Merging novel data sources from various origins for use in dairy cattle - challenges, legal aspects and approaches

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Requirements for the cow of the future
Efficient and healthy, economical, resilient, low environmental footprint

Breeding goal:
- High milk yield
- High feed efficiency
- Few losses over lifetime
- Good fertility
- Longevity to minimize the costs of replacements
- Good milk quality - healthy udders
- No or few claw problems
- No or few problems with metabolism
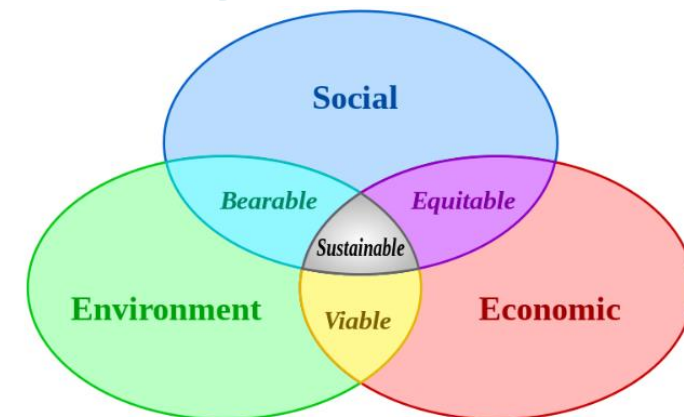- Good meat performance
- Resilient
- Adapted to heat stress,…
- …

Requirements:
- Animal welfare
- Lower environmental impact
- Low use of pharmaceuticals
- …

Foto: HBLFA Raumberg-Gumpenstein

Many requirements and challenges

3 pillars of sustainability

Genetics: phenotypes still needed…
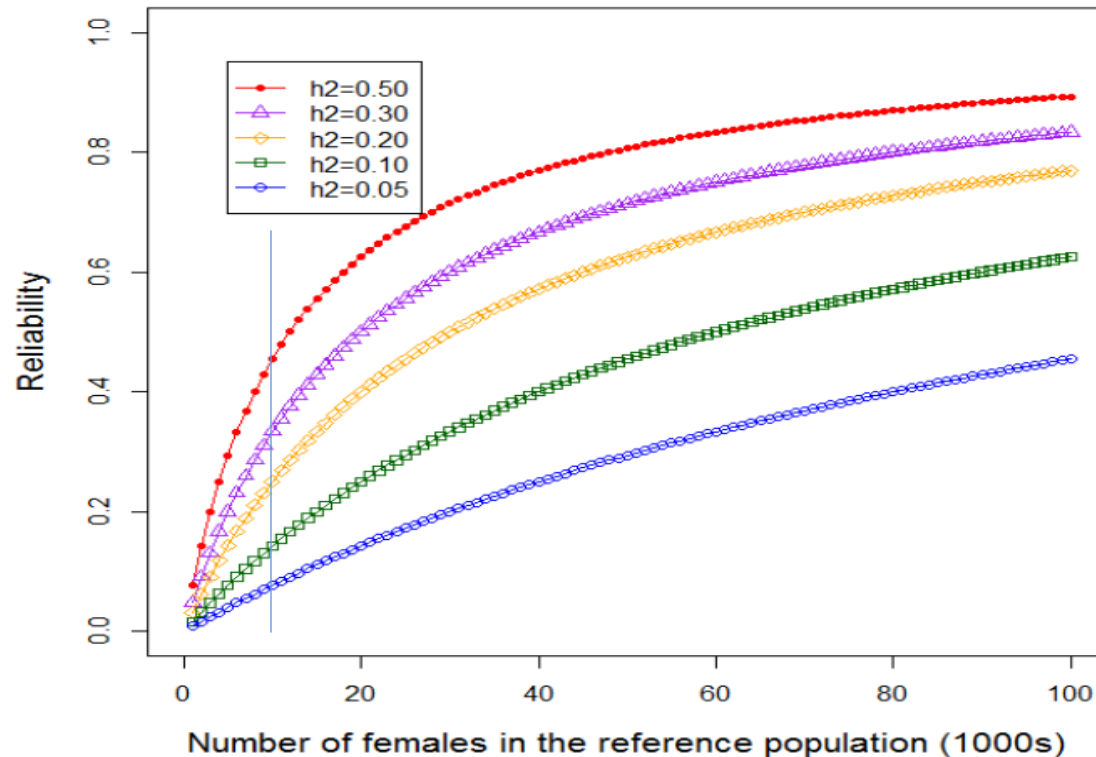
Genetics needs genomics and phenotypes!

Figure 1. Expected reliability for reference populations of 0 to 100,000 (from (Gonzalez-Recio,

- Phenotypes are **still limited especially for novel traits**
  - direct traits
  - auxiliary traits / proxies of interest
- **Cost of phenotyping**!
- **Quality** of phenotypes ⟷ **Higher genetic response / profit!**

Different data sources are of interest! Access and merging of data sources precondition!

