IT-Solutions for Animal Production

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Animal Production

Genetic improvement organization in Beef Cattle in Germany

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Content

- What‘s vit?
- Structure of beef cattle breeding in Germany
  - Breeding assoziations
  - Main breeds
- Responsabilities / legal background
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  - Herdbook
  - Genetic evaluation
- Joint data pool in vit
- Collected traits & genetic evaluation
- Outlook
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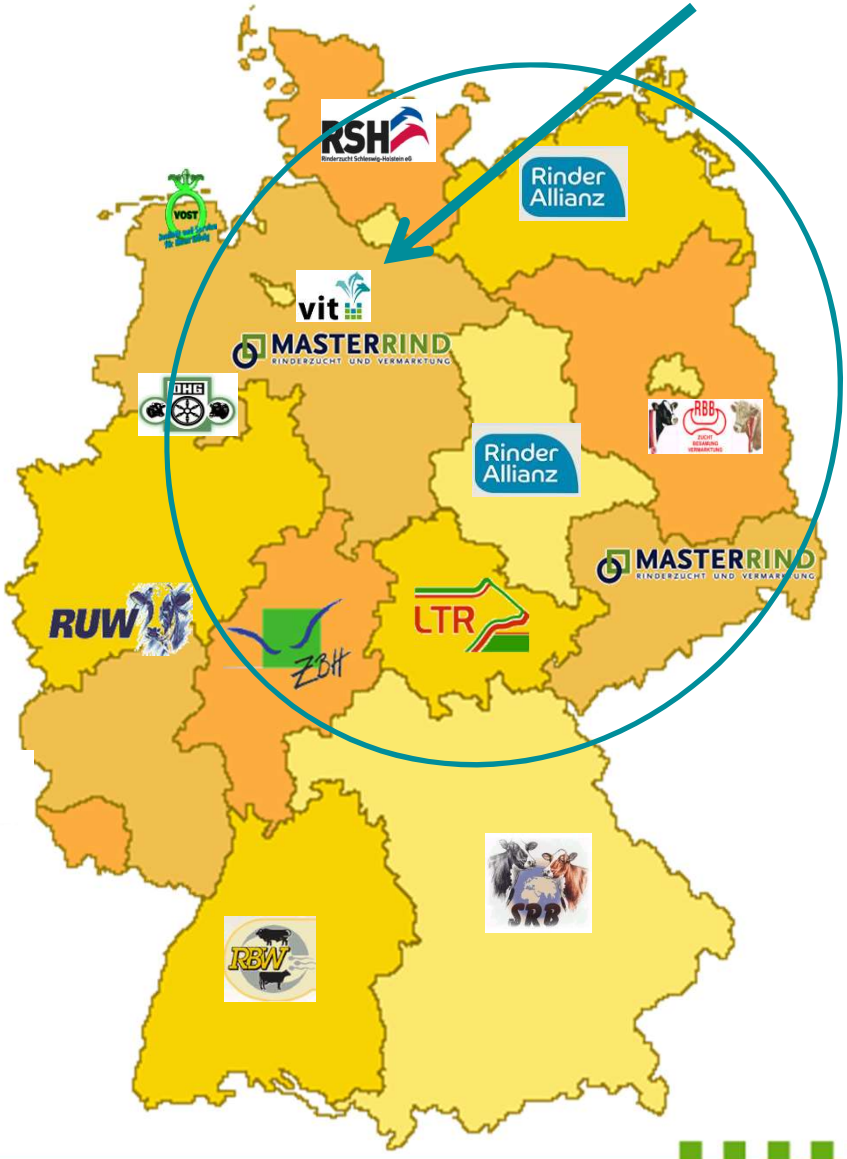
  - Genomics

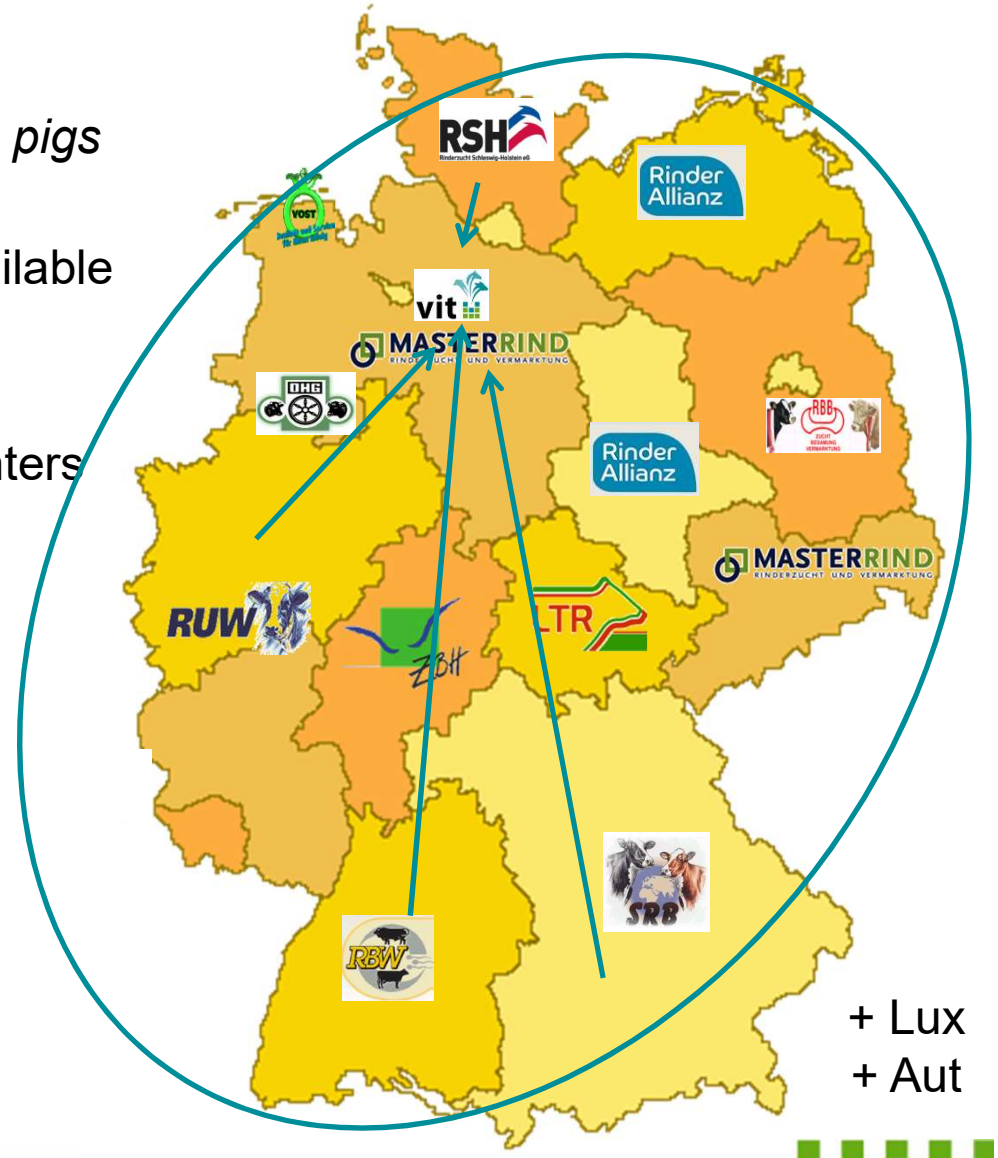
Vereinigte Informationssysteme Tierhaltung w. V. (vit)

