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IT-Solutions for
Animal Production

Data Requirements for Management and Breeding Purposes in Dairy Cattle

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Why data recording?

Data base for

Herd Management

- Management reports (within herd) ➔ farmers, advisors, vets
- Benchmarking across herds ➔ farmers, advisors, vets, administration
- Cross compliance, quality assurance systems (QA)

Breeding

- Genetic evaluation (comparison accross herds)

➔ Selection of sires and dams (mating programs)

➔ Marketing of animals (Total Merit Index, TOP lists)

Farmer: Herd Management > Breeding

BO: Herd Management < Breeding

Different focus on traits

- Society
  - Animal health
  - Animal behavior
  - Animal wellness
  - Robust animals
  - Methane emission, ….
- Consumer
  - Healthy food
  - Cheap food
  - QA, traceability
- Farmer and breeding organizations
  - All classical traits (production, functional & economic traits)
  - Product quality, contents, composition
  - Health traits
  - Feed efficiency, …

Performance recording in the genotyped world

>> We need both <u>Phenotypes</u> and <u>Genotypes</u> ! <<

Phenotype ➔ ➔ Genotype

- Today: Genomic evaluation (GE) ➔ Genomic selection (GS)

- Future: For selection **and** management decisions
  - ➔ Unselected cow reference samples
    (complete herds: genotyped & phenotyped)
  - ➔ New IT services have to be developed
  - ➔ To motivate farmers for genotyping

Performance recording in the genotyped world

In future still valid (more important):

>>>>> Who knows the phenotypes is king!! <<<<<

➔ Genotyping (SNP marker) will become cheaper

but

➔Recording of reliable and unselected phenotypes will become more expensive (traditional and new traits)

➔High data quality for reference samples !!

