75th EAAP Annual Meeting
1/5 September 2024 - Florence, Italy
Session 51. Genetic progress vs animal welfare?

The evolution of dairy cattle breeding objectives

Raffaella Finocchiaro – ANAFIBJ

Francesco Tiezzi – University of Florence

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EFFAB European Forum of Farm Animal Breeders

Università degli Studi di Padova

Università degli Studi Firenze
DAGRI Department of Agriculture, Food Environment and Forestry

Thanks for the invitation by

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Genetics Commission

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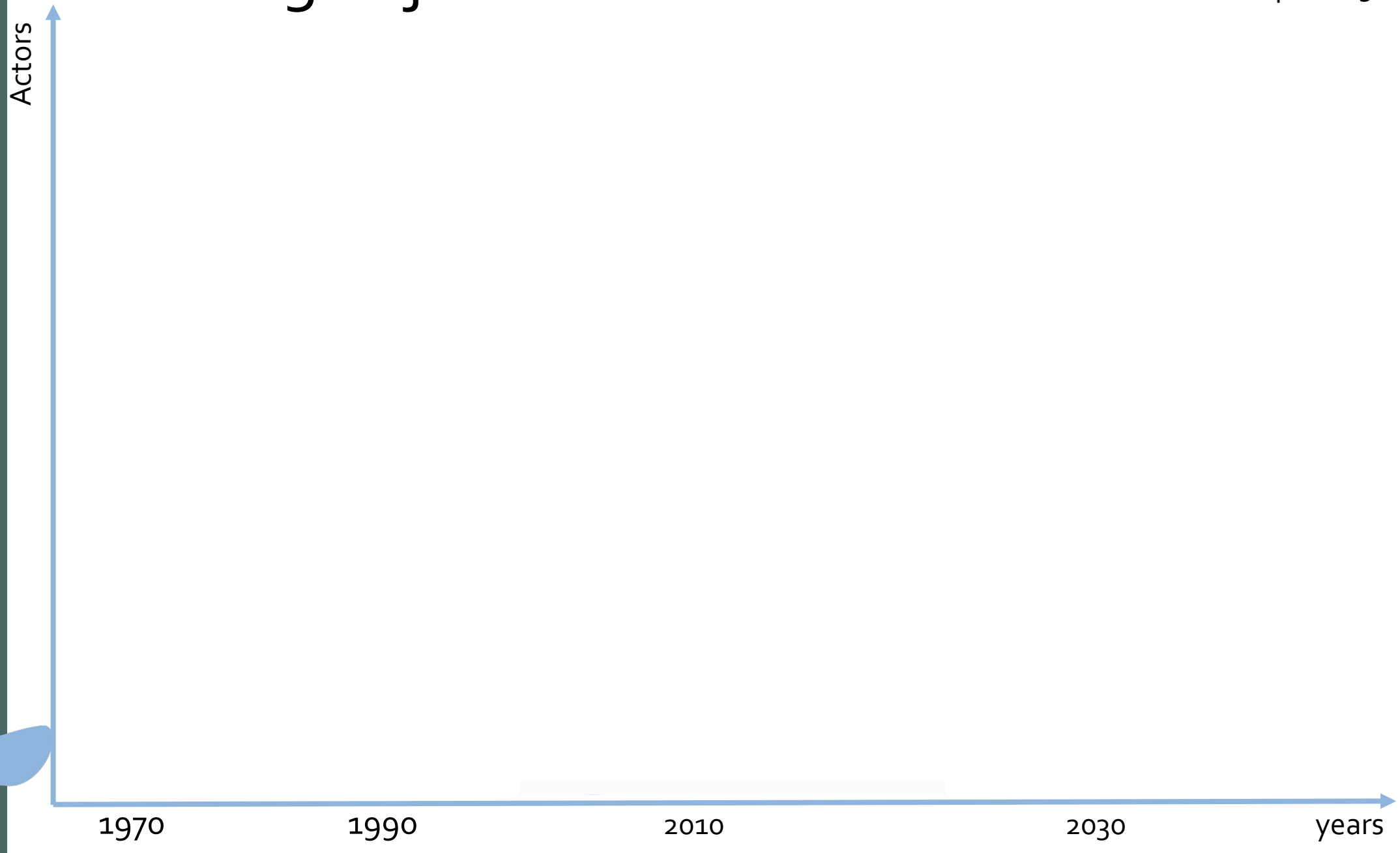
Breeding objectives evolution

from: Cassandro – Aspa 2019



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Breeding objectives evolution

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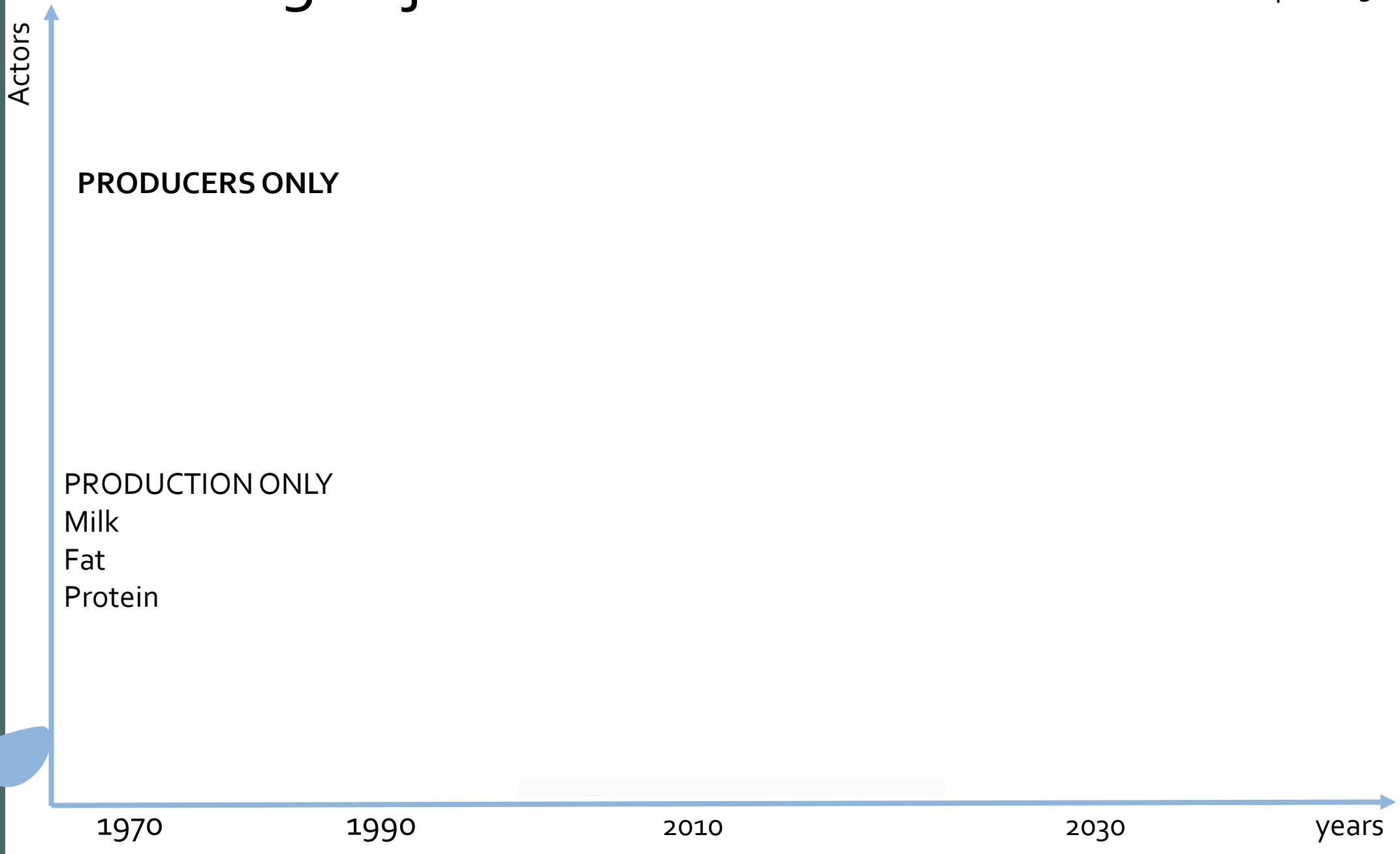