- *IT solutions for animal production*
- *Data processing for*
  - *Identification & Registration*
  - *Milk recording organisations*
  - *Herdbook*
  - *AI*
  - *Genetic evaluation (classic., genomic)*
- *Cattle (Dairy, Beef), horses, sheep, pigs*
- **Germany: ~ 4.267.000 dairy cows**
  - in 79,500 farms (∅ 53 cows/herd)
  - 88% milk recording
  - 66% herdbook
  - 90% A.I. (4.2 Mio. 1st inseminations)
- vit: ~ 65%
- > 85 Mio. cattle stored in vit HB-DB



Vereinigte Informationssysteme Tierhaltung w. V. (vit)

- *Classic genetic evaluation for*
  Cattle (Dairy, Beef), horses, sheep, pigs
- Complete pedigree information available in vit (GE unit)
- Yield data sent by other Comp. centers 3 times a year
- Genomic evaluation (HOL)
  - Since 2010
  - > 200.000 genotyped animals
  - EUROGENOMICS Ref. sample
- INTERBULL
  - Data exchange for MACE/GMACE



BDF: Umbrella organization of German beef breeders

Members:

12 breeding assoziations
(Data Rec., HB, Marketing)

22 breed cooperatives
(breeding strategy within breed)

Duties of BDF

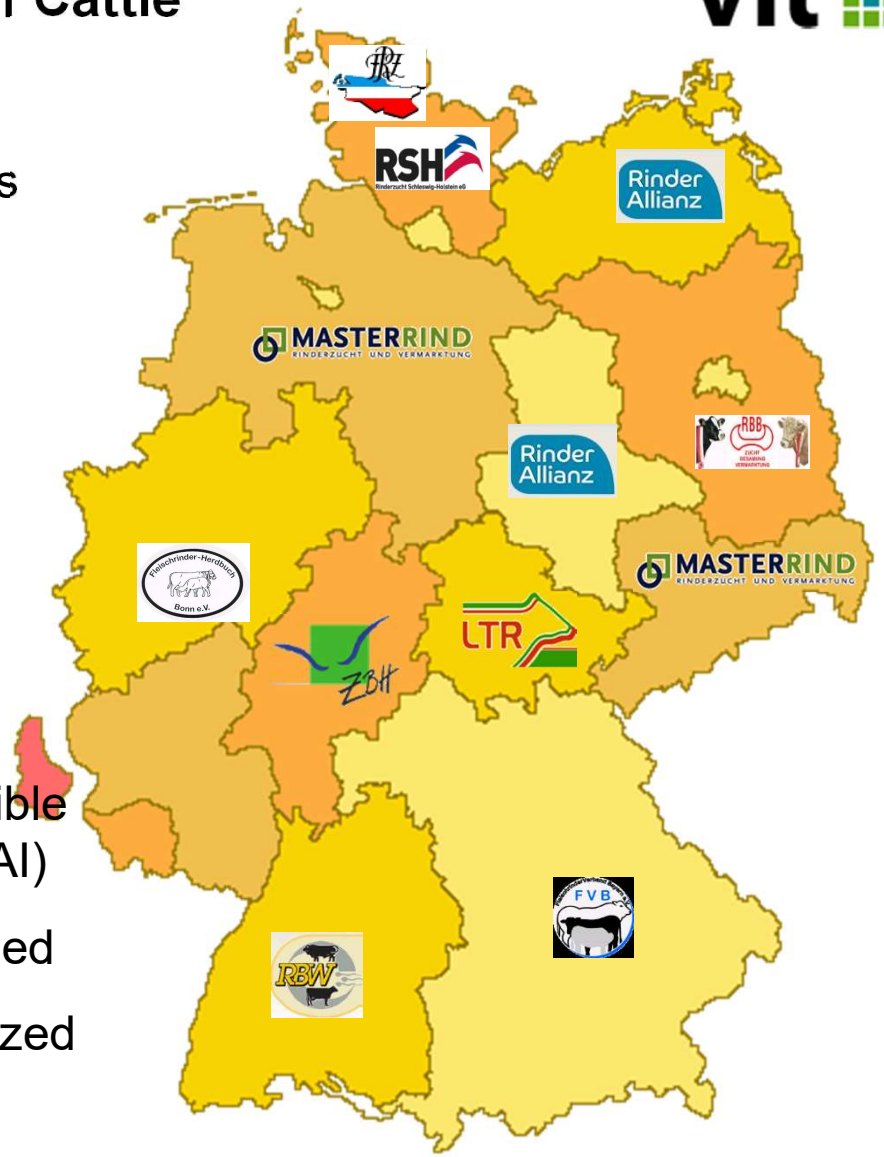
- Coordination of breeding: data recording, HB, GE, breeding programs
- National und international representation of the concerns/interests of German beef cattle organizations
- Organization and participation in expositions (EUROTIER) and shows
- Joint public relations: „Fleischrinder Journal“
- Official annual report

