



Genomics – a new tool for animal breeding
– EU infrastructure enhancements needed
to enable full benefits to be realized.

Brian Wickham (ICBF), Donagh Berry
(Teagasc), Andrew Cromie (ICBF).

Meeting with Patricia Reilly

European Union House, 18 Dawson Street, Dublin 2

10:00 Monday 5th March 2012



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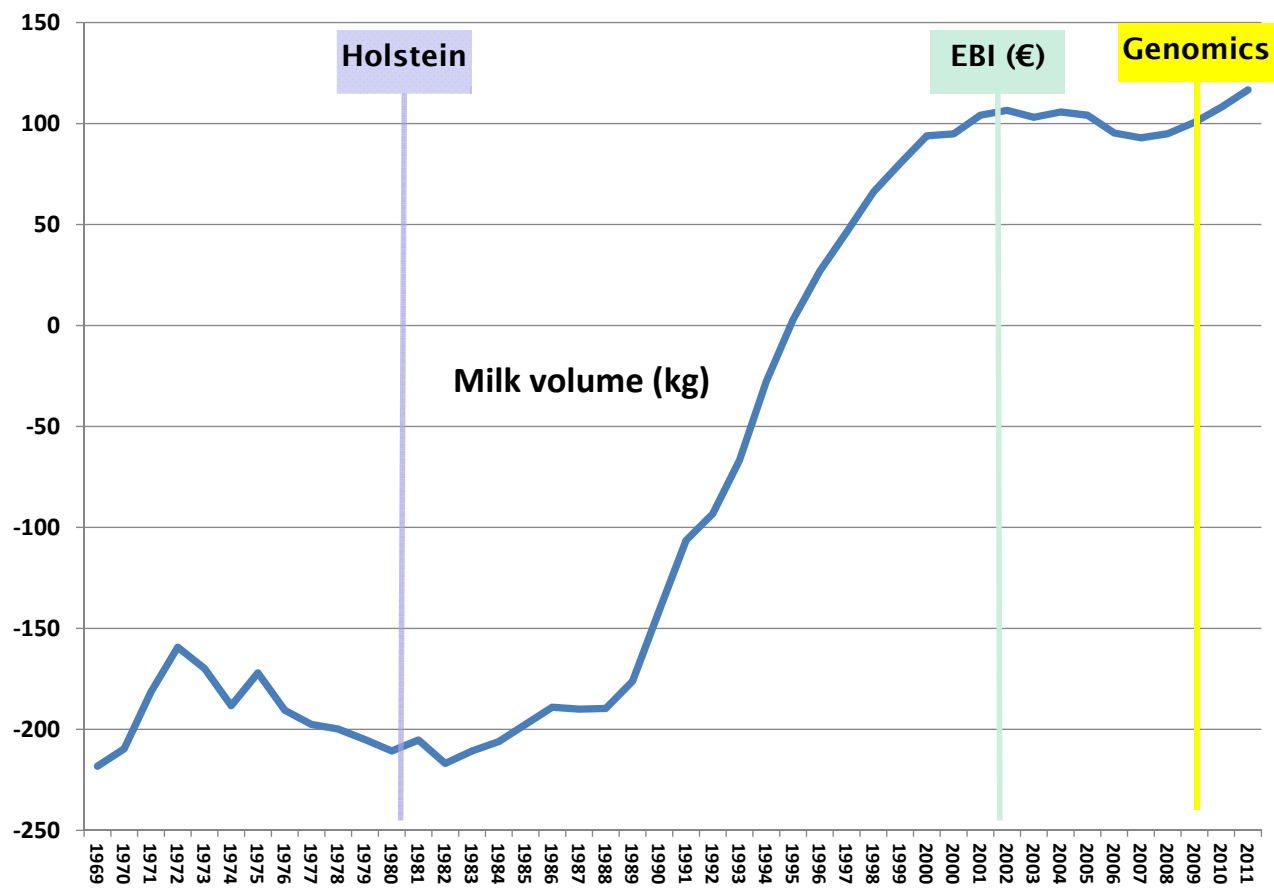
Background

- Chance meeting between Pauric Walsh (past president of IFA) and Commissioner Máire Geoghegan-Quinn at the Horse & Jockey in 2011. This resulted in a brief discussion on our use of genomic technologies in dairy cattle breeding.
- We issued an invitation for the Commissioner to visit our facilities and to be briefed on the implications of this technology for cattle breeding throughout the EU.

