2025 National Breeding Objective review for Australian dairy cattle

T.T.T. Nguyen[1], P. Thurn[1], L. Monks[1], G. Nieuwhof[1], P. Williams[1], M. Axford[1,2], M. Shaffer[1,2]

[1] DataGene Ltd., AgriBio, 5 Ring Road, Bundoora, VIC 3083, Australia

[2] Current address: Dairy Australia, HWT Tower, Southbank, VIC 3006, Australia

Corresponding author: GNieuwhof@datagene.com.au

Abstract

DataGene reviews the Australian National Breeding Objective (NBO) for dairy cattle approximately every 5 years to ensure national genetic selection remains aligned with farmer priorities, economic signals and industry needs. The 2025 review combined stakeholder consultation, economic and genetic review, and scenario testing of national selection indices. Stakeholder consultation included an online survey of 217 dairy farmers and 38 herd improvement (HI) industry personnel, 20 qualitative in-depth interviews with dairy farmers, and discussion of findings at 28 stakeholder events involving 138 participants. The Balanced Performance Index (BPI) remained the most widely used and influential index across regions, breeds and production systems. Consultation supported retaining a simple national index framework while recognising demand for a seasonal pasture-based focus additional emphasis on calving traits in the Health Weighted Index (HWI). Economic updates used forecast milk and feed pricing, including a revised farmgate protein-to-butterfat price ratio that increased the relative value of fat. Genetic parameters were updated, and more than 30 index scenarios were tested using BPI24 as a baseline and August 2024 public-release Australian Breeding Values (ABVs) for Holstein, Jersey and Red breed bulls. Updated BPI, HWI and Sustainability Index (SI) options were recommended and implemented in December 2025. Correlations between 2024 and 2025 BPI values were high across breeds (0.980 to 0.982), although some reranking occurred due mainly to the revised fat and protein emphasis. The updated BPI was predicted to deliver faster genetic gain in fat and slower gain in protein than BPI24, while retaining balanced improvement in profitability, health and fertility traits. HWI25 increased expected responses for survival and fertility and incorporated calving ease and gestation length. SI25 maintained stronger emphasis on production traits to reduce emissions intensity through improved productivity.

Key words: dairy cattle; selection index; breeding objective; stakeholder consultation; genetic evaluation; sustainability

Introduction

The Australian National Breeding Objective (NBO) defines breeding priorities for dairy cattle to improve long-term profitability and ensure genetic selection remains aligned with farmer and industry needs. To remain relevant, the NBO must respond to changes in production systems, market signals, farmer preferences, breeding technologies and trait information.

DataGene reviews the NBO and associated national selection indices approximately every 5 years, with additional reviews undertaken when required. The NBO is delivered through indices that combine Australian Breeding Values (ABVs) into ranking tools for bulls, cows and herds. The 2014 review led to three national indices in 2015: the Balanced Performance Index (BPI), Health Weighted Index (HWI) and Type Weighted Index (TWI) (Byrne et al. 2016; Axford et al. 2021). Following the 2020 review, BPI and HWI trait weightings were revised and TWI was discontinued (Axford et al. 2021). DataGene released the Sustainability Index (SI) in 2022 to accelerate reductions in greenhouse-gas

emission intensity (Nguyen et al. 2023) and removed the milk volume penalty later that year to better reflect Australian milk pricing.

The BPI is the primary economic index and is designed to improve net profit through a balance of production, functionality and type. The HWI places greater emphasis on health and fertility, and the SI places greater emphasis on traits that reduce greenhouse-gas emission intensity through improved productivity. These indices are important decision-support tools for farmers, breeding companies and advisers.

The 2025 NBO review combined three linked components: stakeholder consultation, economic and genetic review, and scenario testing of alternative index options. Stakeholder consultation identified farmer and industry priorities and tested the relevance of existing indices and traits. The technical review updated the assumptions that underpin trait economic weights and expected responses to selection. This paper reports the stakeholder findings and final index updates implemented in the December 2025 Australian Breeding Value release.