Breeding Associations (BO) Beef Cattle

- 10 licensed herdbook associations
- Each herdbook association is responsible for <u>all beef breeds</u> in its region
- Purebreds

Organizational structure:

- regional organizations responsible for data recording, herdbook, (AI)
- Herdbook and A.I. mostly merged
- data processing mostly centralized



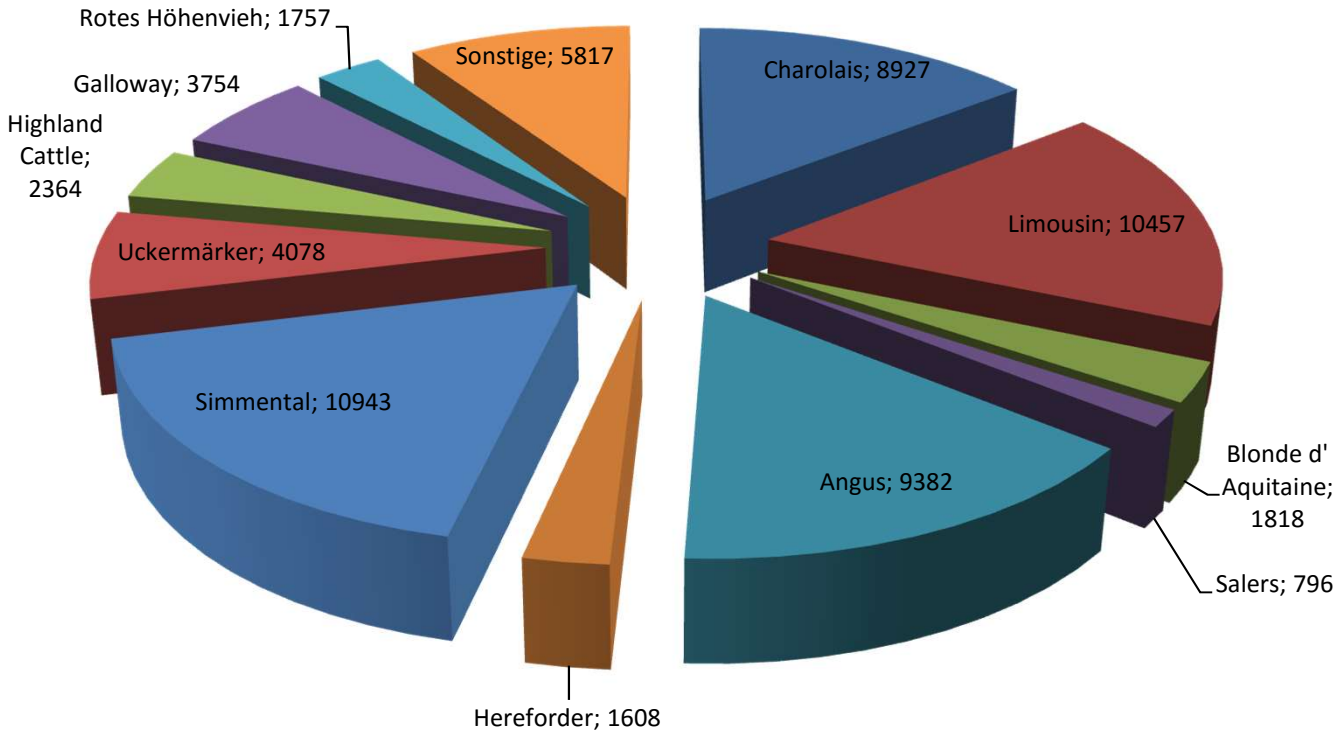
10 Breeding/Herdbook (BO) assoziations

- Fleischrinder-Herdbuch Bonn e.V. (FHB)
- Fleischrinderverband Bayern e.V. (FVB)
- Landesverband Thüringer Rinderzüchter e.G. (LTR)
- Masterrind GmbH, Niedersachen & Sachsen (MAR)
- RinderAllianz, MVP & SA (RA)
- Rinderproduktion Berlin-Brandenburg GmbH (RBB)
- Rinderunion Baden-Württemberg e.V. (RBW)
- Rinderzucht Schleswig-Holstein e.G. (RSH)
- Verband Schleswig-Holsteiner Fleischrinderzüchter e.V. (FRZ)
- Zucht- und Besamungsunion Hessen e.G. (ZBH)

22 beef cattle breeds (breed cooperatives)

- Bundesverband Deutscher **Angus**halter e.V. (BDAH)
- Bundesverband **Aubrac** Züchter (BAZ)
- Bundesverband **Blonde d'Aquitaine** (BBA)
- Verband der Deutschen **Charolais**-Züchter e.V.
- **Dexter** Verband Deutschland (DVD)
- Verband Deutscher **Simmental**züchter e.V. (VDSimmental)
- Bundesverband Deutscher **Galloway**-Züchter e.V. (BDG)
- AG **Gelbvieh** als Fleischrind beim Rinderzuchtverband
- **Glanrind**-Züchterverband e.V. (GZV)
- Bundesverband Deutscher **Hereford**-Züchter e.V. (BDH)
- Verband Deutscher **Highland-Cattle** Züchter und Halter e.V. (VDHC)
- Bundesverband Deutscher **Limousin**-Züchter e.V. (BDL)
- **Maine-Anjou**-Verband Deutschland e.V. (MAVD)
- Verband Deutscher **Piemonteser** Fleischrindzüchter und -halter e.V.
- Bundesverband Deutscher **Pinzgauer** Fleischrinderzüchter e.V.
- Bundesarbeitsgemeinschaft **Rotes Höhenvieh**
- Bundesverband Deutscher **Salers**-Züchter (BVS)
- Bundesverband der **Shorthorn**züchter und –halter e.V. (BUSH)
- Interessengemeinschaft **Uckermärker**
- **Wagyu**-Verband Deutschland e.V.
- Verband Deutscher **Welsh Black** Züchter und Halter e.V. (VDWB)
- Verband Deutscher **Zwergzebu**züchter und -halter e.V.