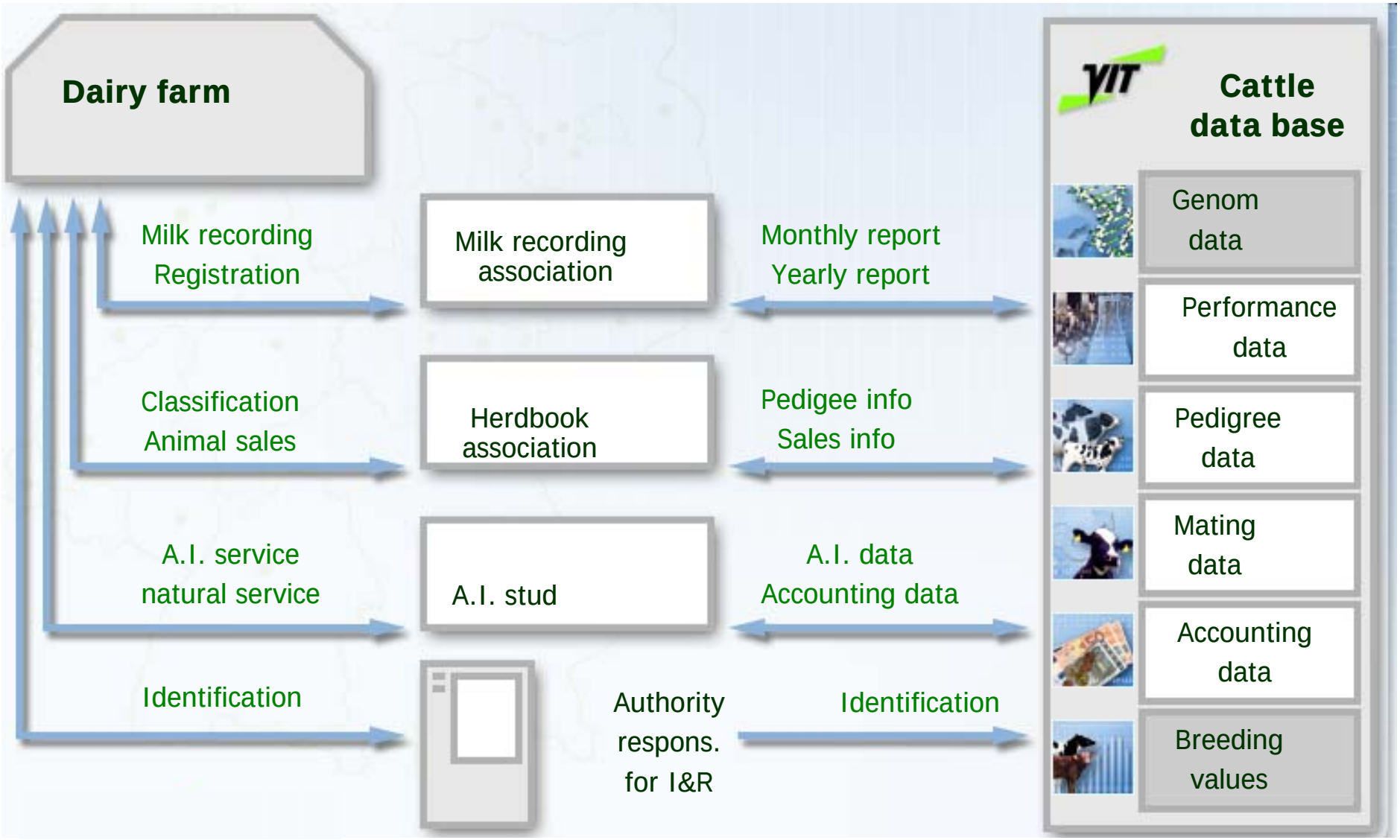
Integrated data base and IT solutions

- Traditionally data are collected and provided by
  - Milk recording organizations
  - Herdbook associations
  - A.I. organizations
  - Linked to national I & R system

- In the future
  - Less data from organizations
  - More data directly from the farmer (automatic on-farm recording)
  - New traits
  - Mass data from automatic devices

Great challenge to expand/assure integrated data basis

Integrated IT-Services for dairy breeding (vit)



Future challenges

- New Phenotypes
  - Animal health and welfare traits recorded on-farm
  - Monitoring system for genetic defects
  - Additional traits from labs
    (spectrometry profils, methane emission, ketosis, pregnancy tests, …..)
- Automatic on-farm data recording
  - Classical performance data
  - New traits (milking robos, heat detection, pedometer, ….)
- Herd environment information
  (feeding, housing, milking, prophylaxis…. Systems)
- Genotype: Genomic data (customized LD, …… sequence data)

ICAR - CoQ - issues

- **How can we check automatic on-farm data recording and processing?**
  - Compliance with ICAR recommendations?
  - Who is responsile for calibration? (manufacturer, DHI, BO ?)
  - Who is responsible for data analysis? (dito)
  - For all farms?

- **How can we check labs?**
  - Labs have allready ISO-CoQ, in which lab processes are audited much more in detail

- **How can we check completeness and correctness of new data for GE?**
  - Health data: Do we get all cases, diagnoses?
  - Consolidation of mass data ➔ Consistent data without loss of information
  - Are all possible plausibility cross checks carried out (just in time)?

Data for breeding programs

Past:

- Breeding organizations got phenotypic data for GE (mostly without costs)

Future:

- Different groups of farmers
  - Production herds (only on-farm recording and analysis) ➔ management
  - ….
  - Herdbook herds ➔ management & selection
  - ….
  - Test/Contract herds with complete and high quality data ➔ cow reference sample fo unbiased GE ➔ management, selection, breeding program
- Diversification of recording systems and IT services
- Breeding organisations have to pay (subsidise) farmers for phenotypic data
- Different costs for recording, different data quality requirements

Additional aspects

- International exchange of data and results
  - Harmonisation of trait definitions
  - Unique (life time) animal identification
  - International verification of pedigree data (IDEA)
  - Basis of parentage verification (GenoEx)
  - Exchange of additional individual information (IDEA)
  - Fixed data transfer protocols

- Data security / data protection
  - Authorized access to farmers and BO
  - Data backups

Genetic evaluation (I)

Classical and genomic evaluation will be merged

- Single Step approach
- Bull ➔ Cow reference sample to avoid selection bias
- We need unselected, complete herds genotyped and phenotyped
  (with high data quality, new traits)
- „Calibration“ of genomic evaluation
- We don‘t need EBV for all animals/herds

Genetic evaluation (II)