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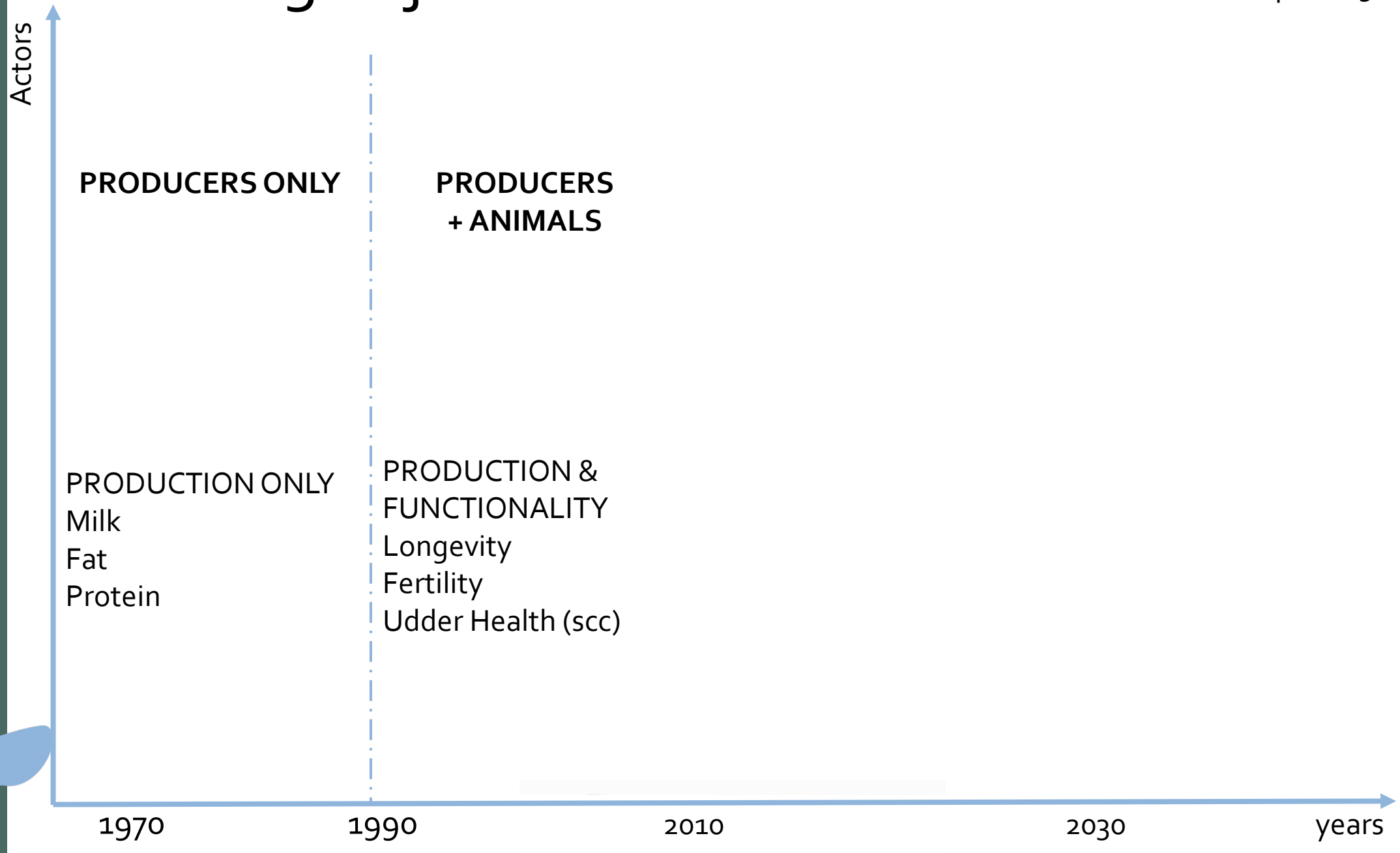

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Breeding objectives evolution

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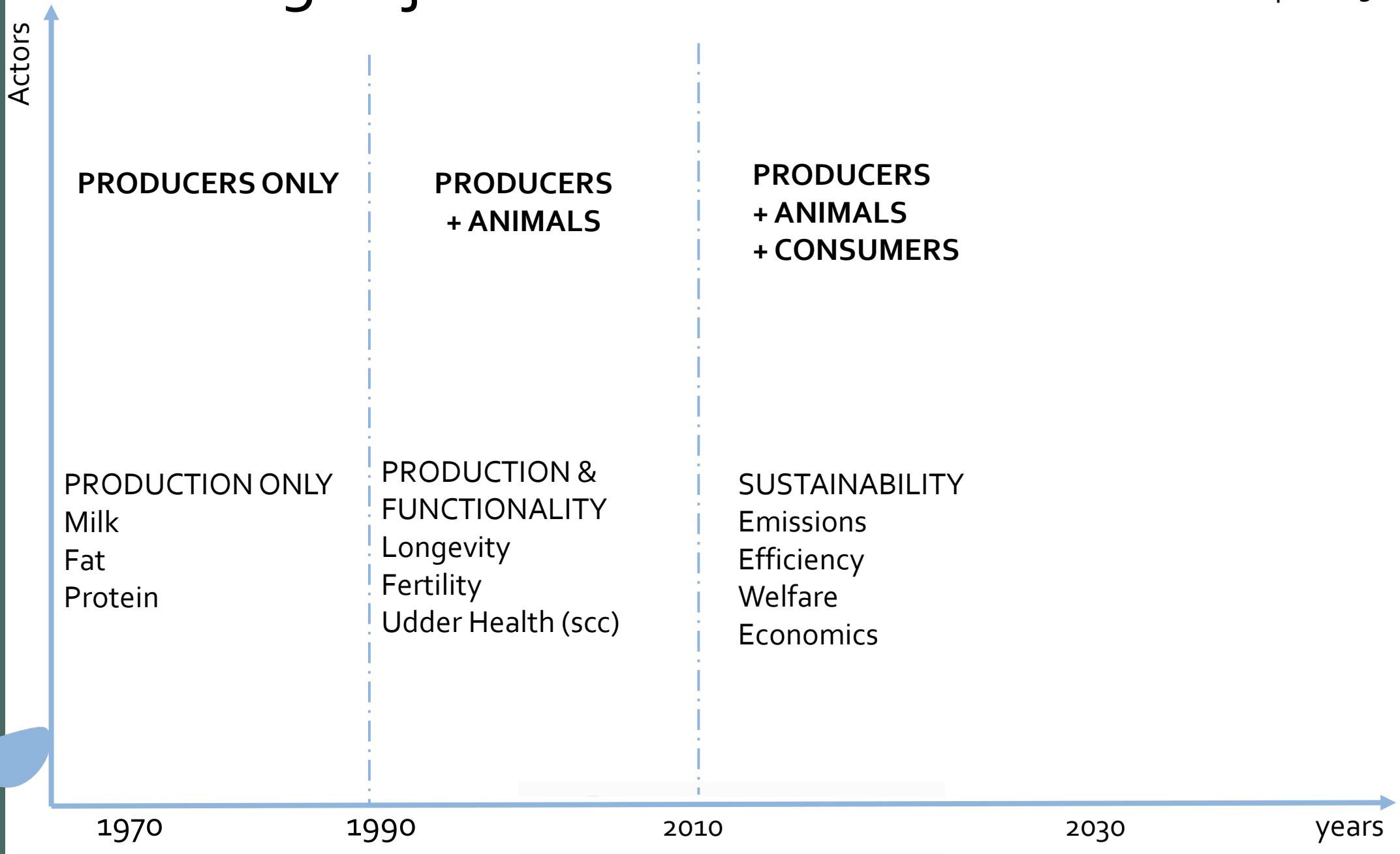

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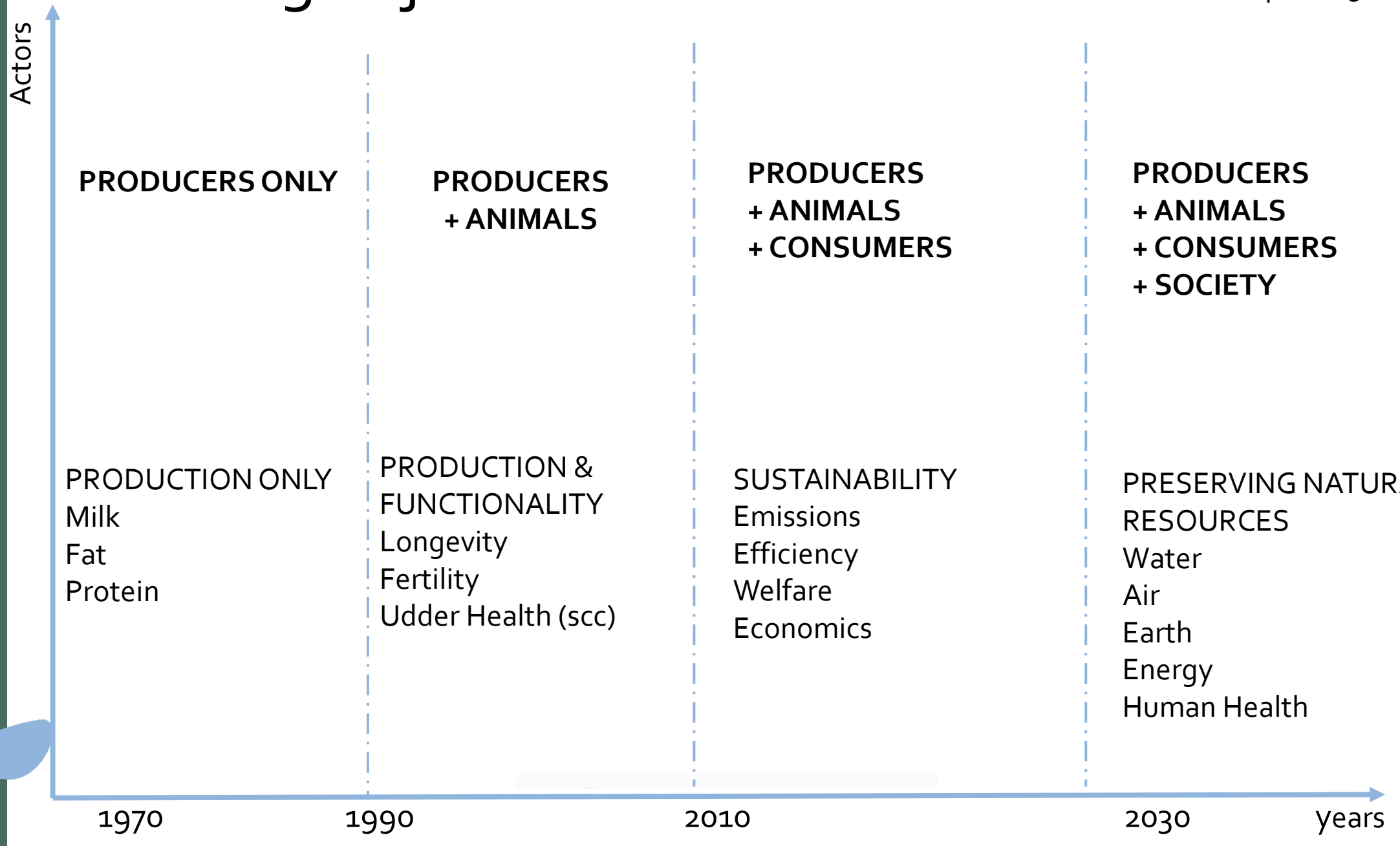

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Breeding objectives evolution

from: Cassandro – Aspa 2019

Actors

PRODUCERS ONLY

PRODUCERS + ANIMALS

PRODUCERS + ANIMALS + CONSUMERS

PRODUCERS + ANIMALS + CONSUMERS + SOCIETY

PRODUCTION ONLY
Milk
Fat
Protein

PRODUCTION & FUNCTIONALITY
Longevity
Fertility
Udder Health (scc)

