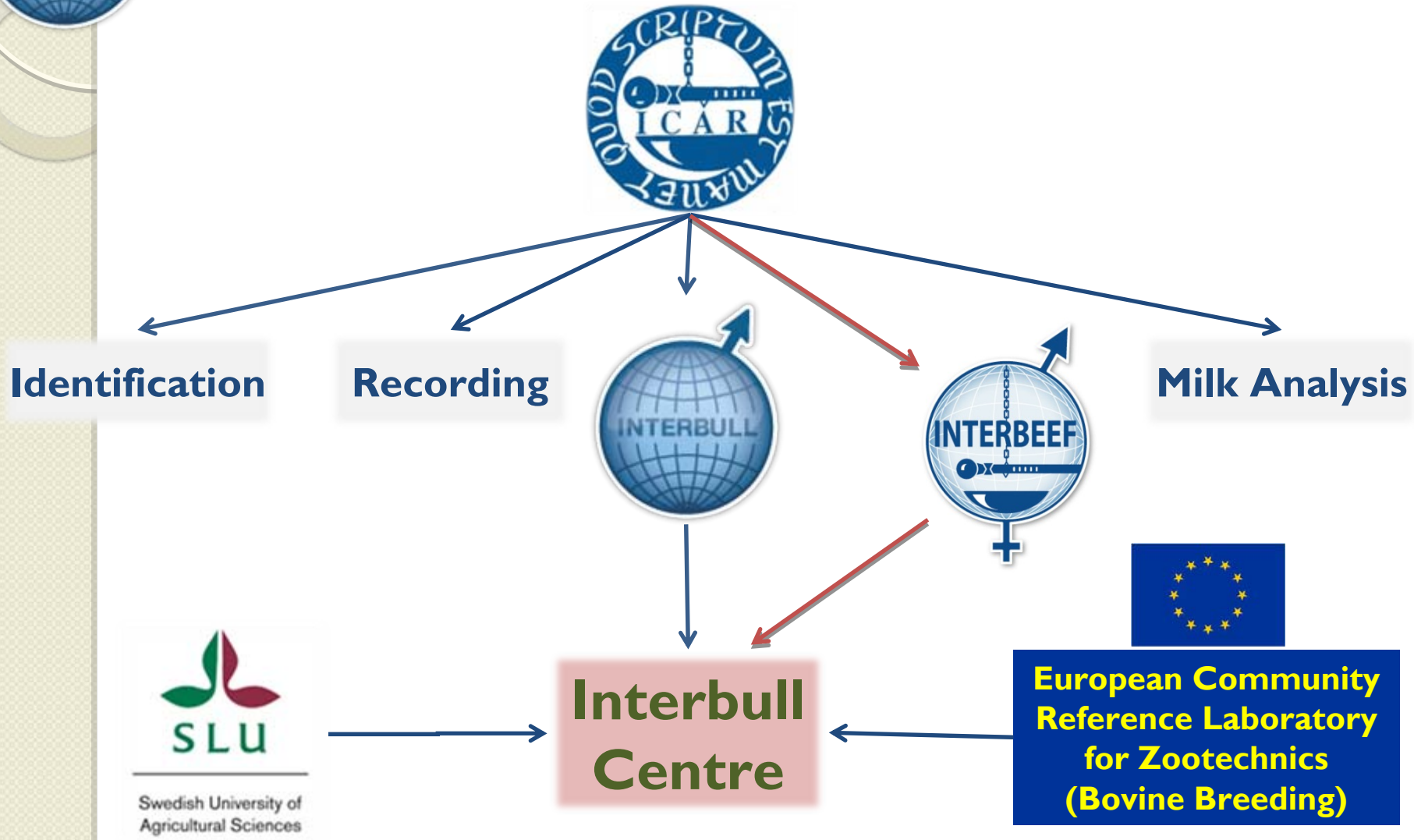
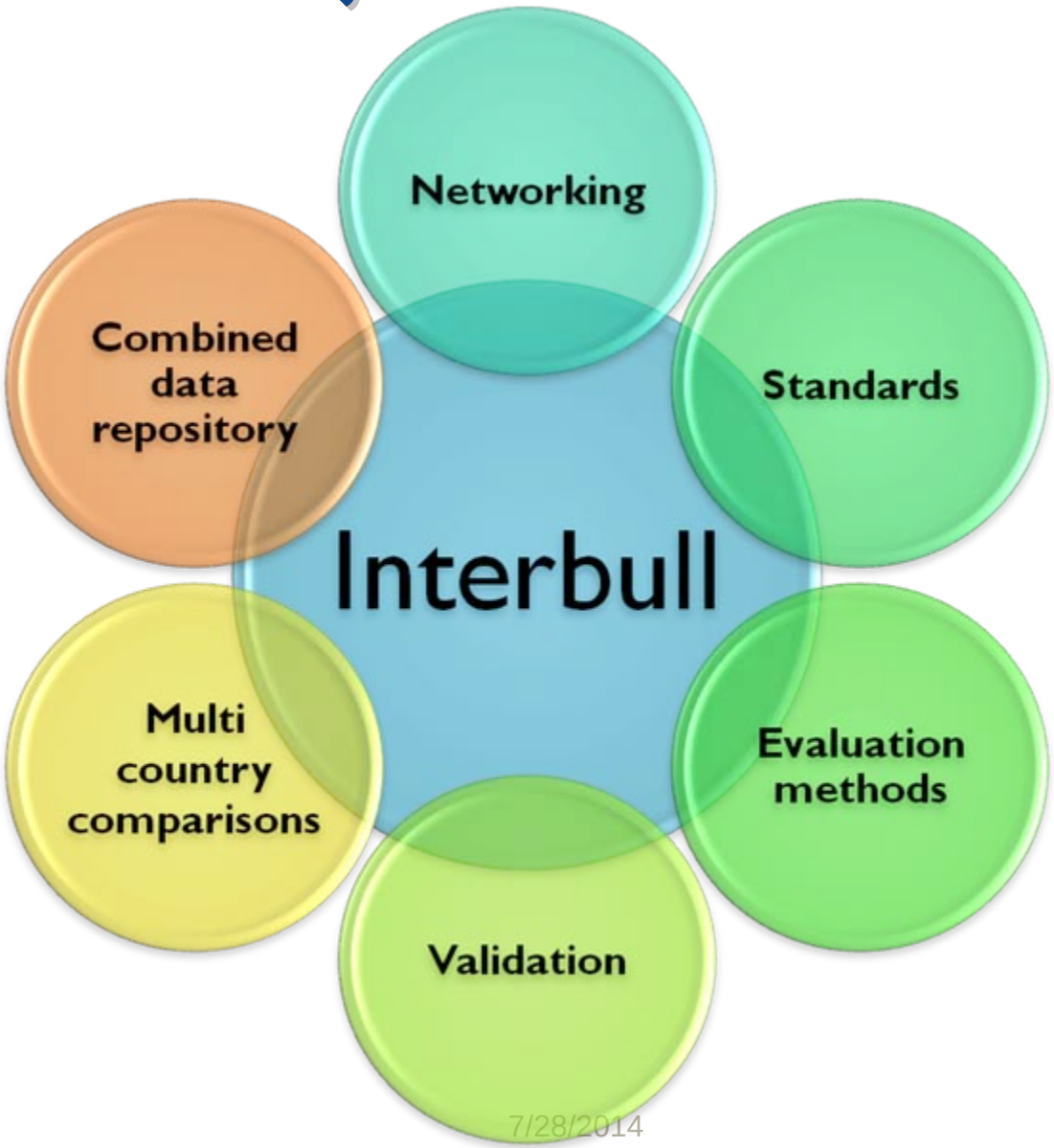
João Dürr – Interbull Centre Director
Hans Wilmink – President ICAR

