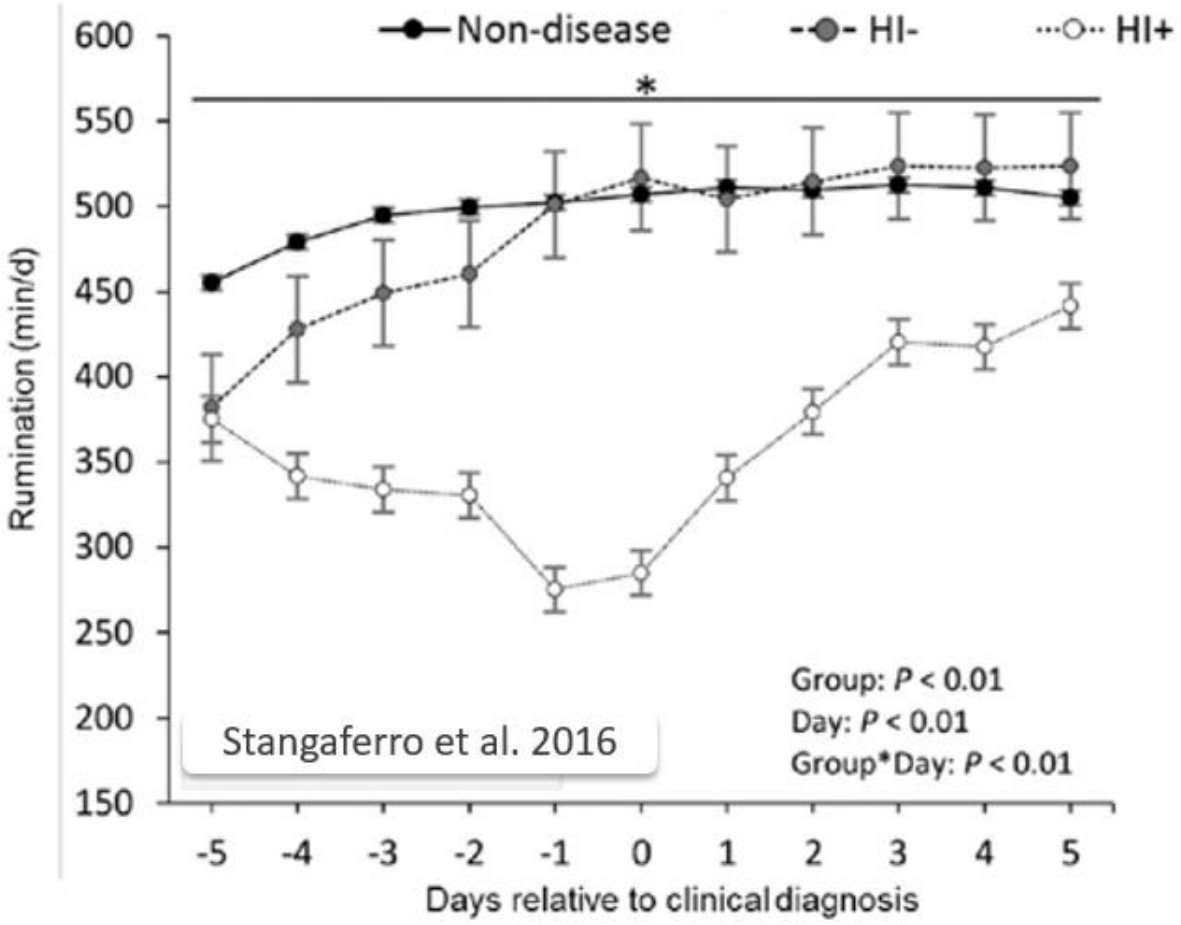
Animal with genotype and phenotypes



Steven Sievert, Chairman ICAR Taskforce

Technological advances allow **precise monitoring of animals and environment** in real-time!