Population sizes:
Active beef cattle herdbook cows in Germany



Source: ADR Jahresbericht (Annual Report) 2015

Number of herds and average herdsizes by breed

Breed	Herds	Cows	Bulls	Total	Herdsize
Angus	434	9382	448	9830	**22,6**
Aubrac	44	1056	54	1110	**25,2**
Blonde d' A.	179	1818	166	1984	**11,1**
Charolais	478	8341	586	8927	**18,7**
Dexter	157	587	92	679	**4,3**
Simmental	405	10943	487	11430	**28,2**
Galloway	486	3754	390	4144	**8,5**
Gelbvieh	45	476	30	506	**11,2**
Glanrind	138	928	103	1031	**7,5**
Hereford	97	1606	88	1694	**17,5**
Highland C.	456	2364	287	2651	**5,8**
Limousin	586	10457	781	11238	**19,2**
Piemontese	28	198	16	214	**7,6**
Pinzgauer	74	726	53	779	**10,5**
Red cattle	271	1757	166	1923	**7,1**
Saler	31	796	19	815	**26,3**
Shorthorn	19	180	15	195	**10,3**
Uckermärker	77	4078	128	4206	**54,6**
Welsh Black	66	692	62	754	**11,4**
Zwerzebu	46	360	44	404	**8,8**
Others	136	614	80	694	**5,1**
Total	**4253**	**61113**	**4095**	**65208**	**15,3**

Source: ADR Jahresbericht (Annual Report) 2015

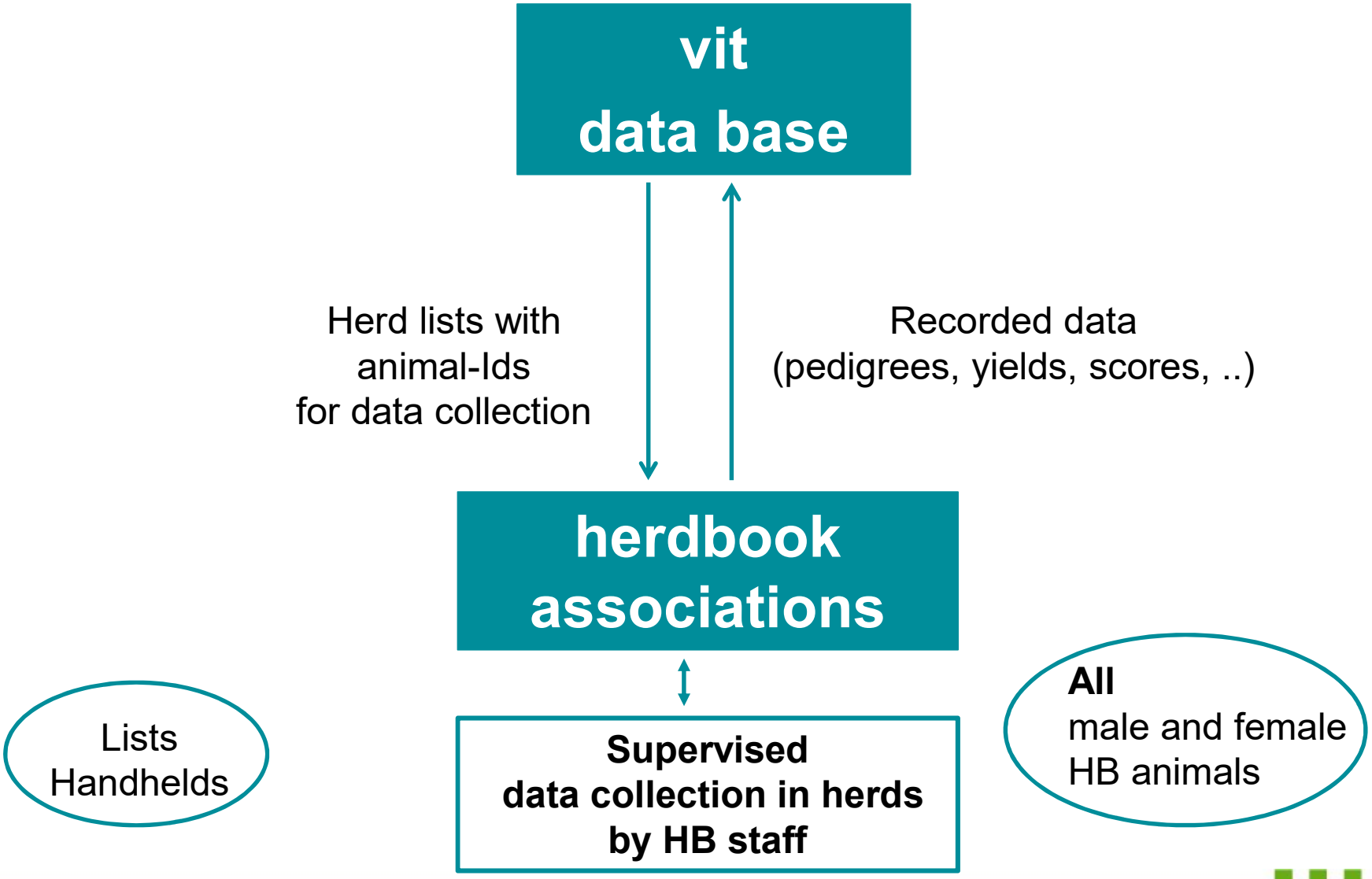
Legal Background

- German Animal Breeding Law
  - Defined and given by the German Legislation
  - In accordance with EU legislation
  - Valid for all regional federal states within Germany
  - Executed by the regional federal states