Materials and Methods

Stakeholder consultation

Stakeholder consultation timing and purposes are presented in Table 1. DataGene commissioned Down To Earth Research (DTER) to implement a mixed-method consultation process. A nationwide online survey was live between late June and early July 2024. Survey invitations were distributed to Dairy Australia levy payers with available email addresses and DataGene Genemail members, and the survey was also promoted through generic links. The survey examined current use of Australian indices, the influence of indices on artificial insemination (AI) sire-selection decisions, attitudes to genetics and breeding, and individual trait preferences.

A total of 296 farmers and industry personnel participated. After partial and poor-quality responses were removed, 255 high-quality responses remained, comprising 217 dairy farmers and 38 herd improvement (HI) industry personnel. Online survey data were analysed by DTER using IBM Statistical Package for Social Sciences (SPSS) and Q research software.

Qualitative in-depth interviews were used to explore themes that emerged from the survey. The first 10 interviews targeted dairy farmers representing Total Mixed Ration (TMR), Jersey, pasture-based, Holstein and subtropical farm segments. A further 10 interviews were added to strengthen understanding of TMR farmer views, because survey participation from TMR farms was low. Interviews were conducted in August 2024, averaged approximately 20 minutes, and used a discussion guide rather than a structured questionnaire to encourage open feedback. Results from the survey and interviews were then presented and discussed at 28 stakeholder events involving 138 participants, including bull companies, resellers, breed organisations, farmers, industry representatives and researchers.

Table 1: Stakeholder consultation activities used in the 2025 National Breeding Objective review

Component	Timing	Sample	Purpose
Online survey	Late June to early July 2024	255 high-quality responses: 217 dairy farmers and 38 HI personnel	Assess use of Australian indices and ABVs, influence on breeding decisions, attitudes to genetics and trait preferences.
In-depth interviews	August 2024	20 dairy farmer interviews	Explore emerging themes for production-system, regional and breed-specific needs, with additional interviews for TMR farms.
Stakeholder meetings	August to October 2024	28 events with 138 participants	Test survey and interview findings with bull companies, resellers, breed organisations, farmers, industry and research stakeholders.

Economic and genetic review

Updated economic and genetic parameters were applied to the bio-economic model used to calculate trait weightings. Economic weights for production traits were derived from evidence-based forecast prices rather than historical prices, reflecting the approximate 3-year lag between index implementation and the first calving of animals bred using updated information. DataGene commissioned EverAg to provide a 5-year historical analysis and 10-year forecast of milk price relative to feed cost and the farmgate protein-to-butterfat price ratio. An intermediate 5-year average milk price scenario, based on projected prices from 2025 to 2029, was selected.

The assumed milk solids price increased from $6.18/kg, based on 2020 prices, to $8.43/kg. The updated protein-to-butterfat price ratio increased the relative emphasis on fat compared with previous indices. Feed costs were updated using Dairy Australia's Dairy Farm Monitor Project data (Dairy Australia, 2024) while maintaining a constant feed-cost-to-milk-income ratio. Genetic parameters were reviewed by Agriculture Science and Technology, Agriculture Victoria. The Survival ABV was replaced with a new Survival trait, also named Survival, defined as an animal's ability to produce daughters that last in the herd for many lactations.

Index modelling and scenario testing

Stakeholder consultation indicated that traits included in the 2024 BPI remained relevant for the updated indices. Consultation also identified a need to include calving ease and gestation length in the HWI to improve its relevance to seasonal calving systems. BPI24 was used as the baseline for developing and testing updated index options. AbacusBio modelled the indices using ABVs from the August 2024 public release for 28,152 Holstein, 1,574 Jersey and 182 Red breed bulls. More than 30 alternative scenarios were tested to address consultation themes and stakeholder feedback. Table 2 summarises testing scenarios for indices that were updated and published in December 2025.

