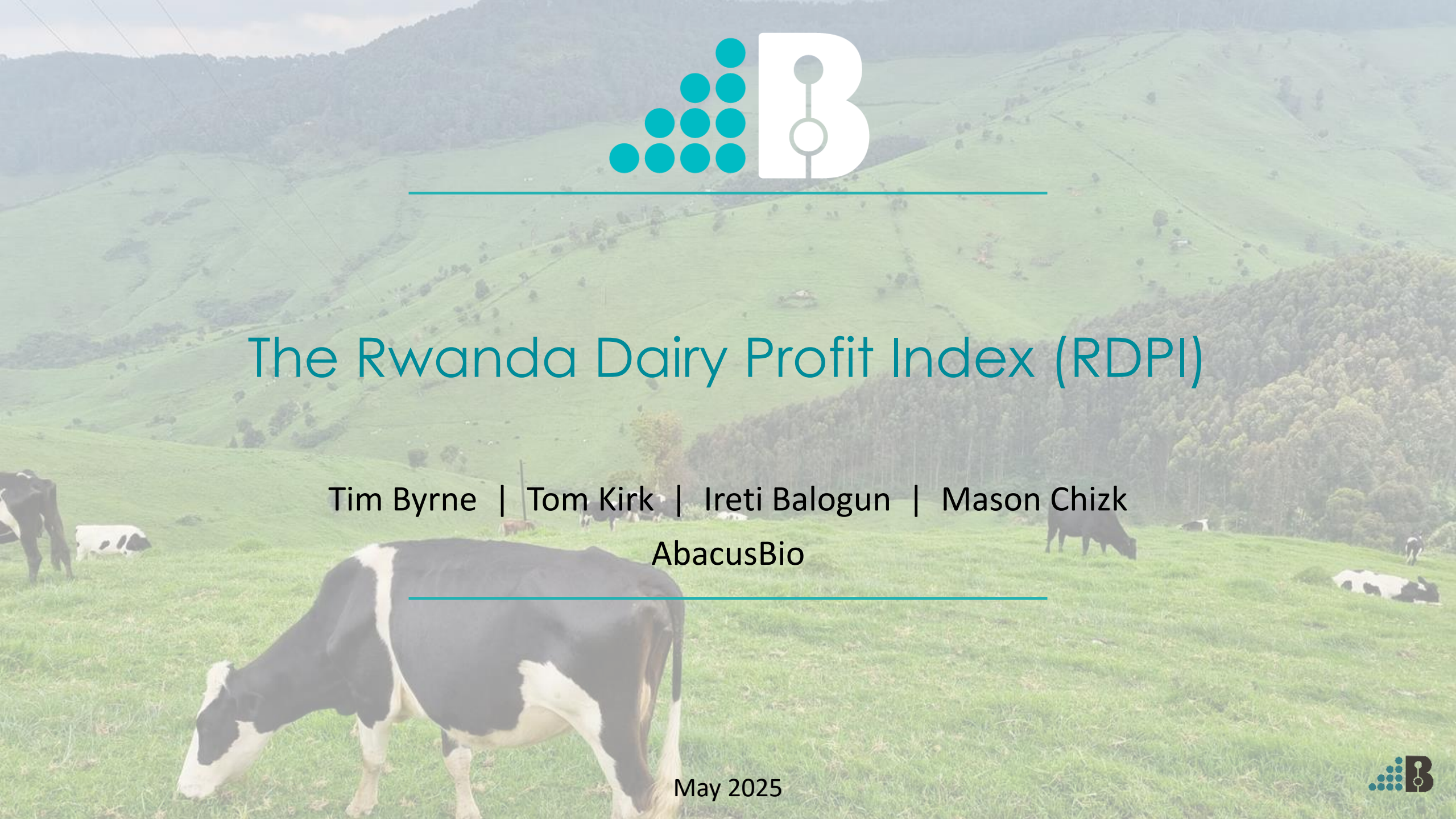


The Rwanda Dairy Profit Index (RDPI)

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Intro

- AbacusBio has been working with Royal Jersey Ag and Hort Society and Rwanda Agriculture and Animal Resources Development Board (RAB) to develop dairy genetic technologies
- This project focused on developing an economic selection index (RDPI) to rank dairy bulls for use in Rwanda