- A breeding organization (BO) is recognized/licenced if it fulfills the following presuppositions/requirements (definded in its statutes)
  - Breeding program
  - Performance recording complying with ICAR regulations
  - Working/valid herdbook system, i.e.
    - breeds
    - animal identification must be uniform and unique, internationally harmonized
  - Genetic evaluation system
  - …

Data collection (Production, Reproduction)

Data collection



Performance Recording, 2015

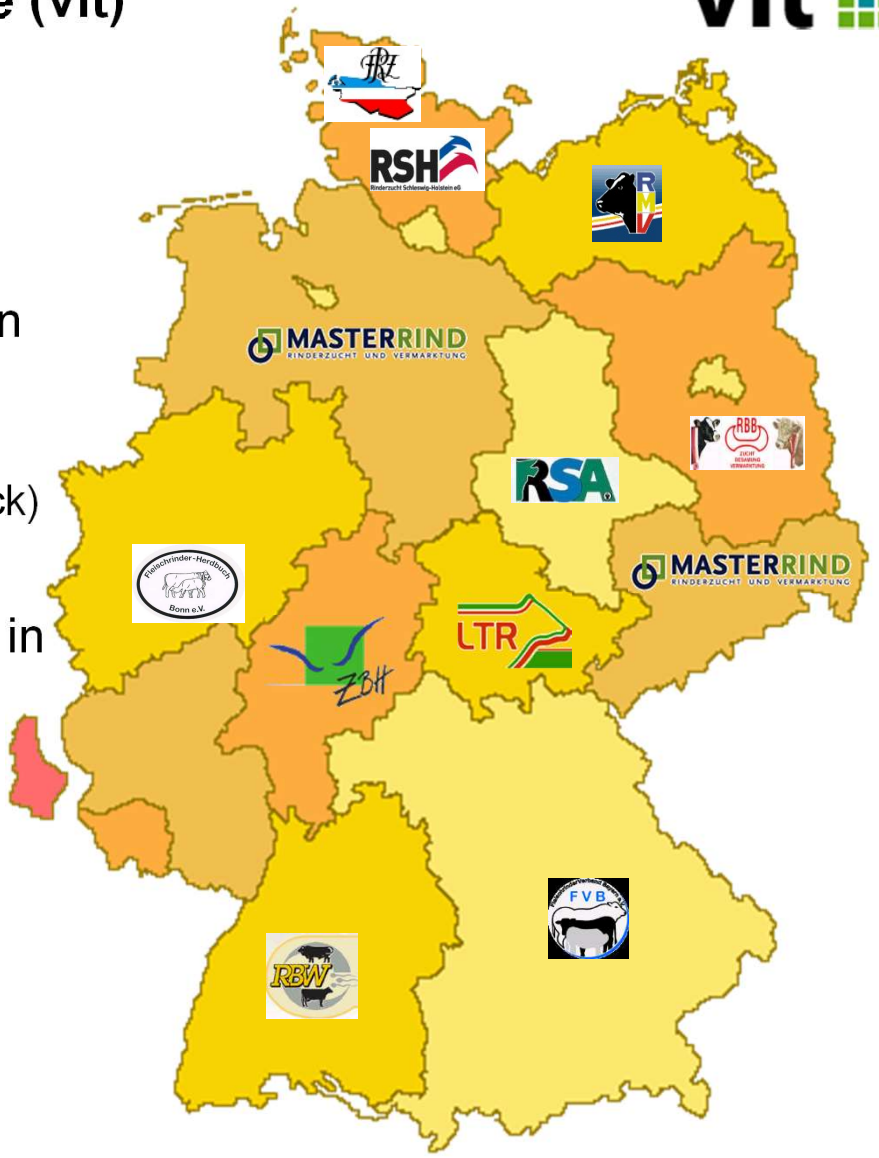
Breed	Born Male	Born Fem.	Total	200d m	200d f	200d total	Rec. %
Angus	4331	4181	8512	3112	2601	5713	67,1
Blonde d' A.	706	785	1491	397	441	838	56,2
Charolais	3877	3657	7534	2564	2395	4959	65,8
Simmental	5151	5018	10169	3597	3477	7074	69,6
Hereford	772	718	1490	558	460	1018	68,3
Limousin	4885	4892	9777	3136	3118	6254	64,0
Saler	318	290	608	202	157	359	59,0
Uckermärker	1871	1946	3817	1430	1483	2913	76,3