New opportunities: more and more data from different sources

- Huge amount of relevant (?) data is generated in dairy operations

- From a lot of different sources on farm and off farm (farmers, veterinarians, claw trimmers, labs, breeding and perfomance recording organisations, dairy processing operations, technology providers, ...)

- Technological advances (genomics, omics technologies, robotics and AI, information technologies, ...)

- Manifold conditions for cattle production (documentation requirements,.)

- Need for farms to optimise aspects of operation (health and welfare, sustainability, …)

APPS
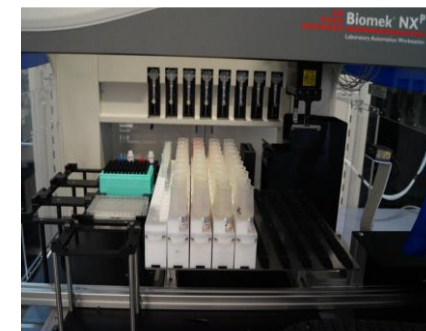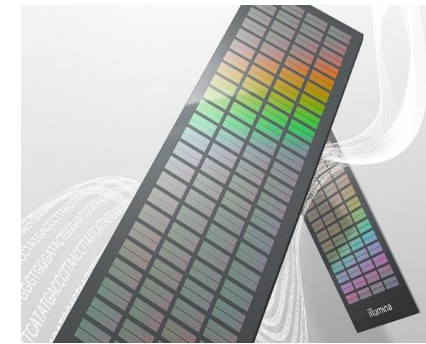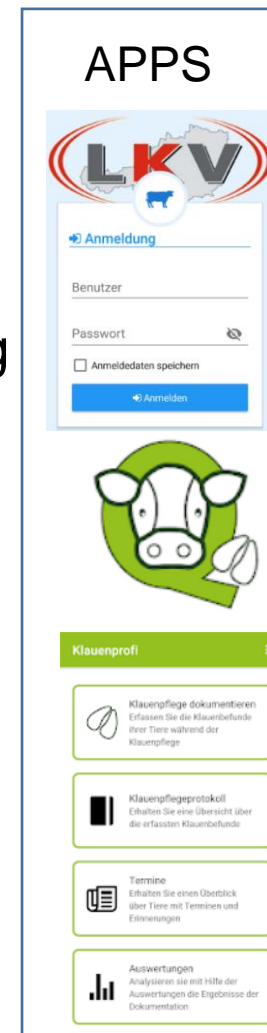
Pictures: SCR by Allflex, smaXtec, Wasserbauer, mpr Bayern, illumina

Rapid increase in Precision Livestock Farming (PLF) equipement on farms! Many new opportunities for breeding!

Data from Automatic Milking System (AMS) and use for genetics

AMS data (e.g. udder geometry) can be used for breeding (Carlström et al. 2016; Poppe et al. 2019, Wethal et al. 2020)

**Heritabilities** for udder conformation traits derived from AMS
- Poppe et al. 2019: 0.37-0.67

Genetic correlations: teat coordinate traits (AMS and classifier-based)
- Carlström et al. 2016: 0.91-0.98
- Poppe et al. 2019: > 0.91

AMS data and health, temperament – of interest: daily milk yields (quarters), milking intervals, conductivity, milkability, ..

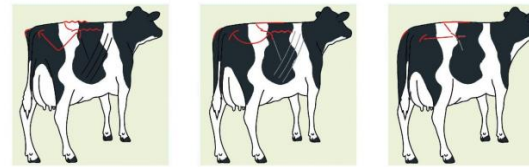High potential of data from Automatic Milking Systems for genetics

1 Outside   5   9 Inside

1 Outside   5   9 Inside
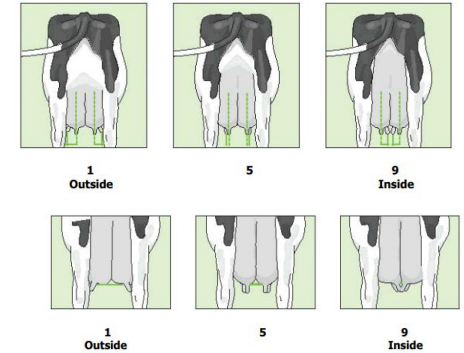
(holstein-uk.org)

www.lely.com

www.delaval.com

Auxiliary traits: example ketosis

Fürst-Waltl et al, 2023
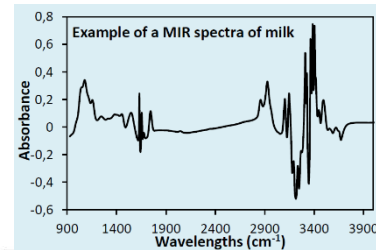
BHB/Ketosis indicators

