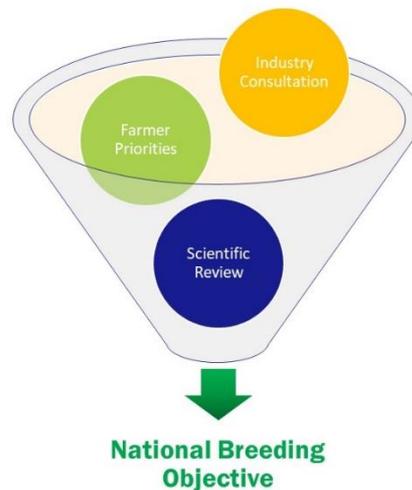


National Breeding Objective 2020

# Recommendations

Your herd. Your asset. Your future.



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### Acknowledgements

Prepared by Michelle Axford, Lee-Ann Monks, Gert Nieuwhof, Matt Shaffer, DataGene on behalf of the Genetic Evaluation Standing Committee

The Genetic Evaluation Committee: Simone Jolliffe (chair), Joanne Dickson, Patrick Glass, Tim Humphris, Rohan Sprunt, Trevor Saunders, Rohan Butler, Peter Thurn, Bruce Ronalds, Christian Hickey, Vaughn Johnston, Steph Bullen, Janet Auchterlonie, Trevor Parrish, Jennie Pryce, Gert Nieuwhof, Michelle Axford, Matt Shaffer

This research was conducted by Michelle Axford, Gert Nieuwhof, Matthew Shaffer (DataGene), Jennie Pryce, Jo Newton (Agriculture Victoria), Katarzyna Stachowicz, Peter Amer, Cheryl Quinton, Bruno Santos and Sam Harburg (Abacus Bio).

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This report builds on preceding reports:

- [Project Factsheet](#)
- [NBO Discussion Paper](#)
- [NBO Options Paper](#)

## Summary

Through the review of the National Breeding Objective (NBO) farmers, industry and scientists analysed economic and genetic trends alongside the feedback from survey participants to compare over twenty options for Australia’s next breeding indices. After careful evaluation, the committee recommends:

1. Balanced Performance Index is updated (to reflect updated values for fat, protein, feed and labour) and adds further emphasis on Daughter Fertility
2. Balanced Performance Index for Jerseys excludes Feed Saved and includes Udder Depth
3. Health Weighted Index is updated (to reflect updated values for fat, protein, feed and labour) and doubles the weighting on Daughter Fertility
4. Type Weighted Index is discontinued but a new table is added to the Good Bulls Guide printed publication and excel downloadable file that ranks bulls by Overall Type and Mammary System.
5. The based used to compare animals remains the same, but a breed purity filter is added so it is a truer reflection of the breed.

These recommendations will be discussed with stakeholders during June 2020 with a final Genetic Evaluation Standing Committee decision expected in July 2020. Any changes to the index will be made in December 2020.

## Context

The National Breeding Objective (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 NBO 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).

DataGene has a policy to review the NBO every five years, to ensure it keeps pace with the evolving needs of dairy businesses, new knowledge and breeding technologies. The previous review, undertaken in 2014, resulted in the introduction of the three indices (BPI, HWI, TWI) in 2015. Since then there has been a sustained increase in the utilization of Australian indices. This review is seen as an update rather than a review that concludes with wholesale change, with the following purposes.

- 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.

This document outlines options and recommended changes based on the findings from consultation activities and scientific review. It provides a foundation for industry discussion.