Rumination and ketosis



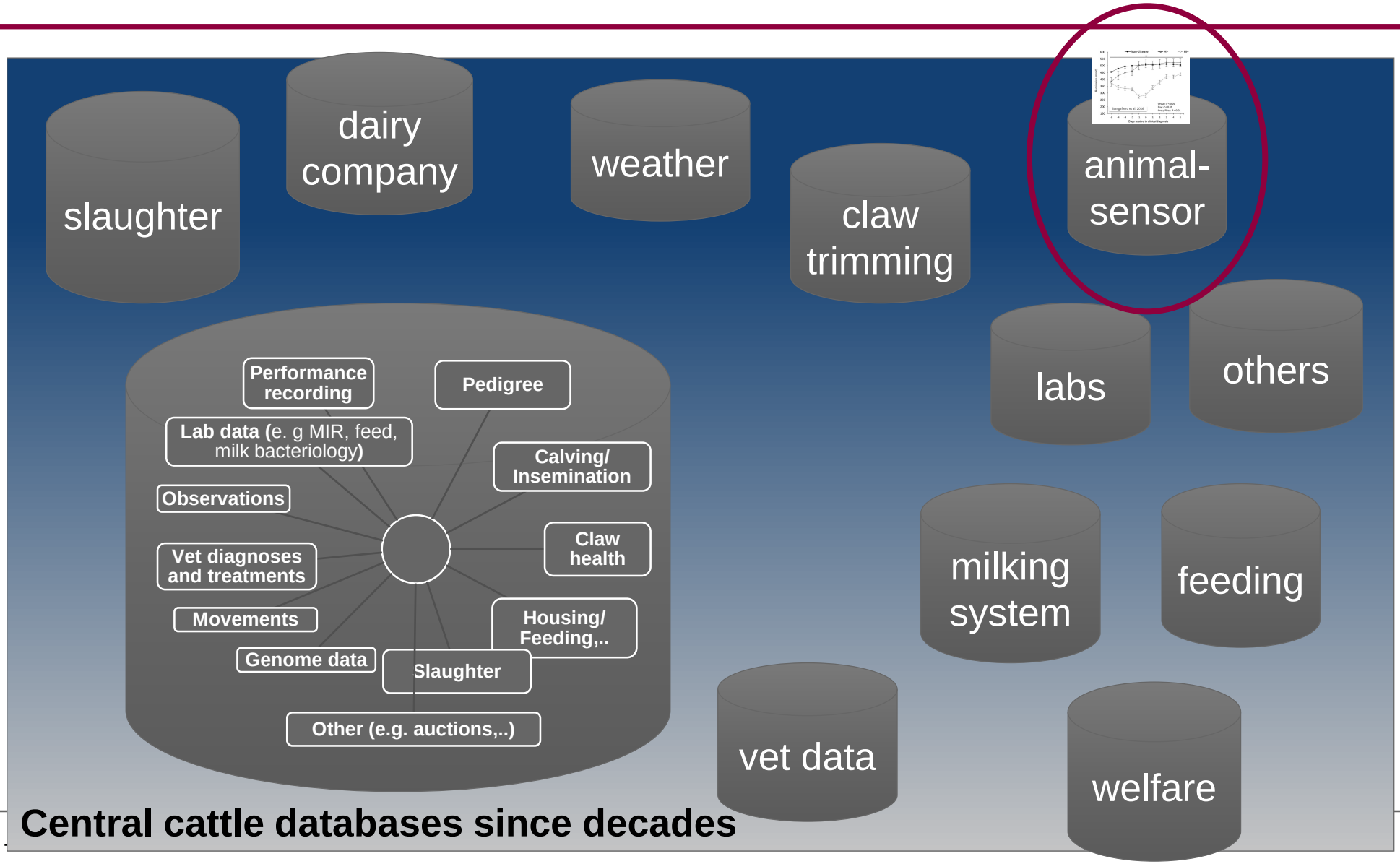
Stangaferro et al. (2016):

- significant reduction in activity already 5 days before clinical diagnoses
- Detection rate 91% (49/54)

Attention: alarm based on activity only is not specific!