Development of ID techniques for genetic evaluation

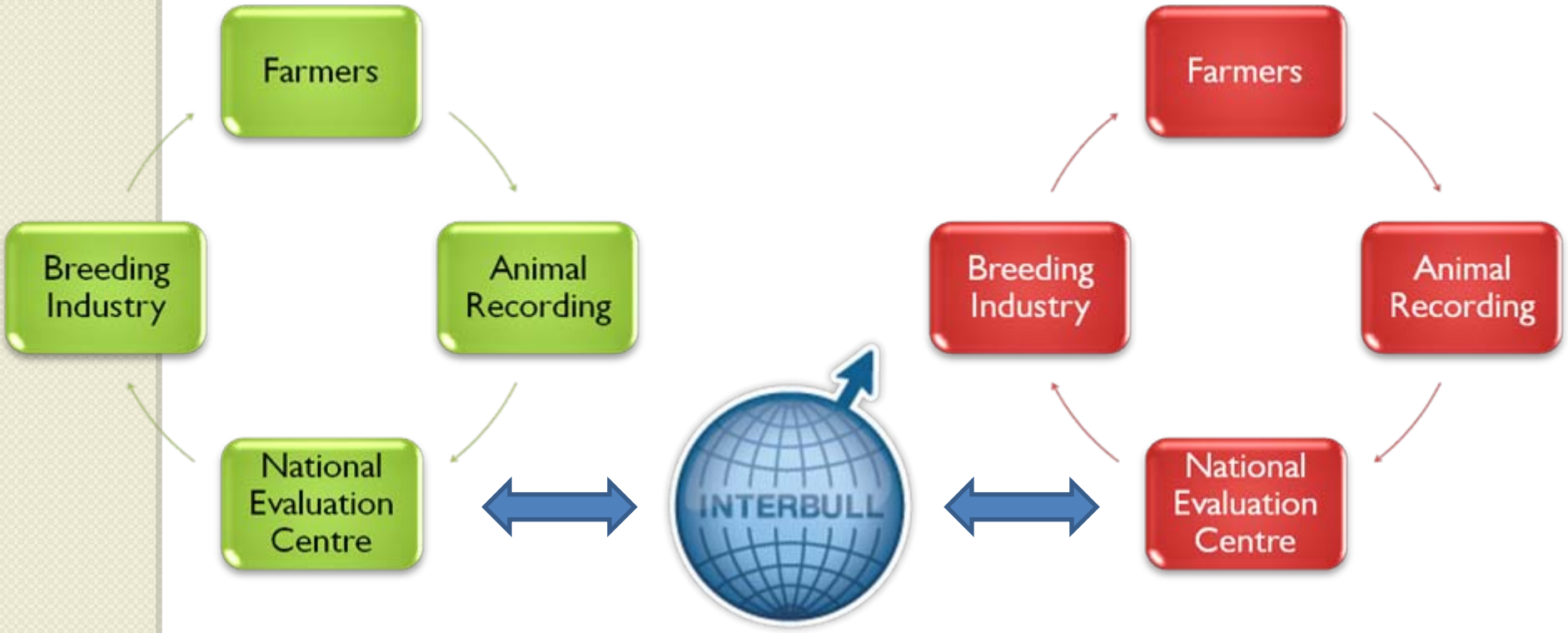
Organization Structure



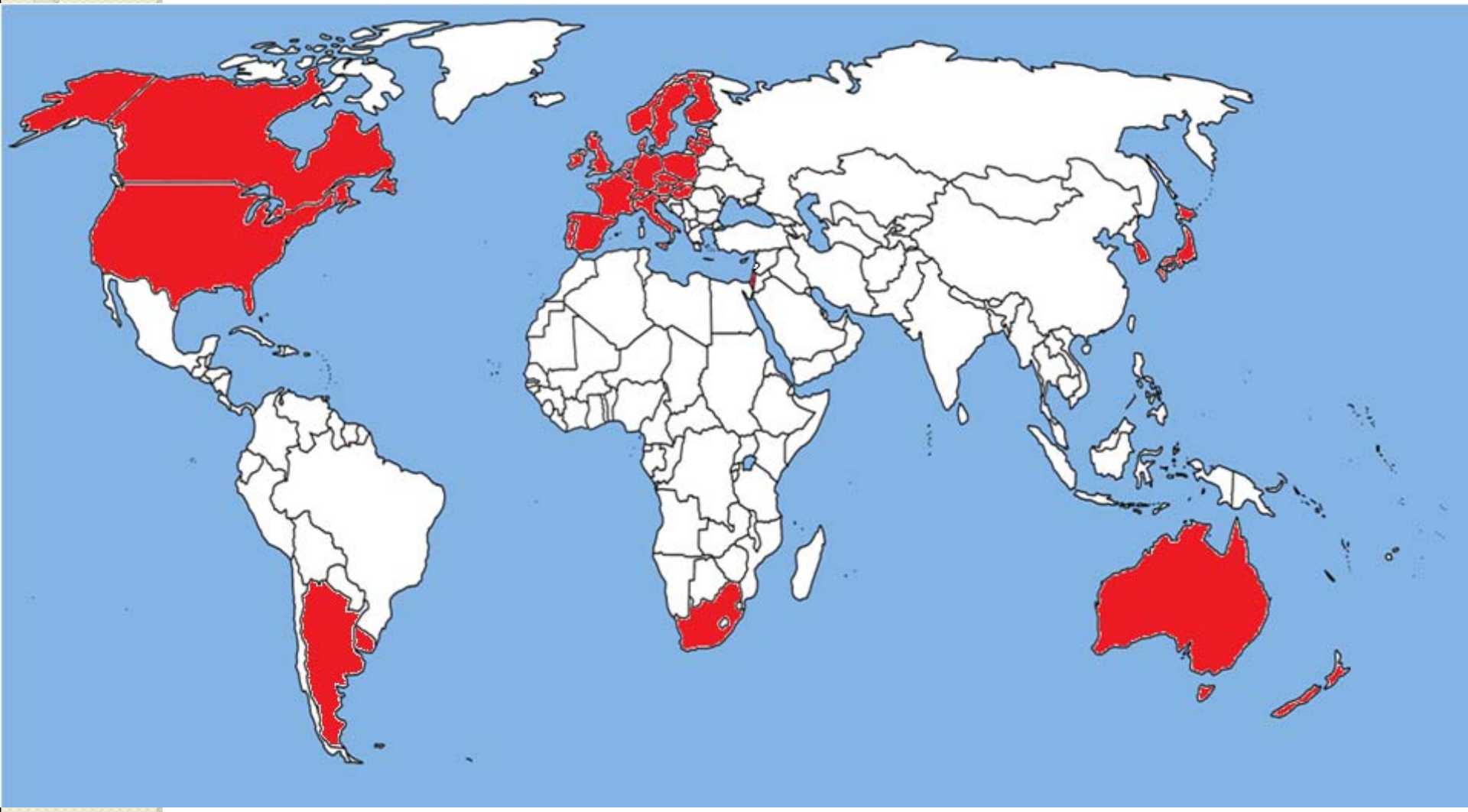
Interbull objectives



Interbull's role



Interbull Map – 32 countries



Populations in MACE (2014-04)

Breed Group	Production (3)	Conformation (23)	Udder Health (2)	Longevity (1)	Calving (4)	Female Fertility (5)	Workability (2)	TOTAL (40)	Number of publishable proofs (production)
Brown Swiss	10	9	10	10	5	9	6	60	9 885
Guernsey	6	4	6	6	0	6	0	28	1 060
Holstein	31	25	29	21	16	20	9	151	135 646
Jersey	11	9	8	9	0	9	4	50	11 055
Red Dairy Cattle	14	9	13	10	7	11	5	69	14 388
Simmental	12	0	10	4	0	0	0	26	28 251
TOTAL	84	56	76	60	28	55	24	383	200 285

Interbull services portfolio

- International Pedigrees
- National EBVs Validation
- Documentation on national and international genetic evaluations
- MACE evaluations
- International forum
  - Events
  - Publications
- International guidelines and standards
- National GEBVs Validation
- Genomic evaluations for Brown Swiss (Intergenomics)
- Under implementation:
  - GMACE evaluations
  - International genomic database

Interbeef

- Different methodology developed
  - Common phenotypic data base
  - Country-specific model
  - Genetic correlation between populations
- Populations
  - Charolais, Limousin
  - Denmark, Finland, France, Ireland, Norway, Sweden and the United Kingdom, Germany, Czech Republic, Spain
- Current developments
  - Increase number of traits
  - Include crossbred animals
  - Include genomic information

