IRISH CATTLE BREEDING FEDERATION

Genetic Improvement in Cattle.

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Department of Agriculture, Food and the Marine
An Roinn Talmhaíochta, Bia agus Mara

Genetic Improvement in Cattle; Key requirements.

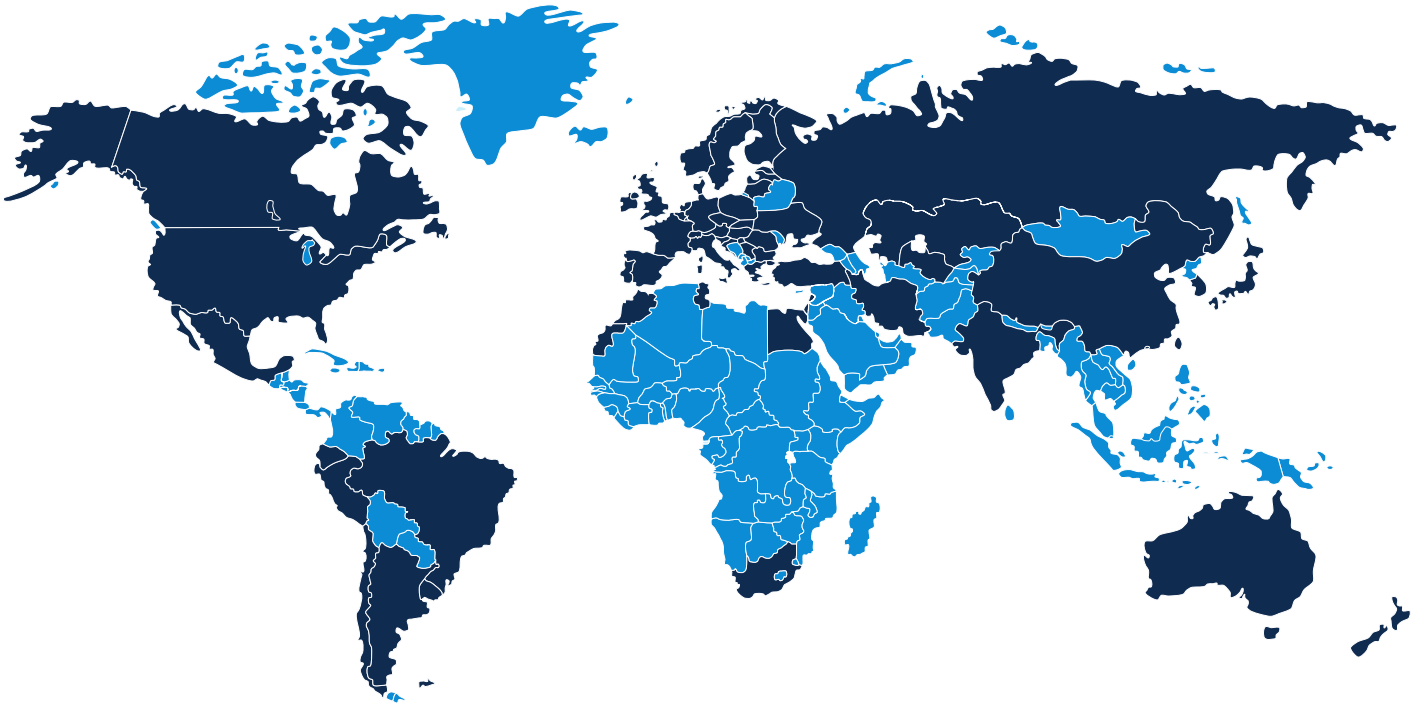
- Close collaboration.
  - Many parts to supply chain, especially in cattle.
  - Examples; ICAR (Interbeef) & ICBF.
- Some basic principles (using ICBF as an example).
  - Accurate identification, performance data, genetic evaluations & breeding Programs.
- Summary & discussion.

ICAR fact sheet

- ICAR: The International Committee for Animal Recording
- Non-Governmental Organization (INGO)
- Formed on March 9th, 1951, in Rome
- ICAR is composed of 117 Members from 59 countries;
  30 Associate Members, 87 Full Members.
- The ICAR activities are managed by 4 Sub-Committees and
  12 Working Groups. Interbeef is one of these working groups.
- ICAR has gone on to be “The” international guideline reference for animal identification, recording systems, data analysis and genetic evaluation.