Challenges and opportunities

Many existing data sources - isolated solutions

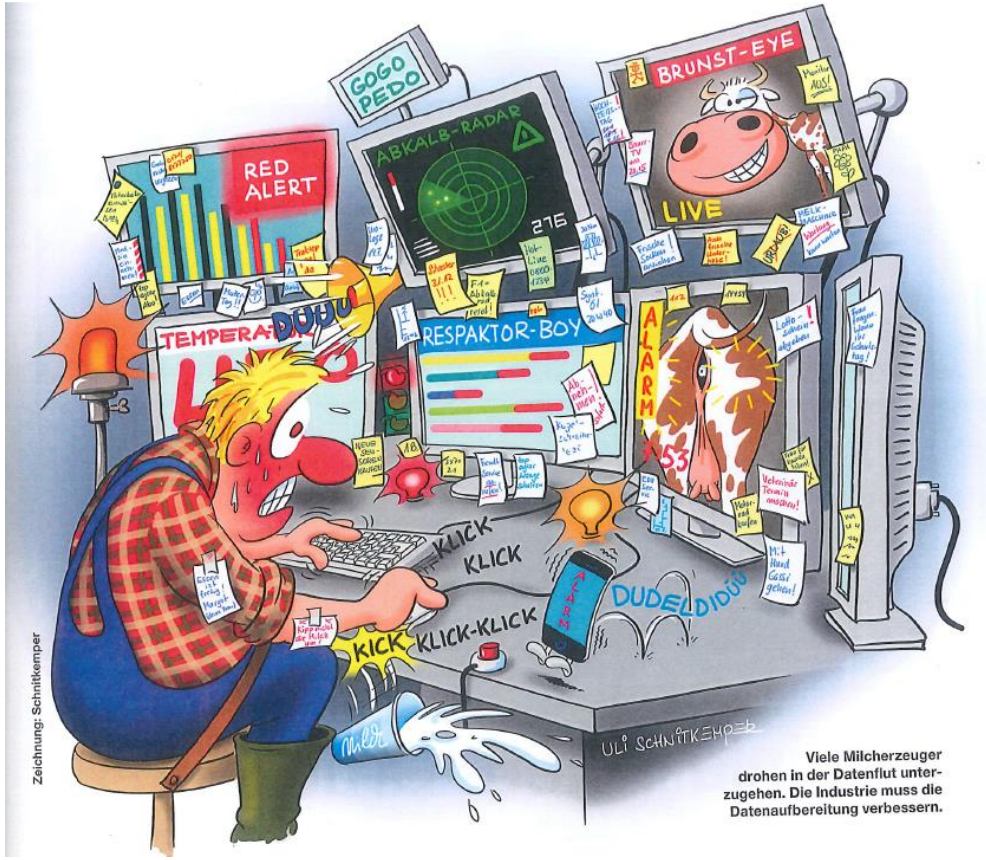


Central cattle databases since decades

Challenges

- **Interoperability / communication**
  - disconnected data silos
  - heterogeneous APIs
  - lack of common standard
- **Comparability of results / standardisation**
  - are results from different sensors comparable ?
  - ..
- **Integration of different data in system**
  - correlation between traits
  - …
- **Data privacy protection**
  - data protection (e.g. GDPR)
  - privacy concerns
    - Farm data ⇒ regarded as farmers' trade secret
    - Sensor-derived information through proprietary algorithms ⇒ regarded as companies' intellectual property
  - business interests

Farmers don‘t want…..