Source: ADR Jahresbericht (Annual Report) 2015

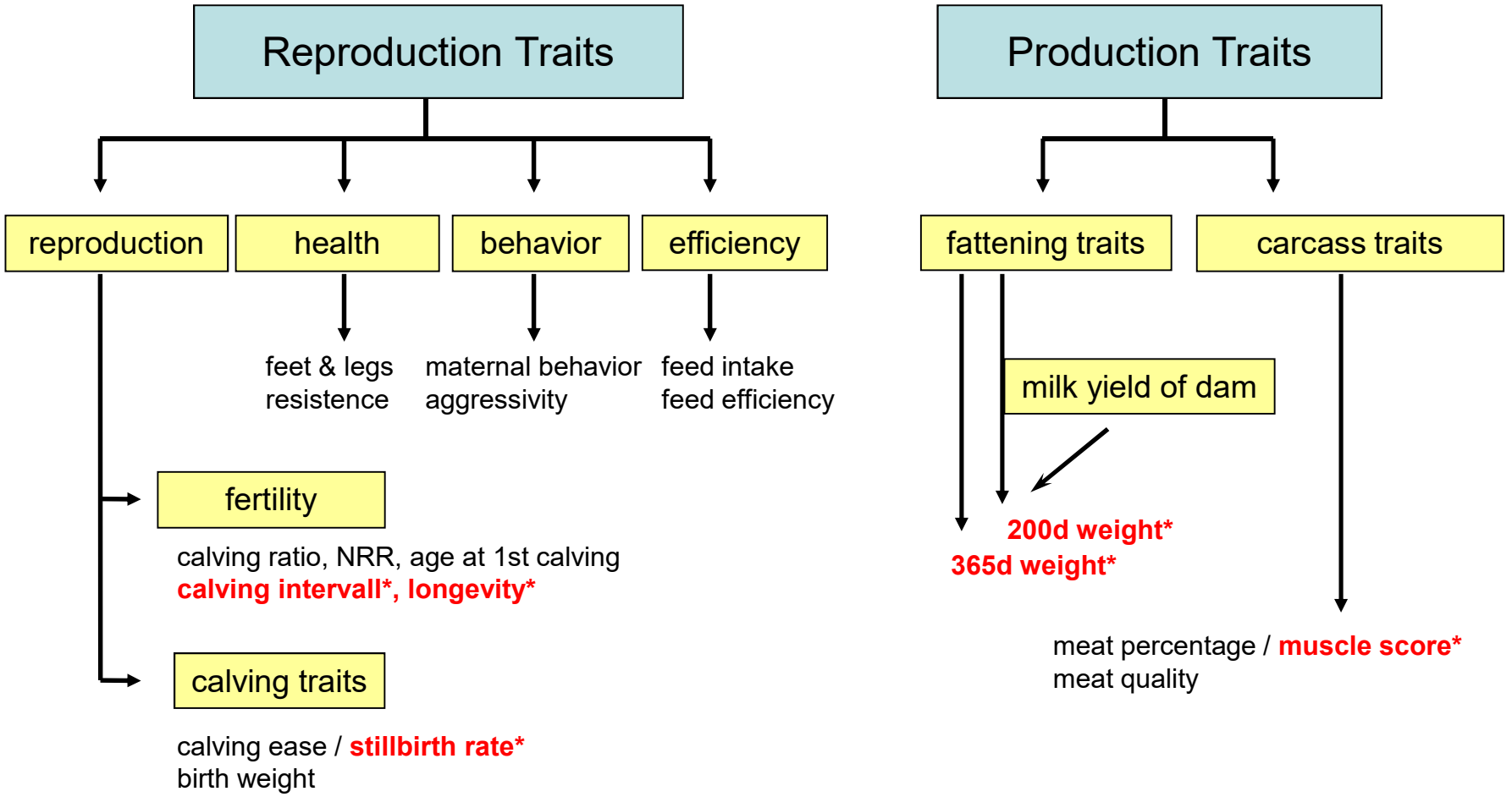
Genetic Evaluation (GE)

Genetic evaluation for beef cattle (vit)

- In charge of 10 licensed BO
- 8 purebred beef breeds included in genetic evaluation for beef **production traits**
  (Cha, Lim, BA, Sim, Sal, Ang, Her, Uck)
- 11 purebred beef breeds included in genetic evaluation for female **reproduction traits**
  (+ Gal, RHV, Highland)
- Supervising committee
  (BO, BDF, vit, Univ.)



Economically important traits in beef cattle



*) Considered in GE

Observed traits included in GE for production traits

- Field
  - birth weight (BW)
  - 200d-weight (W200)
  - 200d-muscle score (MS200)
  - 365d-weight (W365)
  - 365d-muscle score (MS365)
- Test Station (1)
  - 365d-weight (W365S)
  - 365d-muscle score (MS365S)
  - feed intake (FI)

Data horizon and genetic evaluation (production)

- Field data from 1997 onwards
  - BLUP Multitrait Animal Model
- Test station data from 1999 onwards
  - Most young bulls of the „Beef Cattle Herdbook Association Bonn“ (FHB) are tested on station (own performance)
  - BLUP Multitrait Animal Model
- Separate evaluation runs for field and test station traits
- Combination of (field and test station) estimates by index theory

