(Cost-)Effective Utilisation of Genomic Technologies in Beef Production

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Long-term connections ~ *Nothofagus spp:*

Contrasts and constraints

€300m !!!

Contrasts and constraints

$50m AUD

Effective utilisation of genomics:

- For single, or integrated organisations, no challenge at all:
  - Genomic selection works
  - Set your breeding goal
  - Invest in reference phenotypes
  - Select
  - Harvest value

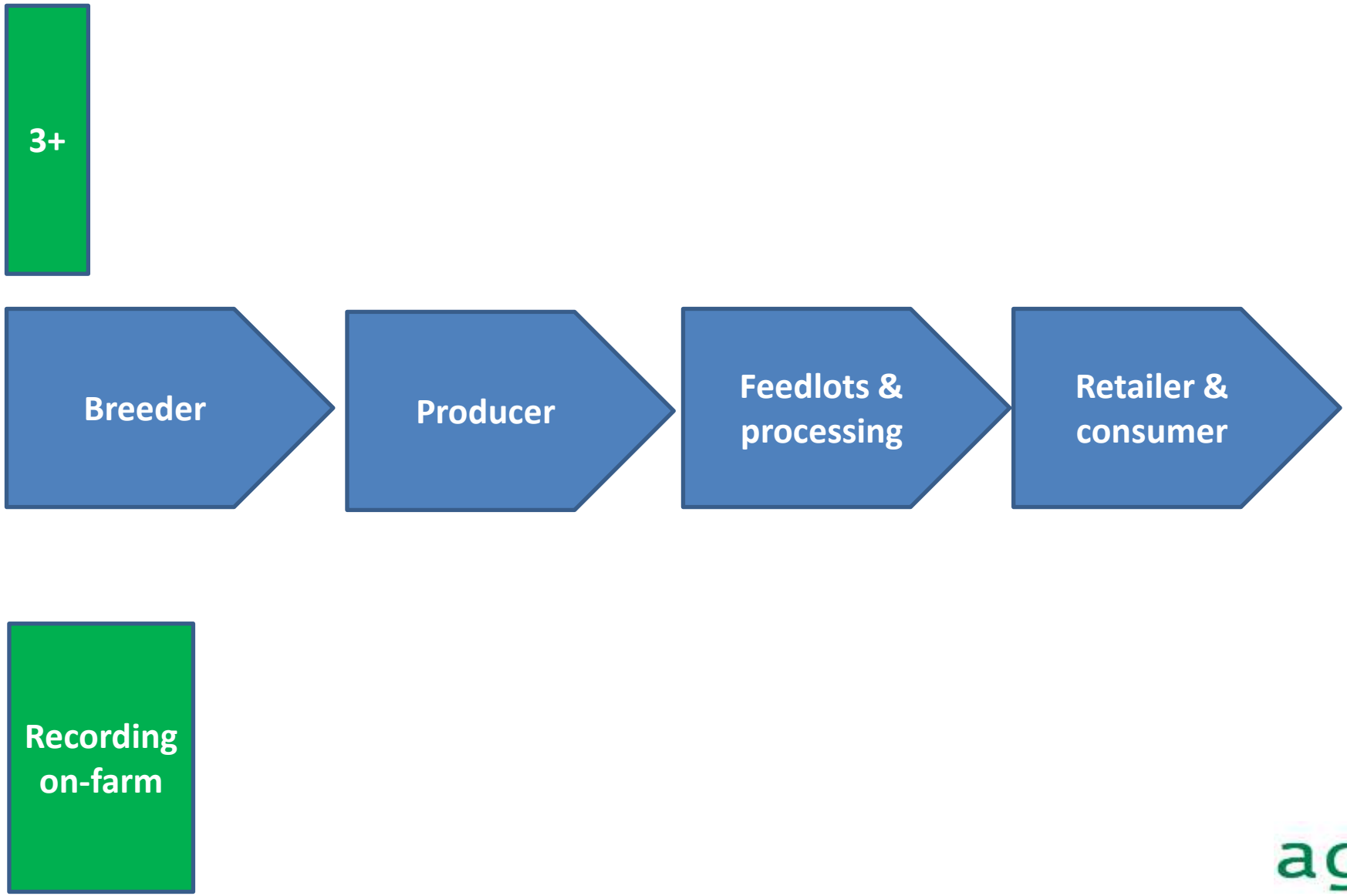
But in most beef industries:

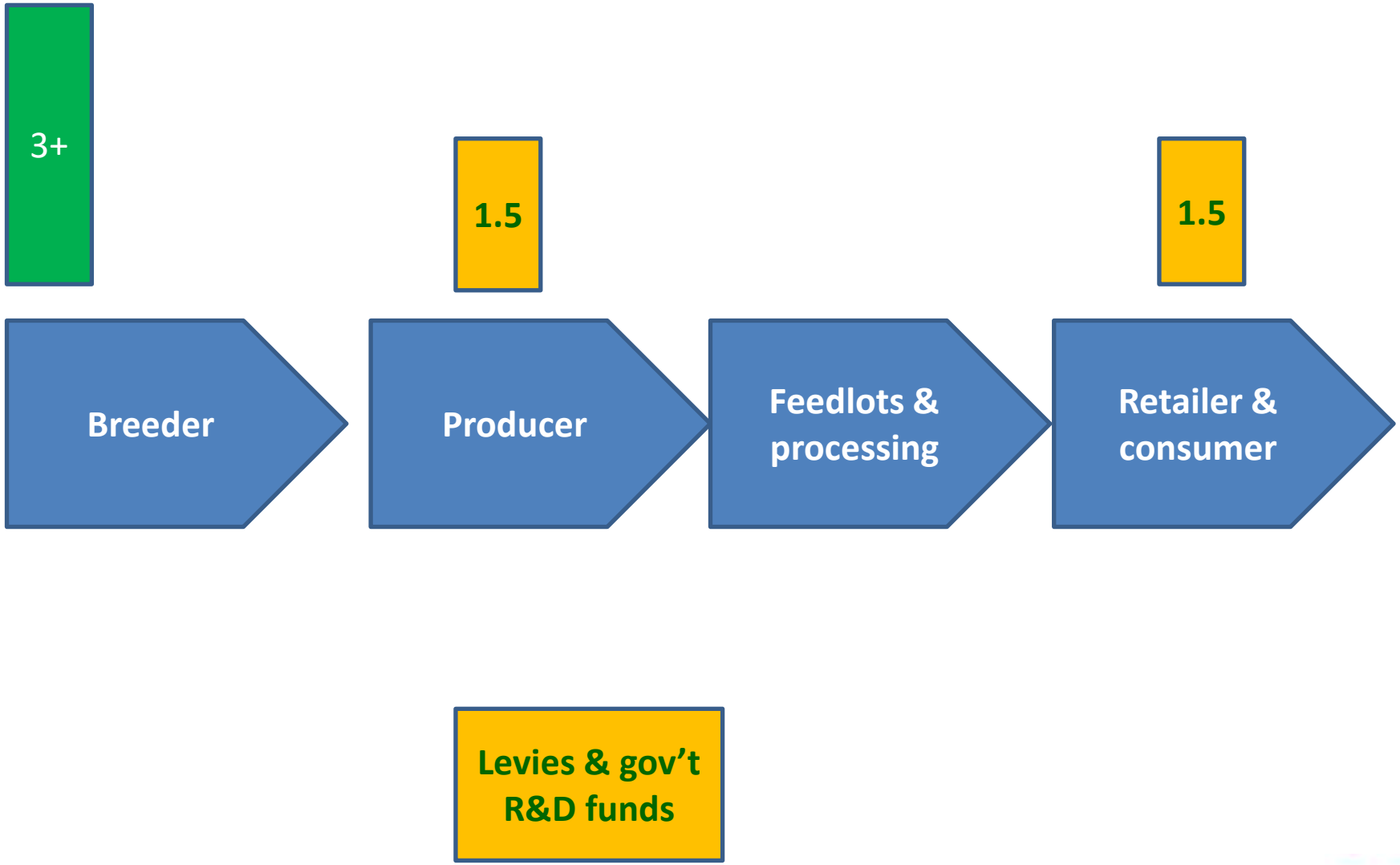
- Cost of technology, compared with returns:
  - Phenotyping: standard ~ $25 per female, high ~ $150 per female
  - Genotyping: ~ $50 per head
- Multiple players:
  - 200-300 breeders in beef in Australia,
  - average female numbers ~ 300-500 cows,
  - turnover ~ $0.5-1m pa
- Number of breeds:
  - Angus, Hereford, Charolais, Limousin, Wagyu, Brahman, tropical composites
- Longer value chain, with limited price signals

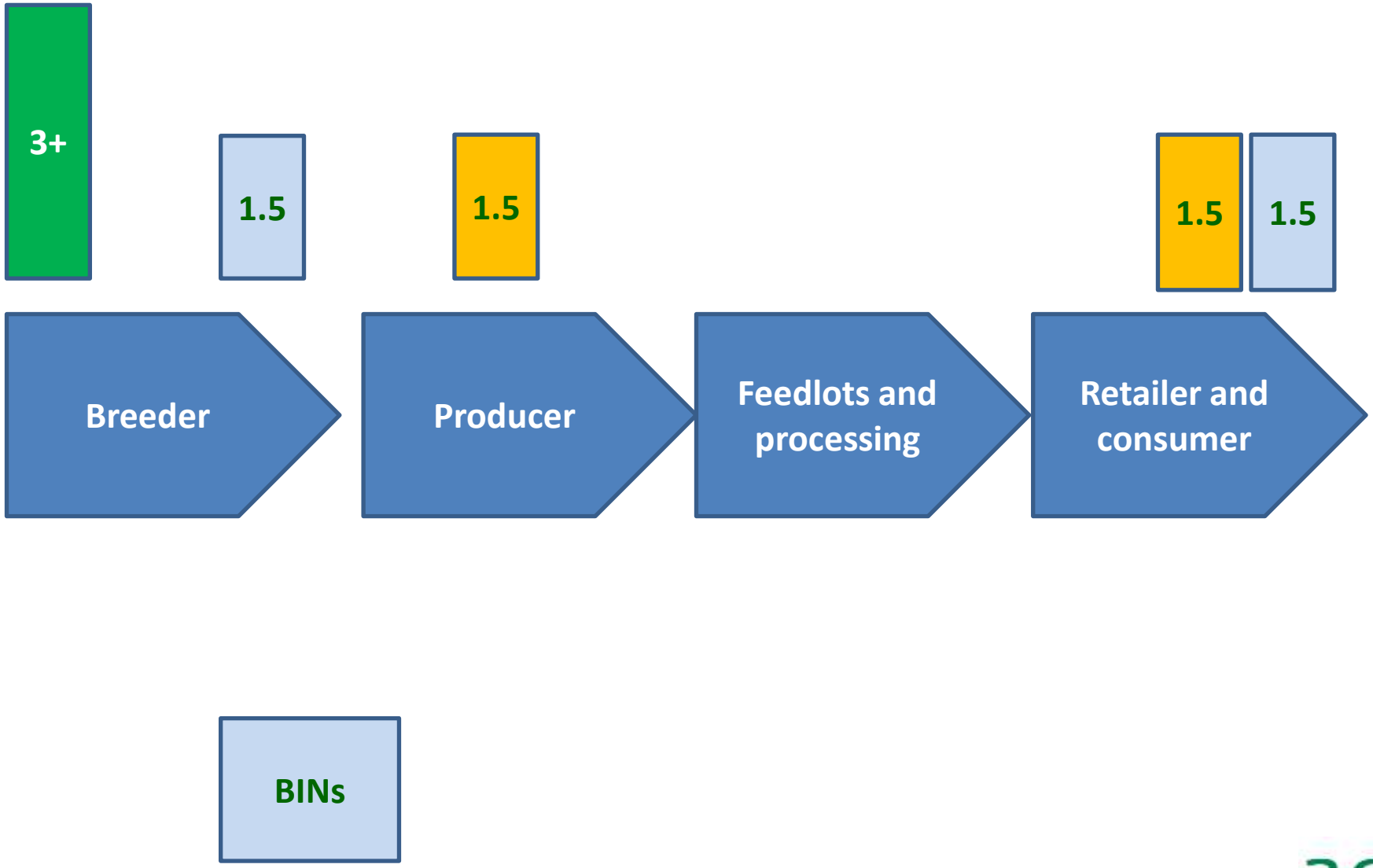
Value chain costs and capture of benefits:

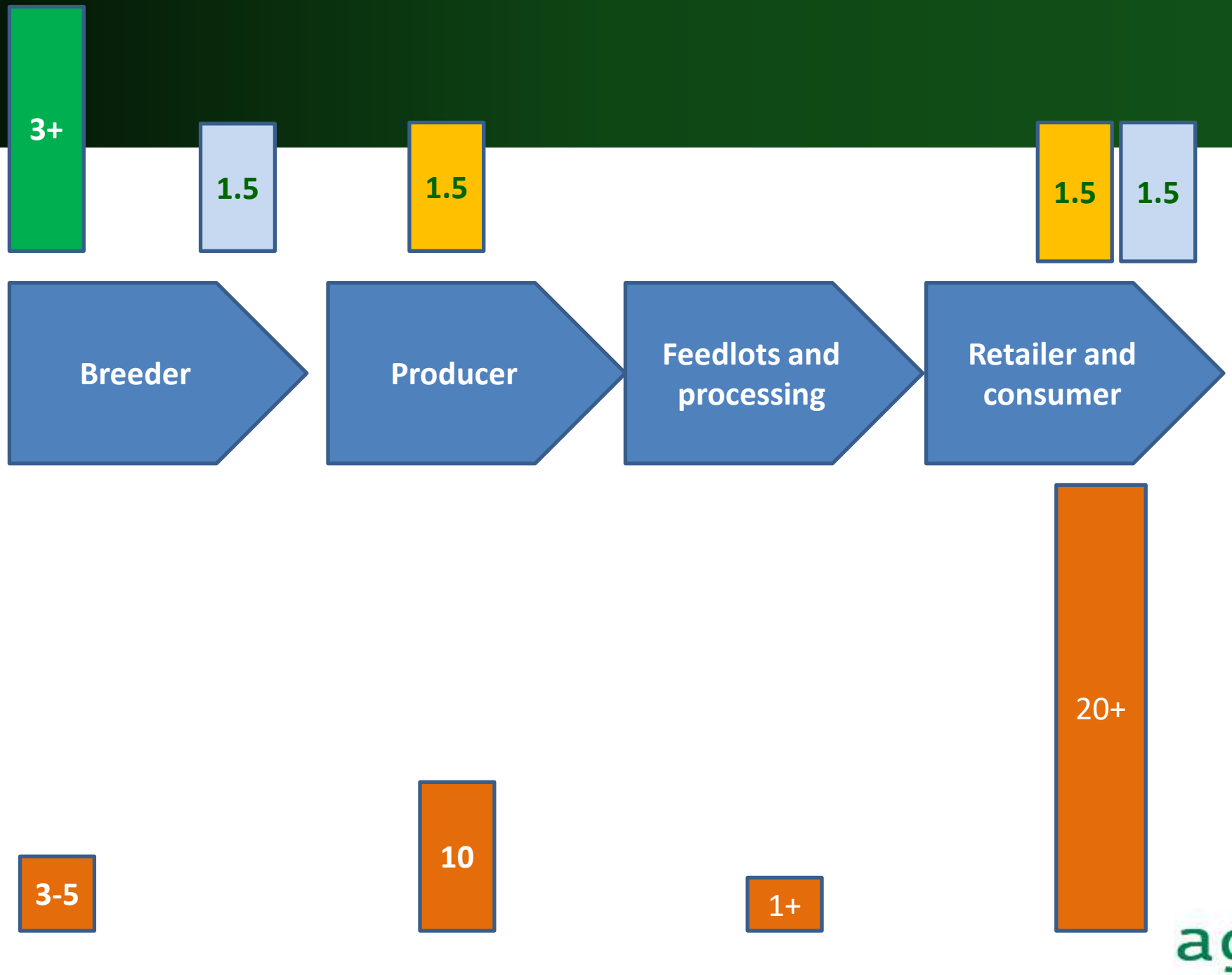
- Costs:
  - On-farm recording: ~ $4m
  - BINs (reference): ~ $3m, and need to be bigger

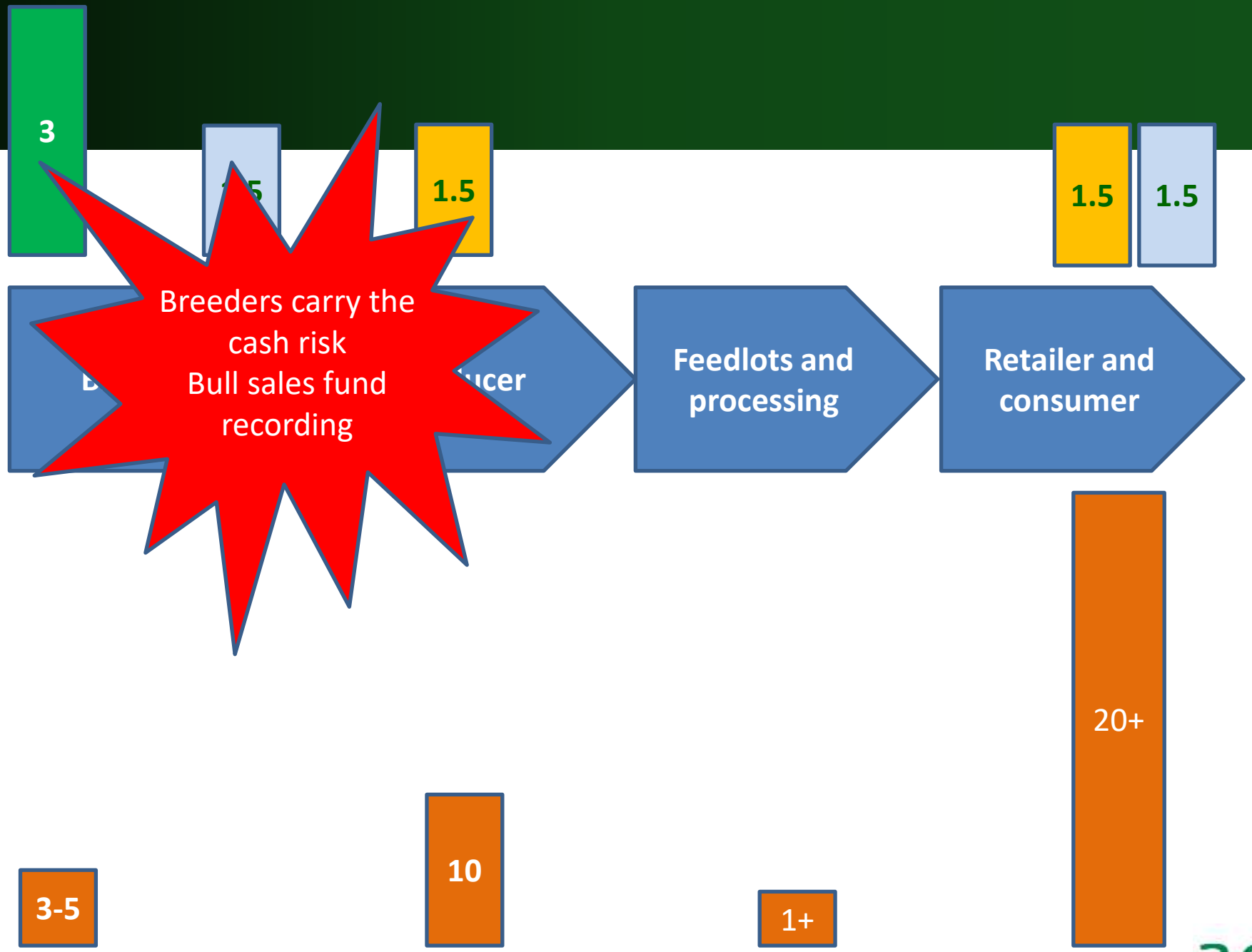
- Returns:
  - Cow-calf operators ~ 25-30%
  - Bull-breeders ~ 3-5%


3+
Breeder
Producer
Feedlots & processing
Retailer & consumer
Recording on-farm


3+
1.5
1.5
Breeder
Producer
Feedlots & processing
Retailer & consumer
Levies & gov't R&D funds


3+
1.5
1.5
1.5
1.5
Breeder
Producer
Feedlots and processing
Retailer and consumer
BINs


3+
1.5
1.5
1.5
1.5
Breeder
Producer
Feedlots and processing
Retailer and consumer
3-5
10
1+
20+


3
1.5
1.5
1.5
1.5
Breeders carry the cash risk
Bull sales fund recording
Feedlots and processing
Retailer and consumer
3-5
10
1+
20+

Systematic approach to genetic improvement:

1. Define breeding objective
    1. impact on profit
    2. Include all traits
2. Evaluate available stocks and use best one(s)
3. Estimate genetic parameters for criteria and objective traits
    1. Additive and non-additive effects
    2. GxE
4. Evaluate crossing and/or selection program
5. Implement recording and genetic evaluation
6. Implement selection, including mate allocation or selection; and/or crossing

BLUP compared with Genomics:

- BLUP:
  - Collect records – get EBVs
  - Recording and selection essentially applied to same animal(s)
  - Largely depends on individual's effort

- Genomics:
  - DNA sample – get EBVs
  - Depends on reference population
  - Recording and selection can be applied to completely separate animals

The wealth creation model:

- Wealth potential (or brand value = breed value)

$$\bar{} \qquad = \delta_{\$}$$

– based on

$$y = \begin{array}{c|c} \mathbf{X'X} & \mathbf{X'H} \\ \hline \mathbf{H'X} & \mathbf{H'H} \end{array}$$

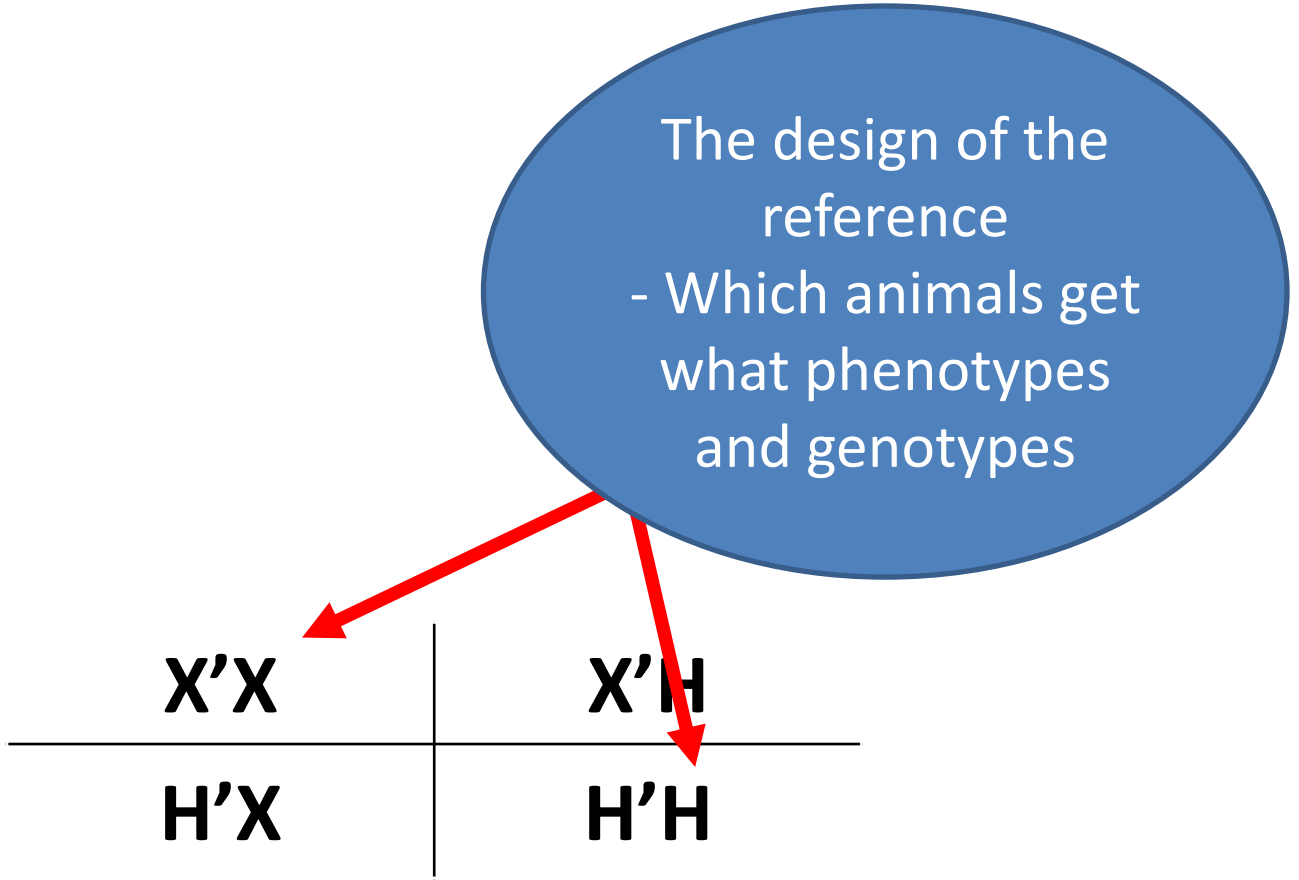
The wealth creation model:

- Wealth potential

– $= \delta_{\$}$

– based on

y =



The wealth creation model:

- **The aim is to:**
  - **Maximise $r.\delta_{\$}$ per funds invested**
  - **Maximise i.r/L**

So, who makes what decisions?