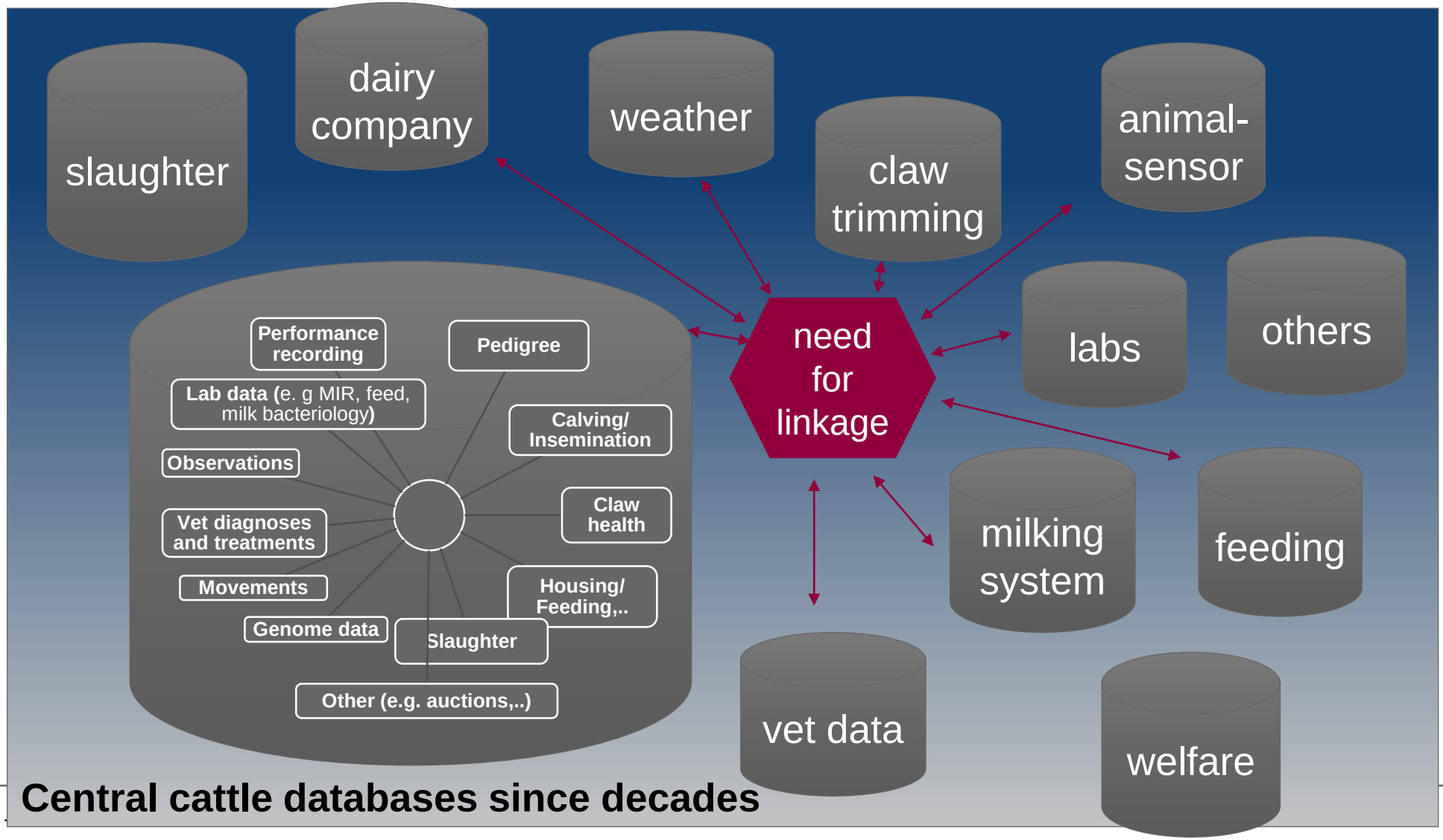


- receive results in pdf
- isolated solutions
- indicate one dataset more than once

Topagrar, 5/2018

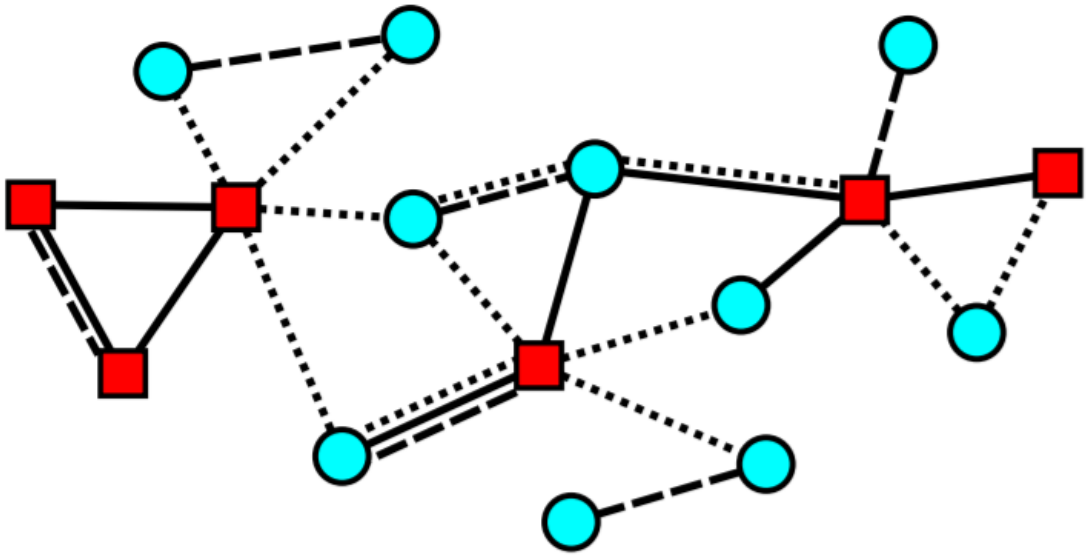
Expect best service out of device and data !

Linkage between systems



Opportunity – advanced analyses

Complex Systems are co-evolving multiplex networks (Klimek, 2019)



Risk factors and network for occurrence of disorders (genetic, housing, feeding, various management related measures, climate,..)

Apply advanced methods – linkage of data precondition for exploitation of possibilities!