SUSTAINABILITY
Emissions
Efficiency
Welfare
Economics

Air
Earth
Energy
Human Health

1970 1990 2010 2030 years

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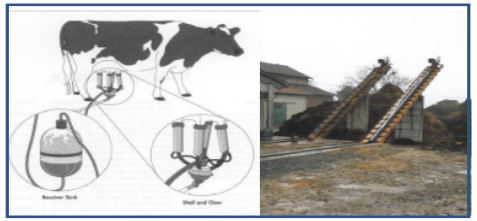
Evolution of the livestock system

LMF — **LIF** — **LPF** — **LOF**

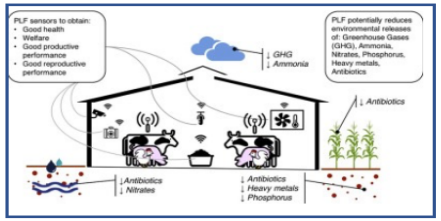


Livestock Mechanization Farming

- Mechanization
- Milking machine
- Less manual labor

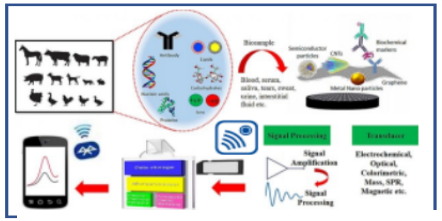
Livestock Intesive Farming

- Infrastructure (LMF)
- Nutrition
- Quantitative Genetics
- Recording data



Livestock Precision Farming

- Livest. Intensive (LIF)
- Automation/Robot
- Genomic analysis
- Management data
- Big-data



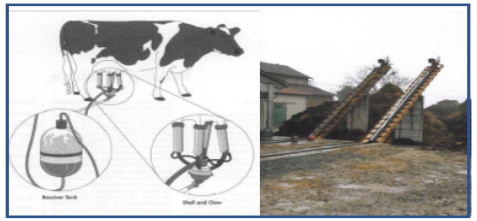
Livestock Holistic Farming

- Precision livestock farming (PLF)
- High-performance phenotyping
- Traits ontologies
- In-/Cross-Breeding
- Genome editing
- Microbiome
- Deep/Machine learning
- Artificial Intelligence

Evolution of the livestock system

LMF **LIF** **LPF** **LOF**

1970
1.0



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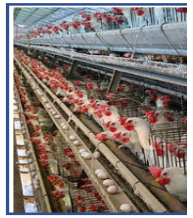

Livestoc Farming

- Infrastr
- Nutritic
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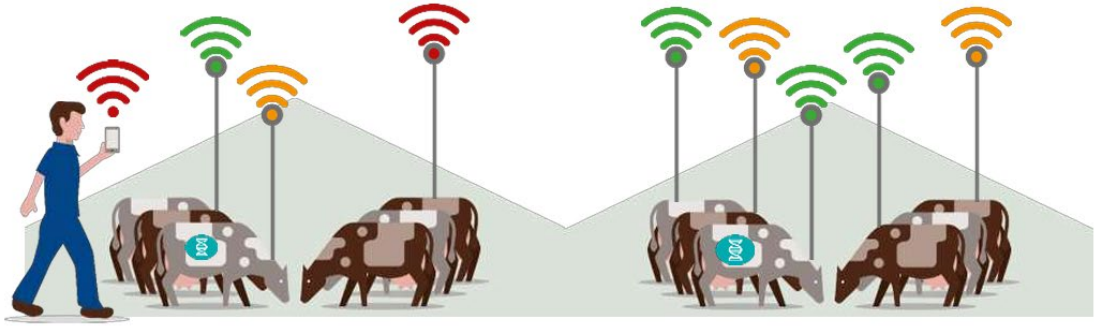
- Recorc

WHAT WE WANT



PREDICT – PRESCRIBE – PERFORM

Integrating traditional and new data sources to enable Smart Herd Management

van der Beek et al. ICAR 2017

BETTER COWS | BETTER LIFE

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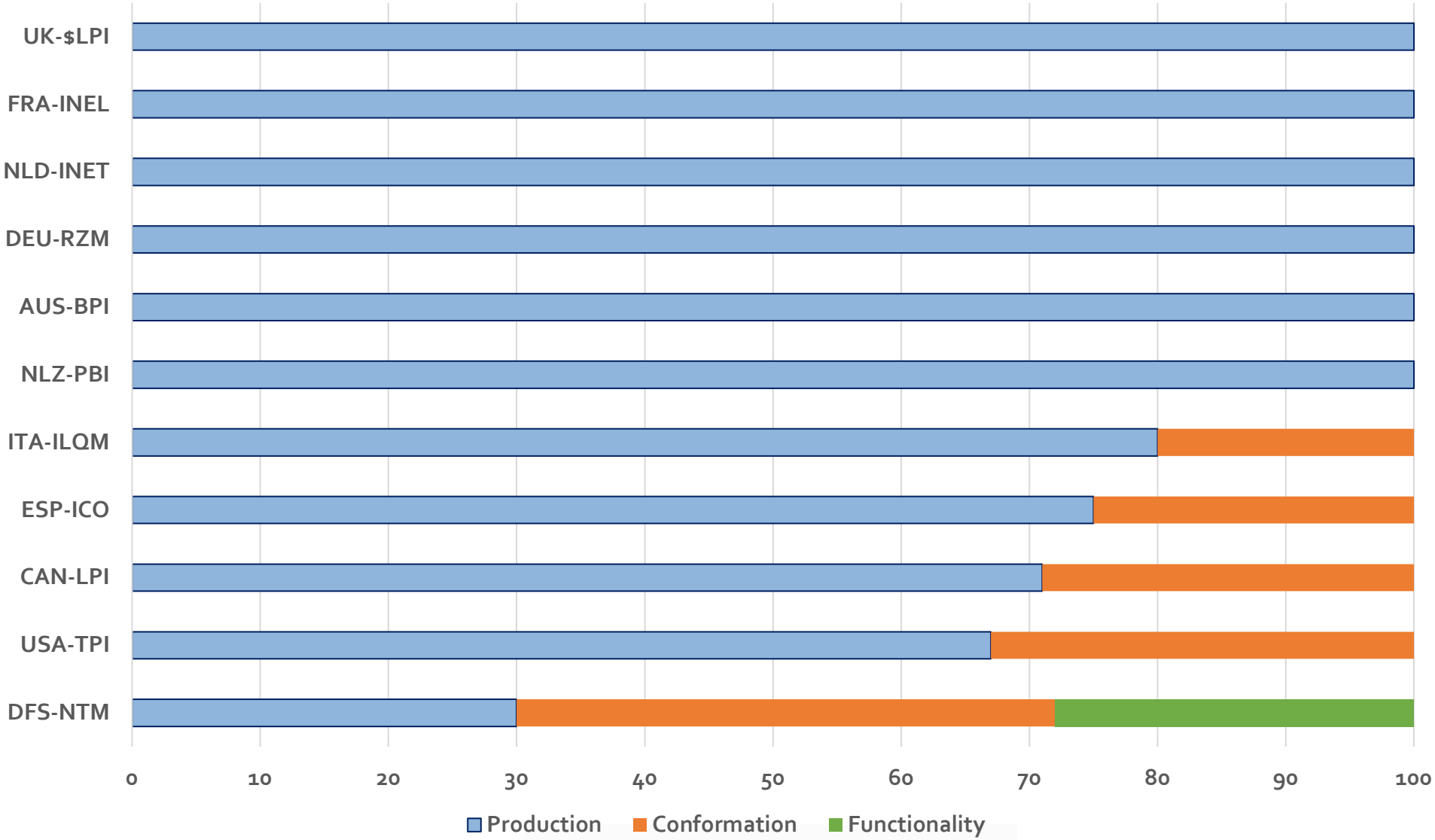
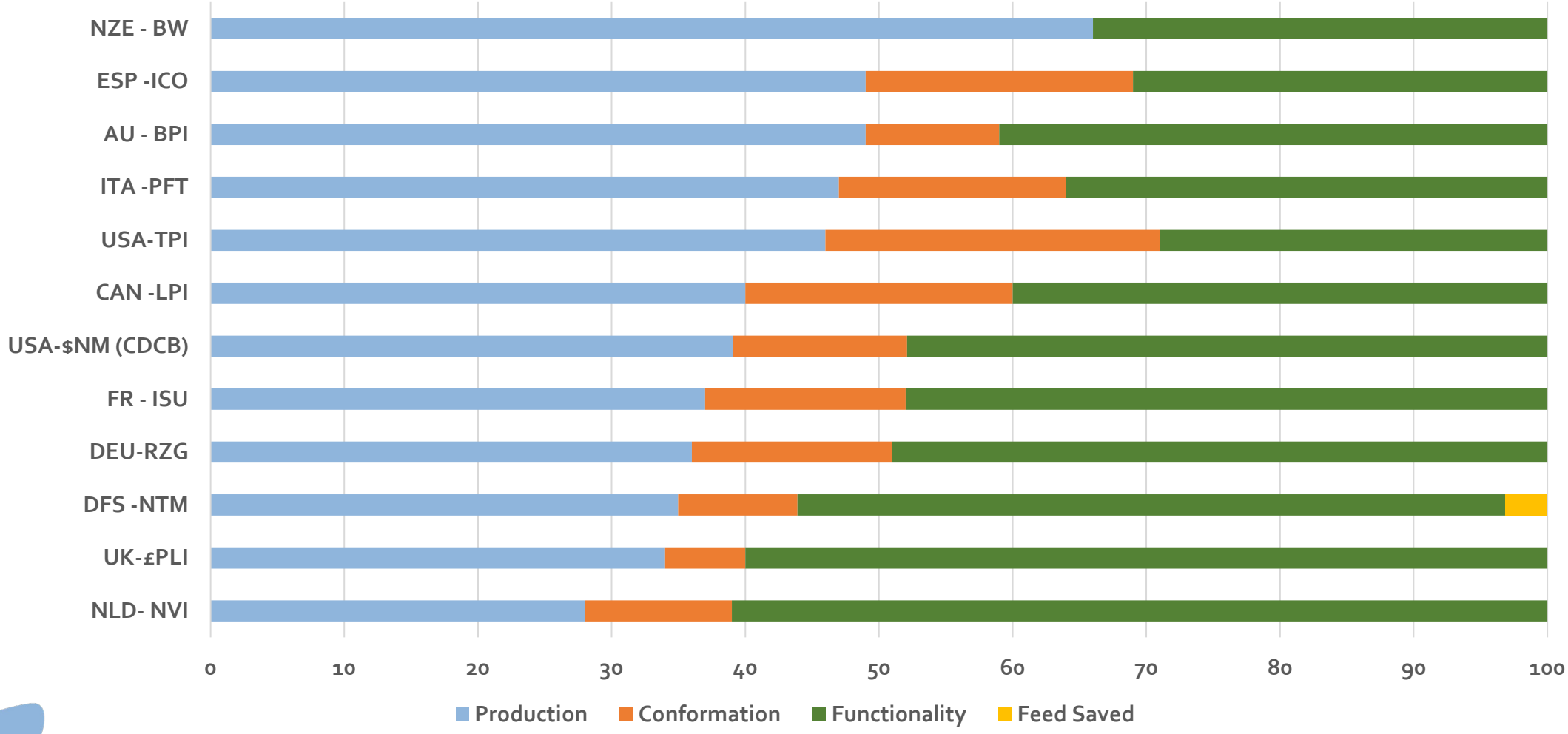
World breeding goal Evolution '90s