(MIR-Spectra) zB KetoMIR

BCS

Traits from milking system
(zB change in daily milk yield)
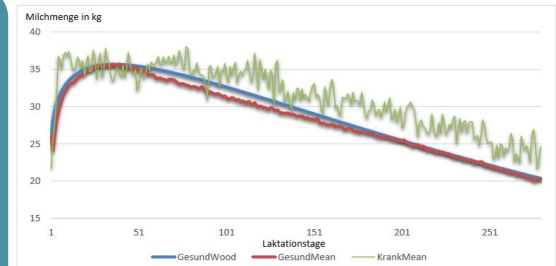
Beta-hydroxybutyrate (BHB)
blood or milk tests
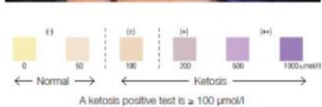
Ketosis
($h^2 < 0,05$)

(subcl. ketosis)($h^2 = \sim 0,1 - 0,4$)

Traits based on sensor
(zB activity, rumination, temperature,..)
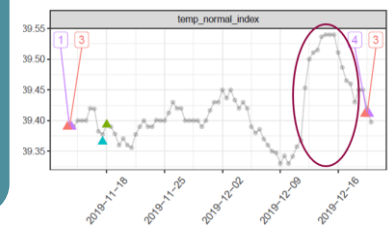
Pictures: ZuchtData, SCR by Allflex, Holstein-UK)

Limitations of direct traits; auxiliary traits of interest (higher heritabilities, ..)

Challenges of merging data

- Only data that is used is useful data

Many different data sources along the milk value chain

Central cattle databases since 1960
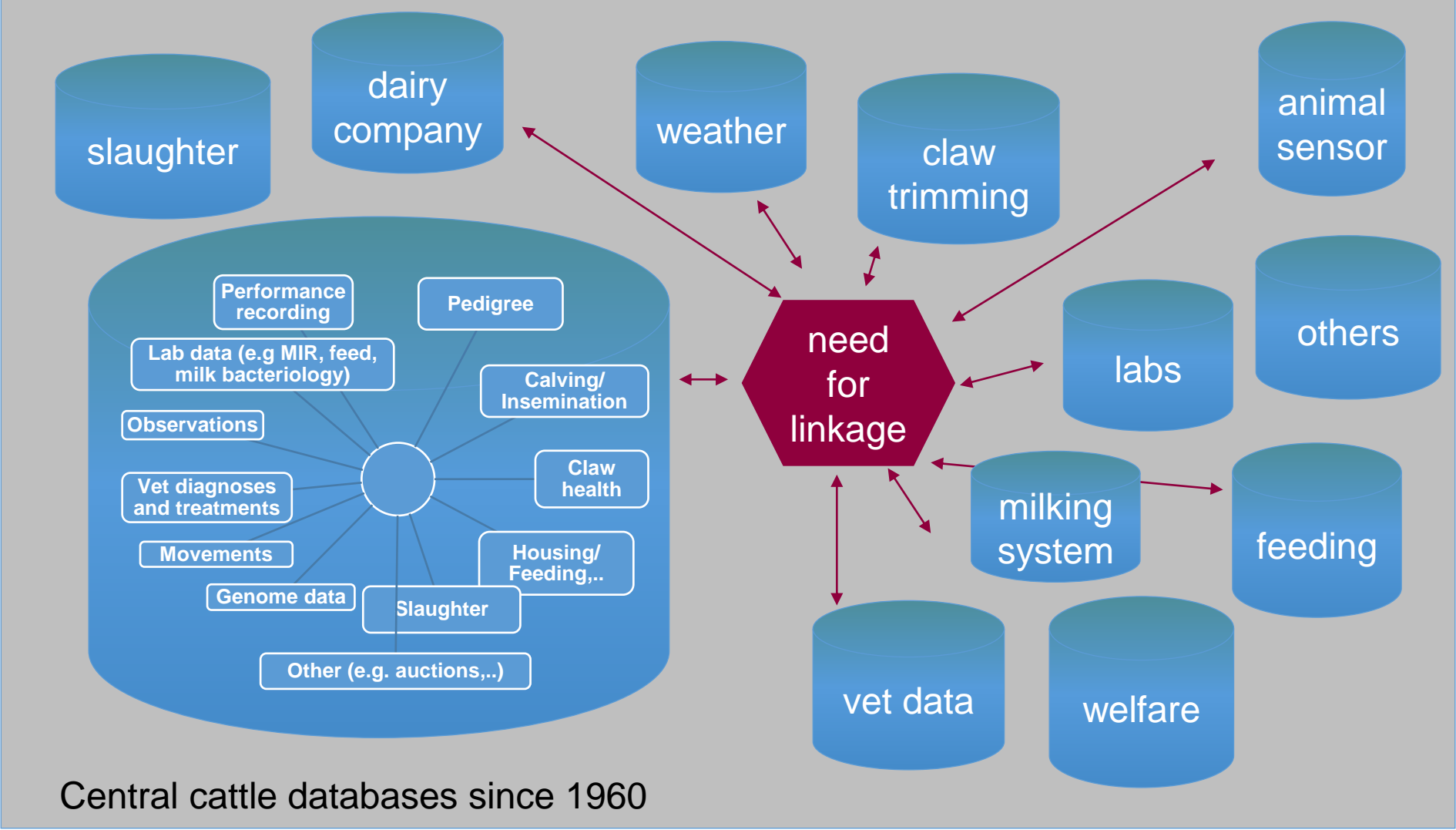
Need for Data Integration

Precondition for added value

Challenges Standardisation, Legal aspects, Technical solutions, Business interests, IPR,..