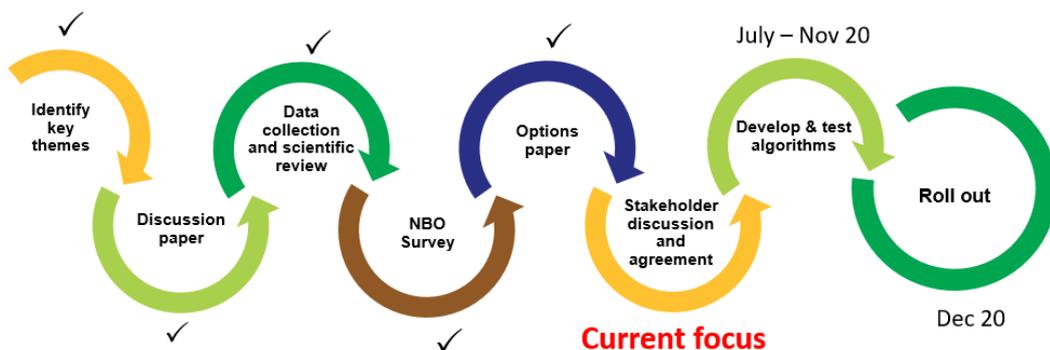


Figure 1. NBO review timelines

## Survey results

A total of 307 people voluntarily participated in the NBO Survey through December 2019 and January 2020, of which 196 were farmers and mainly herd owners. About two thirds of participants are located in Victoria.

In relation to farmers, the main breed for half the participants was Holstein while Jerseys represented 16%, two-way cross and three-way cross was about 10% each. About half of farmers had a split calving system, 31% were seasonal and 18% were year round. 42% of farmers did not register animals with a breed association.

71% of participants named the BPI as the most useful index with 24% favouring HWI and 16% favouring TWI. Participants could select more than one index. Of participants, 24% did not use BPI, HWI or TWI. Only about 4% relied on TWI exclusively.

Participants were asked to rank traits of importance. Overall, Daughter Fertility was significantly more important than any other trait. The second level of priority (with no significant difference between them) included protein, protein %, temperament, fat, fat %, survival/longevity, somatic cell count, mastitis resistance, calving ease and type traits. Next in the order of priority were milking speed, likeability, milk L and feed saved with no significant difference within this group. Gestation length and heat tolerance were ranked lowest.

The survey asked questions directly related to the NBO Discussion Paper and the analysis of this information provided direction for the options that were reviewed by the Genetic Evaluation Steering Committee. The Committee's recommendations are in this paper.

## Analysis and recommendations

During the NBO Review, researchers applied updated economic and physical parameters to a bio-economic model that is used to calculate the weighting applied to each trait in an index. A summary of parameters is included in [NBO Options Paper Appendix 2](#). Of note, the value of fat, protein, feed and labour have all risen. The updated values will increase or decrease the value of each affected trait which is why the economic weights are different in the options presented compared to the current indices. The impact of increasing or decreasing values depends on the relationship between traits within a population.

Updated parameters were applied to the three existing indices. These are referred to as BPI20, HWI20 and TWI20. Compared to current indices, the main additional changes include the introduction of Mastitis Resistance and Survival traits. From there, 21 options were developed, tested and discussed by the Genetic Evaluation Standing Committee. The options explored the themes and feedback from the survey and consultation period. The committee evaluated each option in terms of the economic weights, response to selection and percent emphasis. This report focusses on the current index (labelled 19), updated index with only economic parameters modified (labelled 20) and recommended index (labelled recommended), which are described in Table 1. Economic weights for all options are detailed in [NBO Options Paper, page 7](#).

**Table 1. Index description**

Label	Option description
<b>BPI19</b>	Current BPI
<b>BPI20</b>	BPI20 - the current BPI with updated values for fat, protein, feed, labour and other economic parameters. Mastitis Resistance and Survival are added with strong positive responses for both. As per 2015, feed saved is at half the actual value of feed. Response to selection for daughter fertility is lower than BPI19.
<b>BPI_fert150 Recommended</b>	BPI20 with an additional 50% weight on daughter fertility. This produces an economically efficient index with much stronger response to selection for fertility.  Using this index is expected to result in more health traits, slightly less production, similar workabilities and slightly better mammary system compared to the current BPI.

Label	Option description
	In Jerseys only, the contribution of Feed Saved is removed.
<b>TWI19</b>	Current TWI
<b>TWI20</b>	TWI20 – the current TWI with updated values for fat, protein, feed, labour and other economic parameters. As per 2015, feed saved is at half the actual value of feed. This index is not sufficiently different to the BPI to meet the needs of farmers wanting to use the TWI.
<b>HWI19</b>	Current HWI
<b>HWI20</b>	HWI20 – the current HWI with updated values for fat, protein, feed, labour and other economic parameters. Mastitis Resistance and Survival are added. As per 2015, the feed saved represents the true value of marginal feed.
<b>HWI200fert</b> <b>Recommended</b>	HWI200fert – HWI with twice the weight on fertility. Mastitis and Survival are added. Feed saved represents the full cost of marginal feed.  Using this index is expected to result in more health traits compared to the HWI20 and the current BPI. This index shows strong responses for all health traits and feed saved with slower responses for production and type traits.

The economic weights for each index option are provided in Appendix 1 of this document.

When comparing indices the most important consideration is the expected outcome on the national herd based on the population of cows and the AI bulls used to breed replacements. Figures 2 and 3 show the change in traits that is expected based on genetic selection for each index. For example, the BPI20\_fert150 is expected to achieve an additional 0.6 standard deviation for Holstein Daughter Fertility in a 10 year period . A full table of responses for three breeds is available in [NBO Options Paper, pages 8 and 9.](#)

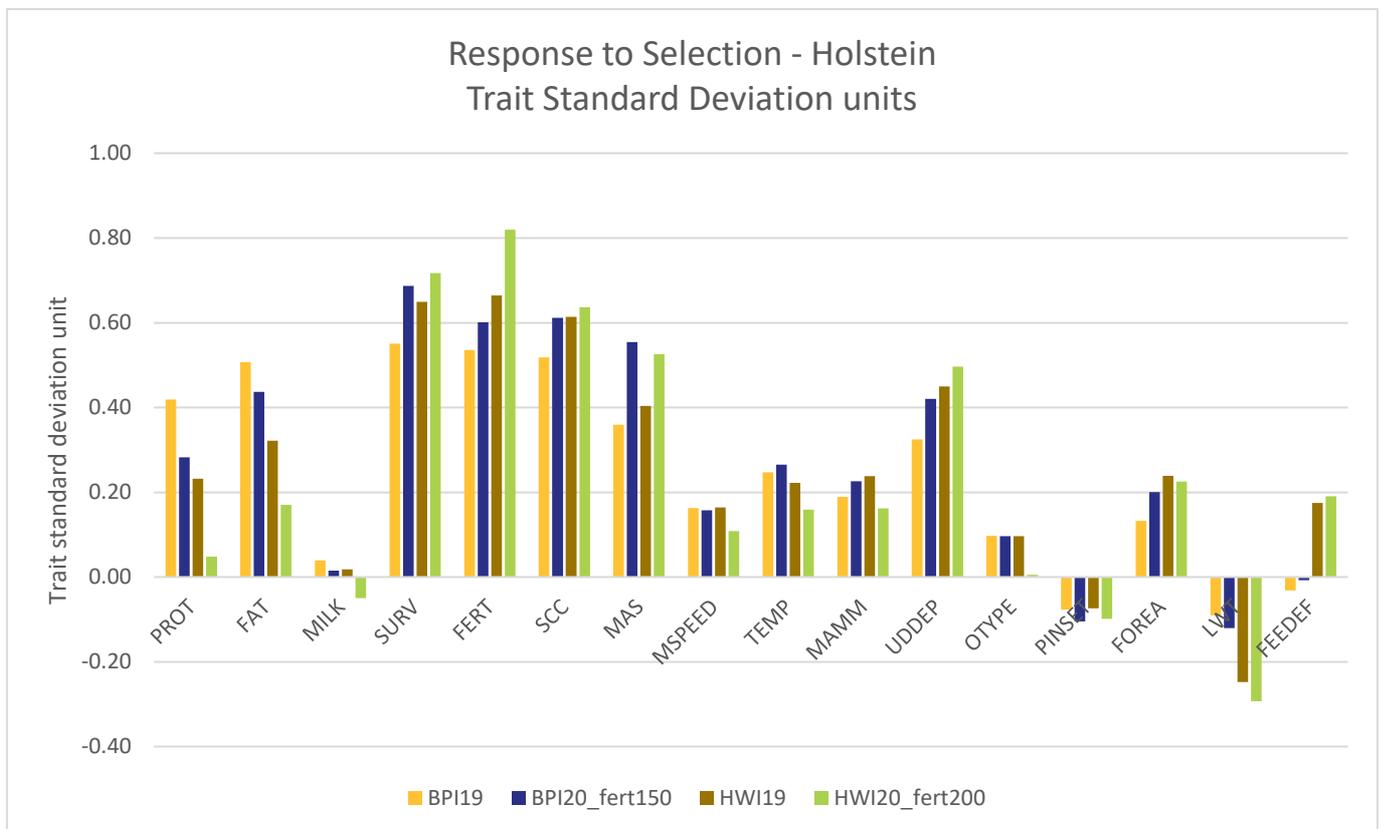
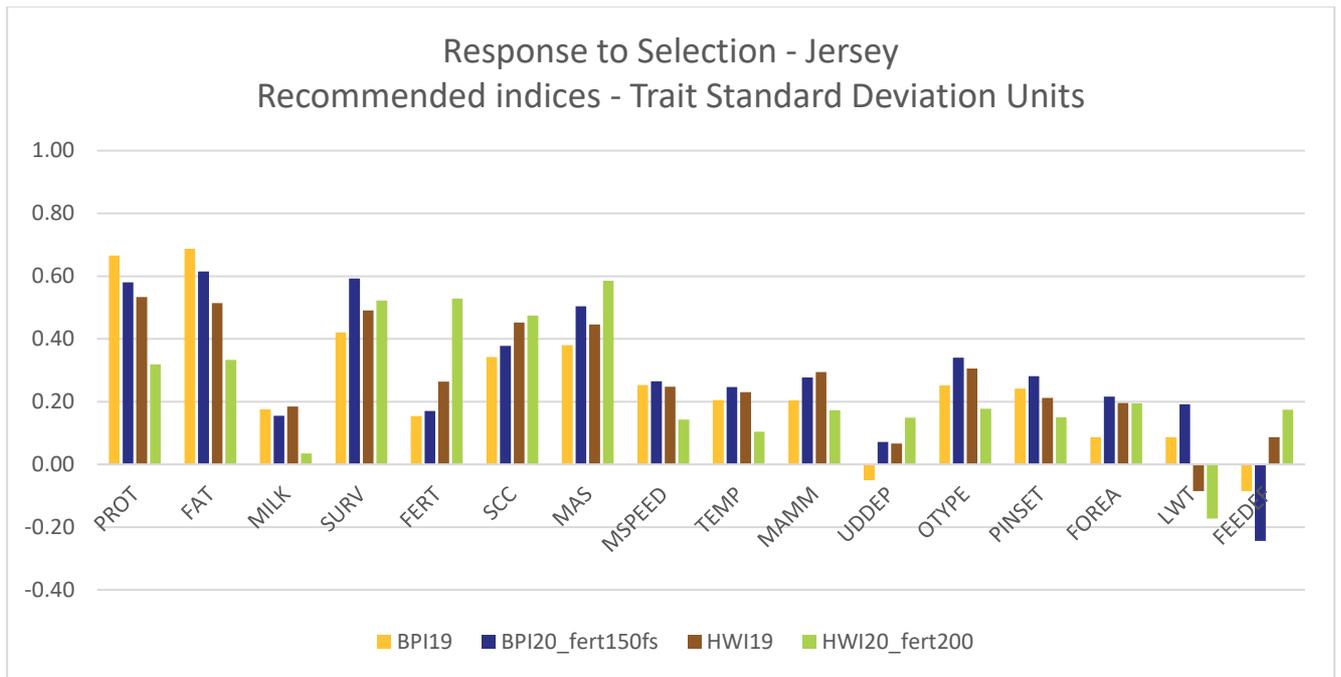
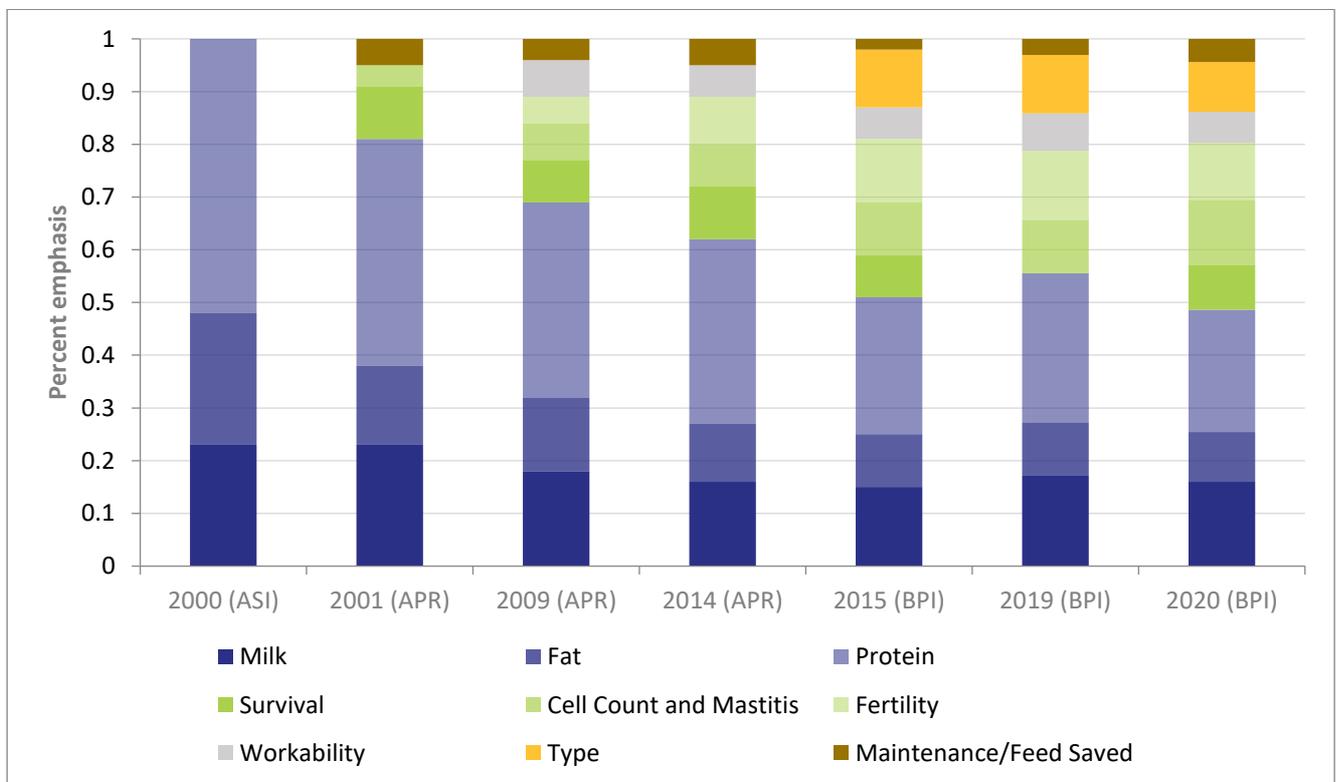


Figure 2 Response to selection for index options in Holsteins (Trait standard deviation units)

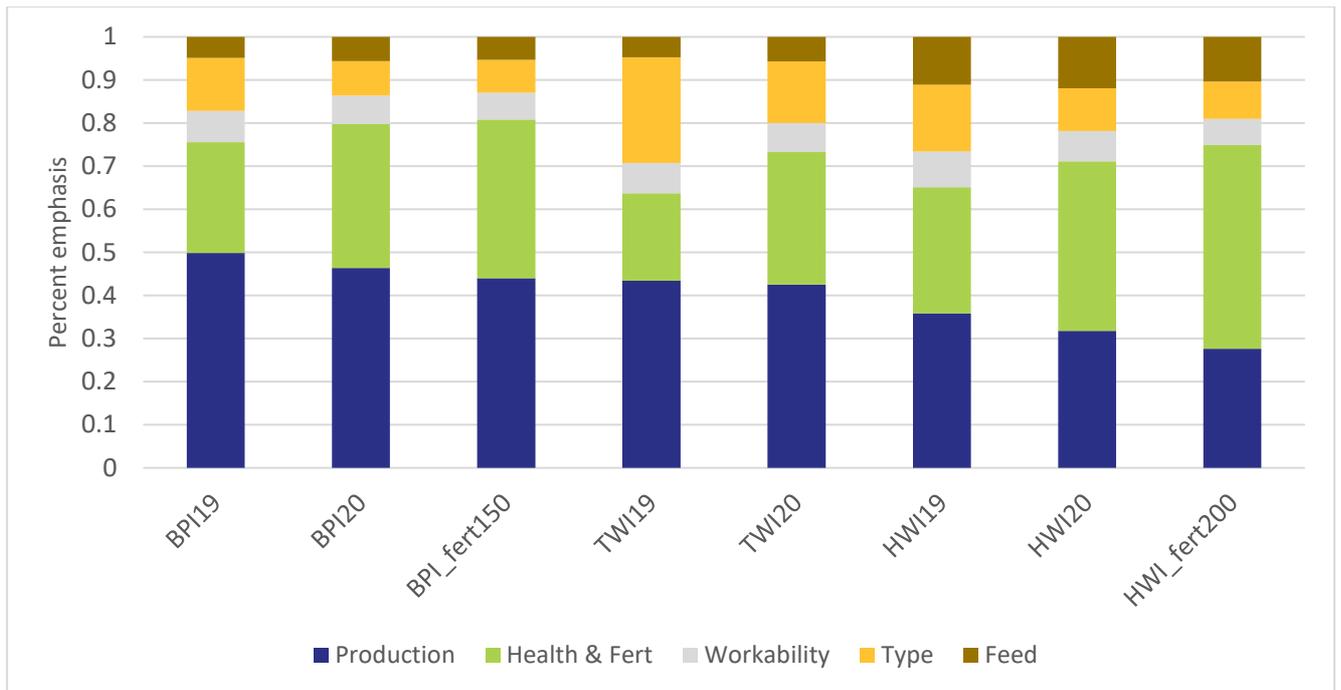


**Figure 3 Response to selection for index options in Jersey (Trait standard deviation units)**

Another way to compare indices is to look at the percent emphasis of a trait or trait group. Figure 4 shows changes in the relative emphasis of each trait group in BPI over time. Figure 5 shows the relative emphasis of each trait group for some of the options reviewed. Compare the emphasis placed on trait groups in each index with the current BPI, HWI, TWI.



**Figure 4 Change in the relative emphasis of traits in the BPI over time**



**Figure 5 Relative emphasis of each trait**

## Reporting back on the key review themes

The Genetic Evaluation Standing Committee identified the following themes for discussion in this NBO Review: Base change, Fat : Protein price ratio, longevity, fertility, feed efficiency, new traits, multiple indices.

### Updating the base (also known as the average)

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. The current policy links base reviews with the 5-yearly NBO review.

Globally, there is an inconsistent approach to base policy. There isn't a right/wrong answer from a scientific point of view. 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 base animals are no longer in Australian herds.

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 ABV (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.

The rules to define breed were reviewed. Refining breed purity by ensuring a consistent 4-digit breed code means that Jerseys are fairly compared to Jerseys.

While no base change is recommended, the impact of changing the base is fully described in [NBO Options Paper, page 12 and Appendix 4](#).

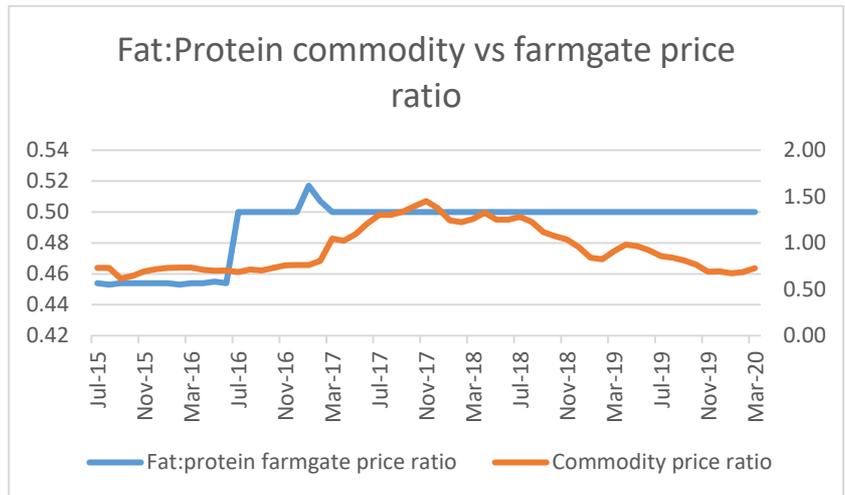
***The committee recommends refining the base by including a breed purity filter but keeping the current base group.***

### Fat: Protein price 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. 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 weights for fat and protein.

Dairy Australia data shows a stable fat:protein price ratio paid to Australian farmers over the past four years, as shown in Figure 6 (blue line). The ratio of 0.5 is lower compared to the commodity price ratio (orange line) that has moved between 0.7 and 1.7 during the same period.



**Figure 6 Fat:Protein commodity vs farmgate price ratio, Dairy Australia, 2020**

An analysis of three fat:protein price ratios was conducted. However, there is little evidence of the national shift in farmgate price ratio to justify an increase in the price ratio applied to the index model.

***The committee recommends maintaining the current milk pricing policy resulting in no change to the fat:protein price ratio.***

### 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 because:

- 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.

Given the strong support for survival in the survey, only one option was considered which was to return survival to the indices. The trait that is included is Survival ABV, rather than Residual Survival which had been previously removed from the BPI. Including Survival ABV means that there may be some double counting of traits like fertility, somatic cell count and mastitis resistance. However, these are considered economically important traits for which double counting is acceptable. The economic value of survival previously associated with Overall Type has been redistributed to Survival.

***The committee recommends that all of the economic value of survival is placed on the trait itself.***

### 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.

**Survey results show Fertility is the No 1 priority for farmers.** Most people (76%) support that HWI should have even more emphasis on Fertility and Health traits. The analysis showed that increasing the weighting on fertility in the BPI by a further 50% maintains it as an economically efficient index while balancing the strong feedback from farmers and industry.

***The committee recommends increasing the weighting on fertility in the BPI by a further 50% and doubling the weighting of fertility in HWI.***

### **Breeding for Feed Efficiency**

The Feed Saved ABV allows farmers to breed cows with reduced feed requirements for the same amount of milk produced. The current BPI has Feed Saved ABV weighted at 50% of its true economic value.

From the survey, industry does not seem to fully support a full weight on Feed Saved in the BPI so the recommendation is to remain at 50% of the true value. In Jerseys, the negative impact of Feed Saved on liveweight was a concern because it inhibits the ability for Jerseys to compete in mixed herds and may have impacts on calf survival. The economic value is recommended to be zero for this breed.

***In the BPI, the committee recommends the application of Feed Saved at half its economic weight in all breeds except Jerseys, where no economic weight is applied. In the HWI, full economic weight of Feed Saved is recommended for all breeds.***

### **New traits**

Since the last NBO review, several new traits have been added to genetic evaluation, including heat tolerance and mastitis resistance. The survey responses supported only the addition of mastitis resistance in all index options.

Adding Mastitis Resistance into the index changes the economic weights for both Udder Depth and Somatic Cell Count. Somatic Cell Count has a lower economic weight in the new indices because the value of lower mastitis is directed towards Mastitis Resistance. Udder depth is included in the multi-trait Mastitis Resistance evaluation so the value of shallower udders is directed towards Mastitis Resistance.

***The committee recommends that mastitis resistance is the only new trait to be added to all index options.***

### **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. Both the survey results and an 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. From the survey, 16% of respondents use the TWI of which only 4% solely use this index.

***The committee recommends that the TWI is discontinued. It also recommends publishing tables for Overall Type and Mammary System in the Good Bulls Guide (excel files and printed document).***

## Appendix 1: Economic weights for current and recommended indexes

Trait	BPI			TWI		HWI		
	BPI19	BPI20	<b>BPI_fert150 recommended</b>	TWI19	TWI20	HWI19	HWI20	<b>HWI_fert200 recommended</b>
<b>PROT</b>	6.92	6.76	<b>6.76</b>	6.23	6.08	4.46	4.36	<b>4.36</b>
<b>FAT</b>	1.79	2.08	<b>2.08</b>	1.61	1.87	1.16	1.35	<b>1.35</b>
<b>MILK</b>	-0.1	-0.11	<b>-0.11</b>	-0.09	-0.1	-0.06	-0.07	<b>-0.07</b>
<b>SURV</b>	0	7.2	<b>7.2</b>	0	7.2	0	7.2	<b>7.2</b>
<b>FERT</b>	6.94	5.3	<b>7.96</b>	4.86	3.71	6.94	7.06	<b>14.11</b>
<b>SCC</b>	1.07	0.69	<b>0.69</b>	1.07	0.69	1.07	0.69	<b>0.69</b>
<b>MAS</b>	0	6.75	<b>6.75</b>	0	6.75	0	6.75	<b>6.75</b>
<b>MSPEED</b>	4.9	5.02	<b>5.02</b>	4.9	5.02	4.9	5.02	<b>5.02</b>
<b>TEMP</b>	3.51	3.6	<b>3.6</b>	3.51	3.6	3.51	3.6	<b>3.6</b>
<b>MAMM</b>	2.29	2.76	<b>2.76</b>	2.52	2.99	2.97	3.59	<b>3.59</b>
<b>UDDEP</b>	0.82	0	<b>0.82</b>	0.9	0	0.82	0	<b>0</b>
<b>OTYPE</b>	2.26	1.36	<b>1.36</b>	6.15	3.7	2.26	1.36	<b>1.36</b>
<b>PINSET</b>	1.28	0.78	<b>0.78</b>	1.41	0.85	1.28	0.78	<b>0.78</b>
<b>FOREA</b>	0	0	<b>0</b>	3.22	1.34	0	0	<b>0</b>
<b>FEDEF</b>	0.1488	0.1927	<b>0.1927</b> <b>0*</b>	0.1488	0.1927	0.2975	0.3853	<b>0.3853</b>

\*for the Jersey breed only Feed Saved is not included in the BPI index.