- **Direction**
  - **Describe as much profit (tangible and intangible) as possible – *who contributes to this?***
- **Records**
  - **Not all records, or genotypes, are worth the same – *how to incentivize the most useful ones? Just genotyping heaps of animals is not smart.***
- **Mate selection**
  - **Not all matings are worth the same – *how to incentivize the most useful ones? Just rely on market rewards?***

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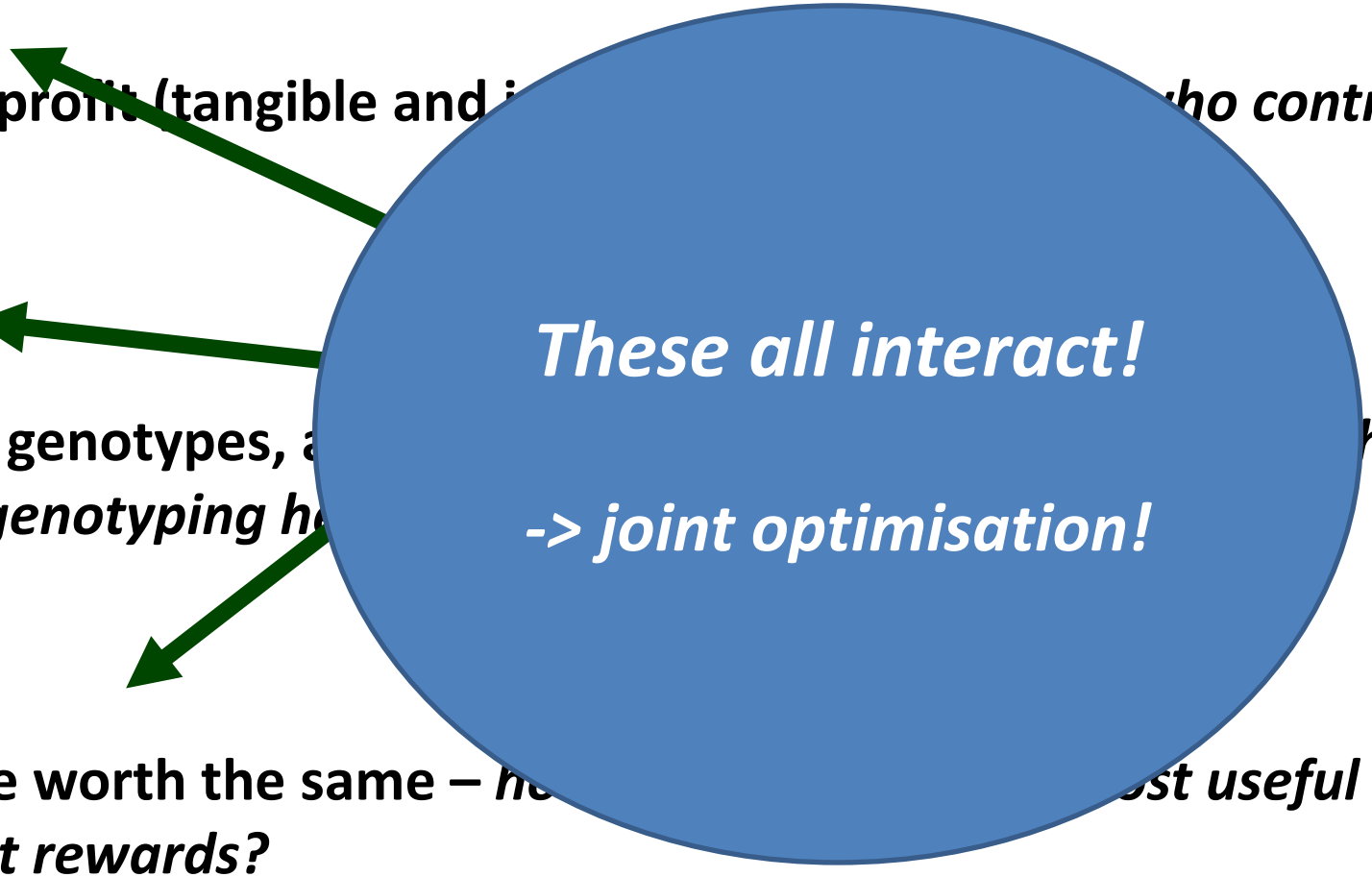


The future for breed associations, societies

- **Is as R&D organisations, aiming to:**
  - **Maximise $r.\delta_{\$}$ per funds invested for some defined gene pool**
  - **Maximise ir/L**

- **This will require:**
  - **New forms of association**
  - **New pricing and rewarding models**
  - **Likely long-term partnerships with others in the value chain (either private and/or public)**

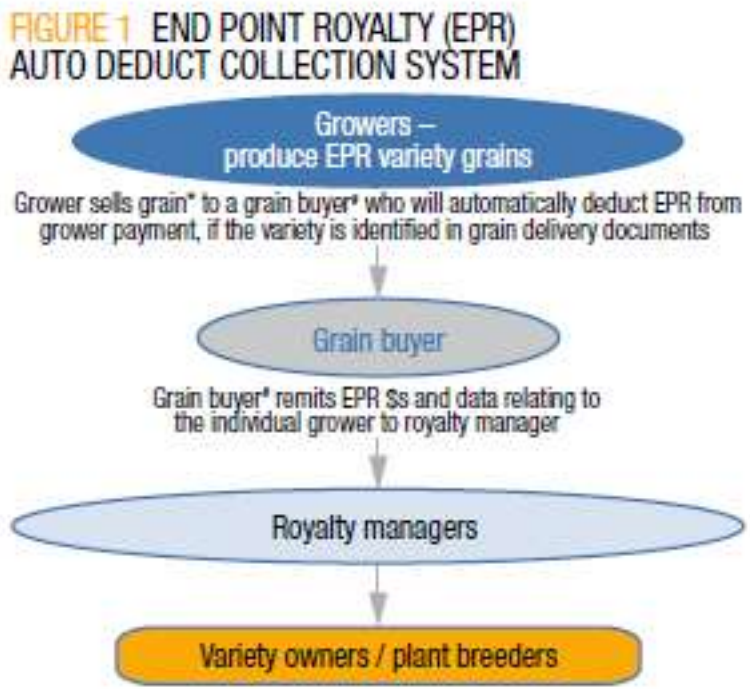
Funding the future ~ End-point Royalties:

Collects a royalty on grain sold

Typically c. 2-3% of value of product (ie 1 tonne of wheat, $3)

Funds collected are allocated to breeding organisation to fund breeding

This is separate from, and additional to, R&D levies



Perspectives, within and between countries:

- **Within-country "rules":**
  - **Have to be equitable and efficient**
  - **Must have well-designed incentives/rewards, and minimise free-riding**

- **Between-country:**
  - **Sharing data is almost invariably a win-win (benefit may be small, but cannot be negative)**
  - **Shared or coordinated design – young sire sampling, designed phenotyping and genotyping – will increase value**
  - **Estimating r_g between countries for objectives and for traits should be core activities**
  - **These are true irrespective of whether there is one evaluation or many**

- **Are these consistent?**
  - **Do "breeds" need to work as global partnerships or networks to survive?**

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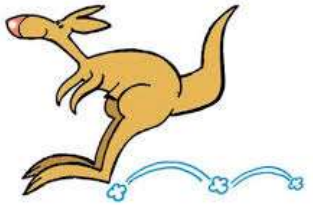
Opportunity cost:

- Increasing the rate of genetic progress
  - From current $2.50 per cow per year, to $5 per cow per year
  - NPV over 15 years ~ $1.5bn (just for Australia)



John Bull

Summary:

- Genomic selection is a radical innovation (breaks the nexus between records and EBVs)
- But it requires radical organisational innovation to obtain benefits:
  - New models for coordinated breeding program design
  - New partnerships to achieve those new models
    - ideally whole chain
  - Focus on creation of information and harvesting its value, not on dragging breeders into new technology
  - As always, effective cooperation can generate greatest long-term benefits
  - We need clever thinking and R&D

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