Contents

- What is a selection index and why use it
- Calculating economic values and economic weights
- The Rwanda Dairy Profit Index (RDPI)
- Bull rankings and trait emphasis
- Recommendations/ next steps

Some terms to remember

Jargon

“Trait” = animal characteristic for which we have an estimated breeding value

“Estimated breeding value (EBV)” = estimate of genetic merit for a trait

“Economic selection index” = calculating the total merit as a weighted sum of different traits

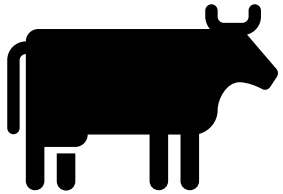
“Economic value (EV)” = the profit derived from improving each trait

“Economic weight (EW)” = the weightings used in the selection index

What is an economic selection index

- Most genetic improvement programs aim to improve several traits
- How can we identify the bulls with the most profitable genetics to use in Rwanda?

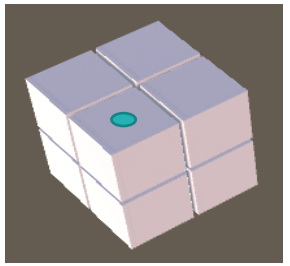
$$Total\ R₣\ merit = ew_{milk}ebv_{milk} + ew_{feed}ebv_{feed} + ew_{fertility}ebv_{fertility} + ew_{long}ebv_{long}$$