Results & Discussion

Stakeholder use of indices and ABVs

The survey specifically targeted farmers using AI. As a result, respondents may have had stronger views on herd genetics than the broader dairy farming population. Nevertheless, the consultation captured diverse farm types. Among dairy farmer respondents, 54% had at least some registered cattle and 46% were solely commercial dairy farms. Holstein was the most common main breed, followed by Jersey, crossbred and Red breed cattle.

Most respondents used at least one Australian index or breeding value when selecting AI sires. This included 88% of dairy farmers and 92% of HI industry personnel. BPI was the most commonly used index, followed by HWI and SI, and remained influential across regions, breeds and feeding systems. Among dairy farmers, 43% reported that BPI had a large influence on AI sire selection and a further 36% reported that it had some influence. Among HI personnel, 61% reported that BPI had a large influence and 29% reported that it had some influence. HWI had greater influence among respondents with commercial dairy farms than among those with registered cattle.

Table 2: Recommended 2025 national selection index updates

Index	Recommended 2025 update
BPI25	Updated BPI for non-Jersey breeds using projected milk values for 2024-25 to 2028-29 and revised fat, protein, feed, labour and other economic parameters.
BPIJe25	Updated BPI for Jersey using the same economic assumptions as BPI25, with Feed Saved excluded.
HWI25	Updated HWI for seasonal calving herds, using the same economic assumptions as BPI25, with Overall Type set to zero, Milking Speed and Temperament adjusted for shorter lactations, and Calving Ease and Gestation Length included.
SI25	Updated SI using projected milk values for 2024-25 to 2028-29 and revised economic assumptions, retaining emphasis on reduced emissions intensity through productivity.

Consultation provided evidence of demand for a seasonal pasture-based index among farmers operating pasture-based systems. Views on a TMR-specific index were more polarised. Some interview respondents saw value in distinguishing between housed and pasture-based production systems, whereas others considered that well-fed cows should perform across systems. Jersey breeders showed strong reliance on existing Australian indices, and a Jersey-specific index was generally viewed as a useful addition rather than an essential requirement. There was also some interest in indices tailored to warmer regions and TMR systems; however, the level of demand was not considered sufficient to warrant publication of these indices. Nevertheless, these options were included in the development and testing process to ensure that stakeholder feedback was appropriately evaluated, but not reported here.

Mammary system, daughter fertility and production were rated among the most important individual traits when selecting AI sires. Farmers in seasonal calving or pasture-based systems placed greater priority on fertility, and subtropical farmers placed greater emphasis on heat tolerance. Stakeholder meetings reinforced four practical communication themes: production remains central to farm income; simplicity is preferred; Feed Saved ABV is important but not well understood. These findings informed the final index recommendations and highlighted areas where extension support remains important.

Updated economic weights

The main economic changes were the higher milk solids price, the revised protein-to-butterfat price ratio and the corresponding increase in the economic weight for fat (Table 3). BPI25 was calculated for non-Jersey breeds, BPIJe25 for Jersey, and HWI25 and SI25 for all breeds. Compared with the 2024 indices, the updated indices placed greater emphasis on fat and survival. HWI25 also introduced non-zero weights for calving ease and gestation length and set Overall Type to zero to align more closely with the intended seasonal-calving health and fertility focus

Correlations between indices

Correlations between 2024 and 2025 BPI values were high for Holstein, Jersey and Red breed bulls (0.980 to 0.982; Table 4). Some reranking is expected, mainly because the revised protein-to-butterfat price ratio favours bulls with superior fat ABVs. Correlations between BPI, HWI and SI were lower, reflecting their different emphasis on production, health, fertility and emissions intensity.

Table 3: Economic weights for traits in 2024 and 2025 national selection indices

Trait	BPI24	BPI25	BPIJe24	BPIJe25	HWI24	HWI25	SI24	SI25
Protein	6.76	7.95	6.76	7.95	4.36	5.12	17.49	13.17
Fat	2.08	5.67	2.08	5.67	1.35	3.68	2.82	7.61
Milk	-0.08	-0.09	-0.08	-0.09	-0.06	-0.05	-0.08	-0.09
Survival	7.20	14.29	7.20	14.29	7.20	14.29	20.21	23.22
Fertility	6.94	14.02	6.94	14.02	14.11	22.86	6.94	8.25
Somatic cell count	0.69	1.26	0.69	1.26	0.69	1.26	0.69	1.26
Mastitis resistance	6.75	10.89	6.75	10.89	6.75	10.89	8.70	12.61
Milking speed	5.02	6.52	5.02	6.52	5.02	6.46	5.02	6.52
Temperament	3.60	0.97	3.60	0.97	3.60	0.97	3.60	0.97
Mammary system	2.76	3.59	2.76	3.59	3.59	4.66	2.79	3.59
Udder depth	0.82	1.08	0.82	1.08	0	0	0.82	1.08
Overall type	1.36	2.70	1.36	2.70	1.36	0	1.36	2.70
Pin set	0.78	1.55	0.78	1.55	0.78	1.55	0.78	1.55
Feed saved	0.19	0.21	0	0	0.39	0.42	0.72	0.74
Calving ease	0	0	0	0	0	0.90	0	0
Gestation length	0	0	0	0	0	-3.14	0	0

Table 4: Selected correlations among 2024 and 2025 index values by breed

Breed	BPI24 with 2025 BPI	2025 BPI with HWI25	2025 BPI with SI25	HWI25 with SI25
Holstein	0.982	0.929	0.970	0.847
Jersey	0.981	0.923	0.980	0.804
Red breeds	0.980	0.842	0.957	0.715

Predicted response to selection

Predicted responses for a 1 standard deviation increase in index value are shown in Table 5. Across all breeds, BPI25 was predicted to deliver faster genetic gain in fat and slower gain in protein than BPI24. This again reflected the revised protein-to-butterfat price ratio and increased fat emphasis. In Jersey and Red breeds, BPI25 was also predicted to deliver greater improvement in survival, somatic cell count and mastitis resistance.

Compared with HWI24, HWI25 was predicted to achieve higher gains in protein, fat and survival. In Jersey and Red breeds, HWI25 was also predicted to deliver substantially greater gains in daughter fertility. Compared with SI24, SI25 was predicted to deliver a faster reduction in emissions intensity in Holstein cattle, at 8.53% compared with 7.64%. The predicted reduction was lower in Jersey and Red breeds, at 6.08% and 3.29%, respectively, compared with 8.96% and 5.52% under SI24. These differences illustrate the value of testing index options across breeds rather than relying only on an average herd or single breed profile

Implementation considerations

The 2025 review supported retaining a national index framework while refining the indices to better reflect current economic conditions, stakeholder priorities and trait information. BPI25 retained a balanced selection objective for profitability, health, fertility, production and type. BPIJe25 acknowledged Jersey-specific limitations for Feed Saved. HWI25 was broadened to improve relevance for seasonal calving herds through inclusion of calving ease and gestation length. SI25 retained its role as the index most directly aligned with reduced emissions intensity through improved productivity.

The consultation also highlighted that technical improvements need to be accompanied by clear communication. Negative weight on milk volume continues to be poorly understood because it reflects feed and other costs rather than a preference for low production. Similarly, Feed Saved was viewed as important but its reliability and interpretation require extension support. These findings suggest that future NBO reviews should continue to integrate formal stakeholder consultation, economic and genetic analysis, and transparent scenario testing so that index changes are both technically robust and usable in commercial breeding decisions.

Table 5: Predicted response to selection for a 1 standard deviation increase in index value

Trait	Hol BPI25	Hol HWI25	Hol SI25	Jer BPIJe25	Jer HWI25	Jer SI25	Red BPI25	Red HWI25	Red SI25
Protein	0.40	0.22	0.55	3.58	1.37	4.95	0.53	0.28	0.70
Fat	0.63	0.37	0.69	7.79	4.65	8.44	0.64	0.27	0.70
Milk	-0.08	-0.14	0.04	21.07	-19.82	63.99	0.21	0.03	0.39
Survival	0.63	0.70	0.59	0.98	1.13	0.95	0.48	0.46	0.43
Daughter fertility	0.54	0.80	0.37	1.22	2.48	0.57	-0.06	0.41	-0.21
Somatic cell count	0.63	0.62	0.58	10.31	12.29	8.97	0.52	0.61	0.38
Mastitis resistance	0.51	0.56	0.44	1.50	1.97	1.27	0.52	0.61	0.38
Milking speed	0.05	0.02	0.02	0.20	0.03	0.19	0.06	0.01	0.04
Temperament	-0.05	-0.11	-0.04	0.04	-0.26	0.04	0.06	-0.02	0.08
Mammary system	-0.02	-0.15	-0.10	-0.03	-1.04	-0.39	0.24	0.05	0.17
Udder depth	0.20	0.25	0.08	0.42	0.97	-0.05	0.22	0.12	0.13
Overall type	-0.04	-0.20	-0.12	0.18	-1.03	-0.08	0.32	-0.08	0.27
Pin set	-0.06	-0.05	-0.08	0.50	0.06	0.44	-0.01	0.11	0.01
Feed saved	-0.07	0.17	0.01	-4.43	7.67	0.80	-0.27	0.06	-0.20

Note: Hol = Holstein; Jer = Jersey; Red = Red breeds. Responses are expressed in the units of the relevant ABV or index trait

Conclusions

The 2025 NBO review updated the BPI, HWI and SI to reflect stakeholder feedback, forecast milk and feed economics, current genetic information and contemporary breeding priorities. Stakeholder consultation confirmed strong ongoing support for the BPI and identified practical needs for simple, broadly applicable breeding tools, with additional relevance for seasonal pasture-based systems. The largest technical change was the revised protein-to-butterfat price ratio, which increased the relative emphasis on fat while maintaining balanced selection for profitability, health, fertility and sustainability. HWI25 was broadened through inclusion of calving ease and gestation length. The updated indices were implemented in the December 2025 ABV release and provide a contemporary national framework for ranking Australian dairy cattle and supporting genetic improvement for profitable, resilient and sustainable herds.

Acknowledgments

The authors acknowledge the contributions of survey respondents, interviewees and participants in stakeholder meetings. The authors also thank DataGene's Genetic Evaluation Standing Committee, Down To Earth Research, EverAg, AbacusBio, Dairy Australia, Agriculture Science and Technology (Agriculture Victoria), the Dairy Farm Monitor Project tea for input, analysis and technical support.

References

Axford M., Santos B., Stachowicz K., Quinton C., Pryce J.E. and Amer P. 2021. Impact of a multiple-test strategy on breeding index development for the Australian dairy industry. Anim. Prod. Sci. 61, 1940-1950. https://doi.org/10.1071/AN21058.

Byrne T.J., Santos B.F.S., Amer P.R., Martin-Collado D., Pryce J.E. and Axford M. 2016. New breeding objectives and selection indices for the Australian dairy industry. J. Dairy Sci. 99, 8146-8167.

Dairy Australia. 2024. Dairy Farm Monitor Project. https://www.dairyaustralia.com.au/industry-reports/dairy-farm-monitor-project

Nguyen T.T.T., Richardson C.M., Post M., Amer P.R., Nieuwhof G.J., Thurn P. and Shaffer M. 2023. The Sustainability Index: a new tool to breed for reduced greenhouse-gas emissions intensity in Australian dairy cattle. Anim. Prod. Sci. 63, 1126-1135. https://doi.org/10.1071/AN23026