Data integration / standards

Why standardization ? Challenges

- Animal ID
- Health information (diagnoses, claw health, lab,…)
- Information from milking systems
- Sensor
- …

Use standards / harmonisation

- Data formats ("36 C" vs. "100100 Celsius")
- Data meaning ("36 C" vs. "96.8 F")
- Data quality ("36 C" vs "36.7 C")
- …

www.icar.org

Importance of ICAR for standardisation – important that existing standards are also used !
Think GLOBAL – work LOCAL = GLOCAL – Strategy!

Legal aspects / data regulations

Patrick Majcen
Head of Legal and Environmental Policy Unit, LK Ö, AT

Fundamental right of data protection

General Data Protection Regulation(GDPR) – directly applicable in EU member states since 25.5.2018

- **data must be processed lawfully, fairly** and in a way that is comprehensible to the data subject
- **data processing** may only be carried out for a **specific purpose**
- **data processing must be limited** to **what is necessary for the purposes** of the processing
- **data must be accurate** and, where necessary, kept up to date
- **data may only be stored for as long as necessary**
- data must be **processed in a manner that ensures appropriate security of personal data**

Fundamental right such as e.g. fundamental right to freedom only for „**personal data**"

GDPR – personal data

- **GDPR - every information relating to a natural person is protected by the GDPR as personal data** (animal data are personal data) because they can usually be linked to the farmer e.g. the farmer has a cow and their medical status is…

- **Each data set needs to be checked** if qualified as personal data to ensure lawfulness under Art 6 GDPR

  - **GDPR requires a specific legal reason for every processing of data** i.e. generating, pooling, mixing, further processing, making available, even deleting!

  - Art 6 GDPR provides different reasons of lawfulness and the most common ones are **lawful data processing with a corresponding consent and lawful data processing due to a (comprehensibly documented) legitimate interest.** But there are also **privileged reasons for research data under the GDPR and specified under national laws.**

Different data sources – different regulations and roles of data processing

Focus on external data sources (view from DHI and breeding organisation):

- Veterinarian diagnoses and drug application

- Data from claw trimmers

- Lab data e.g. on pathogen or resistence patterns

- Documentation requirements for quality assurance,..

- Vaccinations

- Data from automation (milking robots, sensors,..)

- …

Personal data – consent is needed! Role is different! Different approaches!
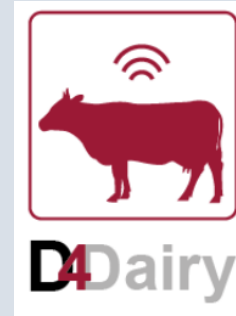
Approaches