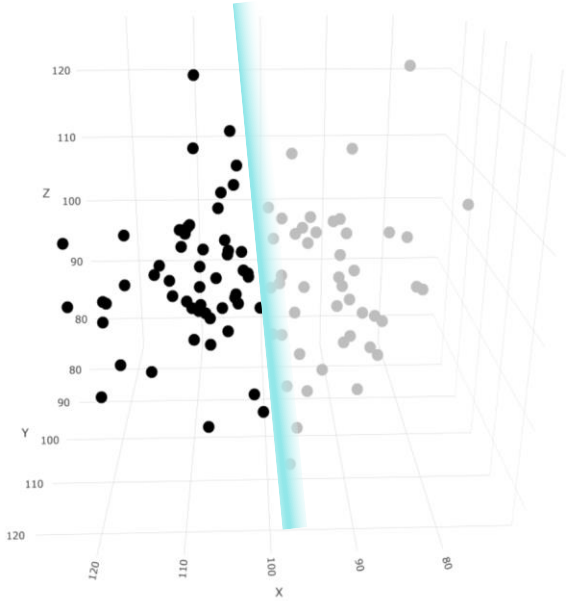




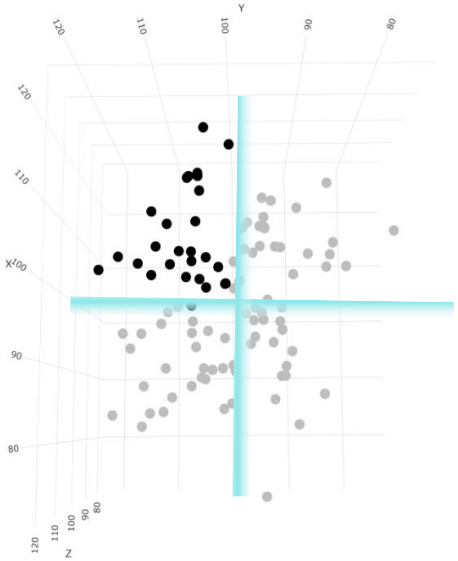


Why use a selection index

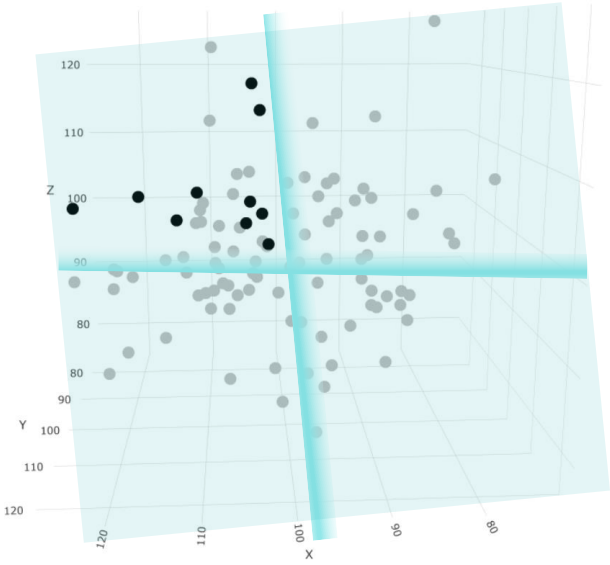




Cull on Trait X

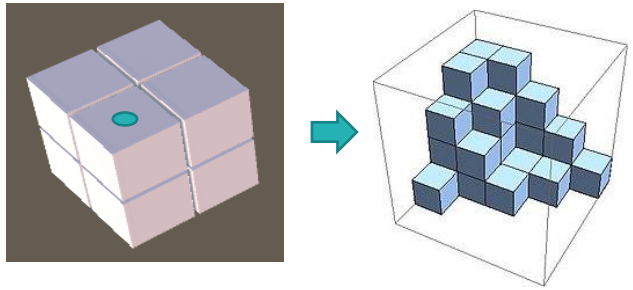


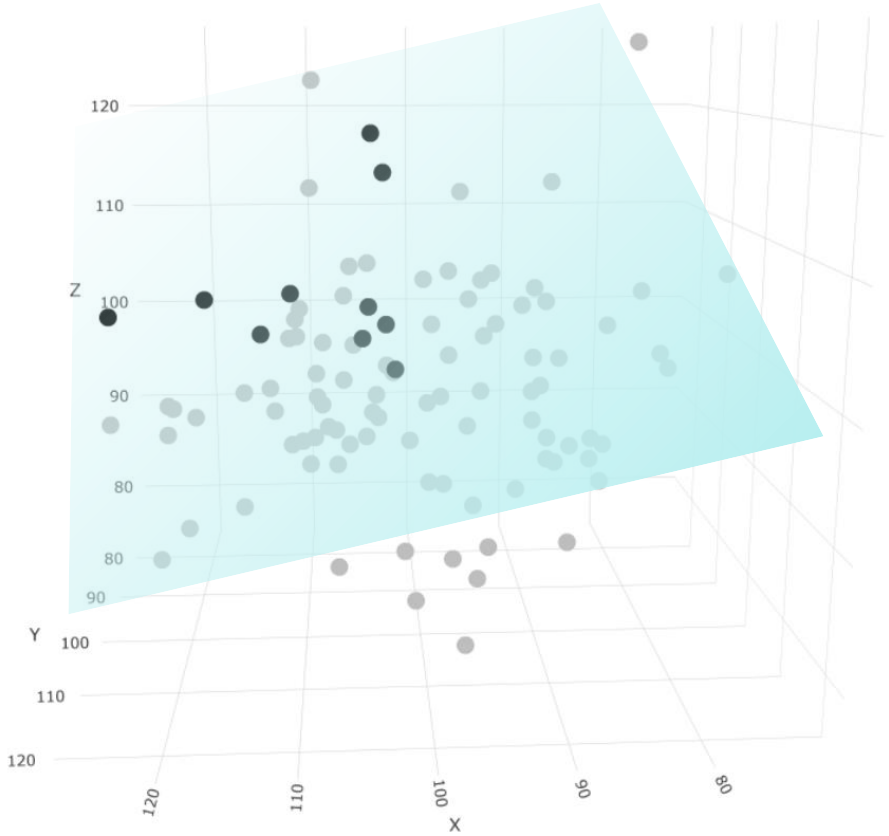
Cull on Trait X & Y



Cull on Trait X, Y & Z

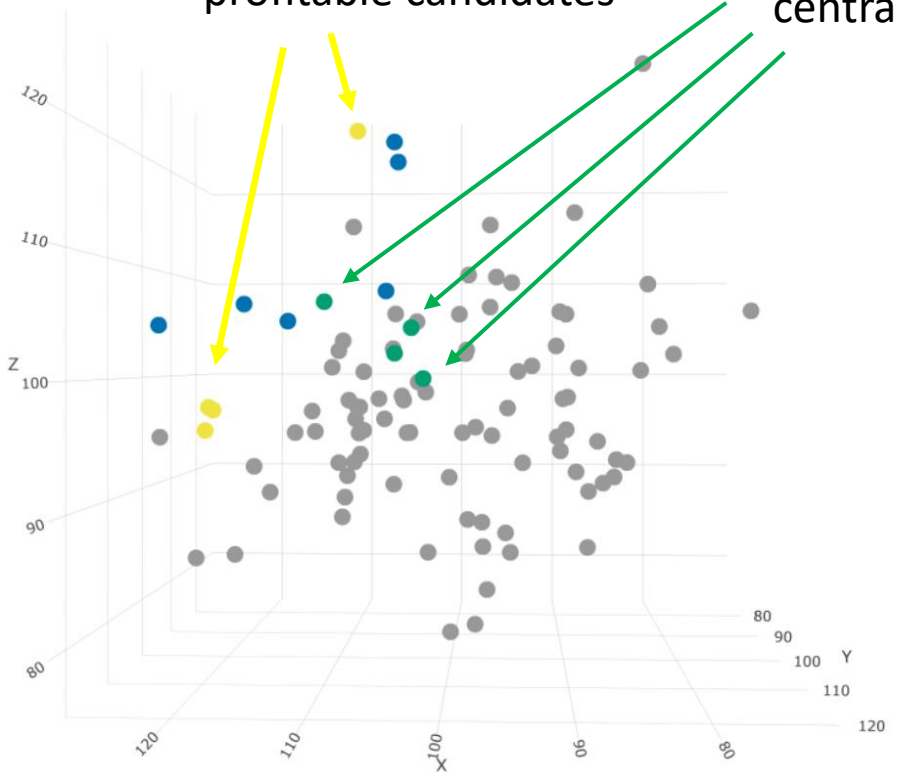
Why use a selection index





Indexes allow selection of most profitable candidates

Thresholds favour central candidates



Why use a selection index in Rwanda

- Aligns with RAB aims to improve dairy cattle productivity through advanced breeding technologies
- Provides a tool that RAB can use to support decision-making when importing dairy bull semen
- Start with key traits – milk, fertility, reproduction, longevity, cow weight – expand to other traits later
- In the future, identify bulls within Rwanda to select as sires

Calculating economic values

Profit

Milk example (per litre)



Minus



= RFprofit

RF400 minus RF180 = RF220

Feed cost based on **energy costs to produce milk** (textbook), **diet composition** and quality (grazed grass, Napier grass, household forage, concentrate), and **cost of different feeds** (rainy and dry season, housed and grazing)

Profit value is a function of both **revenues** AND **costs** associated with trait

Calculating economic values

Profit

Fertility example (per 1% increase in conception rate)

RF ♀ x # services required per cow per 1% increase in conception rate = RF profit