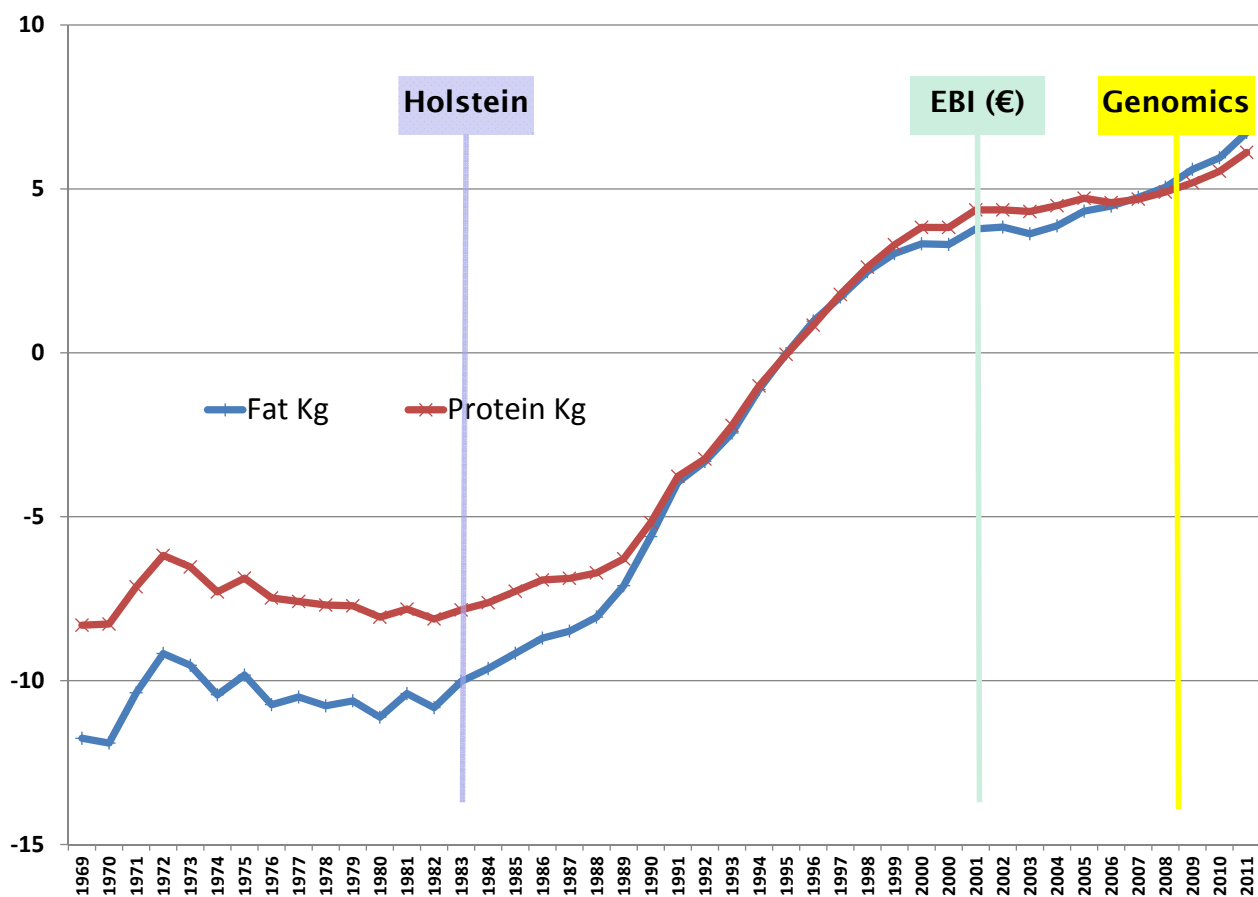
Key Points

1. Genomics technology has enormous potential to accelerate the already large contribution of animal breeding to EU bio economy.
2. Exploitation of genomics requires large populations of animals with measurements on key traits and genotyped.
3. For cattle traits, EU & world wide collaboration is essential to give the required numbers for genomics research.
4. “Commercial” considerations are currently limiting the extent of EU & International collaboration in genomics.
5. ICBF & Teagasc are leaders in the field of genomics and have established an international network of collaborating organisations.
6. ICBF & Teagasc are delivering the benefits of genomics to the Irish breeding industry and Irish farmers.
7. ICBF & Teagasc want to ensure sufficient public funding is provided to education, research and data infrastructure to enable Ireland and the EU to capture the full benefit of this emerging technology.