Example: D4Dairy - integrated research data

D4Dairy – various data based research questions

Cooperation to increase benefits of digitalization along the value chain

Duration: 10/2018 – 09/2022

www.d4dairy.com

Digitalisation, Data integration, Detection and Decision support in Dairying

Research example: data protection and regulation within D4Dairy
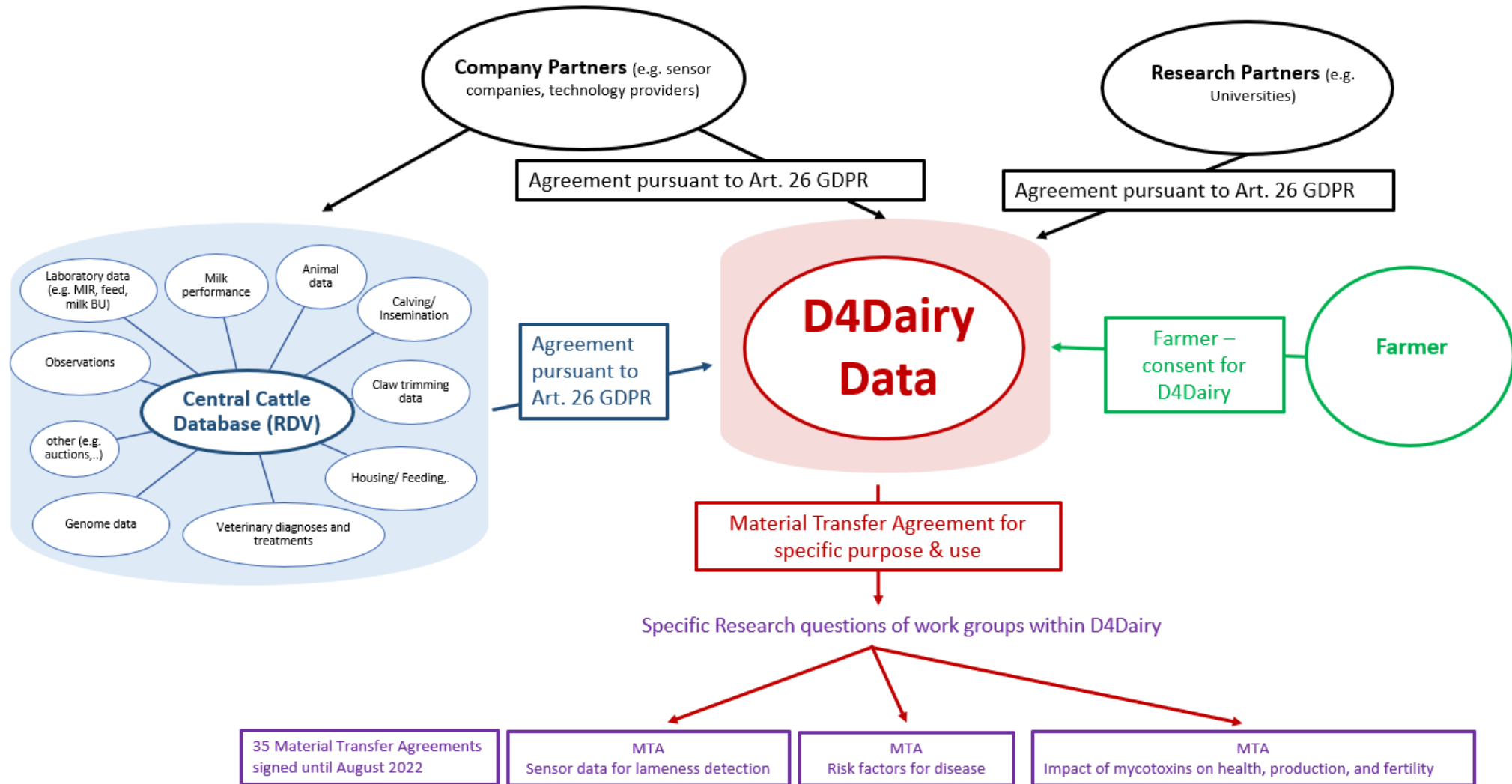
Clear agreements including IPR (consortium agreement), transparency and trust between partners, removel of personal reference / anonymisation of data

Approaches

Example: Data Integration / Routine Applications

Central Cattle Database (RDV)

Expectations and Needs related to digitalisation
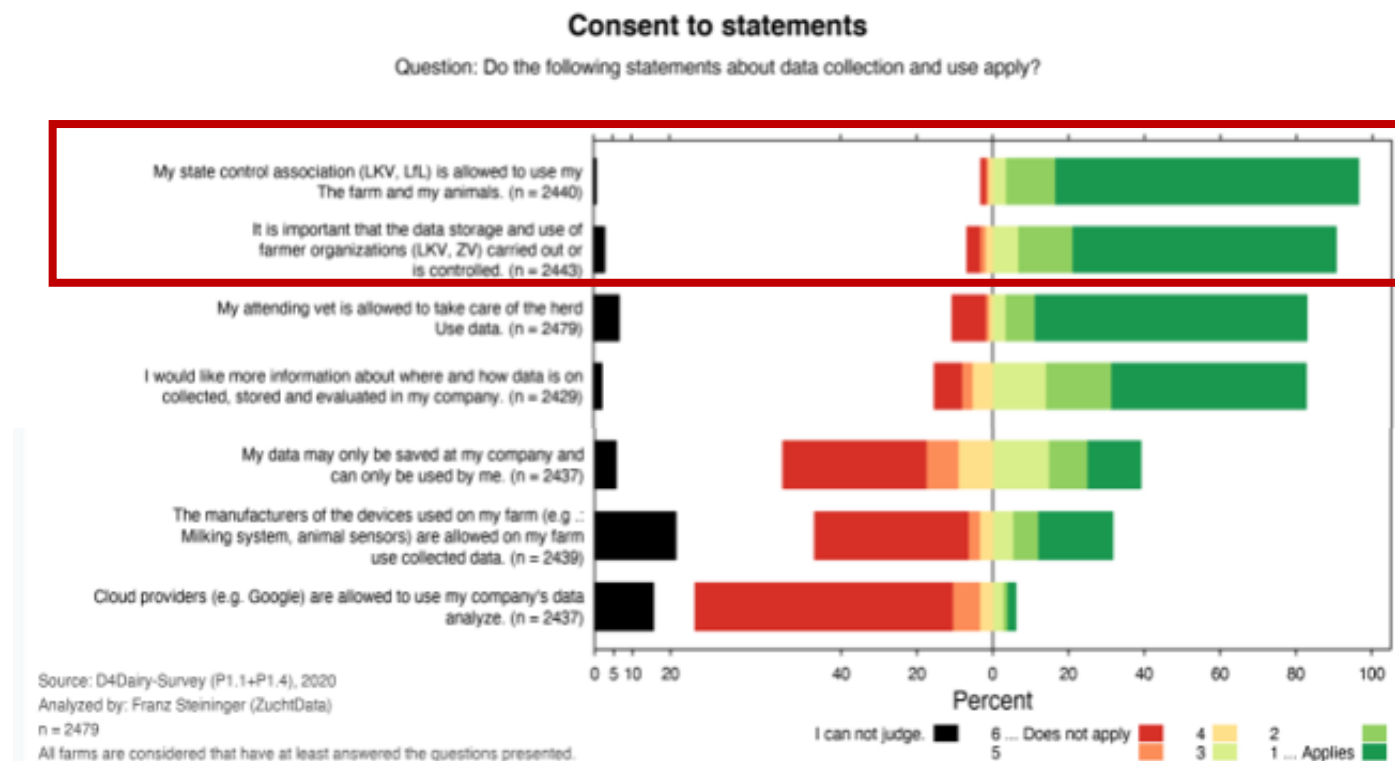
Farmers: Results from surveys (D4Dairy, ADDA, OptiGene)