Genetic Improvement Essentials

Steps of the dairy cattle improvement process

Selection Goals

- Produces a lot of milk
- Milk has lots of fat, proteins
- Produces a calf per year
- Has no calving difficulties
- Stays healthy
- Lasts many years in the herd
- Minimizes greenhouse gas emissions

Information Database

- Identification of animals
- Relationships between animals
- Records of performance
  - *Milk production*
  - *Milk composition*
  - *Conformation*
  - *Reproductive performance*
  - *Health problems, treatments*
  - *Longevity*
- Genomic information

Statistical tools

- Genetic evaluation models
- Genetic parameters (correlations, heritability)
- Inbreeding, heterosis
- Selection indices
- Genomic evaluation models

Selection of parents of next generation

- Bulls for artificial insemination
- Cows for embryo transfer
- Cows within herds

Identification

- Standard ID
  - Country
  - Breed
  - Unique 12 digit

Recording

- Milk Production
- Lab results
- Events
- Conformation
- Health
- Genealogy
- Marker genotypes

Genetic Evaluation

- Pedigrees
- Individual performances
- Environmental + management descriptors

Country without animal identification and recording programs

- Suboptimal herd management practices
- Erratic technical support to dairy farms
- Ineffective programs for improving milk quality
- Lack of strategic planning for the sector as a whole
- Lack of effective traceability of animals and products
- Impossibility of genetic evaluation of livestock

Data exchange for genetic evaluation

GUIDELINES: ICAR STANDARDS FOR ANIMAL IDENTITIES

SECTION 1 – GENERAL RULES

SECTION 1.1 – ICAR GUIDING PRINCIPLES ON METHODS OF IDENTIFICATION

1.1.4 Recognized ICAR Standards for animal identities

1. Specific guidelines for use in data exchange for genetic evaluation (Interbull) and on printed documents, electronic documents and web pages where those evaluation results may be displayed are defined in section 9.

SECTION 9 – ICAR STANDARD METHODS OF GENETIC EVALUATION

9.1.1.2 The International Identity used in data exchange for bovine genetic evaluation

1. Animals should be identified in accordance with the Guiding Principles set out in section 1.1 of the International Agreement of Recording Practices. Particular attention is drawn to the official identity given to an animal remaining unique to that animal at all times, used throughout the life of the animal, both in the country of birth and also by all other countries and never be used again for any other animal of the same or different species.

SECTION 9 – ICAR STANDARD METHODS OF GENETIC EVALUATION

9.1.1.2 The International Identity used in data exchange for bovine genetic evaluation

2. The International Identity of the animal used by Interbull for genetic evaluation purposes and for interchange of evaluation data, is composed of a 19-character string comprising the following components:

Item	Length	Position	Summary / Description
Breed	3 character	1 – 3	The three-character breed code as defined in the Appendices to these guidelines, Section 8.
Country / Nationality	3 character	4 – 6	The three-character country code in accordance with ISO 3166, representing country of birth or other nationality as deemed by Interbull (see points 4-8 below).
Sex	1 character	7	A single character gender code (M=male, F=female)
Animal Identifier	12 character	8 - 19	A 12-character, alpha-numeric (A-Z, 0-9) animal identity. Frequently the same as or close to that used in national identification systems. (See points 5 to 7 below)

International Animal Identity for genetic evaluation purposes

BBBCCCS000000000000

Example: BSWUSAM000000159482

SECTION 9 – ICAR STANDARD METHODS OF GENETIC EVALUATION

9.1.1.2 The International Identity used in data exchange for bovine genetic evaluation

3. All component parts of the International Identity of the animal should be kept intact. If for any reason, modification of the original animal identity becomes necessary, it should be considered as a re-identification and fully documented by a cross-reference table relating the original animal identity to the new animal identity. Such cross-reference information to be made available on request by the authority or organization which makes or authorizes the re-identification to ICAR or other ICAR affiliated or subsidiary organization, including Interbull, along with the original or master identity of the animal.