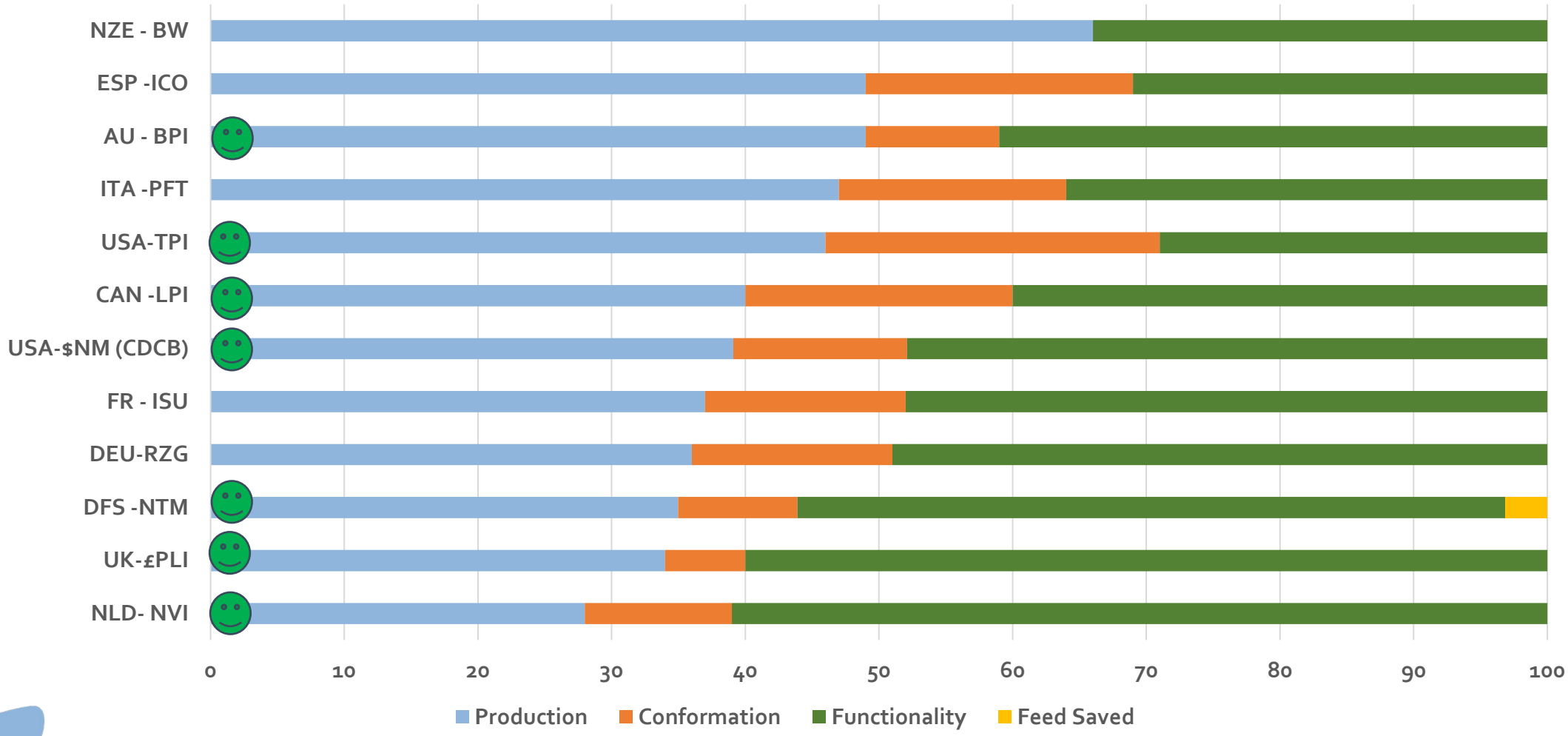


World breeding goal Evolution (today)



World breeding goal Evolution (today)

Countries with **Feed Efficiency** trait included in the breeding goal



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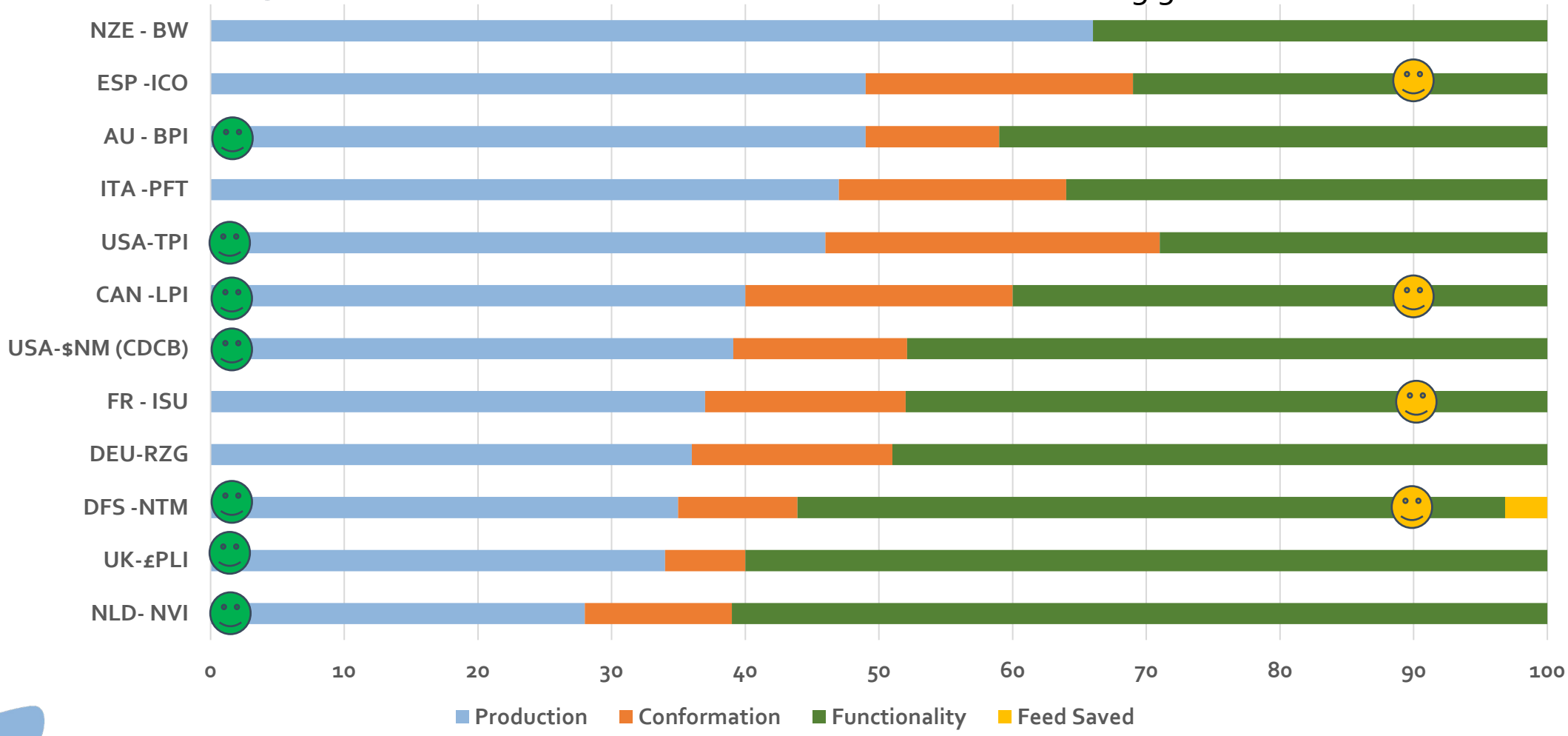
World breeding goal Evolution (today)

Countries with **Feed Efficiency** trait included in the breeding goal

Countries with **Hoof Health** trait included in the breeding goal



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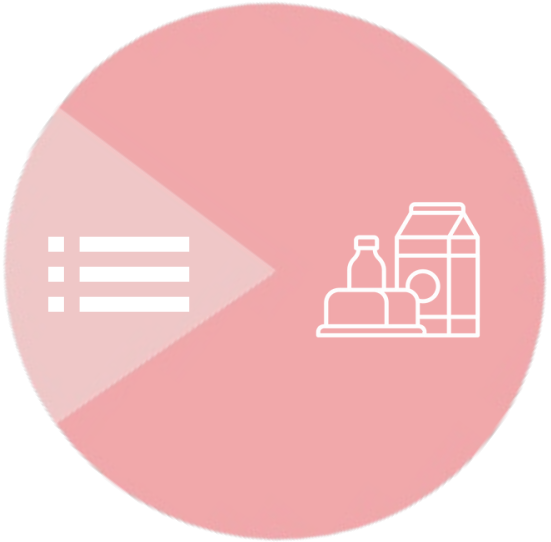
Modern Animal Breeding