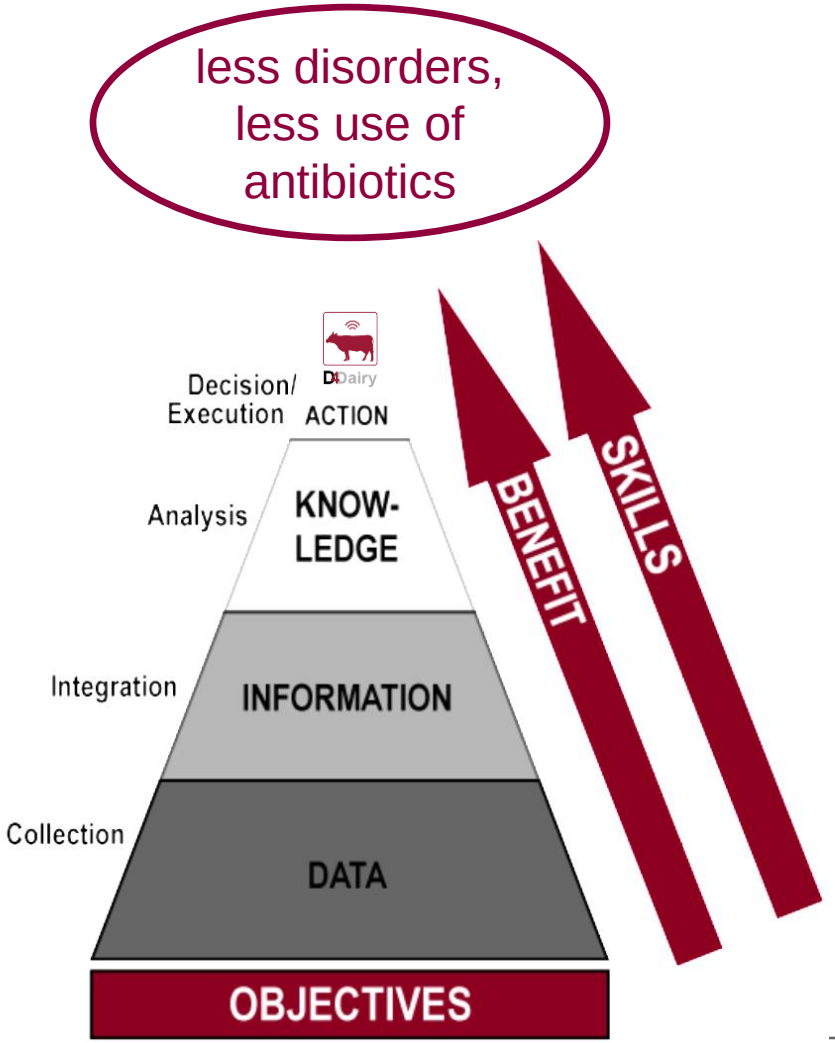
Aim to achieve…

simple decision making tools for farmers

Better decision support tools by …

- collection
- integration
- analysis
- …

Improved value and benefit

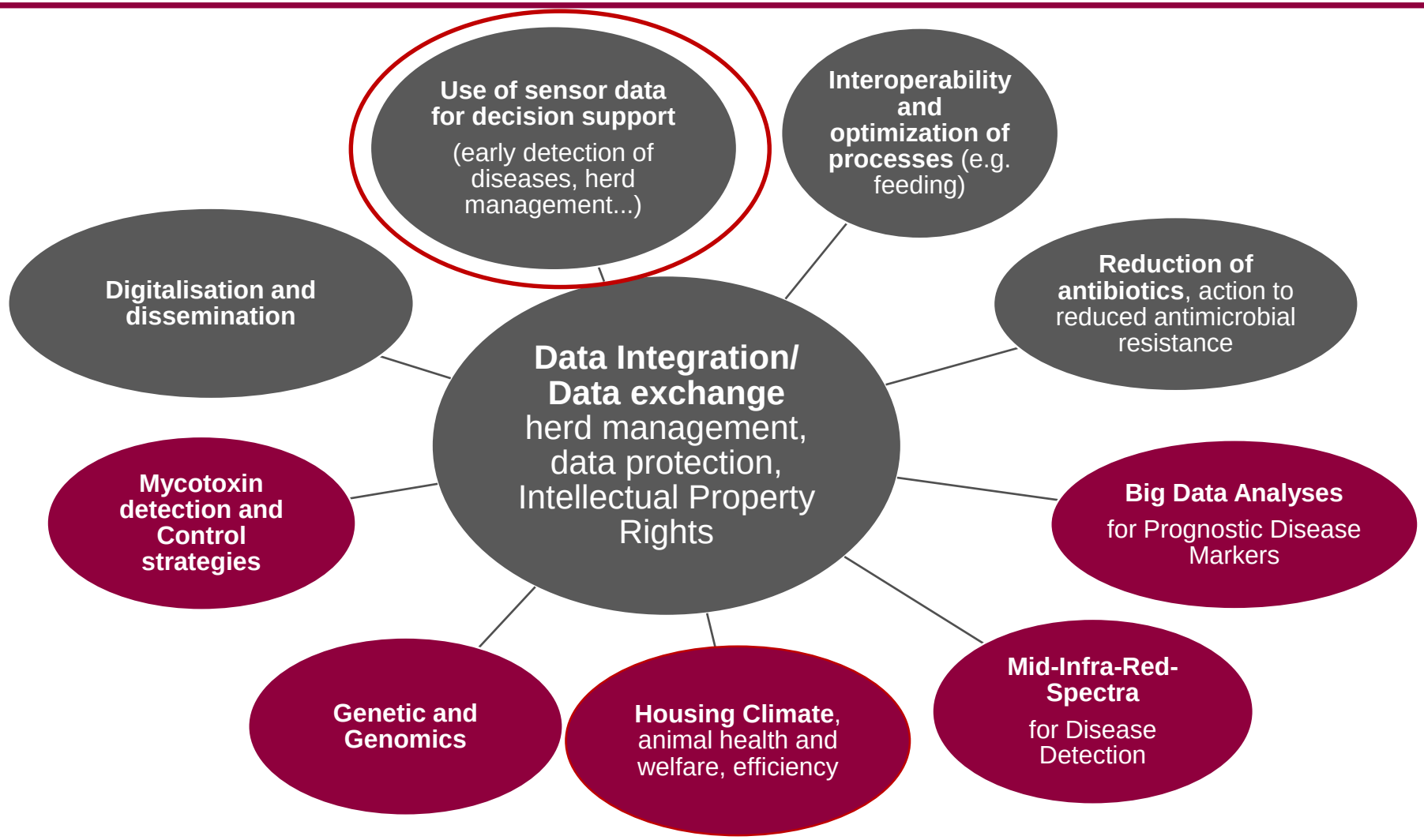


D4Dairy – Digitalisation, Data integration, Detection and Decision support in Dairying

Project period: 1.10.2018 – 30.9.2022
Partner: 31 Economic, 13 Scientific partners
Budget: 5,5 Mill Euro (50% from Economic partners)

Research questions within D4Dairy

Use of existing data and complex data recoding in pilot farms



Data for claw health and metabolism – pilot study

Feet and legs

- Veterinarian diagnoses
- Hoof trimming data
- Lameness – Locomotion Scoring..
- new data sources (activity, rumination, ph-value, rumen temperature,..)

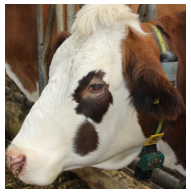
Metabolism

- Vet. diagnoses (ketoses, milkfever,..)
- Body condition score (BCS)
- Lab data (BHB,..)
- On-farm testing - (sub)clinical ketosis
- Milk composition based on indicator traits (F:P ratio, MIR spectra,..)
- new data sources (activity, rumination, ph-value, rumen temperature,..)

Others

- Genome, pedigree, environmental information, welfare parameters,..

Intensive phenotyping in **farms with milking robots and sensor** over an observation period of 18 months!




Pictures: ZAR, smaXtec

Develop decision support tools based on pilot farms
Measures

- **concept of data sharing** elaborated √
- **complex data recording** in farms with high level of automation for different research questions – *in process*
- **data validation**, technical aspects of data sharing for routine,...
- **link data and apply algorithm** for more precise tools
- estimate **correlation** between novel traits and already existing data sources
- learn about **risk factors**
- develop **benchmarks**, **prediction/detection models for diseases**
- **…**

→ **simple, practicable herd management tools**

Acknowledgement

Many thanks to farmers, veterinarians, claw trimmers and colleagues from the partner organisations within D4Dairy for their cooperation and support.

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Interdisciplinary cooperation is key for success!
Thank you for your attention

Duration: 10/2018 – 09/2022

www.d4dairy.com

Research Partners

Company Partners

Cooperation partners for specific topics: