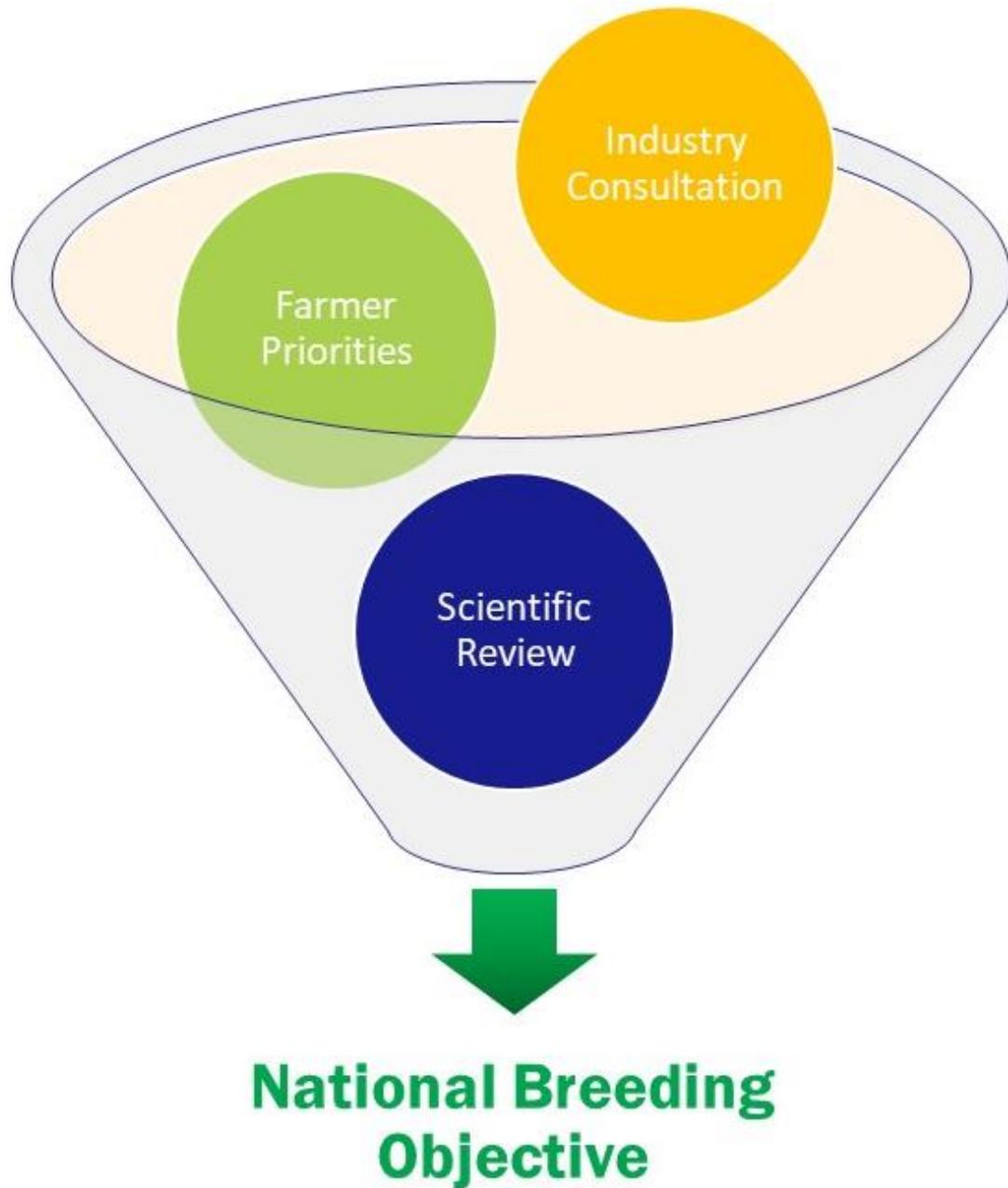


NBO 2020 Discussion Paper

Your herd. Your asset. Your future.



What is a National Breeding Objective?

The National Breeding Objective (NBO) describes the collective breeding priorities for Australian dairy herds. Its purpose is to enable farmers to breed herds that meet the future needs of the Australian dairy industry.

While Australian Breeding Values (ABVs) express a bull or cow’s genetic potential for a single trait such as fertility or protein kilograms most farmers want to improve more than one trait in their herd.

The NBO supports genetic selection pressure for an agreed group of desirable traits, providing direction for both bull and cow breeding across the country.

The current National Breeding Objective for the Australian dairy industry is aimed at increasing net farm profit. It is expressed through the three breeding indices – Balanced Performance Index (BPI), Health Weighted Index (HWI) and Type Weighted Index (TWI) – see box.

Reviewing the NBO

The National Breeding Objective must evolve over time in response to the changing needs of dairy businesses, new knowledge and breeding technologies. As the NBO evolves, so do the indices. DataGene has a policy to review every five years the NBO and the index formulated to meet this objective.

The last review, undertaken in 2014, resulted in the release of the three indices in April 2015. The BPI aligns directly to the top priorities established through Australia’s Longest Farmwalk and Farmer Survey in 2014.

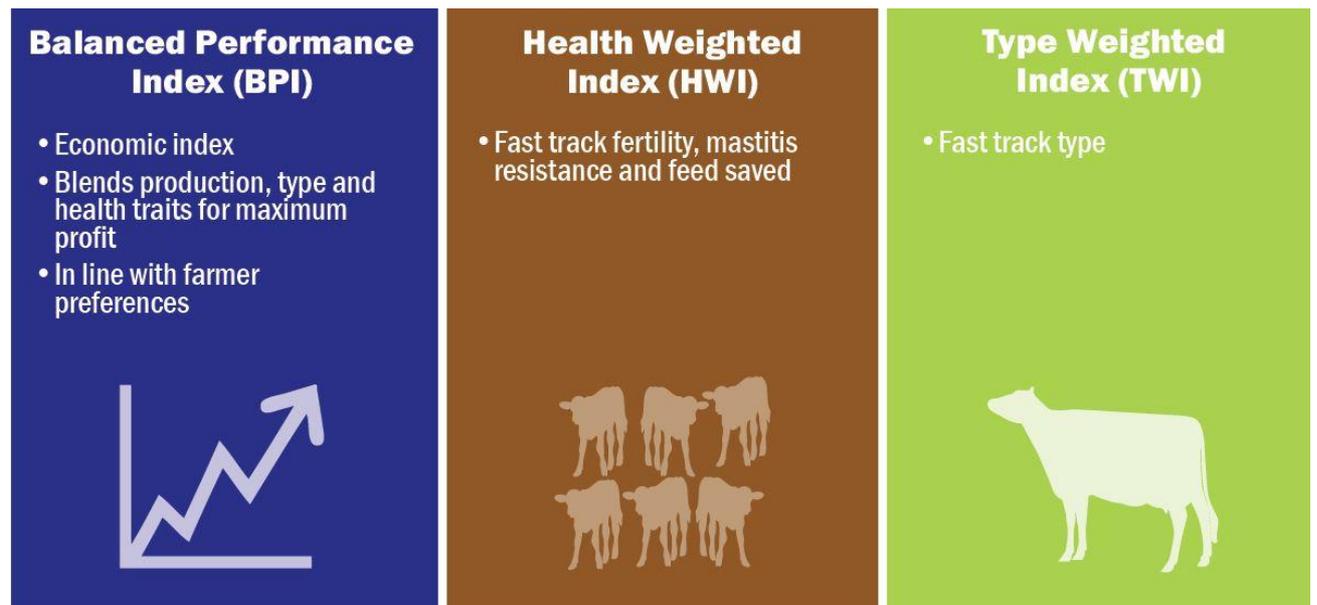
Figure 1: Australia’s three breeding indices

Australia’s three breeding indices (BPI, HWI, TWI) are used to rank bulls, cows and herds so that superior genetics can be identified and used in breeding programs.

These indices combine the traits that drive on-farm profit, with different weightings to reflect different farmer breeding preferences.

The BPI is an economic index that reflects most farmer preferences.

It drives net profit through a balance of functionality, type and yield. The Health Weighted Index puts extra emphasis on traits like fertility and cell count. The Type Weighted Index puts extra emphasis on traits like overall type and mammary system.

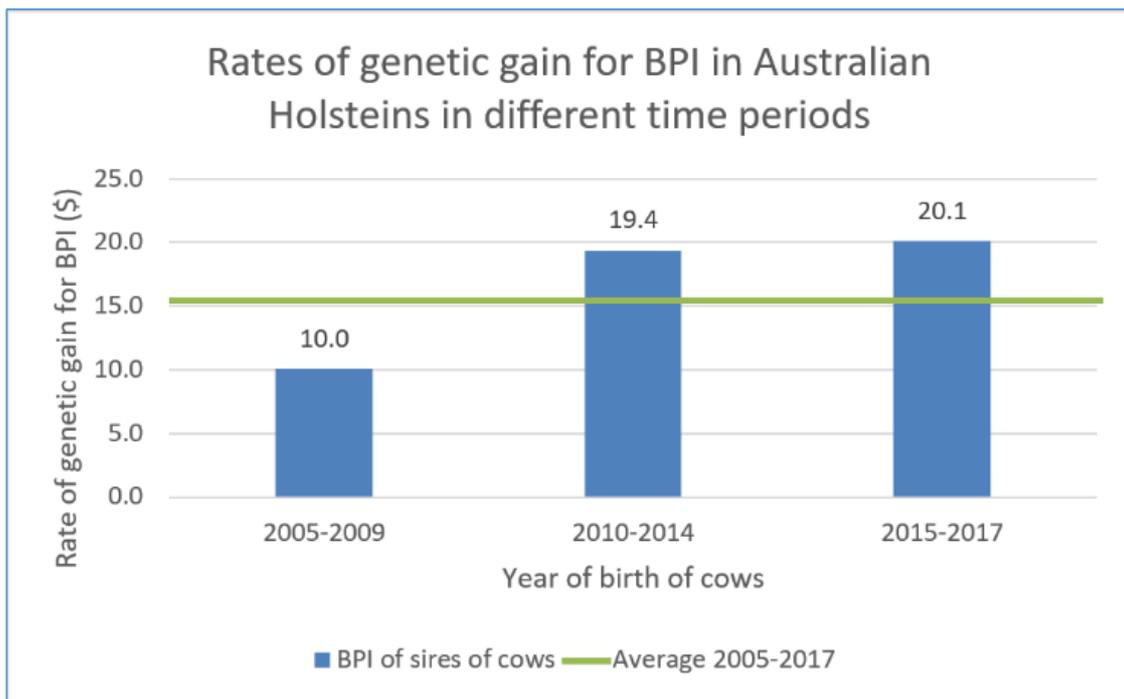


2019/20 NBO review

The purpose of the 2019/20 NBO review:

- to ensure the NBO which is aimed at driving on-farm profit still remains relevant, and
- to develop an index (or indexes) based on strong scientific principles which are in line with farmer preferences and meet the agreed NBO.

Since the introduction of the BPI, HWI and TWI, there has been a positive and sustained increase in the utilization of Australian indices. The combination of an increased awareness in BPI, use of genomics to select young bulls based on BPI and implementation of the Good Bulls Extension strategy have worked together to double the rate of genetic gain in the sires used to produce Australian cows, as shown in the graph. This means that this review is seen as an update rather than a review that concludes with wholesale change.



Process

Australian indices make a difference on the next generation of Australian dairy herds so a collaborative process involving farmers, scientists, processors, herd improvement organisations and farm advisors is key.

The NBO review is guided by DataGene's Genetic Evaluation Standing Committee that includes farmers, scientists, breed association, semen reseller and bull company representatives who have been nominated by Australian Dairy Farmers, National Herd Improvement Association, Dairy Australia or the DataGene Board.

DataGene leads the review process which also involves a team of scientists from Agriculture Victoria and Abacus Bio.

The process and timelines for the National Breeding Objective Review are outlined in Figure 1. It is expected that the review will be complete by Autumn 2020 with an implementation date of December 2020. The timing of the implementation is planned around the main breeding seasons with a December release the most practical option for farmers and commercial organisations.



Different stakeholder groups will be involved in different stages of the process.

| Stage | Stakeholders involved |
|--|---|
| Identify key themes | Genetic Evaluation Standing Committee (July 2019) |
| Discussion Paper | Genetic Evaluation Standing Committee (October 2019) |
| Data collection; scientific review | Agriculture Victoria – Dr Jennie Pryce and Dr Jo Newton Dairy Australia Trade & Strategy Group and Farm Team Abacus Bio DataGene staff |
| Circulate discussion paper and request responses to NBO survey | Farmers, breed organisations, bull company managers, herd improvement service providers, Regional Development Programs, DataGene Social Media |
| Options paper and discussion | Genetic Evaluation Standing Committee Bull company managers Breed organisations Dairy Australia Farm team |
| Stakeholder agreement | Genetic Evaluation Standing Committee |
| Development & testing of algorithms; updating GESNP | DataGene ABV Team and external testers |

Key themes in this Review

The Genetic Evaluation Standing Committee have identified the following areas of focus during the current NBO Review: Fat : Protein ratio, Longevity, fertility, feed efficiency, new traits, multiple indices.

Fat: Protein Ratio

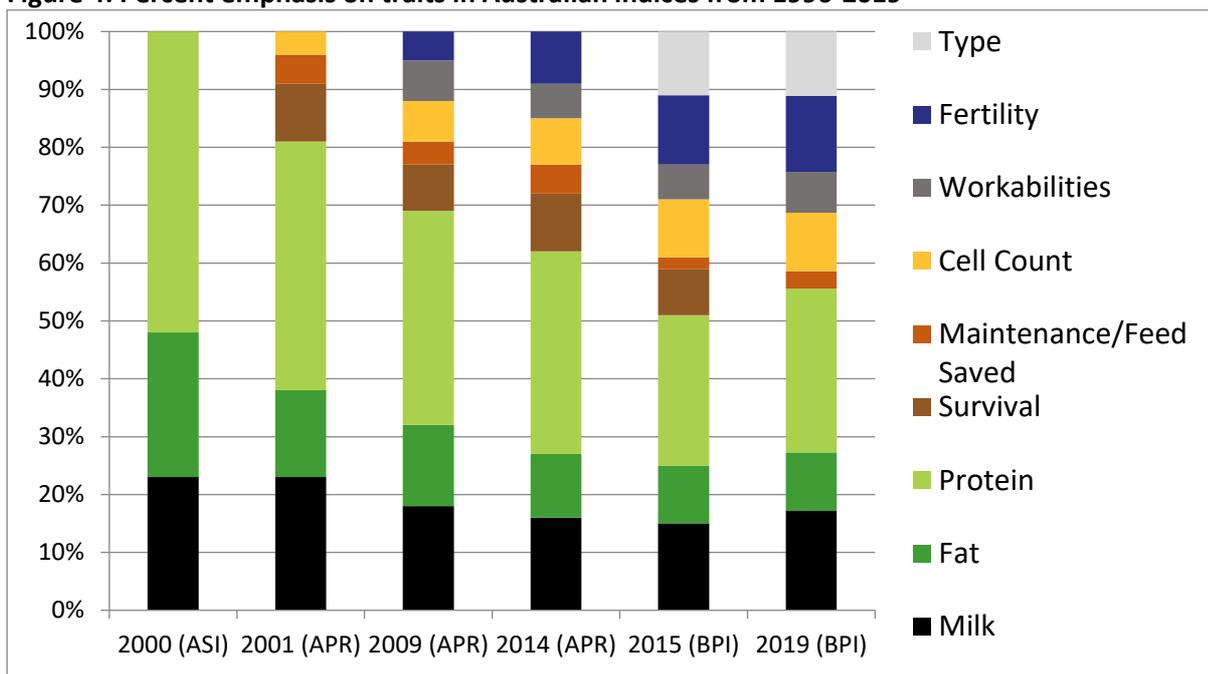
The Balanced Performance Index is an economic index built from a detailed analysis of input costs and farmgate returns for milk and stock. Milk price is a vital component of the analysis. The current analysis utilises component pricing based on a four-year historic average plus one-year forecast, supplied by Dairy Australia. As farmgate returns for protein yield have been historically stronger compared to fat yield, indices have reflected this, as shown in Figure 4.

If the relative price paid for fat to protein changes then it is appropriate for breeding indices to reflect this change using the same methodology. However, if there is a forecasted shift in the value of fat, compared to protein, then consideration should be given to a different methodology for calculating the economic values for fat and protein.

What’s the question?

Is the existing policy for establishing economic values appropriate; where values are based on 4 years of historical data plus 1 year forecast?

Figure 4: Percent emphasis on traits in Australian indices from 1996-2019



Breeding for Longevity

The two most important determinants of a dairy bull’s genetic merit for profitability are milk yield and survival. Survival – also known as longevity or productive herd life – refers to a bull’s ability to produce daughters that last in the herd for many lactations.

Survival is a significant contributor to overall profitability on dairy farms in Australia. By improving longevity:

- Fewer replacements are needed, which means lower heifer rearing costs (or greater income as surplus heifers are sold).
- The herd is more mature – more mature cows have greater milk yields than younger cows.
- A greater proportion of the culling decisions can be based on yield, resulting in an increase in the average yield of the herd.

The economic value of Survival, in the BPI, is distributed amongst traits that influence survival. For example, yield, fertility, cell count and type. There is a component of survival, known as residual survival, that includes traits we don't currently measure, such as lameness and metabolic disorders; while avoiding double counting those traits already included in the indices. Residual survival was removed from Australia's breeding indices in April 2019, based on the following rationale. Residual Survival had proven challenging to implement and had caused some instability from run to run. This had led to larger than expected movements of bulls between runs so the Genetic Evaluation Standing Committee requested its removal from the indices.

This NBO review aims to resolve how Survival is best accounted for in indices. It could be by:

1. Applying the economic value of survival to its contributing traits. This means no direct weighting on Survival.
2. Applying some of the economic value of survival to the trait itself and the rest to its contributing traits. This will likely mean some double counting that could over-emphasise traits linked to survival.
3. Applying all of the economic value of survival on the trait itself. This would reduce the weightings on fertility, cell count, type and other traits.

What's the question?

Is it important that Survival/Longevity has its own place in an index, rather than indirect emphasis through other traits?

Breeding for fertile cows

The Daughter Fertility ABV provides a genetic estimate of the percentage of a bull's daughters that will be pregnant by six weeks after the mating start date compared to the average. For year-round calving herds, this is equivalent to the percentage of daughters pregnant by 100 days after calving. The economic value of fertility and its associated index weight has steadily increased over the past decade. The BPI has the heaviest weighting on fertility compared to its predecessors. However, the HWI goes even further to add extra emphasis on fertility to meet the needs of farmers wanting to put more focus on health traits.

The economic value for fertility is derived from longer survival, costs associated with re-breeding, value of extra AI calves and lost milk associated with longer calving intervals.

This review aims to:

1. Check for further sources of economic value for fertility.
2. Determine if the genetic gains for daughter fertility are considered acceptable.
3. Determine if the HWI, should shift further away from an economic index to a desired gains index with a more extreme position on health traits.

What's the question?

Is the rate of genetic gain in daughter fertility fast enough?

Should the HWI shift further away from the BPI by putting even more emphasis on health traits?

Breeding for Feed Efficiency

The Feed Saved ABV was introduced in 2015 to quantify genetic differences in feed efficiency between animals. Australia was the first country in the world to produce a genetic evaluation using residual feed intake information. The Feed Saved ABV allows farmers to breed cows with reduced feed requirements for the same amount of milk produced. The Feed Saved ABV was introduced at 50% of the true economic value for this trait in the BPI. The cost of feed is based on the historical marginal cost of feed over the past four years with a 1-year forecast. During this review, it is appropriate to review both the feed costs as well as the 50% discount that was applied to this new trait.

What's the question?

Are we ready to count feed saved at its full weight?

New traits

Since the last NBO review, there are several new traits that are/will be evaluated, including heat tolerance and mastitis resistance.

Heat Tolerance, another global first, was developed by DairyBio and released by DataGene for the first time in 2017. Heat Tolerance identifies animals with a greater ability to tolerate hot, humid conditions with less impact on milk yield. The economic value of Heat Tolerance will vary according to the location of the farm; it will have a greater economic value in locations where there are more hot and humid days and nights.

What's the question?

As there are hot and humid days in nights in virtually all regions, should the index include a base value for Heat Tolerance? Farmers who want to apply more pressure are supported through tools like the Good Bulls App where filters can be applied to screen out animals with a Heat Tolerance ABV below a nominated threshold.

Is there support for generating a different index for hotter regions that would have a much greater emphasis placed on Heat Tolerance?

Mastitis Resistance is expected to be available in 2020. This new ABV utilizes a multi-trait model that includes clinical mastitis records, udder conformation traits and cell count to evaluate genetic differences in clinical cases of mastitis. Although highly correlated, Mastitis Resistance ABV is not the same as Cell Count ABV. Cell Count ABV uses only cell count information from herd recording but has a higher reliability than Mastitis Resistance.

What's the question?

Should Mastitis Resistance be included in indices, in addition to Cell Count ABV? The economic value that is currently applied to Cell Count ABV would be spread across both traits.

Multiple indices

Australia's three breeding indices reflect the range of preferences identified in the 2015 NBO Review. All three indices account for the traits that affect profit and longevity in the herd. The difference is in the emphasis given to specific traits. Analysis of marketing materials used to promote bulls shows the BPI is most popular, followed by HWI. The TWI is less often used in marketing material. If the TWI is no longer relevant, we have the option to discontinue it to focus attention on BPI and HWI.

What's the question?

Is there still a role for the Type Weighted Index?

Jersey specific index

The Jersey breed is the second largest breed in the country. While Jersey data is combined with data from all other breeds to generate the BPI, HWI and TWI, breeders have asked for a breed-specific index. A breed specific index would be based on Jersey-based inputs, where information is available.

What's the question?

Would dairy producers with Jersey and Jersey cross animals be better off with a Jersey specific index?

Would dairy producers select Jersey bulls on the basis of a Jersey specific index rather than the BPI or the index from another country?

Update the Average (known as the base)

ABVs are relative measures that can be compared to each other or to an average (known as the base). The last base change occurred in 2014 following a period of annual base adjustments. Keeping a constant base from year to year improves market stability as it avoids annual ABV adjustments. However, over a period of time, the base can lose some relevance as the animals are no longer in Australian herds.

Globally, there is an inconsistent approach to base policy. There isn't a right/wrong answer from a scientific point of view.

In Australia, the base includes cows that are now 11 years +/- 2 years (so cows that are 9,10,11,12,13 years of age). Between 2008 and 2015, ADHIS policy was that the base be updated in April of each year up. The current policy links base reviews with the five yearly NBO review.

The based is highly linked to the marketability of ABVs. For example, bulls are very difficult to market if they fall below a threshold such as 100 for Type (domestic semen market) or 0 for milk (export semen market). However, the base also needs to provide a clear benchmark from which ABVs can be compared.

Maintaining a relatively young group of cows in the base means that the next generation are only a bit better so ABVs aren't very large. This provides clarity about the sort of expected improvement a farmer is likely to achieve in his/her herd. When comparing an ABV to 'average', it is easier to picture current cows that are still milking in herds rather than a group of old cows that are long gone.

An older base has the benefits of showing the new animals to be quite a lot better than the older animals for most, but not all, traits.

Lastly, there may be a desire to apply a different base to each breed so that there is more uniformity in the scale of the top BPI animals in each breed. While ABVs cannot be compared between breeds, it can be confusing to see the top bulls in one breed have a BPI of 400 while another breed may be only 100.

What's the question?

Should the base be adjusted to a more modern base, even though it will mean ABVs drop for most traits?

Should there be a different base for each breed so that the top bulls of each breed are more similar in BPI?

Have your voice heard

The NBO Review makes a difference to the characteristics of future generations of Australian dairy cows. Farmers and service providers are asked to carefully consider the questions in this discussion paper and contribute your perspectives.

Round 1: Survey and response to discussion paper. In December and January 2019, go to www.datagene.com.au to provide your feedback. If you prefer to talk to a real person, call 0448 001 819 to be surveyed over the phone.

Round 2: Feedback, discussion and agreement following the development of index options. This will be primarily through stakeholder meetings in February and March 2020.