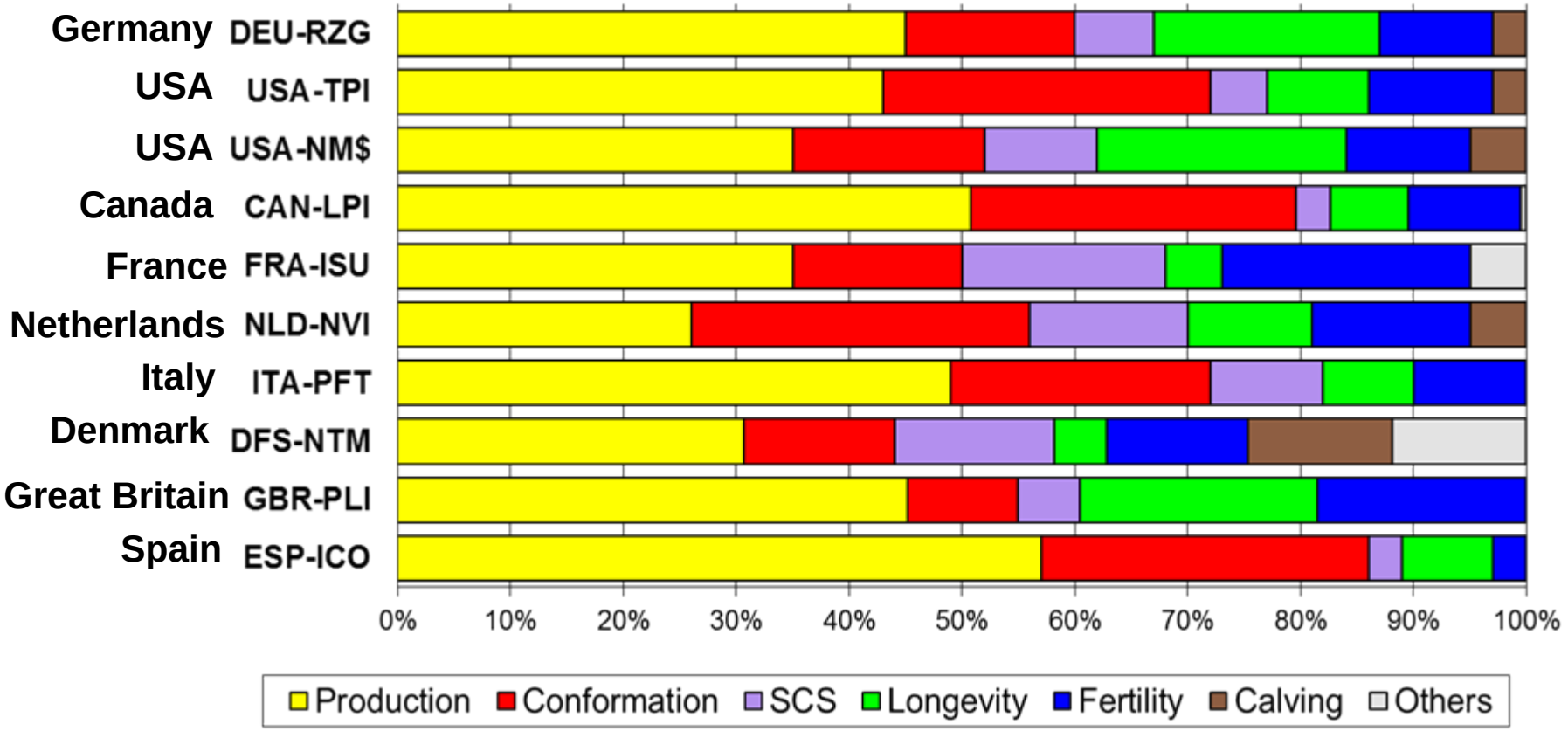
More focus on „real“ functional traits

- Less conformation, more lab information
- Better (more reliable) data of classical functional traits
  (fertility, mastitis, calving traits, …)
- Survival of calves and cows
- New traits to distinguish culling reasons
  (Health traits, claw disorders, metabolic traits, behavior traits)

➔ **To meet economic demands of industry and animal welfare demands of the society/consumers**

International comparison of Total Merit Indices

Holstein 2014: Balanced breeding goal for production and functional traits



Genetic evaluation (III)

Genomics

- Identification of causal mutations and carriers of recessive genetic characteristics (positve & negative)
- Variability in inheritance (uniform / variable progeny groups)
- **Genomics for management decisions**

  (based on genotypes, phenotypes und more environmental info)
  - G x E
  - Feeding
  - Behavior
  - …

Main issue

➔ **Additional benefit for farmers** from

official milk recording and integrated data bases

compared to

stand alone herd management systems
connected with on-farm recording

Additional traits
Additional analyses / figures (within and accross herds)
Additional management and breeding web-based tools

What expects a farmer?

Integrated (complete but diversificated) IT solutions for management and breeding decisions

- Automatic data recording
- Automatic and secure data exchange with integrated data bases
- Herd data linked to all other data sources
- Just in time data processing
- Comprehensive and significant statistics and figures
- Benchmarking

- Mating programms considering all available information
- Cows for replacement, beef crosses
- Which genetic fits best to my management system/environment
- …

Breeding Organizations

- Trend to fully integrated breeding companies
- Covering all fields

  R&I, data recording, HB, GE, breeding programs, AI, international marketing

- Marketing of AI bulls

  ➔**Unique selling proposition**

  - New traits, genetic characteristics
  - New indices (Robot, Health, …)
  - More sophisticated mating programs
  - Additional services (pregnancy tests, mastitis tests, …)
  - Consulting services for management and breeding
  - …..

Conclusions

- An integrated data base is a precondition for intelligent integrated IT solutions for the benefit of farmers and breeding organizations

- Modern communication technologies (web-based, mobile access) enable
  - access to all current data at any time and place
  - shared simultaneous work on the same data
  - access to “unlimited” computer capacities
  - de-central use of information with central data/software

- Phenotypes and genotypes are important
  - New traits and data sources for breeding and management
  - High data quality for cow reference samples
  - Use of genomic information for management purposes

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