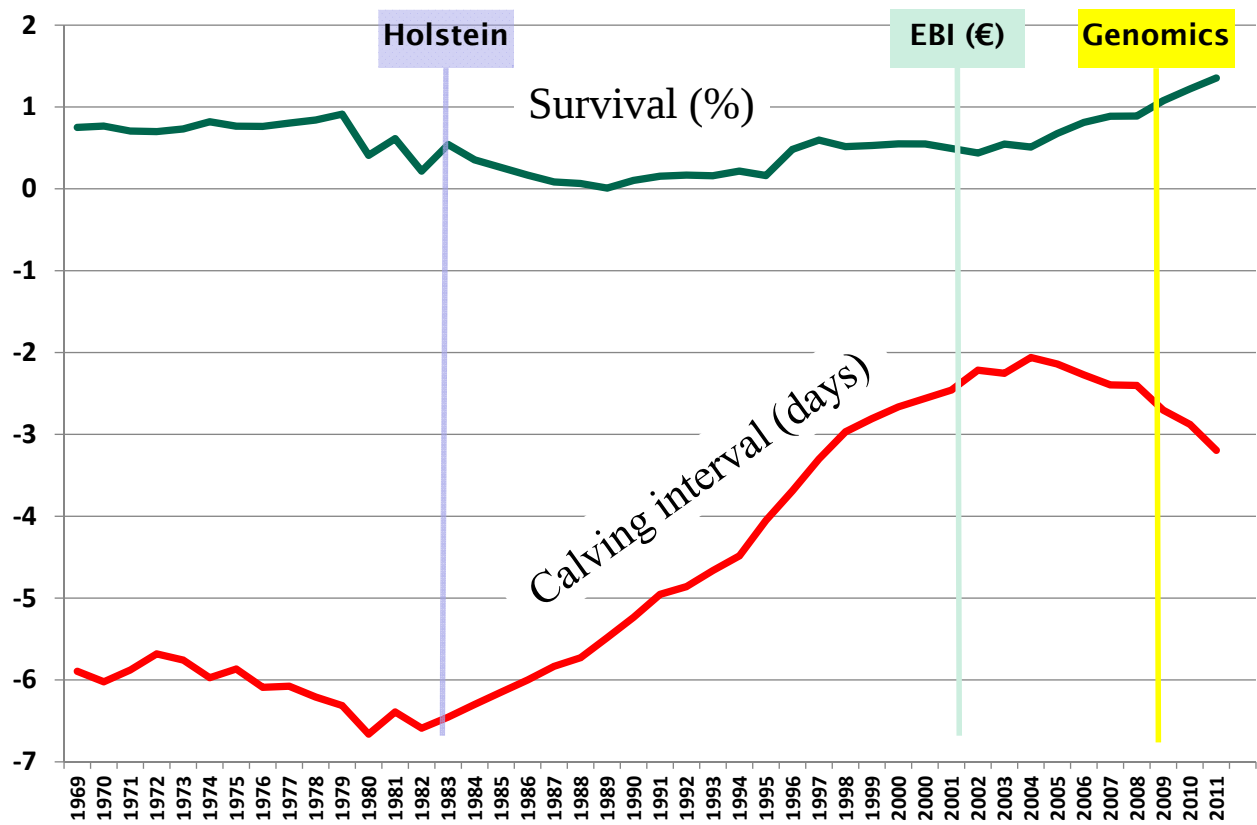
HISTORY – IRISH DAIRY CATTLE BREEDING



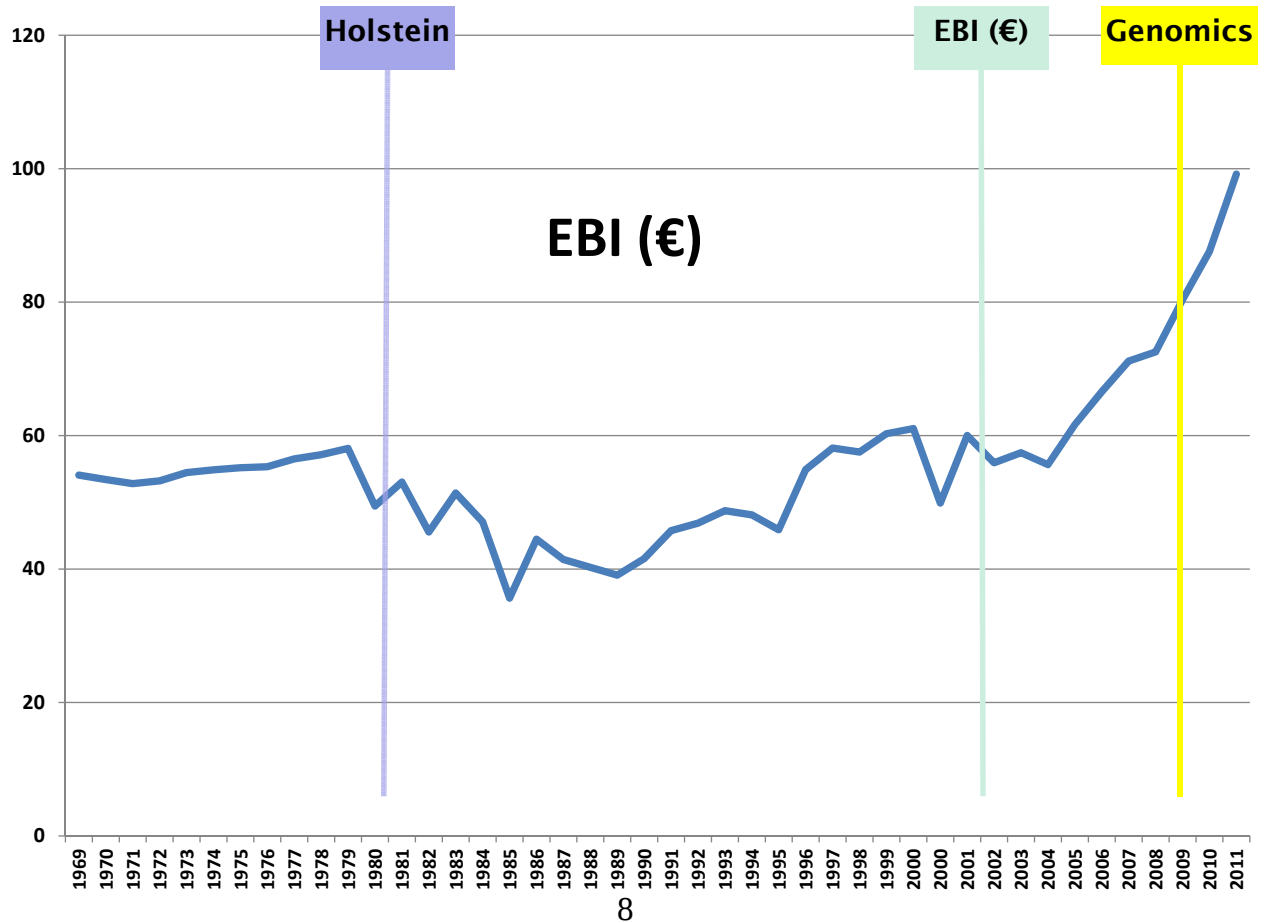
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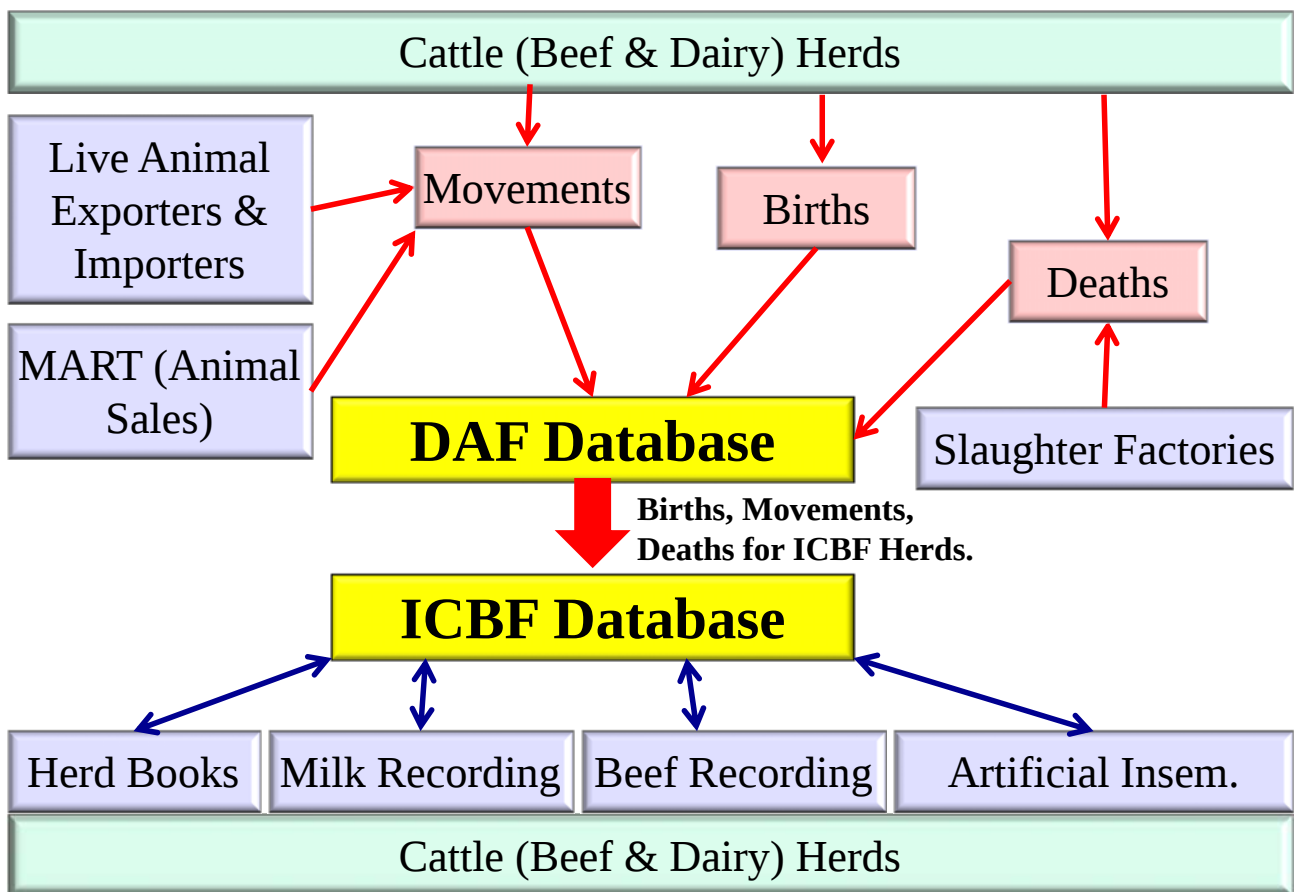
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Background - Genomics

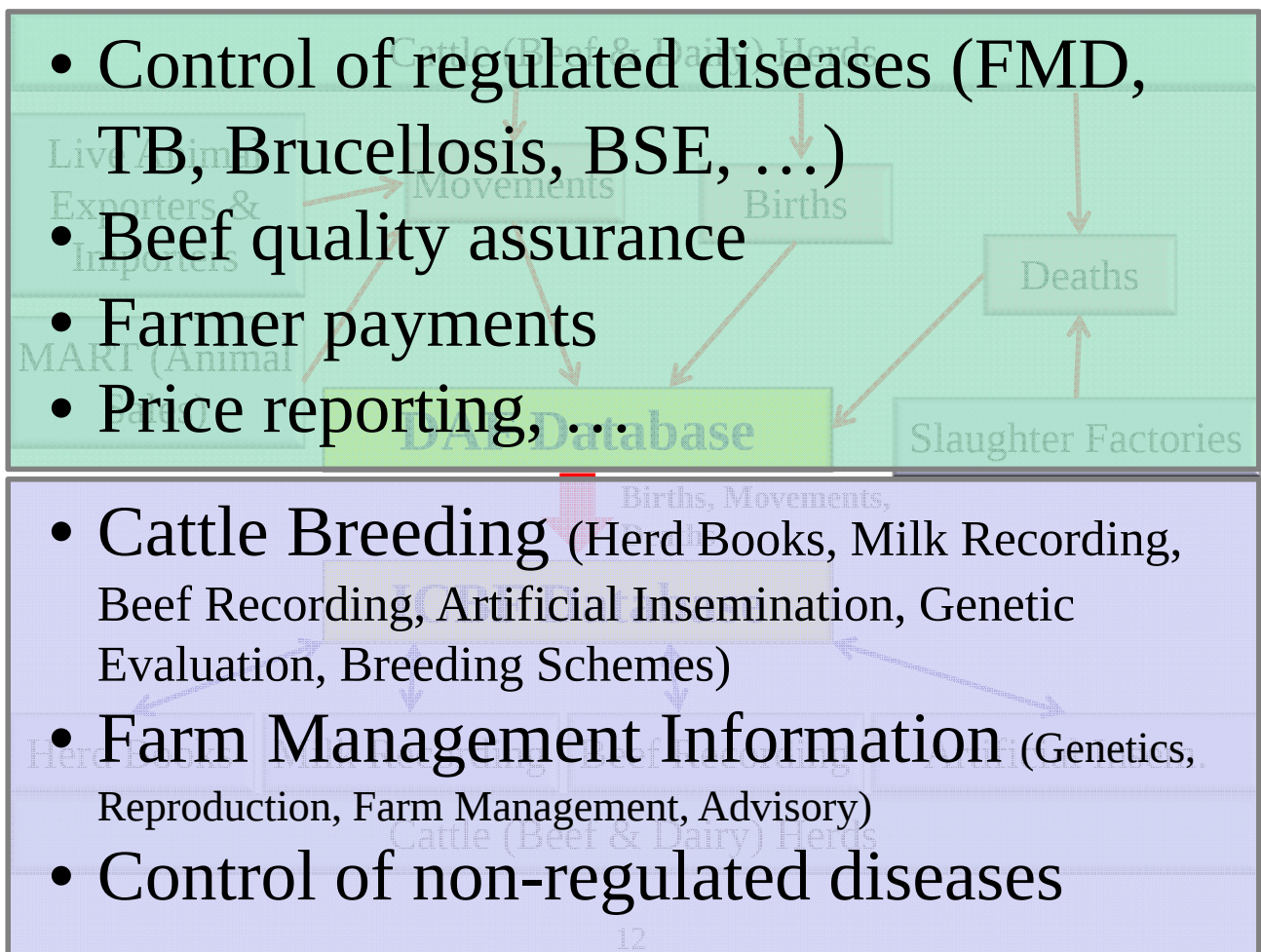
- Cost of genotyping using DNA is reducing rapidly.
- Genotypes can be ***trained*** to predict genetic merit for a wide range of traits.
- ***Training*** require genotypes and phenotypes for many animals.
- Genomics has been used in Irish dairy breeding for three years.
- Use of genomics in Irish beef breeding is being researched.

Background

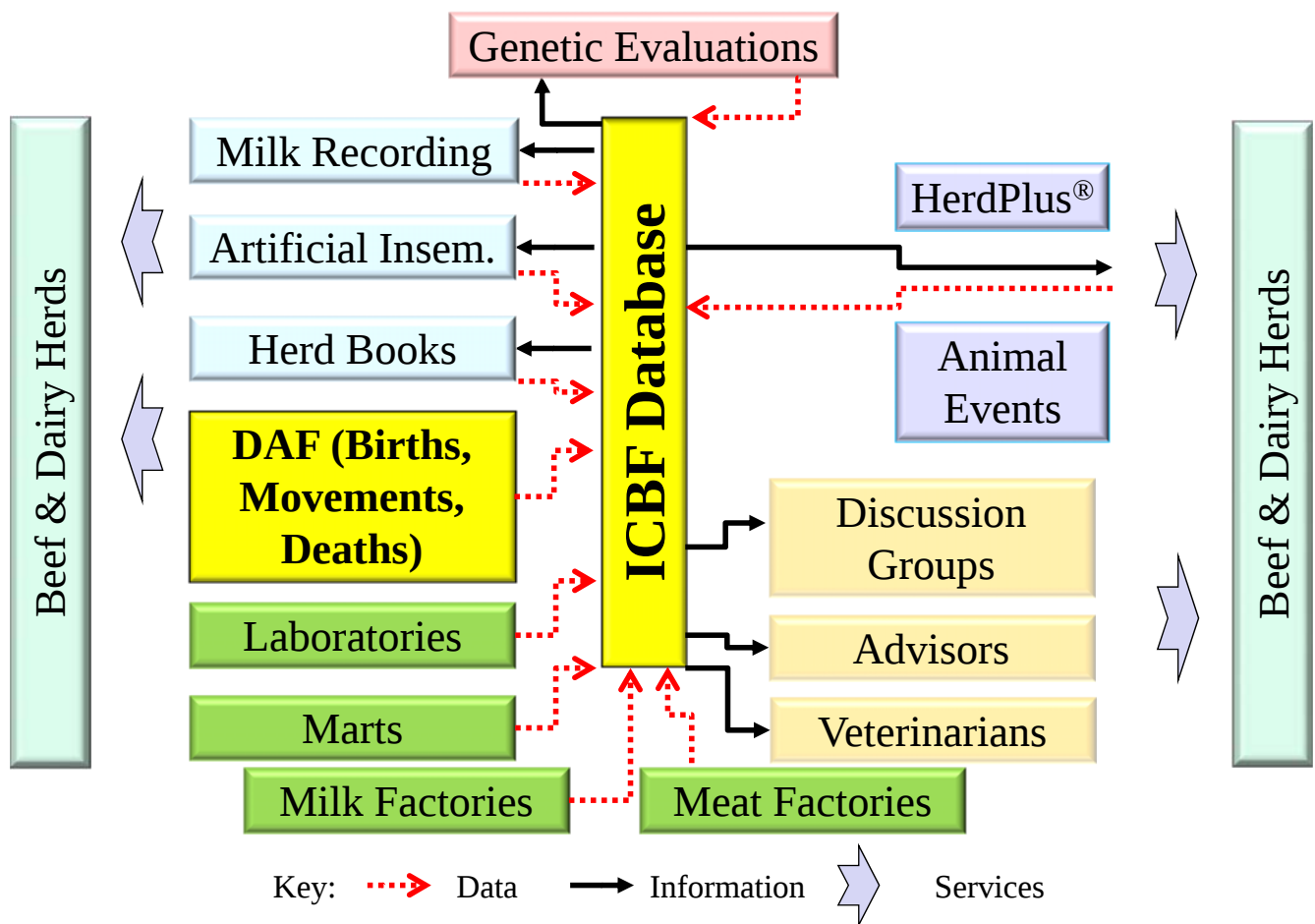
DATABASES



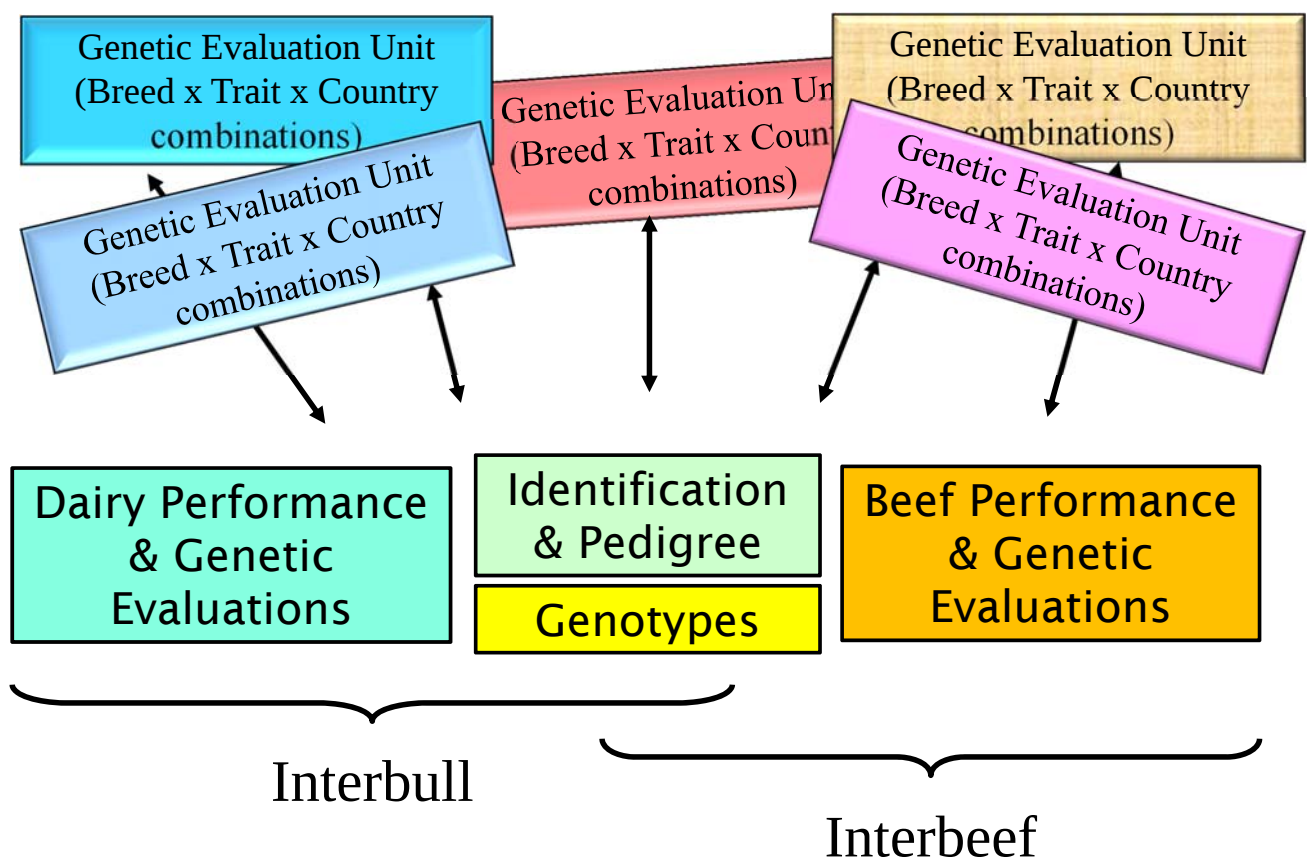
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International Collaboration for Cattle Breeding

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ROLE OF GENOMIC TECHNOLOGY

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How might genomics help?

- **Increase accuracy** of evaluation on selection candidates – stock bulls & replacement females
- **Reduce age** at which accurate evaluations are available on selection candidates – AI bulls
- **Increase number** of selection candidates – AI bulls

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RESEARCH

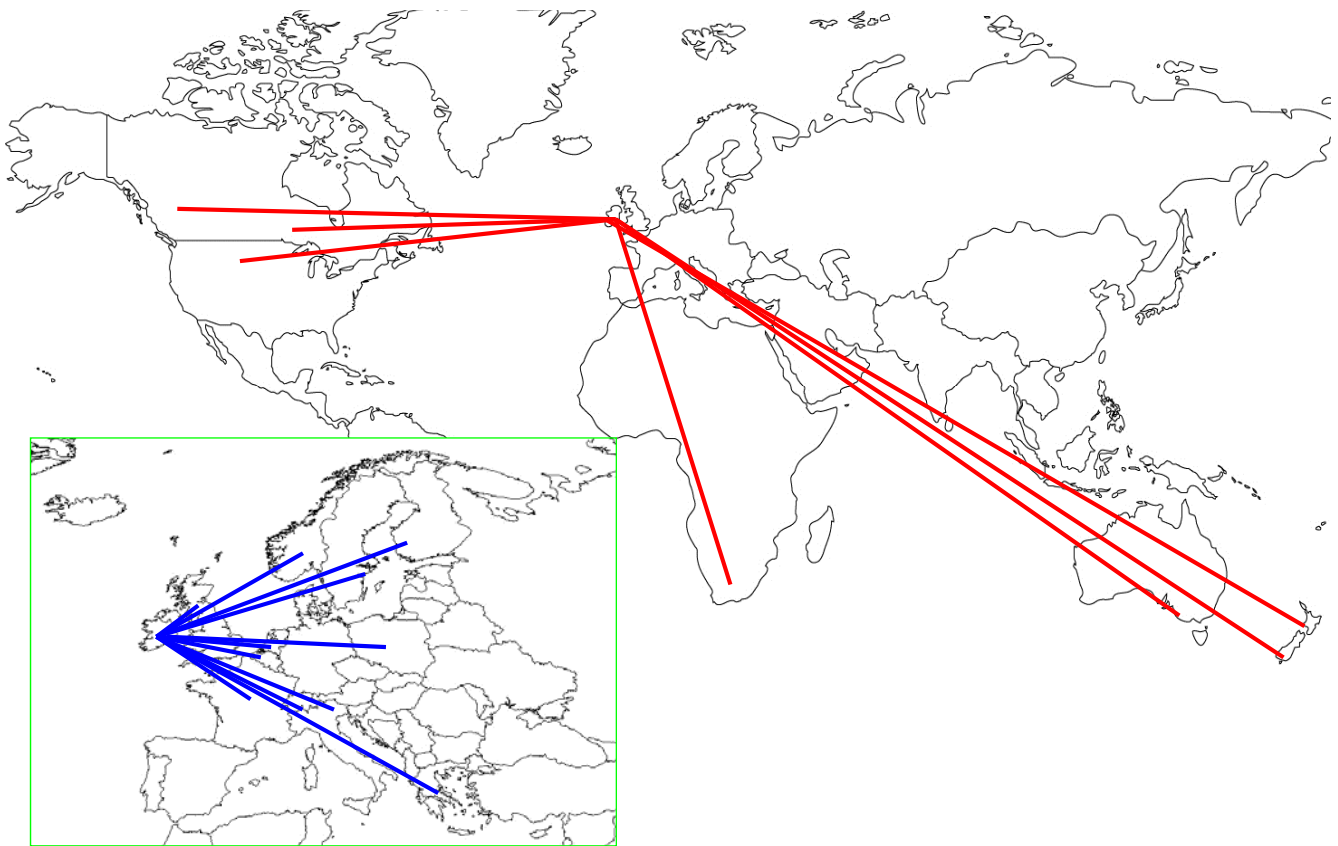
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Actions - Research

- **Relationships**
 - **Open sharing** with anybody willing and able
 - **ICBF & Teagasc** – Teagasc research, ICBF implement for benefit of Irish farmers
- **Skills**
 - PhD program quantitative genetics – 1 completion/yr for 13 years
 - Teagasc Walsh fellowship provides funds
- **Knowledge**
 - **Papers and participation in International Scientific meetings** by Scientists on routine basis
 - Scientists regularly **present and publish for Irish farming audiences**
 - **Breeding consultation** meetings – 3/yr involving breeding industry – research plans, research results, implementation plans

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Our Collaborators



Actions - Research

- **Phenotype Data**
 - ICBF database
 - ICBF across breed genetic evaluations
 - Interbull dairy AI sire MACE evaluations in Irish base & scale
 - Interbeef soon?
- **Genotypes**
 - **Irish:** AI sires & stock bulls – 1,100 50K for dairy, expect >1,000 800K for beef in near future
 - **International:** bi-lateral exchanges – ca 6,500 50K for dairy, growing number of countries
 - **IGenoP:** prototype database for international sharing of cattle genotypes (3k, 50k, 800k) to eventually be hosted by Interbull

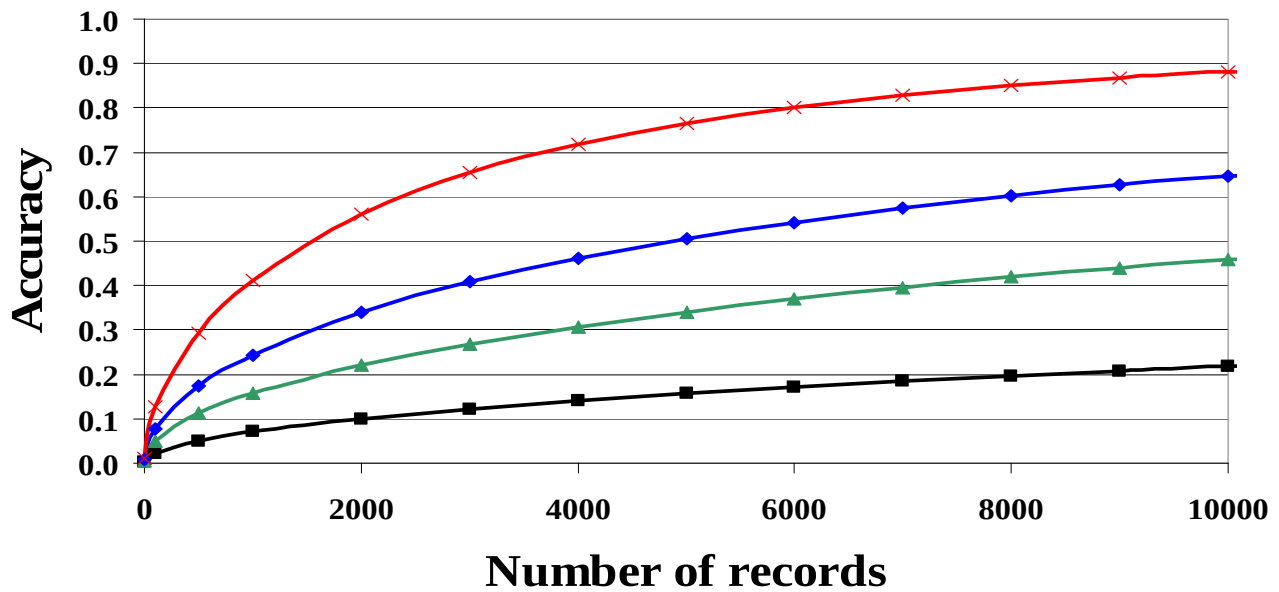
Training population

- **Year 2009**
 - 945 Holstein-Friesian AI bulls with progeny in IRL
- **Year 2010**
 - Up to 3660 HF AI bulls with international evaluations
 - Extra genotypes obtained through swapping
- **Year 2011**
 - More swapping
 - >4,500 Holstein-Friesian AI bulls
- **Year 2012**
 - >5,500?

International training populations

Country	Size
Ireland	4,500 (milk)
UK	11,480
Eurogenomics	14,385
North America	17,256 bulls + cows
New Zealand (HOL)	2290
Australia	2193

Size matters!!



■ $h^2 = 0.03$ ▲ $h^2 = 0.15$ ◆ $h^2 = 0.35$ ✕ $h^2 = 0.90$



The Irish Agriculture and Food Development Authority

Actions - Research

- Tools
 - **Software** – freely sharing with whoever is interested
WWW.GENOMICSELECTION.NET
- Funding
 - **ICBF** – public & industry funding for; semen purchase, blood sampling, & genotyping
 - **Teagasc** – public funding for genotyping & salaries
 - **Data** – “free” for use in research

IMPLEMENTATION

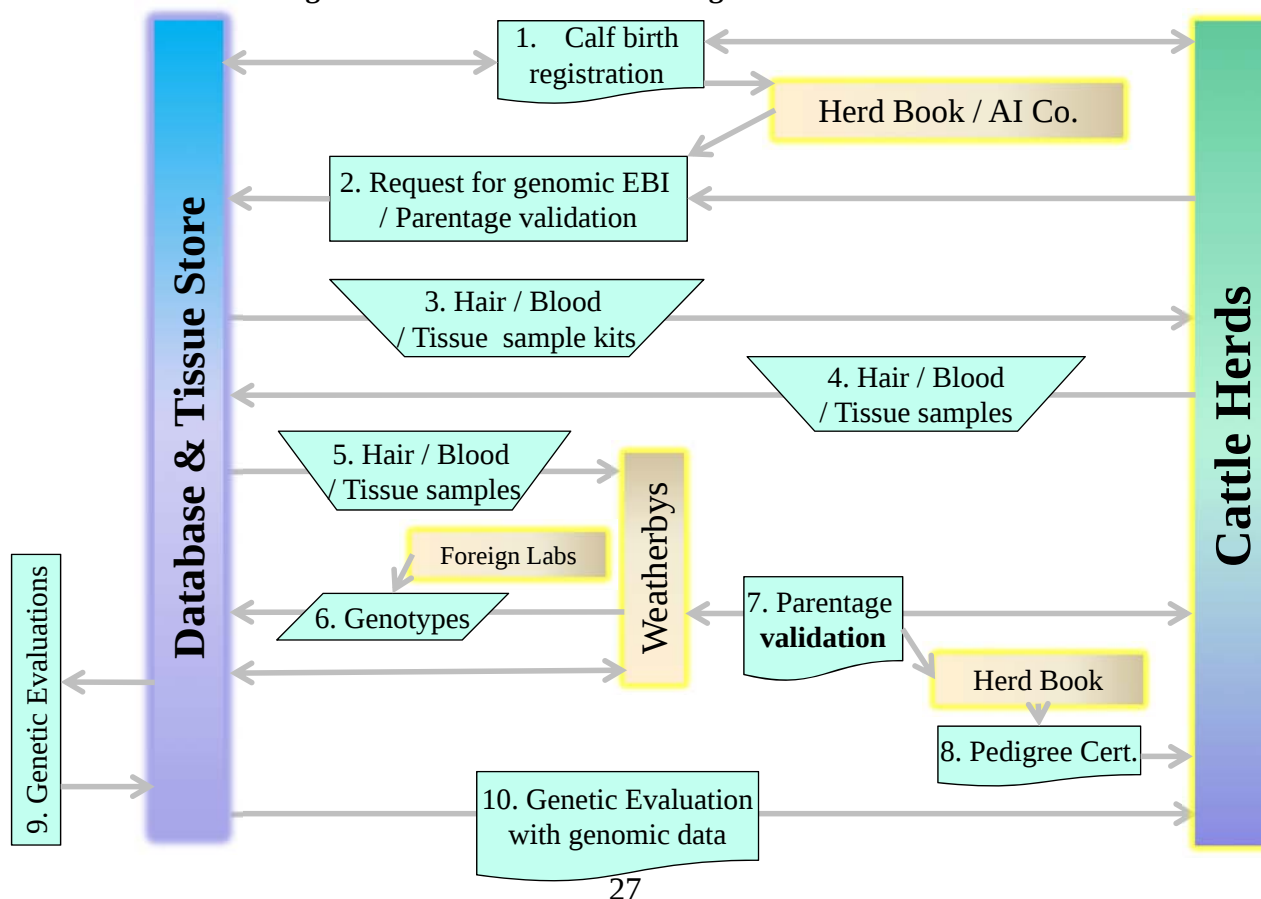
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Actions- Implementation

- **System Development**
 - Transfer knowledge & software from Research
 - Develop efficient interfaces between database & genetic evaluation system
- **Funding**
 - By ICBF – State, Farmer & Services
- **Operational steps**

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Draft (16/12/2011) ten steps in delivering parentage validation and a genetic evaluation that includes genomic information.



www.icbf.com – Dairy Active Bull List

View as Excel

Evaluation Date: Dec 2010

Rank	Tag	Bull Name	Sire	Main Breed	Herd Book Status	HO %	EBI	Rel %	Proof Source	Milk	Fert	Calv	Beef	Maint	Health	Calv Recs	Avail.	Price	Supplier
1	SOK	(IG) SUNNYBANK OMAN	OJI	HO	PED	63	279	56	GS	73	170	32	-7	2	8	1508	Low	20	NCBC
2	KOZ	KEVINSFORT OJI HAZE	OJI	HO	PED	94	264	61	GS	59	159	43	-4	-2	10	330	Medium	20	NCBC
3	MUJ	MORRISHEEN OJI FRANK	OJI	HO	PED	88	262	56	GS	121	108	36	-20	12	4	1390	Low	19	Eurogene/LIC

Main Breed	Herd Book Status	HO %	EBI	Rel %	Proof Source	Milk	Fert	Calv	Beef
O					GS	73	170	32	-7
O					GS	59	159	43	-4
O					GS	121	108	36	-20

DP–IRL daughter proven in Ireland

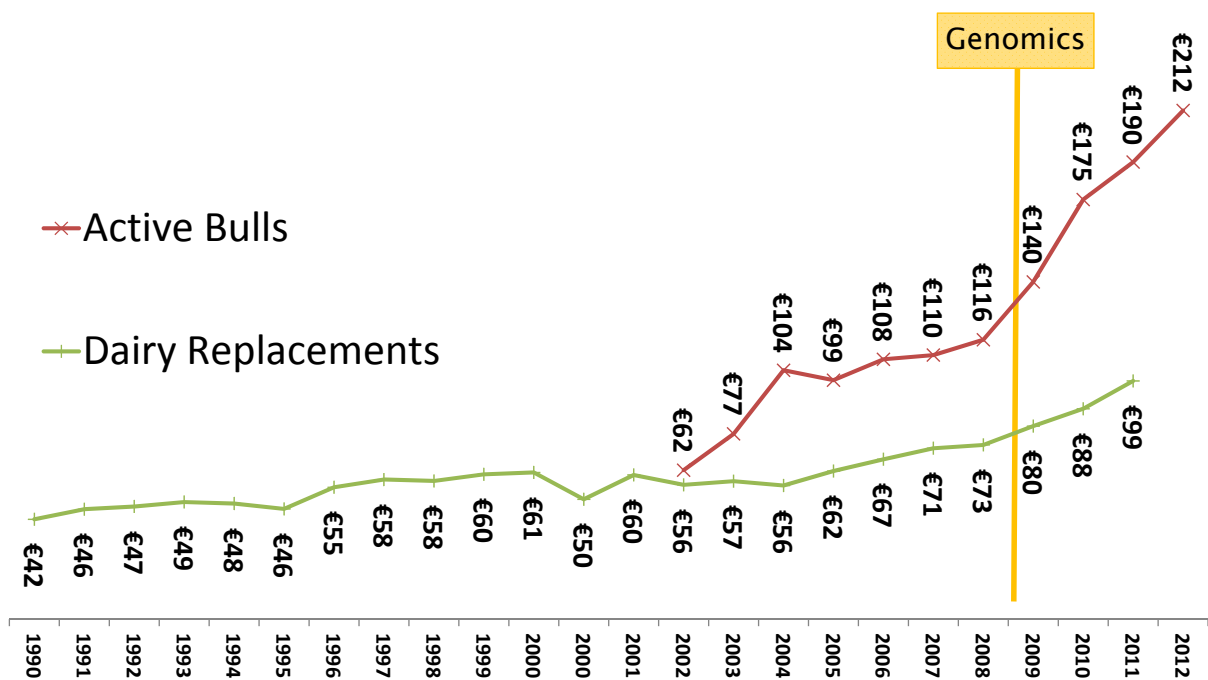
DP–INT daughter proven internationally

GS genomic selection

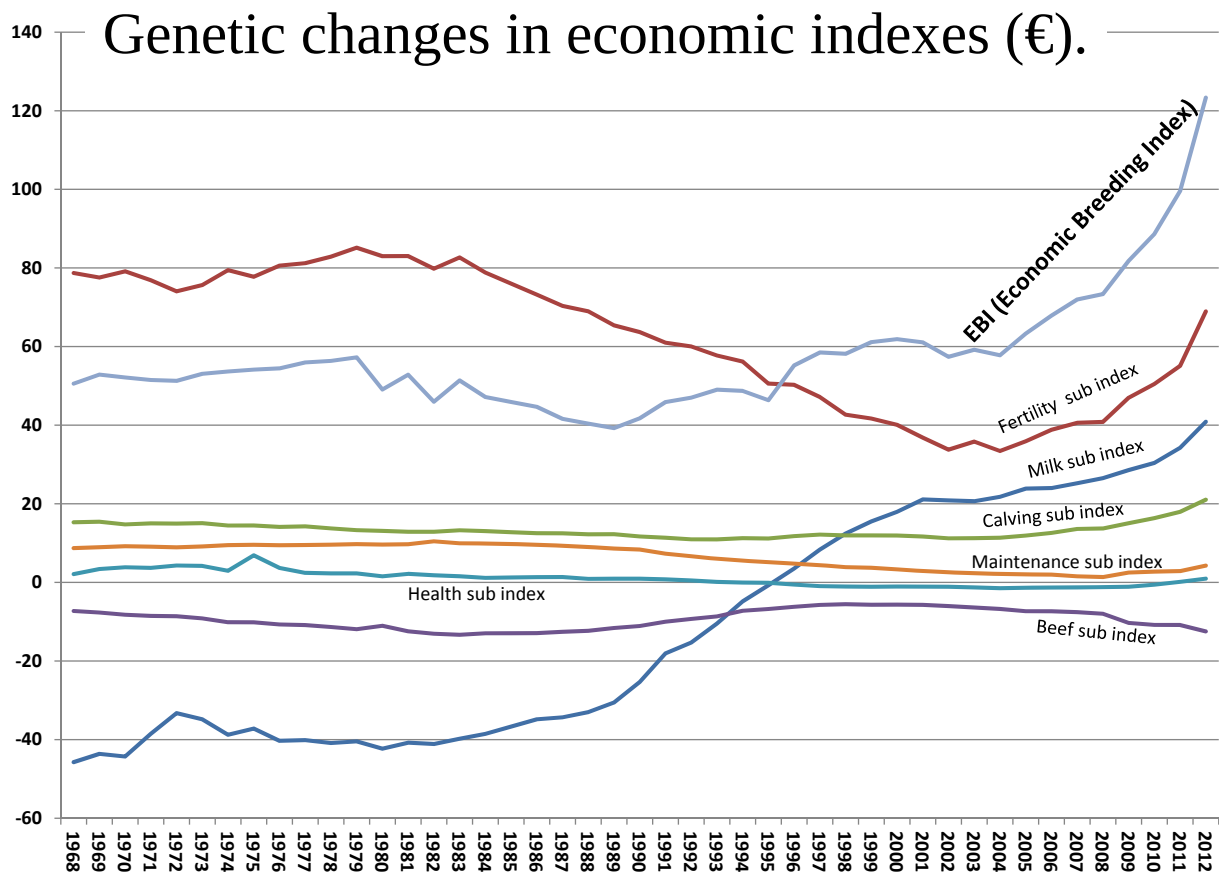
RESULTS – SO FAR

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EBI Trends – average EBI by year



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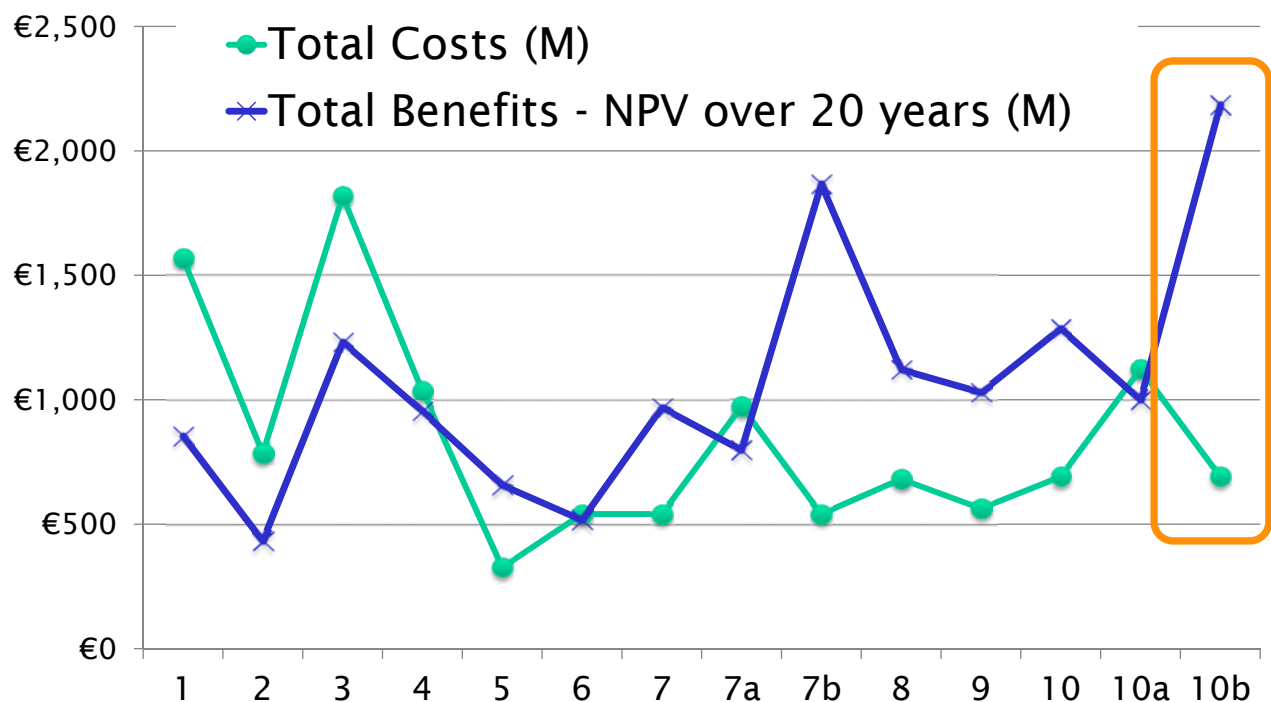


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BREEDING SCHEME

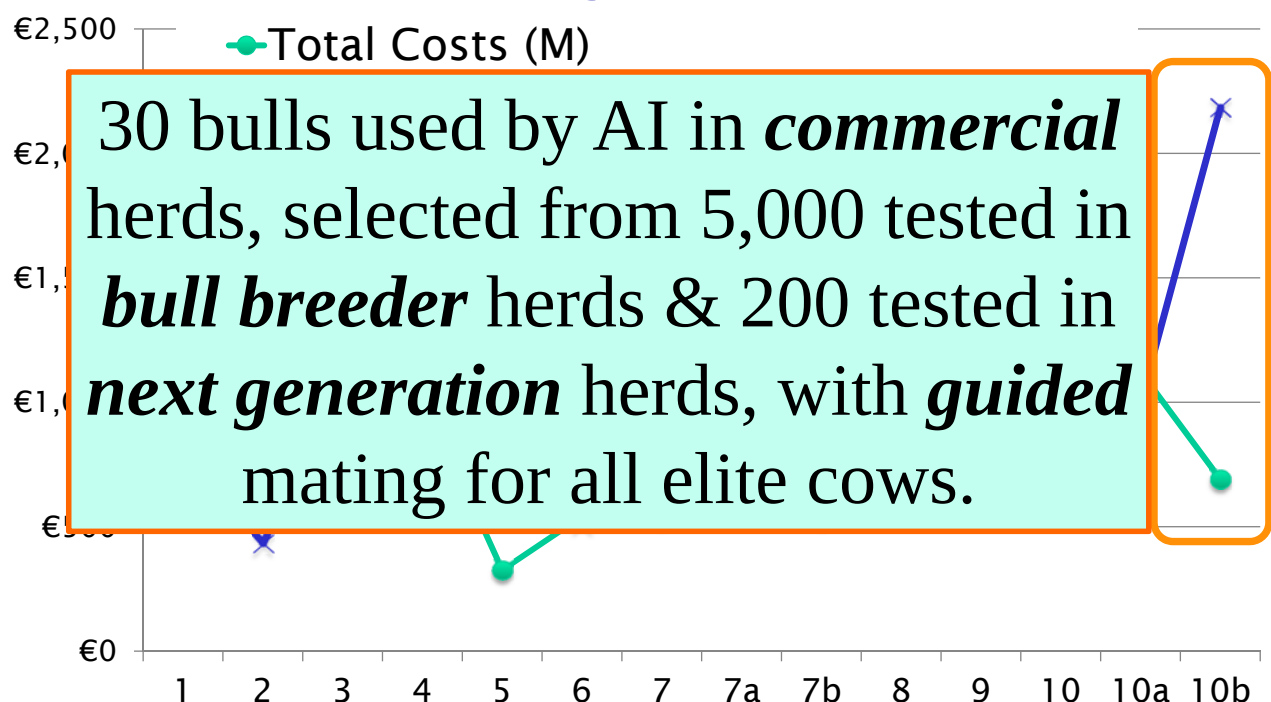
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Costs & benefits for different dairy breeding schemes



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Costs & benefits for different dairy breeding schemes



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Conclusions

- Animal breeding is a unique and powerful tool for improving the profitability of cattle farming in Ireland.
- Irish animal breeding has been transformed through a unique partnership between farmers, the breeding industry and DAFF.
- Genomic technologies, used appropriately, are already contributing by improving the profitability of dairy production in Ireland.
- We are working on beef.
- Continued investment in genomics is expected to give excellent returns.
- A strategy of openness, international collaboration and sharing is paying large dividends for Ireland.

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The poster for the ICAR 2012 Conference is set against a green background with a faint world map and a grid pattern. The title 'ICAR 2012 CONFERENCE' is in large white and green letters. Below it, a collage of images shows various aspects of agriculture: a red tractor, a person milking a cow, a herd of cattle, and a group of people. To the right, the text 'CORK IRELAND' is in white, followed by the dates 'Mon 28th May - Fri 1st June 2012'. At the bottom right, there are two circular logos: one for 'ICAR' (International Cattle and Animal Register) and another for 'INTERBULL'. The website 'www.icar2012.ie' is at the bottom in white.

ICAR 2012 CONFERENCE

CORK IRELAND

Mon 28th May
- Fri 1st June 2012

www.icar2012.ie