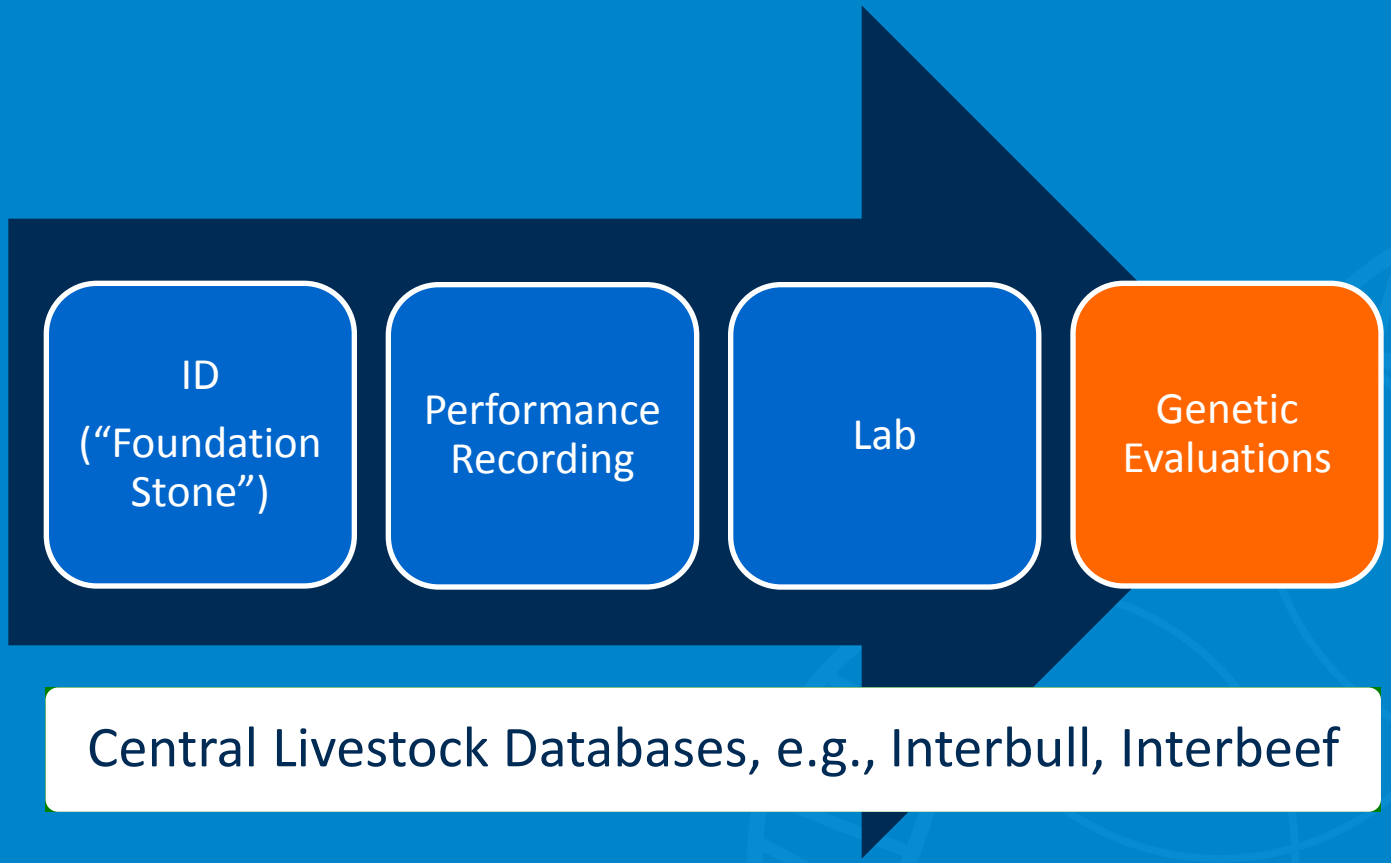
ICAR's members

ICAR has 117 members (87 Full members + 30 Associate members) in 59 countries



Countries (in dark blue) with at least one organisation as ICAR Member

ICAR's Building Blocks



ICAR Current Technical Organisation

Animal identification Devices SC

Milk Analysis SC

Interbull SC

Recording & Sampling Devices SC

4 Sub-Committees

Animal Data Exchange

Artificial Insemination Technologies

DNA Genomics

'Feed & Gas'

Interbeef

Breed Assns

Dairy Cattle Milk Recording

12 Working Groups

Global Reach

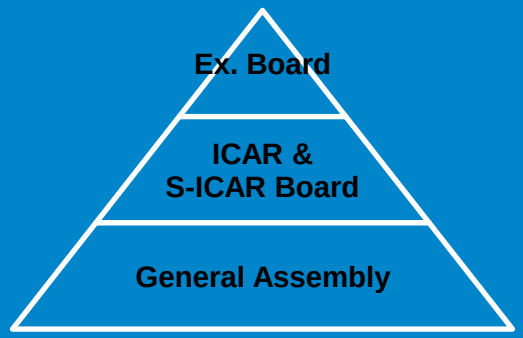
Sheep, Goat & Small Camelids

Conformation Recording

Animal Care *

Functional Traits

Administrative bodies



Expert Advisors and Task Forces

ICAR's core products and services

- Guidelines
- Evaluation Services
- Certification Services
- Seminars and workshops

for

ANIMAL IDENTIFICATION

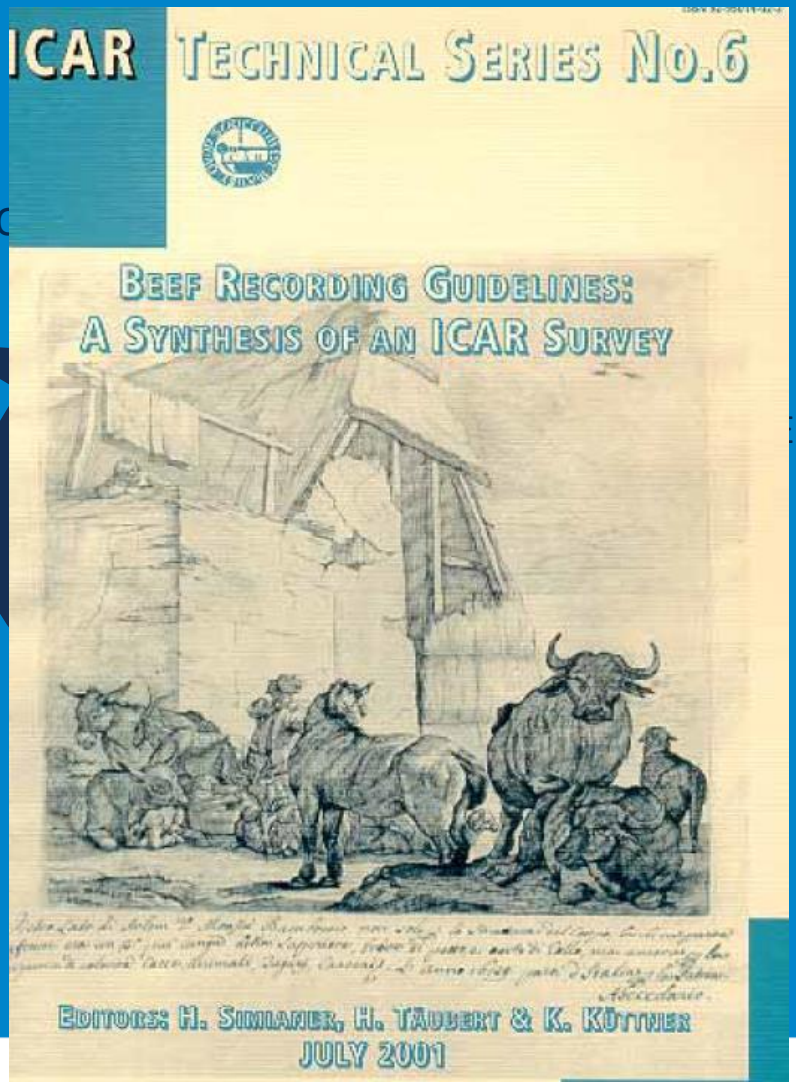
ANIMAL RECORDING

ANIMAL EVALUATION

ANIMAL DATA MANAGEMENT

ICAR Guidelines and Standards

- Results of the work of the ICAR Sub-Committees and Working Groups are the “ICAR RECORDING GUIDELINES”
- Guidelines are a “live process” of amendments/updating, according to new technologies, tools and developments
- Every year new text of RG is proposed to GA for approval
- This meeting is timely as beef guidlines have not been updated (formally) since 2001. Focus of activity has been on genetic evaluations.

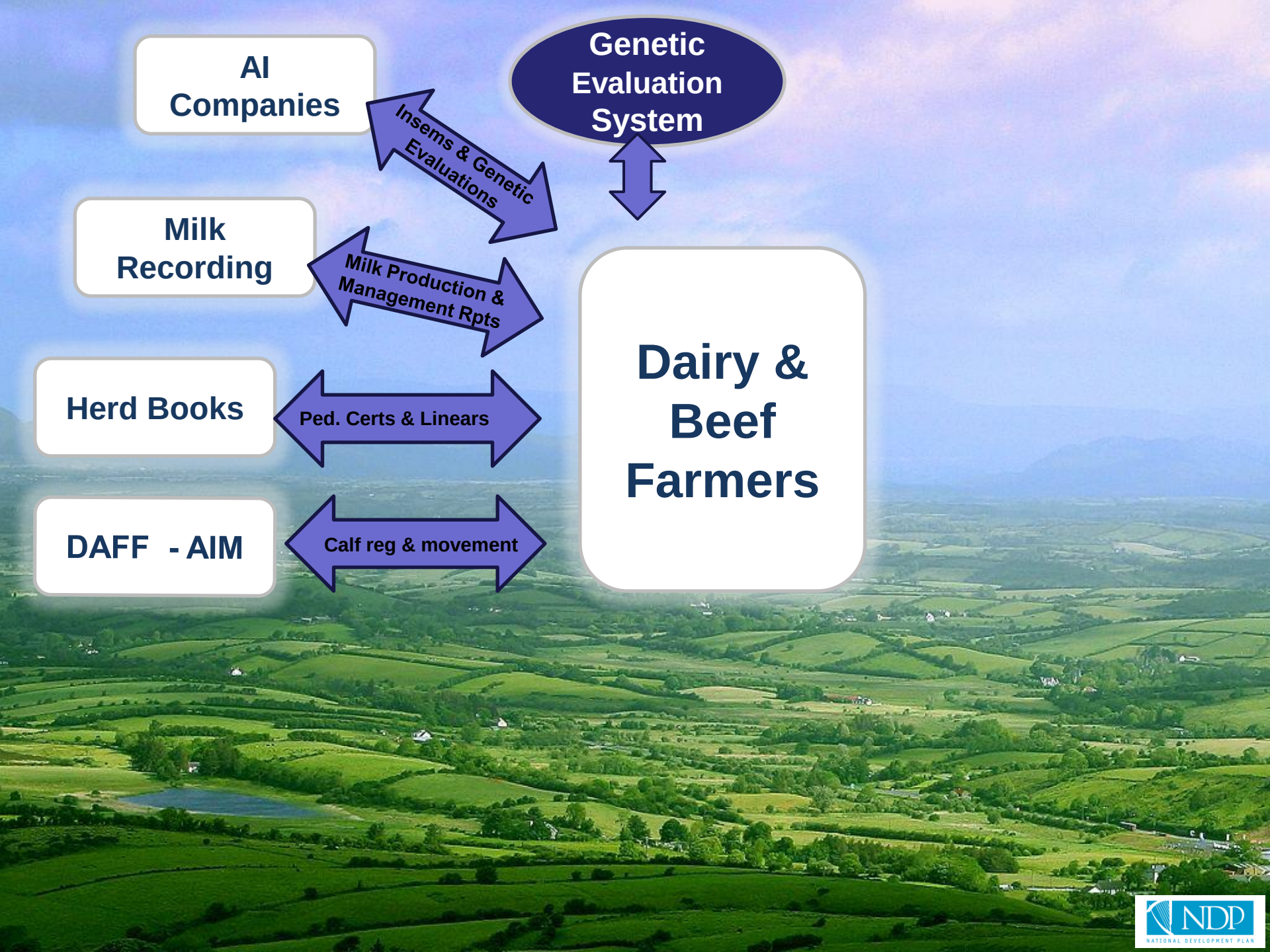


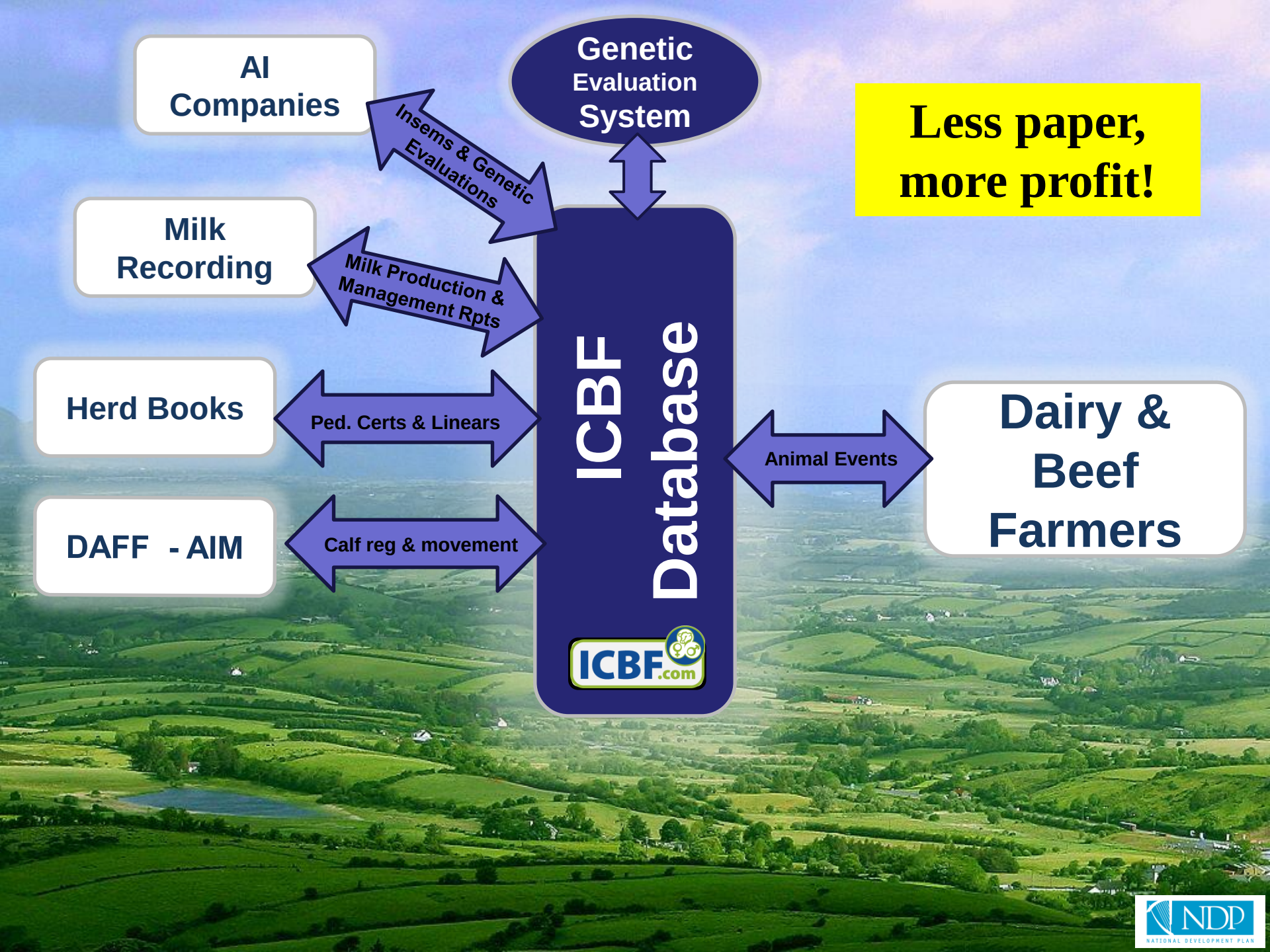
Irish Cattle Breeding Industry.

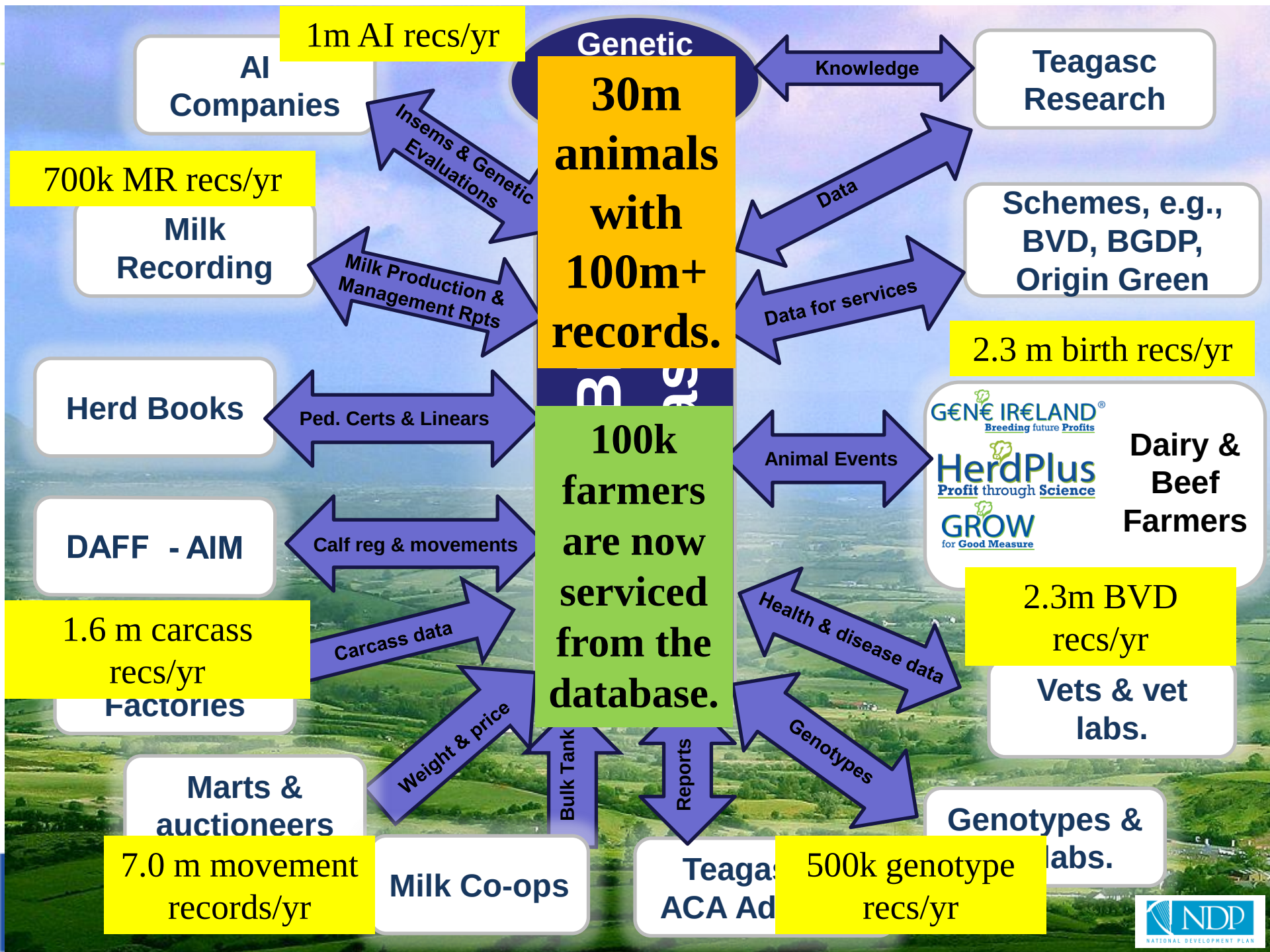
- Co-ordinated by ICBF.
  - ICBF => a “non-profit” co-operative of 30 cattle breeding organisations (AI, HB + MRO’s) + 2 Farm Organisations.
  - Established in 2000. Industry now responsible for cattle breeding decisions.
  - Central database in 2002. Now key cornerstone of Irish AgFood industry.
- Funded by industry & government (DAFM).
  - Turnover of €8m in 2015. 20% govt funding.

ICBF – Key Principles.

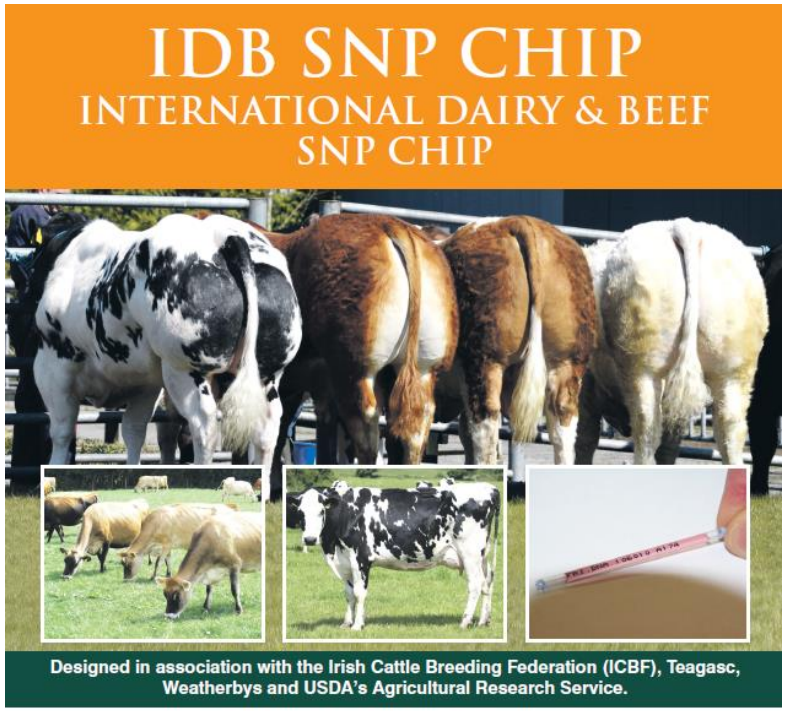
- Focused on farmer benefit.
  - Many stakeholders, but farmer is core.
- Strong principle of “Profit from science”.
  - Key relationship with Teagasc (govt research & extension).
- Independent genetic evaluations.
- Aim to be world-leading (research => implementation).
  - 2nd in world to launch dairy genomics, after US.
  - Beef Genomics => largest livestock genomics project globally.

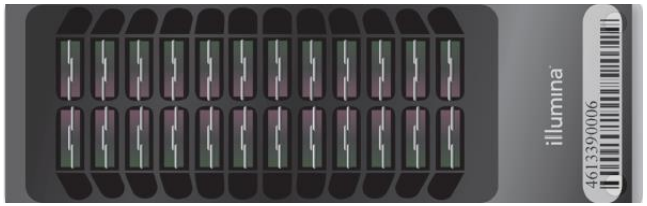

AI Companies
Genetic Evaluation System
Insems & Genetic Evaluations
Milk Recording
Milk Production & Management Rpts
Herd Books
Ped. Certs & Linears
DAFF - AIM
Calf reg & movement
Dairy & Beef Farmers


AI Companies
Genetic Evaluation System
Insems & Genetic Evaluations
Less paper, more profit!
Milk Recording
Milk Production & Management Rpts
ICBF Database
Herd Books
Ped. Certs & Linears
Animal Events
Dairy & Beef Farmers
DAFF - AIM
Calf reg & movement
ICBF.com
NDP
NATIONAL DEVELOPMENT PLAN


1m AI recs/yr
AI Companies
Genetic
Knowledge
Teagasc Research
Insems & Genetic Evaluations
30m animals with 100m+ records.
700k MR recs/yr
Milk Recording
Milk Production & Management Rpts
Data
Schemes, e.g., BVD, BGDP, Origin Green
Data for services
2.3 m birth recs/yr
Herd Books
Ped. Certs & Linears
100k farmers are now serviced from the database.
Animal Events
GENE IRELAND Breeding future Profits
HerdPlus Profit through Science
GROW for Good Measure
Dairy & Beef Farmers
DAFF - AIM
Calf reg & movements
2.3m BVD recs/yr
1.6 m carcass recs/yr
Carcass data
Health & disease data
Factories
Vets & vet labs.
Weight & price
Bulk Tank
Reports
Genotypes
Marts & auctioneers
Genotypes & labs.
7.0 m movement records/yr
Milk Co-ops
Teagasc ACA Ad
500k genotype recs/yr
NDP NATIONAL DEVELOPMENT PLAN

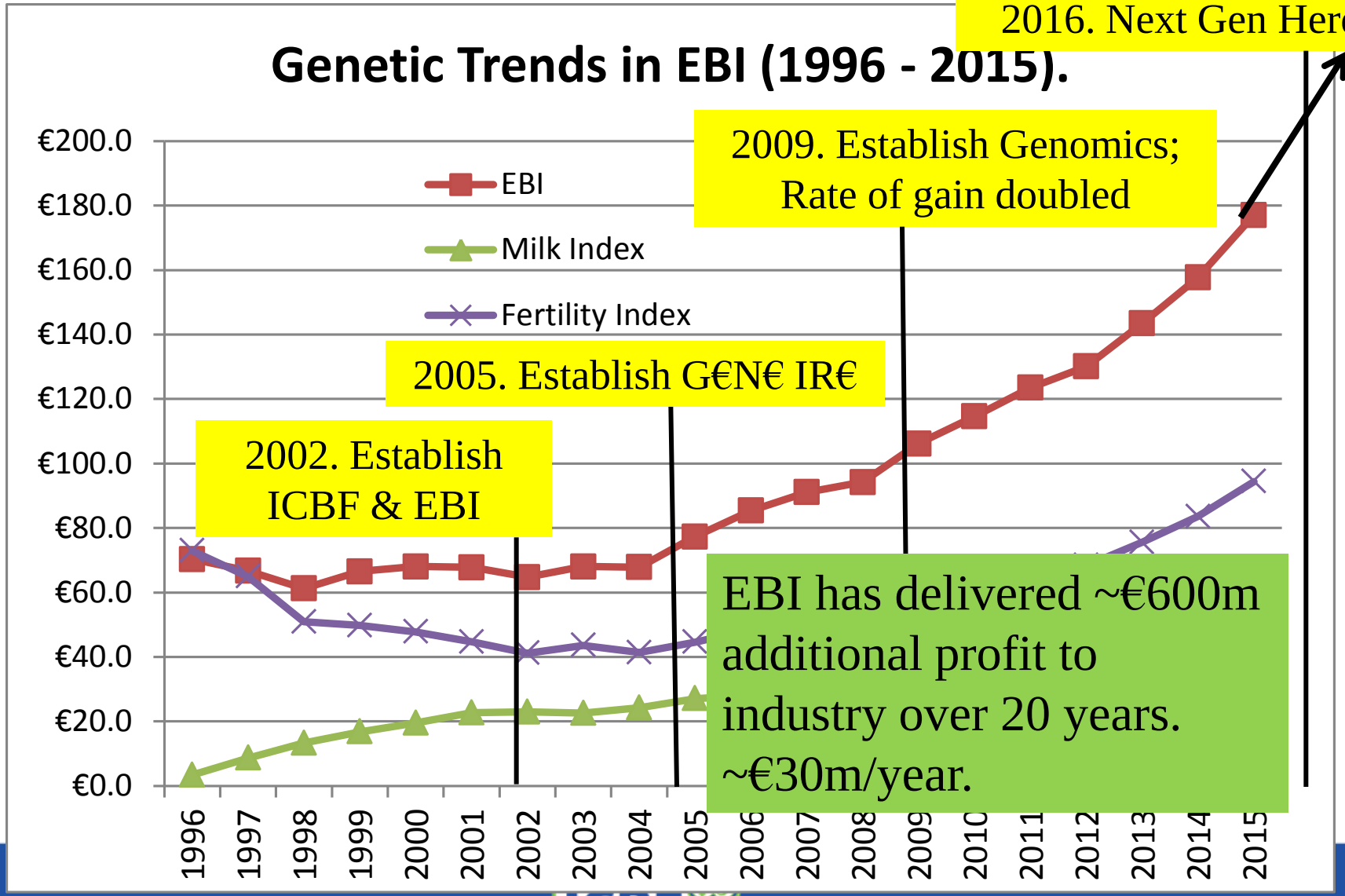
IDB Chip – The database in 54k SNP's!





- The International Dairy & Beef Chip.
- Developed in Ireland, with Illumina. Currently on v3.
- 54k SNP's.
  - 40k core, 6k for better imputation, 7k for "regions of interest" & 1k for major genes/defects.
- 160 Major genes/defect.
  - Database will drive this.
- DNA based calf reg.

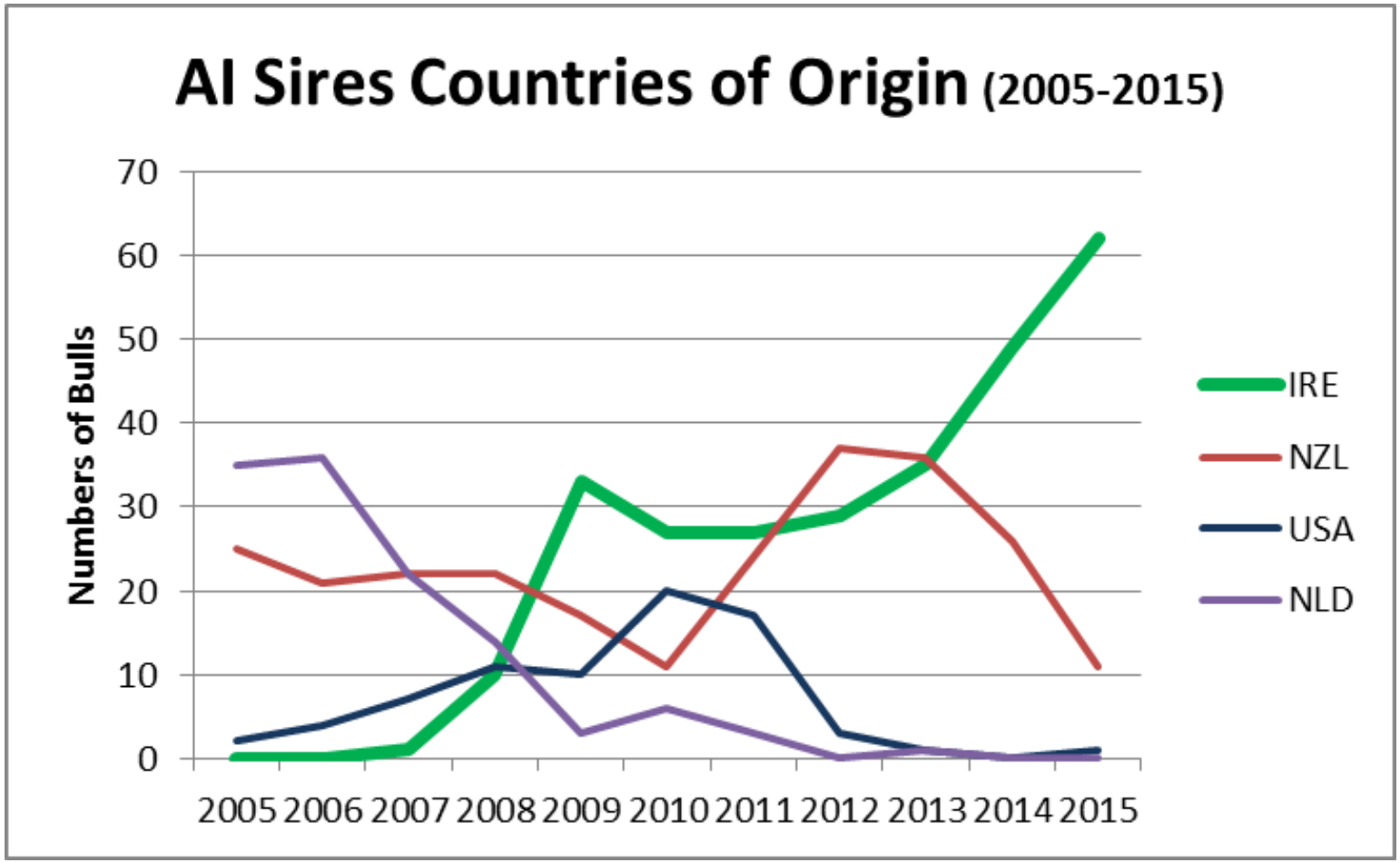
Genetics Works; Example EBI



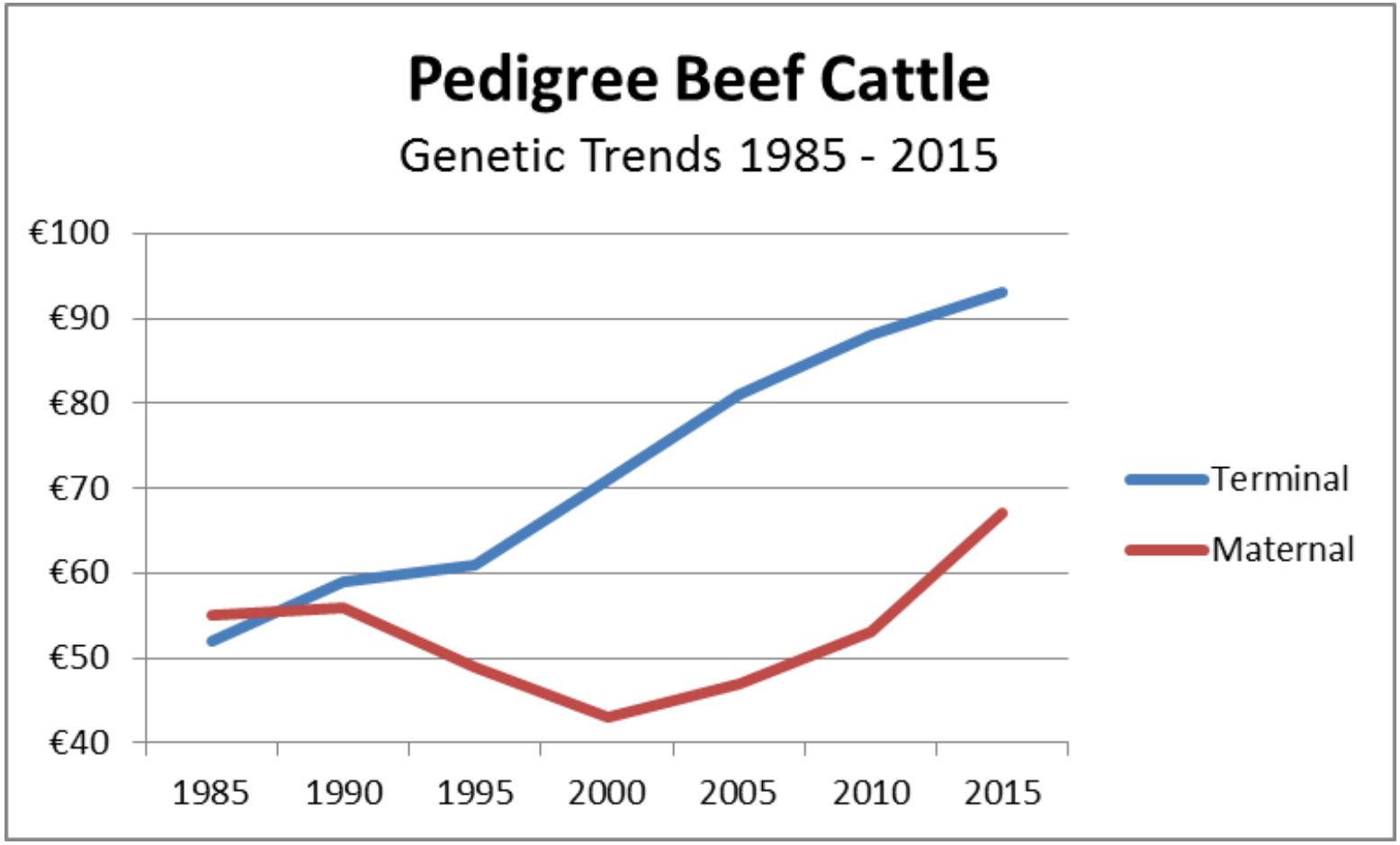
NextGen results - 2016

	National Average	Elite
Days in milk	150	153
Milk solids to date (kg)	277	293
Fat %	4.12	4.41
Protein %	3.41	3.57
Live-weight	534	514
BCS	2.81	2.95
Submission 3 weeks (%)	91	96
6 wk in-calf rate (%)	51	77
9 wk in-calf rate (%)	69	91

G€N€ IR€LAND Breeding Program – Est 2005.



Genetic Trends in Pedigree beef Herd.



€uro-Star Replacement Index.

Trait	Goal	Relative wt
Calvin		1[illegible]%
Feed		[illegible]%
Carca		[illegible]%
Mater		[illegible]%
Female fertility	More	28%
Docility	More	4%

Emphasis:

Cow traits 71%

Calf traits 29%

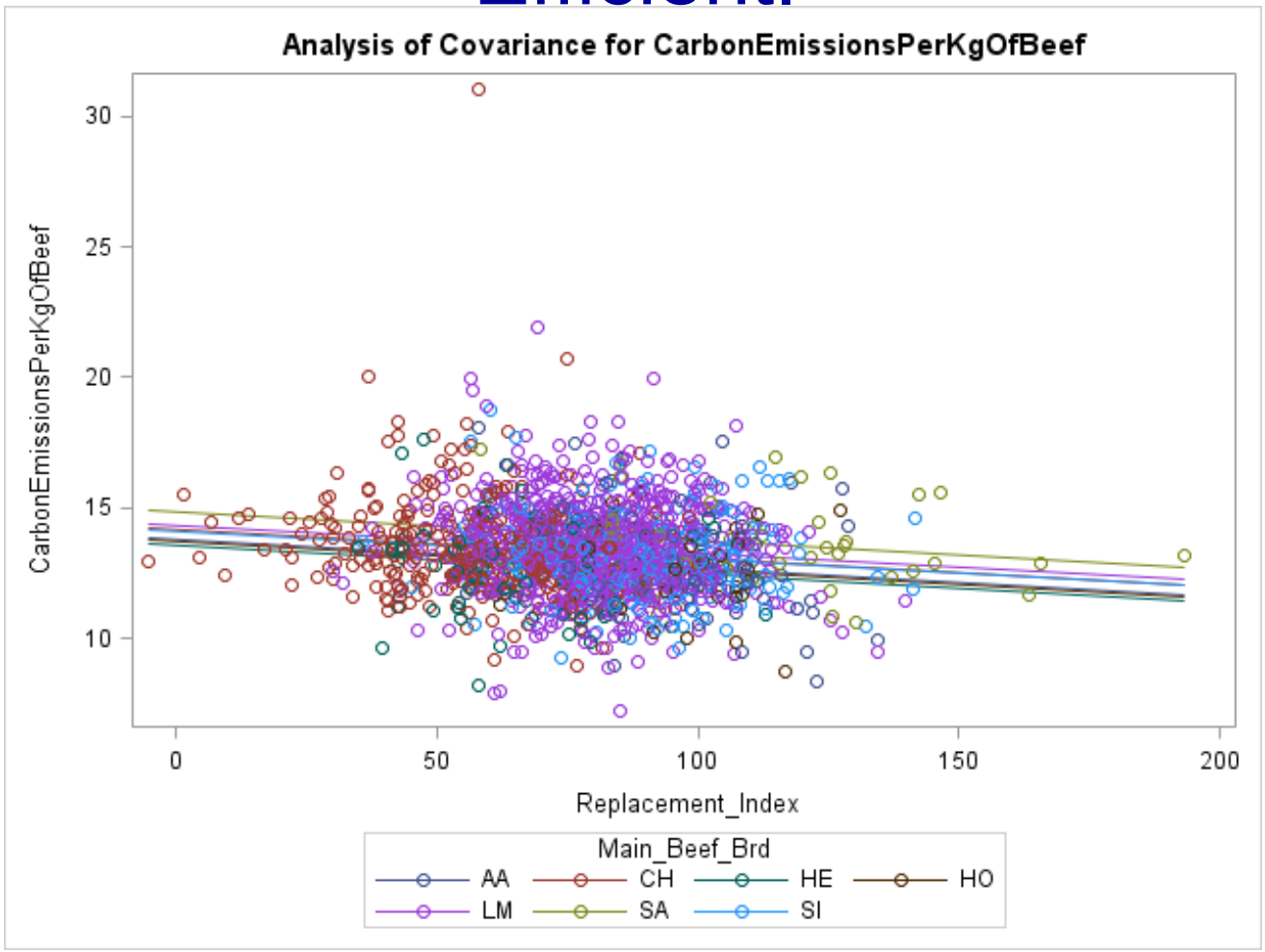
5 Star Cows Leaving More Profit....