D4Dairy

Farmers:

- Linkage of data – **avoid multiple recording**

- **Reduction of work load**

- **Better tools** due to use of technological advances

- High level of **trust** in farmer owned data storage and processing

- …

Other partners: data integration, new and better products

Consent to statements

Question: Do the following statements about data collection and use apply?

My state control association (LKV, LfL) is allowed to use my
The farm and my animals. (n = 2440)

It is important that the data storage and use of
farmer organizations (LKV, ZV) carried out or
is controlled. (n = 2443)

My attending vet is allowed to take care of the herd
Use data. (n = 2479)

I would like more information about where and how data is on
collected, stored and evaluated in my company. (n = 2429)

My data may only be saved at my company and
can only be used by me. (n = 2437)

The manufacturers of the devices used on my farm (e.g .:
Milking system, animal sensors) are allowed on my farm
use collected data. (n = 2439)

Cloud providers (e.g. Google) are allowed to use my company's data
analyze. (n = 2437)

Source: D4Dairy-Survey (P1.1+P1.4), 2020
Analyzed by: Franz Steininger (ZuchtData)
n = 2479
All farms are considered that have at least answered the questions presented.

Percent

I can not judge. 6 ... Does not apply 4 2
5 3 1 ... Applies

D4Dairy, 2020

Various challenges (interoperability, comparability, data privacy protection, business interests, ...)

Documentation of diagnoses and drug use
Standardisation is precondition (diagnoses, drugs,..)!

Legal documentation requirements

paper

without paper / digital

DHI, farmer

vet

Catte database
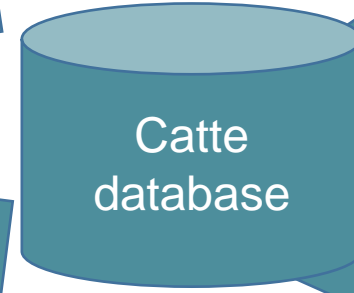
Use for genetics

Benchmark and management
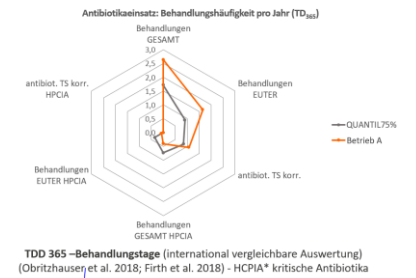
Bilder: ZAR

Standardisation, recording / logistic and agreements based on legal background

Legals circumstances for data processing
(example Austria)

- **Law of animal breeding / Animal breeding regulation**: data within performance recording, genetic evaluation, breeding program
- *Chamber of Agriculture: contracting authority*
- *RZA (Cattle breeder AUSTRIA) service provider, ZuchtData: sub service provider*
- *Data subjects: farmers and veterinarians*

- **Law on drug control** / Residue Control Regulation / Veterinary Antibiotic Volume Flow Regulation
- Receipt for drug use (information on animal, farm, diagnoses, treatment and date of treatment, Vet-ID,.. has to be documented and issued by the veterinarian)
- *Contracting person for documentation: veterinarians*
- *Data subjects: farmers*

To define for each dataset the specific regulations and circumstances

Who has the right to collect and process data?