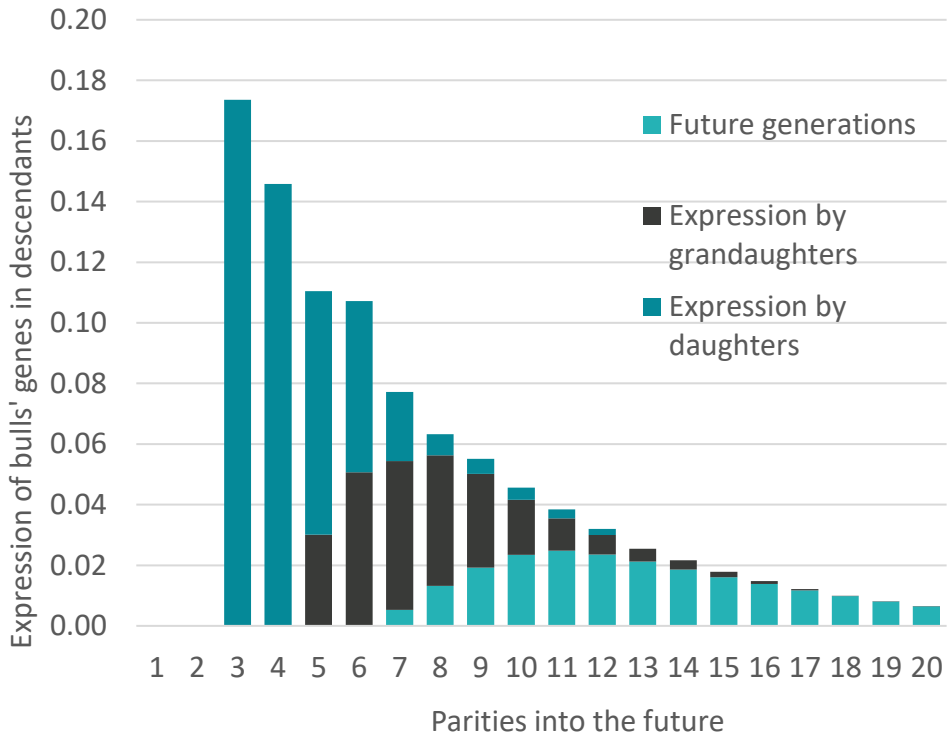
RF4,388 x 0.012 = RF53

Accounts for the **average cost of a mating** and how many **fewer matings are required if conception rate increases**

Repeat for calving interval, mature weight, and longevity

Calculating economic weights

- Economic values are converted to economic weights to account for:
- Timing and frequency of trait expression
  - e.g., milk yield over 4 or 5 lactations, longevity once at end of life
- Scale of trait expression
  - Data behind EBVs comes from UK (and other countries)
  - e.g., average milk production per cow in Rwanda is 28% of milk production in the UK



RDPI economic weights

Trait	Economic weights (RWF/ trait unit)
Milk yield (1L)	49.16
Fertility (1%)	159.9
Calving interval (1 day)	-2404.94
Mature weight (1kg)	-1037.36
Longevity (day)	227.78

The RDPI

$$Total\ RF\ merit = ew_{milk}ebv_{milk} + ew_{feed}ebv_{feed} + ew_{fertility}ebv_{fertility} + ew_{long}ebv_{long}$$



- $RDPI = 49.16 \times EBV_milk + 159.9 \times EBV_fert + 227.78 \times EBV_longevity - 2404.94 \times EBV_calvinterval - 1037.36 \times EBV_mature$

- International sires evaluated in the UK genetic evaluation

- 1982 bulls with EBVs for all 5 index traits: milk yield, fertility, calving interval, mature weight, and longevity

- Assess RDPI (compared to the primary UK index):
  - Breed representation in top 100 bulls
  - Contribution (in RWF) of traits to index value of top 100 bulls

Context for international indexes

- UK Profitable Lifetime Index (PLI) is based on the UK production system
- Select for high input/ more intensive systems
- US indexes like Net Merit Dollar select for performance in a similar system (to UK)
- This analysis is aimed at assessing how the RDPI ranks bulls and emphasises traits, relative to the UK PLI (as an example of an international index)