1970's - 1980's

Other traits



Production Traits

2000's – Today

Improved animal health and welfare

Better production and quality of the products

Ensured food security

Better use of resources

Reduction of environmental impact

Preserving genetic diversity

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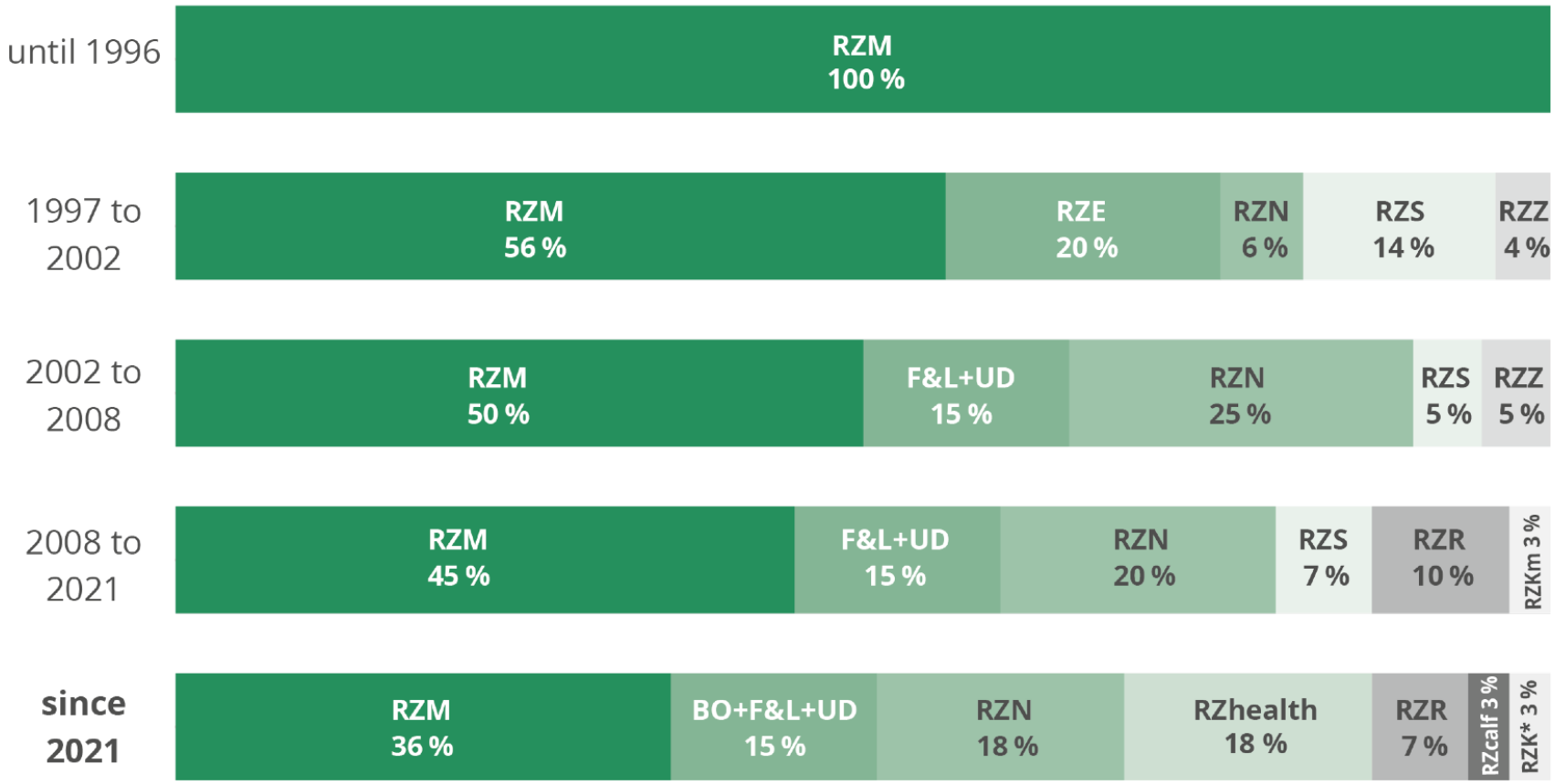
Few countries example: Germany



Total merit index (RZG) for German Holsteins

Explanation of the breeding value abbreviations

RZM	milk production
BO	body
F&L	feet and legs
UD	udder
RZN	functional herd life
RZhealth	health
RZR	daughter fertility
RZcalf	calf health
RZKm	maternal calving ease
RZKd	direct calving ease
RZE	conformation
RZS	somatic cell score
RZZ	breeding performance

* RZK = RZKm 1,5 % + RZKd 1,5 %

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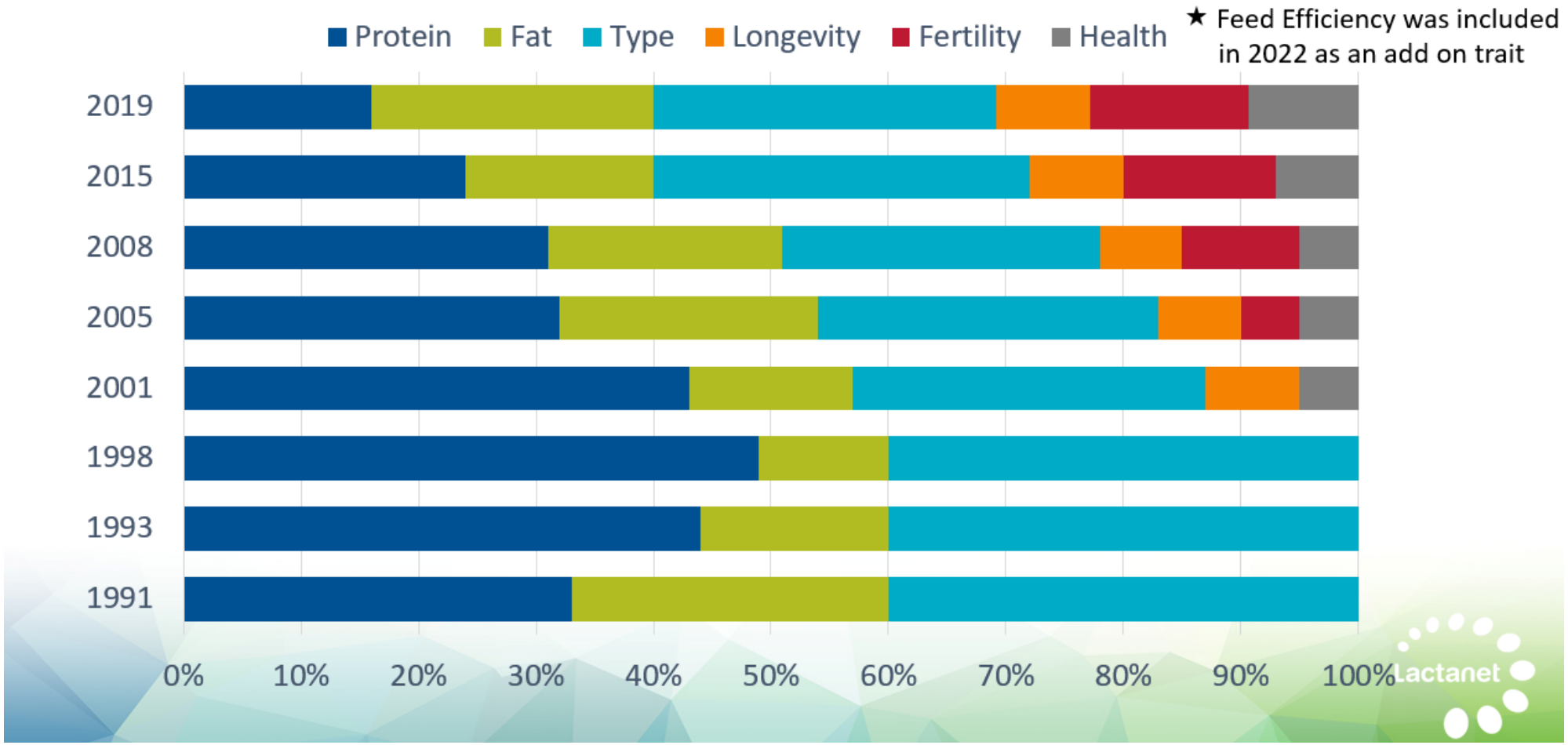
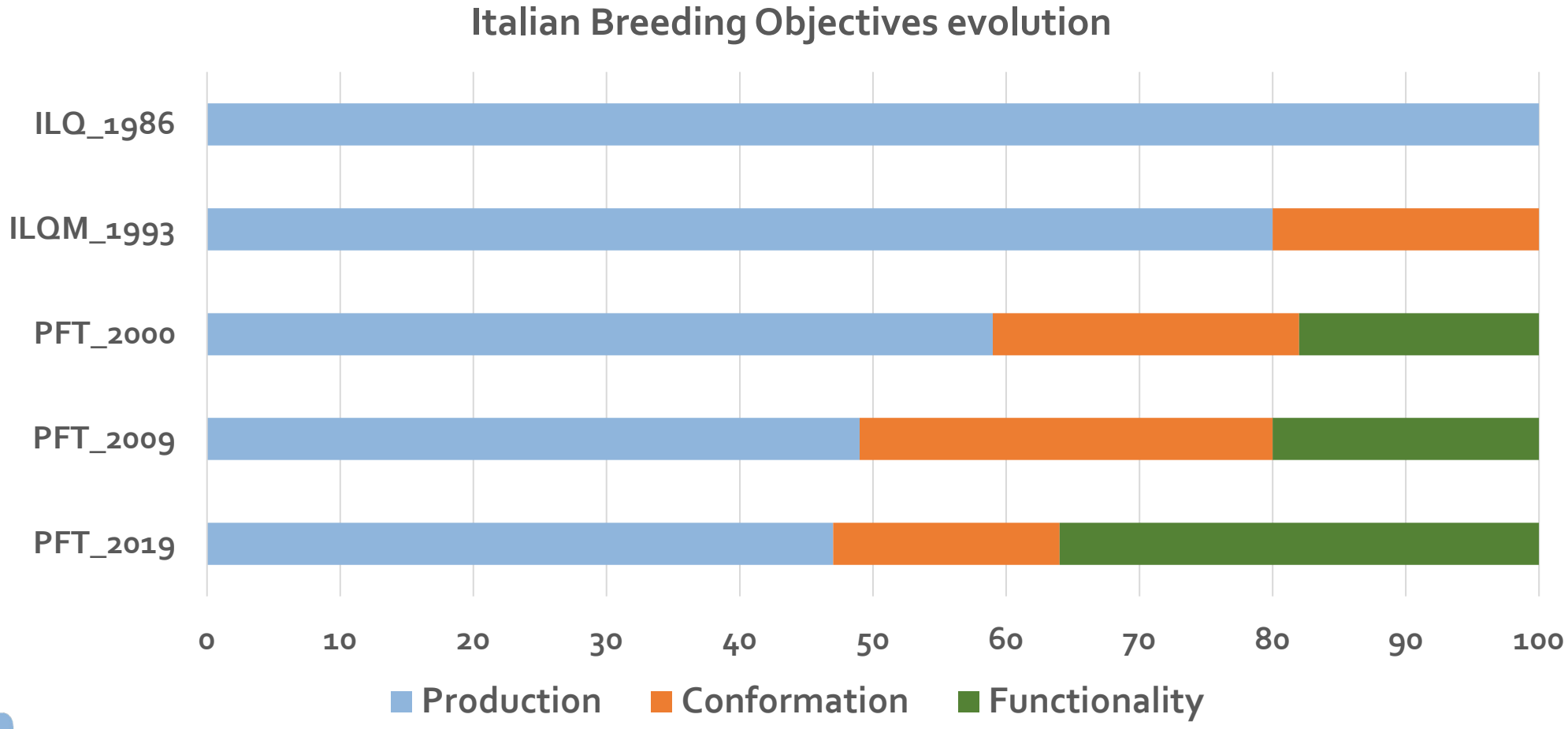
Few countries example: Canada