Example veterinarian diagnoses

- Formal legitimacy *(§§ 6-9 DSG 2000, § 13 DSG 2000, §§ 17ff, § 50 DSG 2000, § 10f DSG 2000)*

- **There has to be a purpose/reason for collection of data** (e.g. bylaw of an organisation,...)
  - aim of the organisation includes improvement of animal health by genetics
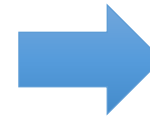 - membership arrangement include the collection of this data for this purpose
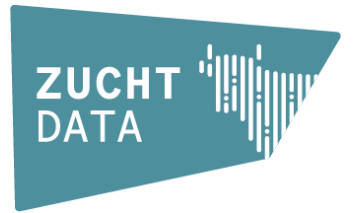 - ....

Veterinarian diagnoses from data from official receipt on drug application and use can be processed

If the identity of the vet is recorded the vet has to agree!

Farmer is affected but has agreed already due to agreement within membership in breeding organisation.

Key factors for success to integrate health data into central database

Austria: veterinarian diagnoses recorded for breeding and managment purposes since 2006 in central cattle database (RDV)

- more than 10.000 farms in Austria with diagnoses recording
  (most of them direct electronic transmission by veterinarians)
- recording and use of claw trimming data set up
- lab data (bacteriological findings, resistancy standardised and implemented in RDV)
- ..

Measures and key factors:

- **standardisation** diagnoses (Austrian wide health key – link to ICAR Health Key)
- **added value for stakeholders** (farmers, veterinarians,..)
- **no / little additional work** e.g. service agreements with external partners concerning consent of farmers with contracting authority for central database (RZA)
- data safety/security – **trust in system** – transparency – agreements!

Routine interfaces with PLF – systems

- **Farmer requires data linkage**

- **Many different systems (different technical background) and products**

- **Agreements between partners**

  - Which data to exchange?

  - Who is allowed to use it?

  - For which purpose?

  - …

- **Standardised interfaces** – international cooperation essential (ICAR, iDEEN) – important to reduce work for partners!

- **Benefit for stakeholders involved important!**
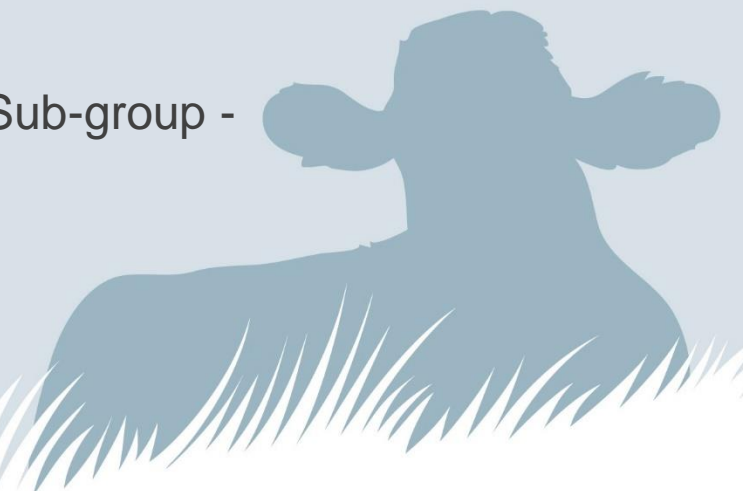
- **Trust and cooperation are essential!**

Outlook

EU regulations (P. Majcen, LK Ö)

EU Expert Group on B2B data sharing and cloud computing contracts / Sub-group - stakeholders (E03840/1)

- Data Governance Act

- Data Act

[European data strategy (europa.eu)](#)

The European data strategy aims to make the EU a leader in a data-driven society. Creating a single market for data will allow it to flow freely within the EU and across sectors for the benefit of businesses, researchers and public administrations

[The European Data Act (eu-data-act.com)](#)

Cheaper prices for aftermarket services and reparation of their **connected objects**.

A factory robot breaks down.

TODAY	TOMORROW
Only the manufacturer can access the data, leaving no alternative for the company but to call them for repairing.	The user could request that a repair service that may be cheaper also gets access to the data.

New opportunities to use services relying on access to this data.

A farmer has equipment from different manufacturers (tractor, automatic irrigation system).

He cannot outsource the data analytics of its different equipment, the data is locked with each manufacturer.	He could receive customised advices from a company gathering data from the different equipment.

Better access to data collected or produced by a device.

A bar owner wants to serve better coffee, and the coffeemaker company wants to improve its product.

Only the company can access the data produced by the machine to design the next generation of coffeemakers but the bar owner cannot access information such as the quantity and temperature of water or coffee strength.	The Data Act clarifies that both parties can access all data collected by the machine.