Suboptimal Structure of Field Data

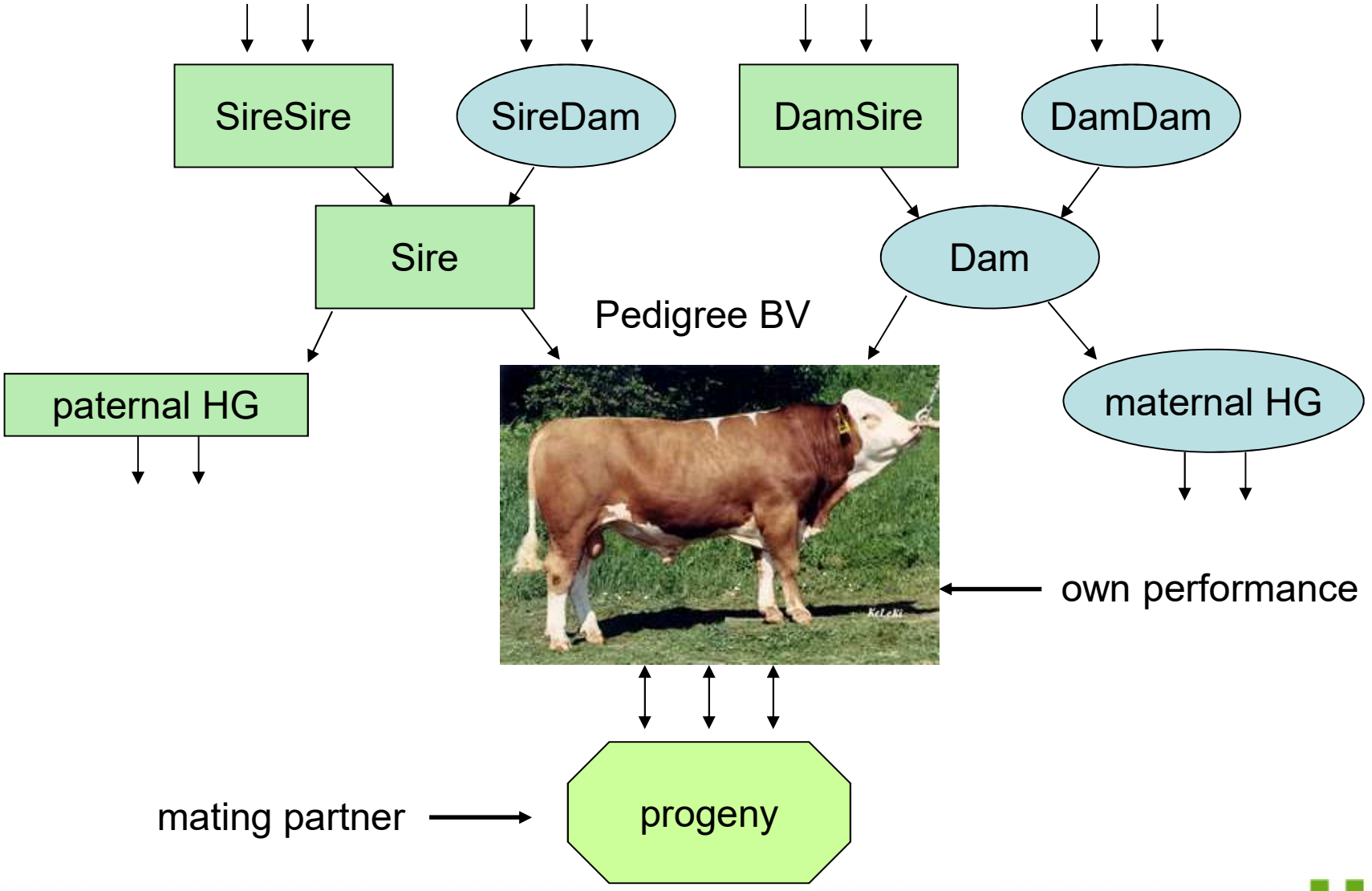
Suboptimal comparison structure to differentiate between genetic end environmental effects („one bull in one herd“)

<u>problem:</u>	sire and herds*year often confounded Genetic potential only estimable via bull sires
<u>solution:</u>	AI reference bull system (→ like in France) should be expanded

Attributes of BLUP Animal Model

- Simultaneous estimation of environment and genetic effects
  - Mutual correction of environmental and genetic effects
- Consideration of genetic level of mates
- Consideration of genetic competition within environmental comparison groups
- Optimal combination of all sources of available information
  - Performance of related animals
  - Genetic correlations between traits considered

Information Used in an Animal Model



GE Model for Field Records

Environmental effects

- herd * birth year (random)
- sex of calf
- single/twin
- month of birth
- parity * age of the dam at calving
- age at test (regression) nested within breed and sex

Genetic effects

- direct genetic effect (all traits)
- maternal genetic effect (weight, 200d)

Transformation of EBVs

- Field
  - Birth weight
  - 200d-weight, direct
  - 200d-weight, mat.
  - 365d-weight, direct
  - 200d-muscle score
  - 365d-muscle score
- Station
  - 365d-weight, direct
  - 365d-muscle score
  - Feed intake

The resulting EBV of both runs (field data, station data) are combined via selection index theory

The EBV for weights are transformed to EBV for daily gain:

➔Maternal EBV for daily gain 200d
➔EBV for daily gain 365d
➔EBV for conformation score 365d

} Relative EBV (100 / ± 12)

Traits & Models, reproduction traits

- R & D – project (2011-2012): GE for reproduction traits in beef cattle
- Introduced as routine evaluation (December 2012)

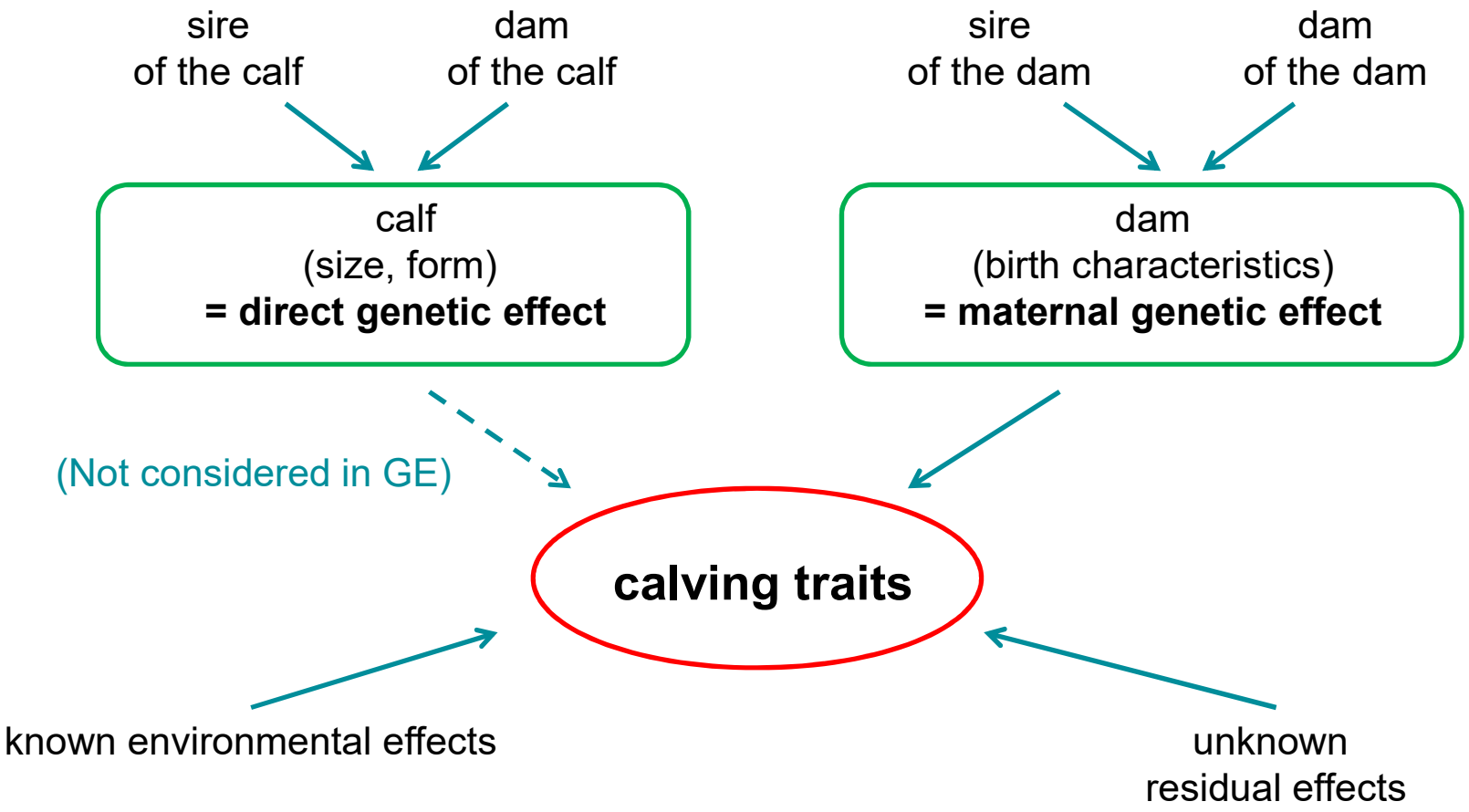
BLUP Multitrait Animal Model (repeated records) for reproduction traits:

- **Age at 1st calving**
- **Calving interval**
- **Calving ease**
- **Stillbirth rate**

Survival Kit (V. Ducrocq)

- Functional herd life (longevity) → **Number of calvings**
- Censored records
- Sire – MGS – model
- Back solution for cows

Genetic model for calving traits



GE models

Calving traits (CE, SB)

Environmental effects

- herd * calving year (random)
  (incl. direct effect of calf sire)
- sex of calf
- parity * age of the cow

Genetic effect

- Maternal genetic effect

Calving interval

Environmental effects

- herd * year (random)
- NS or AI
- parity * age of the cow

Genetic effect

- Maternal genetic effect

Economic Weights
Relative Breeding Values: Prod. (RZF) & Reprod. (RZL)

Traits (RZF)	Economic weights
Maternal EBV daily gain 200d	40 %
EBV daily gain 365d	40 %
EBV muscle score 365d	20 %

Traits (RZL)	Economic weights
Calving interval (Fertility)	40 %
Stillbirth rate (Calving)	30 %
Number of calvings (Longevity)	30 %

Current base and scale of Relative EBV (December 2015):

- Breed specific (rolling) base — Progeny tested bulls born 2007-2011
- Mean of the index — 100 points
- Standard deviation of the index — 12 points

Frequency of Estimation, Publication

- GE for all traits is performed once a year (December)

- Publication rules (RZF):
  - Bulls and cows having a reliability of RZF ≥ 30 % are officially published
  - Bulls having at least 5 progenies and a reliability of RZF > 40 % are officially published in the top list
  - Cows having at least 1 progeny and a reliability of RZF > 30 % are officially published in the top list

- Publication rules (RZL):
  - Bulls having a reliability of RZL ≥ 30 % are officially published
  - Cows having two calvings are officially published (reliability ~ 20 %)

➔ www.vit.de

Summary classical GE for beef cattle in Germany (vit)

- Since 1997 estimation for breeding values for the **production traits**
  - ➔ Relative breeding value beef (**RZF**) in Germany
- Since 2012 estimation for breeding values for available **reproduction traits**
  - ➔ Relative breeding value reproduction (**RZL**)
- A Total Merit Index (production & reproduction) is not used for beef cattle in Germany, yet.
- GE for beef cattle is certified by ICAR since 2013 (CoQ)

INTERBEEF

- Germany takes part in INTERBEEF international evaluations since 2014
  - Countries: FRA, IRL, GBR, DFS, CZE, CHE, GER
  - Charolais, Limousin
  - Adjusted Weaning Weight (AWW)
  - Evaluation on the base of pedigree- and yield data of participating countries
- Simmental, AWW: Test runs, 1st routine eval. scheduled for Jan 2017
- Next breeds: Angus, Hereford
- Current R&D-projects:
  - CZE: Genetic evaluation for calving traits (CE, SB)
  - UK: Carcass traits
  - GER/vit: Reproduction traits (CI, Age 1st Calving, Number of calvings at 78 month)
  - IRL: Including crossbred animals

INTERBEEF

- Benefits:
  - Harmonized animal identifications
  - Harmonized (adjusted) pedigrees accross countries
  - Set of comparable traits
  - Comparable EBV across countries on each country scale

➔ **Increased transparency for international marketing**

Genomic evaluations ?

- Current situation in all countries (except France)

  Small populations ➔ to small reference samples for estimation of SNP-effects

  ➔ Solution: Joint reference samples across countries

  ➔ Precondition: Comparable phenotypes (for AWW now available)

- Further actions / political agreements)
  - Establish cooperations (like EUROGENOMICS in HOL)
  - Country of origin should/must allways be included (France)

  - Example / Option:

  Germany genotyped already 300 Lim. bulls with reliable phenotypes

  Proposal:
  - Put 200 of these bulls into the french reference sample
  - Estimate SNP-effects for AWW
  - Use the other 100 bulls for validation
  - If successful: ➔ Start with GE for young candidates

Thank you!

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