Holstein LPI Relative Emphasis Over Time



Few countries example: ITALY



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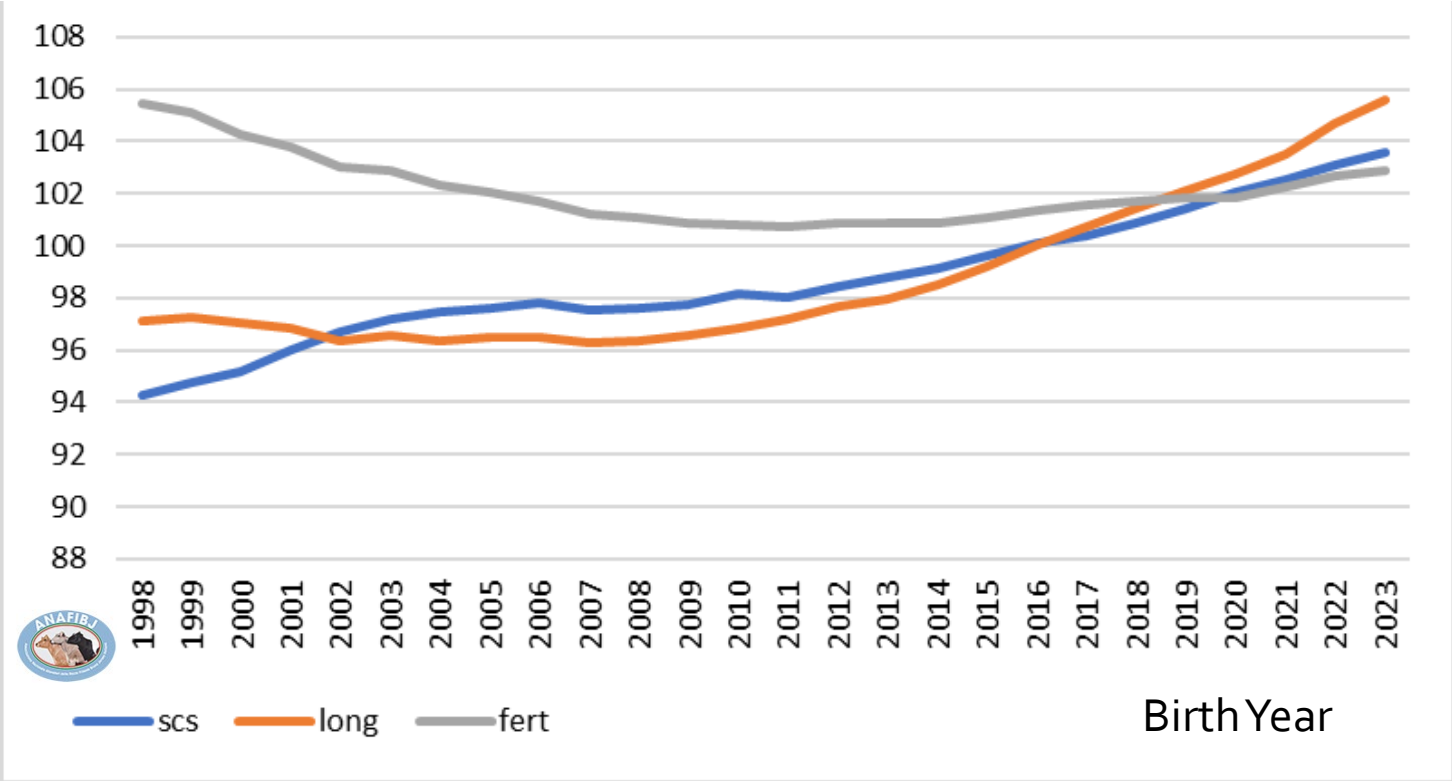
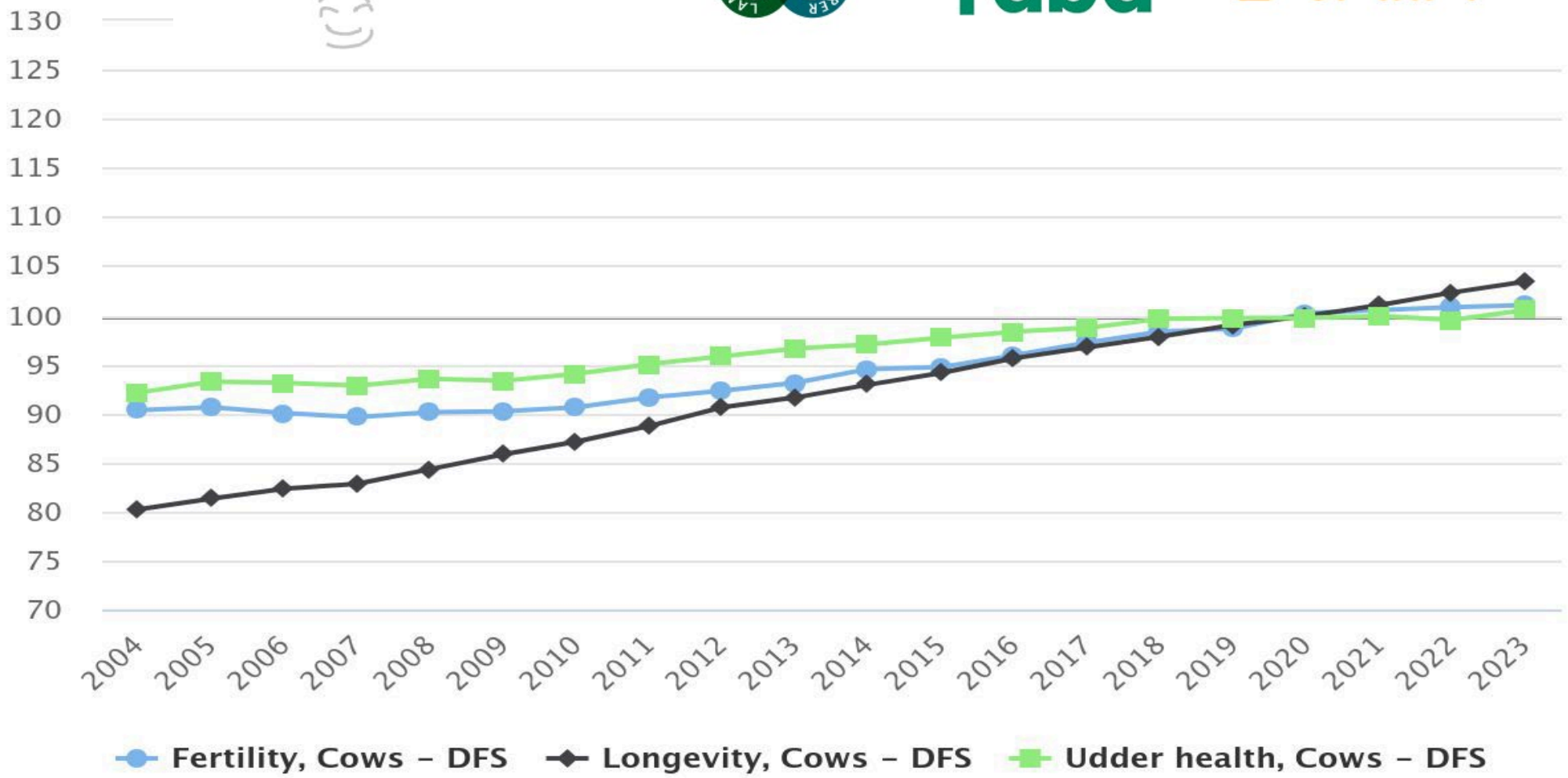
Progress is made since fertility and longevity were included in breeding goals, resulting in a genetic progress for these traits