All Suckler Cows

Cow Details				Milk Performance		Fertility Performance			Progeny Carcass Performance		
Star Rating	No. of Cows	Replacement Index	% Still Alive	Calf Weaning Weight (kg)	Cow Milk Score (1-5)	Age 1st Calving (months)	Calving Interval (days)	No. of Calvings	Carcass Weight (kg)	Carcass Value	Age at Slaughter (days)
★★★★★	33,493	€108	83%	336	4.08	30.2	403	2.69	358	€1,474	697
★★★★	24,317	€76	80%	324	3.87	30.9	407	2.56	356	€1,469	712
★★★	21,644	€60	79%	319	3.74	31.3	411	2.47	356	€1,470	715
★★	20,908	€43	76%	315	3.61	31.5	416	2.40	357	€1,475	721
★	23,911	€12	72%	309	3.36	32.1	423	2.25	357	€1,477	726
Difference 5 Star V's 1 Star		**+€96**	**11%**	**27kg**	**0.72**	**-1.9 months**	**-20 days**	**0.44 calves**	**0kg**	**€-2**	**-29 days**

Performance of all suckler females, born in 2011, when ranked on new generation test proofs

High Genetic Merit Herds are More Carbon Efficient.



*Breeds with at least 40 herds in data set

The Irish BDGP Scheme.

- Focused on breeding more profitable , sustainable and carbon efficient cows.
- Funded from EU Rural Development Program.
  - Co-funded by Irish government (DAFM).
- €300m total funding 6 years (2015-2020)
  - Farmers paid ~€90/cow/year to complete key actions re: the scheme.
  - ~500k animals genotyped to-date.
  - ~2.5m animals in total will be genotyped during period of scheme.

Expected reductions in emissions from genetics

- Total non ETS GHG emissions from Ireland estimated at 41,680 kT, with 18,657 kT from agriculture (EPA 2012 report)

	2020			2030		
Suckler beef breeding strategy	kT of CO2e	% reduction Agri	% reduction All	kT of CO2e	% reduction Agri	% reduction All
Current replacement index trend	-66.14	0.4%	0.2%	-529.1	2.8%	1.2%
Genomics with increased Gene Ireland AI	-261.56	1.4%	0.6%	-1,442.1	7.8%	3.3%
Genomics with best case Gene Ireland AI	-385.02	2.1%	0.9%	-2,270.2	12.2%	5.2%

New Traits of Interest; Carcass and meat eating quality

- Length of loin, for a fixed loin area (retail pack).
  - Work underway between ICBF, Teagasc and meat processing industry.
  - Current status; Based on VIA images (1.6m animals/year), 200k animals with actual cut data (from one processor) + ~500 data from a primal grading machine.
  - Next 18 months; 7.5k animals with complete data (cut and meat eating quality) => apply to all animals.
- Meat eating quality.
  - Large differences within and across breeds. Heritability for tenderness of 25%.

Genetics for Meat Eating Quality

- Can we breed to improve meat eating quality?
- Evidence from breed premium schemes, e.g., Angus & Hereford, would suggest yes.
- What about within each of our main beef breeds? Are there bulls that will breed progeny that are good to taste and those that are not so good to taste!
- Current focus of work within the G€N€ IR€LAND performance test program at Tully.

Top AI bulls for Meat Eating Quality*

- Early results indicate significant genetic variation in meat eating quality.
- Initial "test" proofs generated based on sires with progeny evaluated at Tully*
- Early results are very promising => plan to have official proofs during 2017.

Table 1. Top AI sires for meat eating quality

Brd	Code	Name	Owner
AA	RWB	Rawburn Lord Rocket	Dovea AI
BA	KCE	Kilmoney Bruce	Dovea AI
BB	VMP	Viilablues Empire	Dovea AI
CH	FSZ	Fiston	NCBC
HE	GZS	Goulding Poll Superduty	NCBC
LM	EFZ	Elite Flag	NCBC
PT	CBQ	Cambridge	NCBC
SA	PZB	Bonaparte	NCBC
SH	CZB	Creega Dice	Dovea AI
SI	RWV	Raceview Van Halen	Dovea AI

Results from Consumer Tasting Session, Grange July 2016

Table 1. Consumer tasting session, Teagasc Grange Beef Open Day, 5 July 2016*

Panel	High EBV Steak			Low EBV Steak			Diff	Consumer Score	
	Brd	Tag	EBV	Brd	Tag	EBV	EBV	High	Low
1	BB	IE331469770176	3.3	BB	IE111104920402	-0.3	3.6	5	2
2	CH	IE281166191119	3.6	CH	IE281170330957	-3.2	6.8	6	1
3	CH	IE341454730305	2.8	CH	IE281170360943	-3.6	6.3	5	2
4	LM	IE331469720188	2.9	LM	IE371072440485	-4.0	6.9	7	0
5	LM	IE331469750190	2.5	LM	IE111104960414	-2.9	5.4	4	3
6	LM	IE281158740537	2.2	LM	IE281170320956	-5.6	7.8	6	1
7	SA	IE331469760183	1.7	SA	IE331469760191	-1.6	3.3	7	0
8	SI	IE331518830647	-0.2	SI	IE331518890644	-6.7	6.5	6	1
9	AA	IE341454770291	2.3	AA	IE301049020234	-2.4	4.7	7	0
10	BB	IE151826250311	2.6	BB	IE301159890412	0.0	2.5	3	4
11	CH	IE151052580966	3.0	CH	IE281158730536	-3.0	6.0	5	3
12	CH	IE361198261193	2.2	CH	IE221068630680	-0.1	2.2	3	4
13	LM	IE341454770300	2.4	LM	IE281170310947	-1.0	3.4	5	3
14	LM	IE151826220317	2.2	LM	IE301049090240	-0.1	2.3	6	2
Tot			2.4			-2.5	4.8	75	26

** Based on young bulls slaughtered (<16 mts) on 11 Jan and 18 Jan 2016*

Summary.

- Genetic improvement in Ireland is now generating €30m/year for Irish dairy farmers with similar potential for beef. Additional GHG benefits.
- But, effective genetic improvement in livestock requires close collaboration at national and international level.
  - ICAR and ICBF are relevant examples.
- We must collaborate if we are to meet the “food versus climate” challenge in the future.
- We are very keen to engage with more partners in generating further improvements for farmers & industry, e.g., UNECE.

A balanced cow in Ireland!