EU data policy
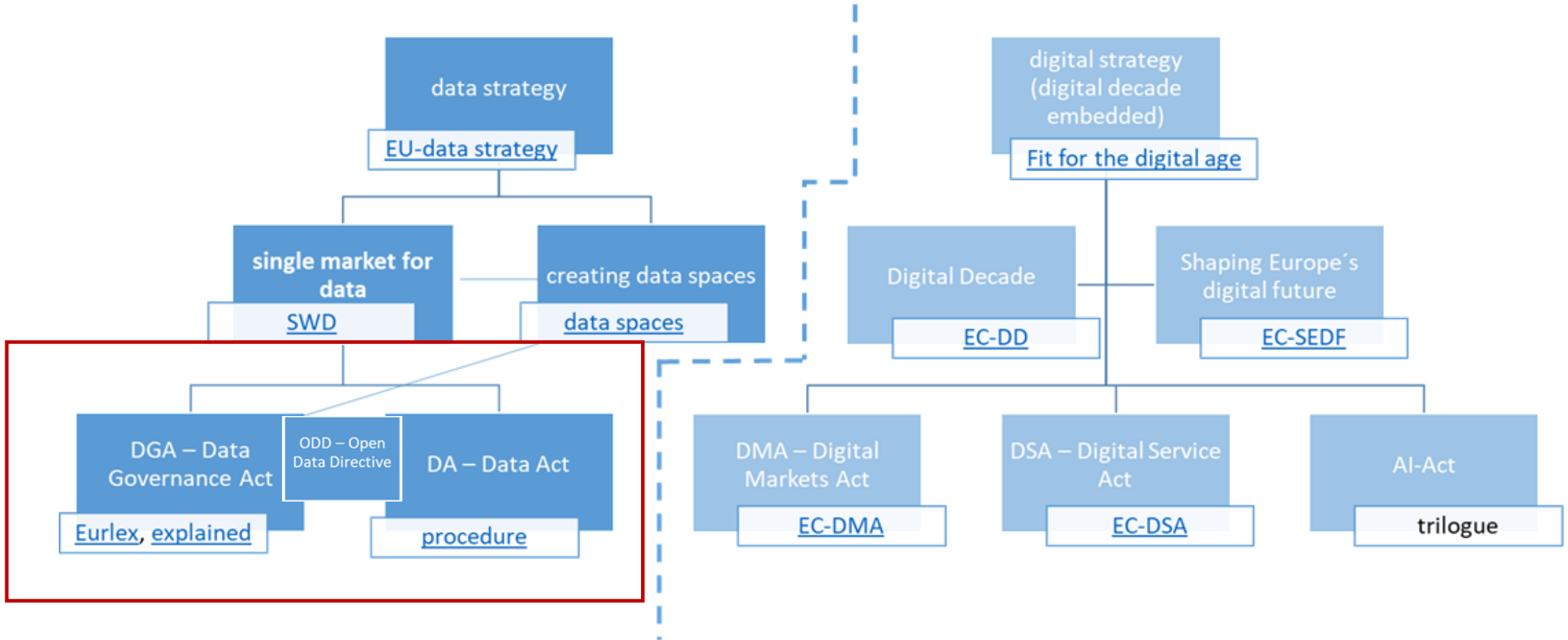
EU Data Governance Act

The Data Governance Act

The [Data Governance Act](#) (DGA) is a horizontal piece of legislation that means all sectors are adressed. The DGA aims to make more data available by

1. **regulating the re-use of publicly/held and protected data**,
2. improve data sharing through the regulation of novel data intermediaries and
3. encouraging the sharing of data for altruistic purposes.

The **re-use of unprotected data** is already possible under the **Open Data Directive**.

Under the DGA you can now apply for protected data hold by the public sector and they shall grant access if they can prevent the disclosure of protected elements.
This can be done by special technical measures laid down in the DGA or other assistance and shall lead to possible innovation and uphold protected rights at the same time.

EUData Act

all kind of data

Key facts - Data Act

• **Access to IoT-Devices** – 20 billion by 2030

Problem: Insufficient opportunities for data management - e.g. 80 % unused industry data

Only a few benefit from data - data silos of manufacturers

Solution: Data Act: politically adopted – in force until mid 2025

- Grants access to data from IoT devices

- Allows data to be shared with third parties

- Gives third parties the right to request data
  directly from data holders on behalf of the user (compensation)

- Trade secrets of data holders can be protected by technical protection measures
  agreed with the user. If it is impossible or impractical, the data holder can restrict
  access to the data.

- Possibility for the user to lodge a complaint in the case where a holder does not share
  the data.

Conclusions / Take home message

- **Circumstances** in cattle production – **need to optimize**!
- **Technological advances** and many new data sources offer **many new possibilites** (resource efficiency, prevention, early detection, proxies for breeding,..)
- **Data integration** of on- and off-farm data sources – **big potential**
- **International cooperation** for standardisation and technical solutions (ICAR, iDDN,.) very important
- **Trust, transparency and benefit for partners to share data** and collaborate
- **Farmers trust DHI and breeding organisation** for their data processing
- **EU Data Governance and Data Act** will enforce possiblities to work with integrated datasets
- **Research and collaboration** (on different levels) is **key**

Thank you for your attention!