Breed make up top 100 bulls

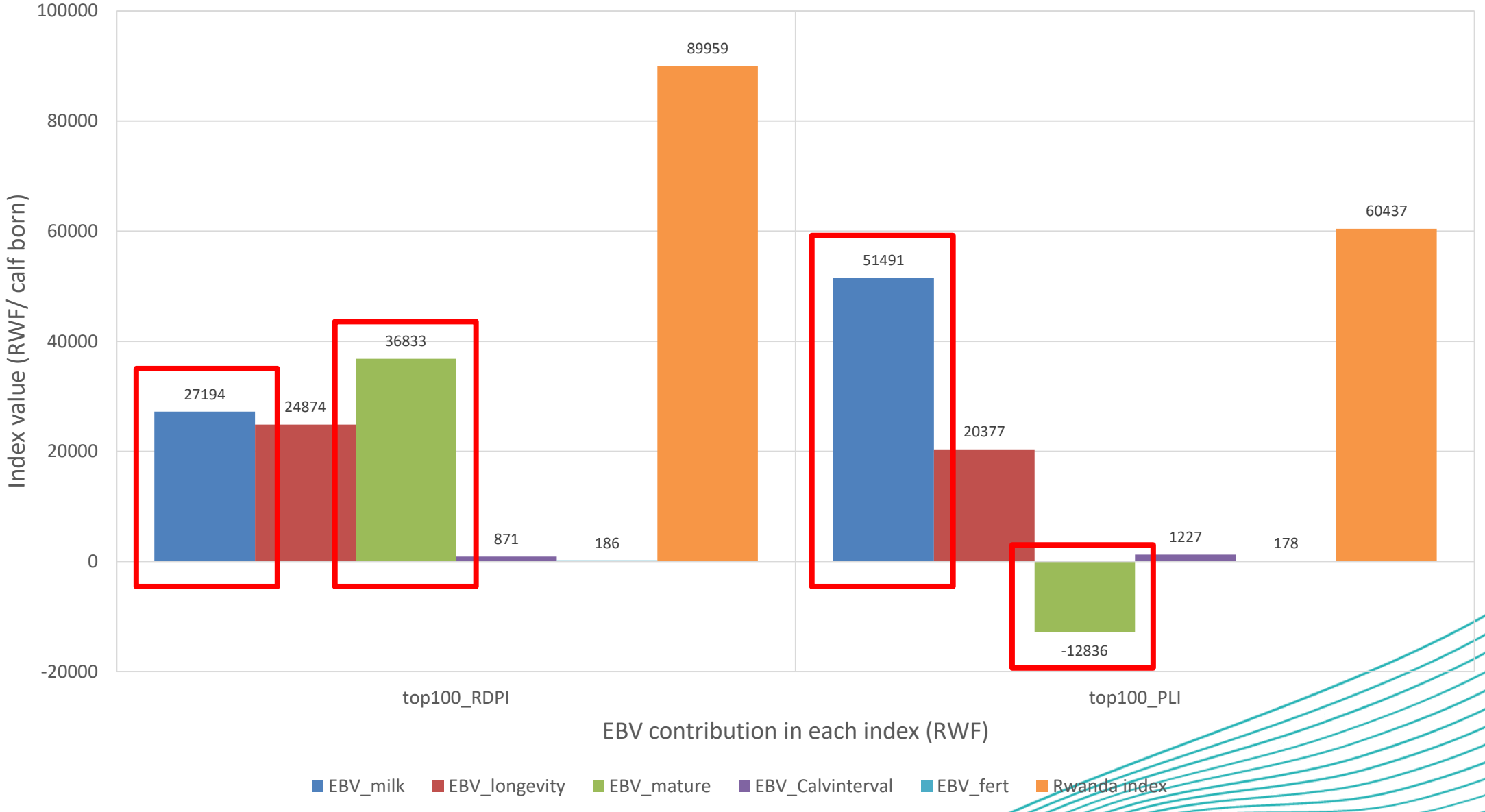
Breed	RDPI	PLI
Holstein	56	100
Jersey	43	0
Ayshire	1	0

- RDPI is selecting more Jersey bulls, relative to the PLI
- Would expect similar changes in breed ranking compared to other global indexes (e.g., Net Merit Dollar)

Contribution of traits to index value

- Rank the top 100 bulls on the RDPI and PLI
- Multiply the average EBV of top 100 bulls (ranked on each index) by the EW for the RDPI
- This gives the economic contribution of each trait to profit in Rwanda, if the bulls were selected on the RDPI or the PLI

Contribution of traits to index value



RDPI summary

- RDPI (relative to the PLI) is selecting bulls/ cows:
  - With lower milk production (but still more milk)
  - That are much smaller
  - Have a longer lifespan
  - A longer calving interval (but still getting shorter)
  - A higher conception rate

- Also (data not shown):
  - Lower fat and protein components (because less milk)
  - Higher fat and protein percent

Recommend

- Using the RDPI to select international bulls to maximise profit in Rwanda
- Gains in milk production but from smaller longer living cows
- With improvements in calving interval, fertility, and milk quality

Next steps

- Work with RAB on calculating the index for bulls on offer
- Support designing the specification for bull importing to align with the index

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