Genetic trend for Somatic Cell Count, Longevity and Fertility



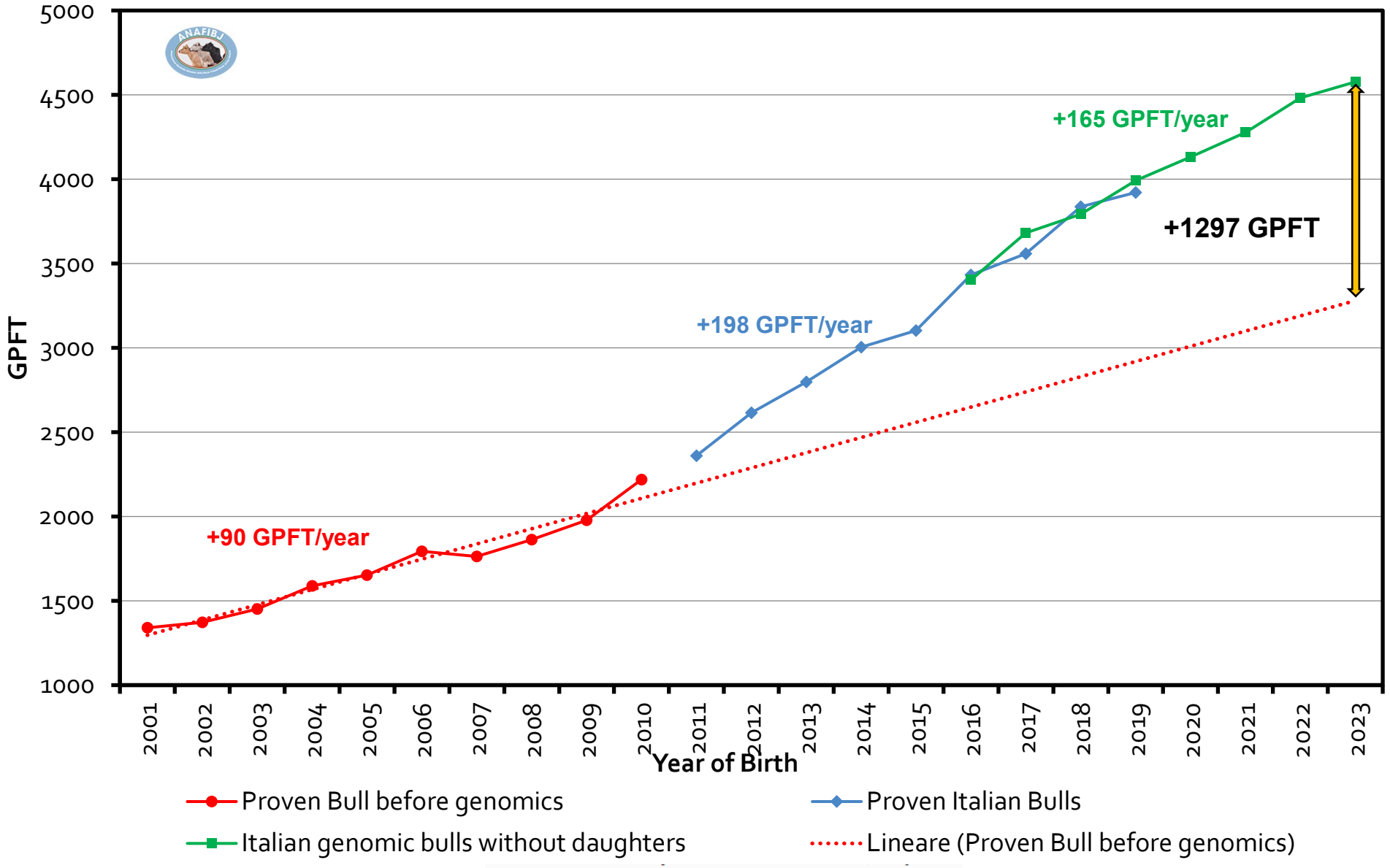
- -14 days calving-concive
- -80 000 cells / mL
- +92 productive days

Phenotipic value of 1 1 DS of index



NAV trends - Dairy (mloy.fi)

PFT trend 2001-2023



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…more and more on farmers side

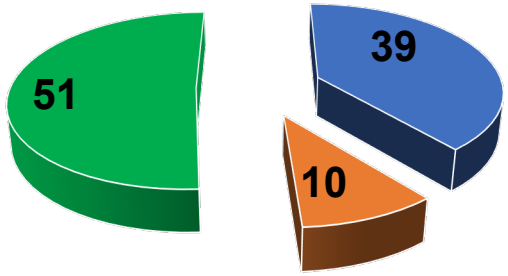
- Each country has more indexes
- Efforts to select for **improved resilience** and **heat tolerance** are already implemented
- The evolution of breeding goals is also incorporating **environmental efficiency**, addressing **global warming** and developing selection indices **for improved efficiency**

Economic and Sustainable Indexes

Production Type conformation Functionality

Economic Health Index (2016)

IES Indice Economico Salute



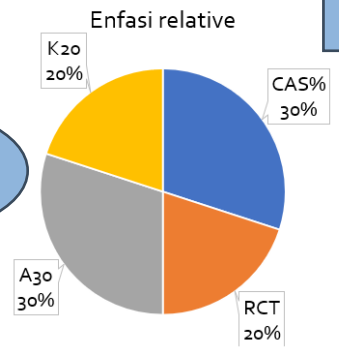
Functionality

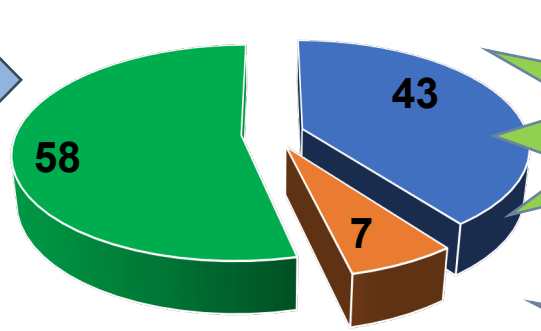
- Longevity **21%**
- Fertility **18%**
- Somatic cells **6%**
- Calving easy **3%**
- BCS **3%**

Sustainability and cheese-making capacities Index– Parmigiano Reggiano (2018) vs 3.0

ICSPR INDICE CASEIFICAZIONE ····· SOSTENIBILITÀ ····· PARMIGIANO REGGIANO

IQC 6% index





Aword K-Cas B

Penalty K-Cas E

- Fertility **15%**
- Somatic sells **14%**
- Longevity **11%**
- Calving easy **5%**
- Mastitis **5%**

BB +0,10 euro/d of milk lifetime
B +0,05 euro/d of milk lifetime

EE -0,050 euro/d of milk lifetime
E -0,025 euro/d of milk lifetime

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Florence, Italy

Australia

Australia's three indices

4

Australia's three breeding indices take the hard work out of breeding for more than one trait at once. The difference is in the emphasis given to specific traits. Choose the index that best matches your breeding priorities. Indices have a base of zero.

Balanced Performance Index (BPI)

- Economic index
- Blends production, type and health traits according to their economic values
- In line with farmer preferences

Health Weighted Index (HWI)

- Fast track fertility, mastitis resistance and feed saved
- Modelled on a strictly seasonal calving system

Sustainability Index (SI)

- Fast track genetic gain for lower emissions
- Continue gains for important economic traits

Jennie Pryce presentation
15th World Conference, 2023 –France

Australia

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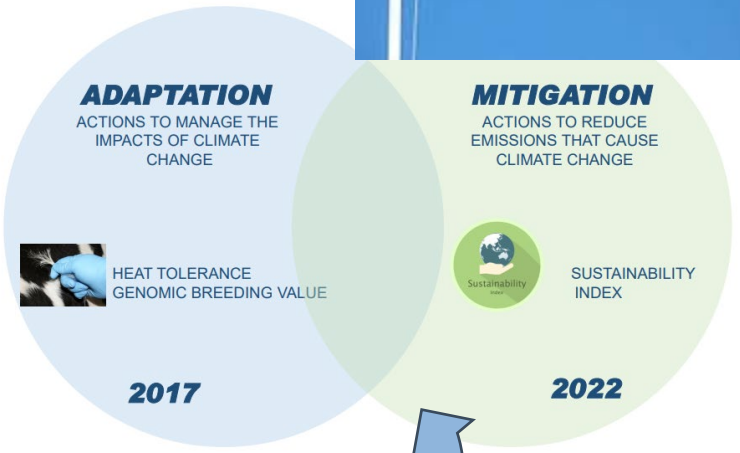

DataGene
Solutions for Herd Development

Jennie Pryce presentation
15th World Conference, 2023 –France

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New Zeland

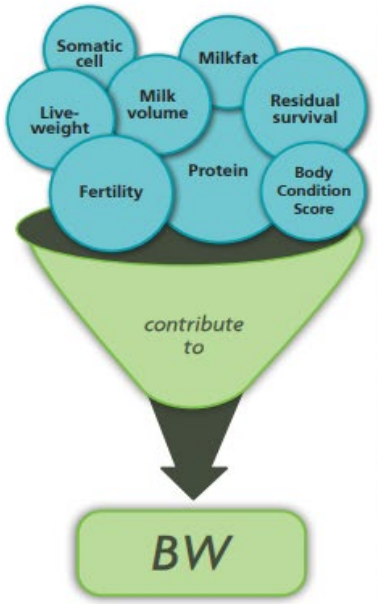
Breeding Worth explained

This guide is brought to you by New Zealand Animal Evaluation Ltd (NZAEL), a wholly owned subsidiary of DairyNZ, which is owned by you, the New Zealand dairy farmer. NZAEL sets the National Breeding Objective and determines the traits included in Breeding Worth.

For the best bulls consult the RAS list.

dairynz.co.nz/nzael

Eight traits of a highly efficient cow



How to use Breeding Worth, Production Worth and Lactation Worth

	BW	PW	LW
Meaning	Genetic ability for breeding replacements	Lifetime performance	Current season performance
Use for	Selecting bulls and replacements and purchasing heifers	Culling and purchasing cows	Culling
$ terms	+68 = expected to breed daughters that are $34 more profitable than daughters of a 0 BW cow	+78 = expected to generate $78 more profit, in each of her lactations, than a cow with a PW of 0	+98 = expected to generate $98 more profit, in the current season, than a cow with a LW of 0
Traits	Milkfat, protein, milk volume, liveweight, fertility, somatic cell, residual survival and body condition score	Milkfat, protein, milk volume, liveweight, SCC	Milkfat, protein, milk volume, liveweight

National breeding objective (BW):

"Animals whose progeny will be the most efficient converters of feed into farmer profit."

- **The Breeding Worth** ranks male and female animals for their genetic ability for breeding replacements
- **The Production Worth** ranks female animals for their lifetime performance.
- **The Lactation Worth** ranks female animals for their current season performance.

Genetic gain contributes $45 million annually to the national economy which compounds over time.

AE dairynz.co.nz/nzael | info@nzael.co.nz | 0800 4 DairyNZ (0800 4 324 7969)

DairyNZ

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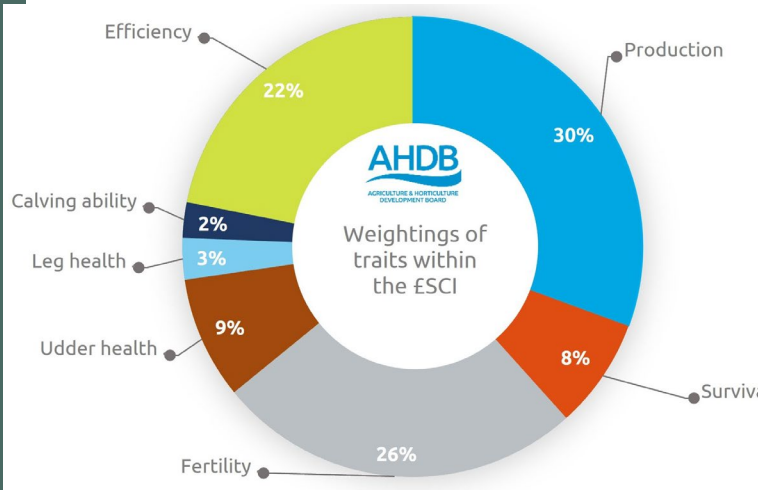
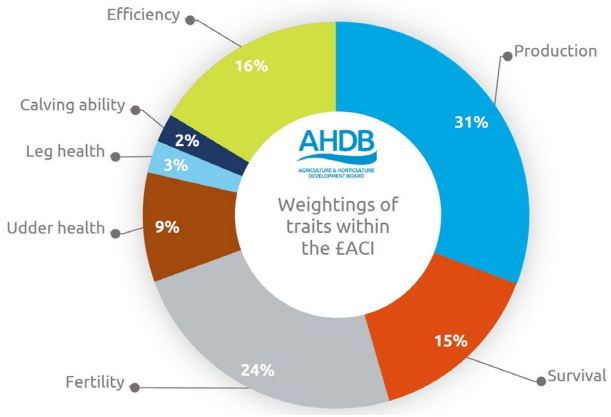
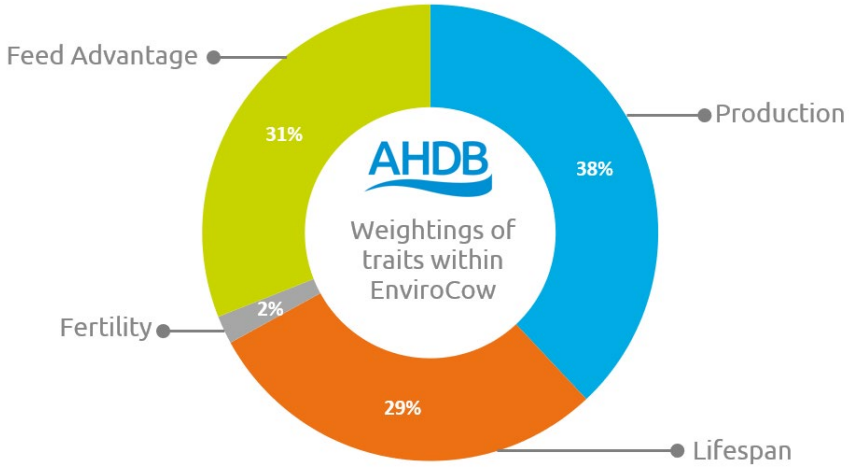
United Kingdom







Spring Calving herds

Autumn calving herds

EnviroCow index

ranking bulls across breeds

environmental weighted index

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Breeding Services for farmers

- All the indexes developed and implemented
- The genetic progress reached
- Without the farmers progress would not be reached

- Each country has developed and implemented several management tools which help the farmers to take any decision

New Farmers Tool Modules

- **To optimize dairy herd replacements combining conventional, sexed and beef semen**
  - Support farmers to identify annual female replacement needs
  - Based on herd performance level and combination of semen type (conventional, sex-sorted and beef semen) in order to optimized farmer economic outcome

- **To calculate «Global Warming Potential» at farm level**
  - A simplied method for the estimation of the carbon footprint of cow milk. To be used by farmers, both as a self-assestment system, and to simulate what would happen if more indicators varied.

EFFAB has developed a certification that proves the use of sustainable, responsible and balanced farming practices that can improve animal welfare and contribute to food safety.


CODE • EFABAR
The commitment to responsible breeding

European Forum of Farm Animal Breeders (EFFAB)

We herewith state that

ANAFIBJ

is in compliance with

CODE EFABAR
Code of Good Practice for Responsible Farm Animal Breeding and Reproduction Organisations
Version 2020

CERTIFICATION
Period of validity: 08/09/2022 – 08/09/2025

Brussels, 08/09/2022

Ana Granados Chapatte, EFFAB Director

EFFAB European Forum of Farm Animal Breeders

CERTIFICATE

BREEDING

«BALANCED»

« SUSTAINABLE»

«RESPONSIBLE»

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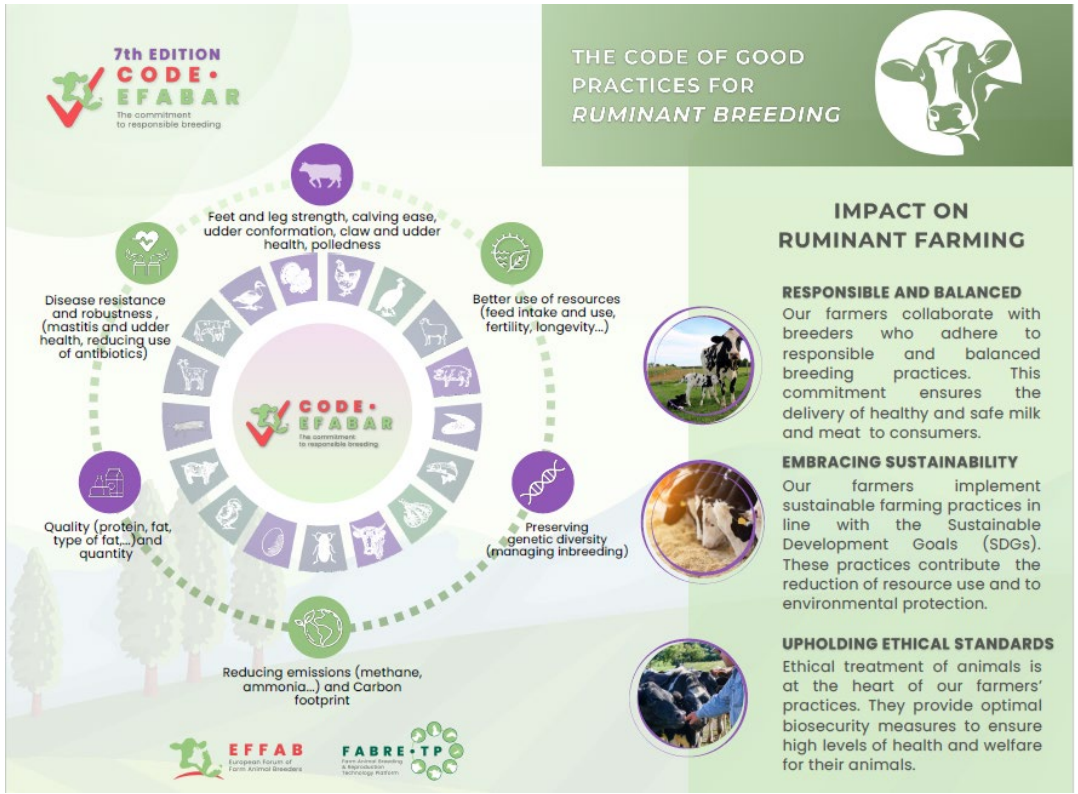
ANAFIBJ new farmers service

- ANAFIBJ offers the Code EFABAR to its members acting as a **'bridge'** between the breeder and EFFAB.
- In order to obtain THE certification, ANAFIBJ prepares, on behalf of the farmer, a template with information on the farm accompanied by reports developed by **HerdUP** and **PGA** applications



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CODE • EFABAR
The commitment to responsible breeding

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We herewith state that
AZ. AGR. ANCELLOTTI SERGIO E ROBERTO's Breeding program by ANAFIBJ
is in compliance with

CODE EFABAR
Code of Good Practice for Responsible Farm Animal Breeding and Reproduction Organizations
Version 2023

CERTIFICATION
Period of vality: 29/07/2024 – 28/07/2027

Brussels, 29/07/2024

Ana Granados Chapatte, EFFAB Director

EFFAB European Forum of Farm Animal Breeders

CERTIFICATE

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Conclusions

- Genetic improvment has been VERY successeful impacting positively
  - Profitability
  - Health and Welfare
- Genomic Selection allow accurate genetic progress for all economically important traits

Material provided by

- Filippo Miglior
- Rasmus Bak Stephansen
- Marco Winters
- Stephanie Minery
- Noureddine Charfeddine
- Mathijs van Pelt
- Jutta Jaitner
- Ezequiel Nicolazzi

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Administration office group

«Service» office group

Herdbook office group

President Anafibj

DG Anafibj

Genetic Center Stable Group

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