SECTION 9 – ICAR STANDARD METHODS OF GENETIC EVALUATION

9.1.1.2 The International Identity used in data exchange for bovine genetic evaluation

4. The primary International Identity of the animal and its Nationality component, shall normally be those assigned from birth. Or as deemed by Interbull from time to time, country of primary registration may be used, where that is not the same as country of birth. Attention is also drawn to paragraph 10.2.7.4 of these Guidelines, discouraging the use of manufacturer RFID device identity codes in this context.

5. The Animal Identifier component used will often correspond to the identity used in National or other local identification systems such as those mandated or permitted by local legislation. The National identity used may be modified where necessary to enable it to fit the criteria listed here in points 6 to 8 consistent with a unique International Animal Identity being maintained.

SECTION 9 – ICAR STANDARD METHODS OF GENETIC EVALUATION

9.1.1.2 The International Identity used in data exchange for bovine genetic evaluation

6. Permitted characters.

The Animal Identifier component should consist of 12 alpha-numeric characters (including check digits where used), with leading zeroes inserted where the national or other official identity being used is initially less than 12 characters. These 12 characters should contain only ASCII upper case letters A-Z or numbers 0-9.

The following characters should NOT be used in the International Identity of the animal:

a) spaces, lower case letters,

b) language specific or other script specific or non-ASCII alphabetic special characters,

c) graphic signs used as field separators in data handling, i.e. dot (.), comma (,), semi-colon (;), colon (:), backslash (\), forward slash (/), tilde (~), asterisk (*) or hyphen (-).

SECTION 9 – ICAR STANDARD METHODS OF GENETIC EVALUATION

9.1.1.2 The International Identity used in data exchange for bovine genetic evaluation

7. Where the identity of the animal used in a national identification system originally includes a country identifier using a 2-character ISO 3166 country code (for example as part of a visible eartag identity), then it is recommended this country code be omitted from the International Identity and the equivalent ISO 3166 3-character country code be used instead, in positions 4-6 of the International Identity. Reason: for simplicity of the International Identity and to avoid clashes or possible conflicts between the country of birth/nationality used in positions 4-6 as deemed by Interbull and the eartag nationality such as may appear in tags used in some counties for imported animals and/or replacement tags.

SECTION 9 – ICAR STANDARD METHODS OF GENETIC EVALUATION

9.1.1.2 The International Identity used in data exchange for bovine genetic evaluation

8. Where the identity number of the animal used in a national electronic or RFID identity scheme includes the ISO 3166 3-digit numeric country code then it is normally preferable to use the equivalent ISO 3166 3-character alphabetic country code in the Nationality component of the International Identity of the animal, used for genetic evaluation. However, in situations where this may compromise the uniqueness of the overall International Identity so derived, then the ISO 3166 3-digit numeric country code may be carried forward from the national electronic identity to the Nationality component of International Identity in place of the preferred 3-character ISO 3166 country code. E.G. USA vs. 840.

9. By preference, the full International Identity should also be shown in printed documents, electronic documents and web pages where the genetic evaluation results are also displayed.

SECTION 10 – TESTING OF DEVICES USED IN ANIMAL IDENTIFICATION

10.2.5.4 The use of Manufacturer codes and Country codes

Manufacturer codes (900-998 series) should only be used in connection with electronic identification (RFID) devices, in accordance with ISO 11784 and section 10 of these Guidelines, including Annex 10.2.2 Code of Conduct for RFID device manufacturers.

Where a competent national authority has assumed the responsibility for ensuring and maintaining the uniqueness of the RFID identification code for a specific species in that country, the ISO 3166 3-digit numeric country code may be used in place of the manufacturer code in the electronic identity or RFID of that specific species of animal.

The use of manufacturer codes in the International Identity used for genetic evaluation purposes is discouraged (Section 9.1.1.2).

Conclusions

- Animal improvement involves integrating animal identification, animal recording and genetic evaluation programs, which are the essence of the ICAR mandate.
- Countries lacking a solid infrastructure for animal identification and recording cannot establish their own genetic evaluation services and, consequently, depend permanently on imported genetics without having an actual control of the selection process.
- The globalization of the dairy breeds created the need for international comparisons of livestock and Interbull + Interbeef provide the network for harmonization of methods and procedures, as well as regular international genetic evaluations for the most important traits.

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THANK YOU!