# Adoption challenges associated with adding new traits to existing selection indices

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## Summary

The introduction of new traits is expected to further farmers' ability to selectively breed for improved animal health, welfare and environmental impacts. Logically, new traits will be added to national breeding indices to improve overall profitability while managing the relationships between traits. However, it is important that indices are well accepted and well used to achieve a high rate of genetic gain. This paper makes some observations about the implementation challenges associated with incorporating new traits into existing indices.

*Key words: dairy selection index, breeding objective, new traits, farmer preference*

## Introduction

Establishing an agreed breeding objective is fundamental to the delivery of high quality genetic evaluations that support successful farmers. In many countries, the agreed breeding objective is an economic index aimed at breeding more profitable cows. In the paddock, farmers might describe a breeding objective slightly differently. Farmers commonly speak of breeding the 'ideal cow'. Berry (2014) describes the characteristics of that ideal cow:

1. Produce a large quantity of high value output
2. Good reproductive performance
3. Good health status
4. Good longevity
5. Does not eat a large quantity of food
6. Easy to manage
7. Good conformation
8. Low environmental footprint
9. Resilient to external perturbations

Indices have been successful in improving many traits from this list, especially production, reproduction, longevity, easy to manage and good conformation. To complete the 'ideal cow', farmers require evaluations for a new generation of traits. Many research teams and evaluation units have already progressed new traits such as feed efficiency, heat tolerance and more detailed health traits. Environmental traits such as methane are expected to follow.

When a new trait is introduced, the logical assumption is that it should be included in an index so that the relationships between traits can be correctly treated to achieve a more profitable animal. The objective of this paper is to make some observations on the implementation challenges associated with incorporating new traits into existing indices.

## Index acceptance and use

Farmer acceptance and use of an index are important contributors to reaching a high rate of genetic gain. Farmer acceptance of an index influences the marketing of genetics and the subsequent breeding programs that deliver the next generation of bulls for selection. This is particularly true in environments such as Australia, where the majority of semen is imported from 11 companies that can sell product on the basis of nine different national breeding objectives. To achieve higher rates of genetic gain, it is most effective if farmers accept and use their own nation's breeding objective.

In a 2013 survey of randomly selected Australian farmers, 74% were aware of the Australian Profit Ranking (APR) which was the national economic index of the time. However, 22% were not confident in the APR because of a lack of understanding or trust in the figures (Watson and Watson, 2013). This led to the development of a new approach in reviewing the national breeding objective that delivered the Balanced Performance Index (BPI), Health Weighted Index (HWI) and Type Weighted Index (TWI). Compared to previous reviews, this process relied on active industry and farmer participation, the derivation of non-market values using the '1000 minds' technique and a broader scope in gathering economic and farming system inputs to the bio-economic model. The review concluded by delivering an economic index (BPI) and two highly-correlated but separate indices that are in line with farmer preferences (Byrne et al., 2016, Martin-Collado, et al., 2015). The intent of this activity was to increase acceptance of the index while achieving a greater rate of genetic gain for profit.

Eighteen months after the new indices were released, a national random survey of farmers reported that 65% of respondents were aware of the BPI. Awareness was higher in x-large and xx-large herds. Almost 80% of those aware say that the BPI influences bull selection decisions. Again, this is higher in large, x-large and xx-large herds (Watson and Watson, 2016).

## An implementation case study of a new index and trait

One way of analyzing an index's relevance is to compare the characteristics of bulls selected by companies for marketing. In an analysis, 3474 genomically tested bulls born during 2015-2016 were divided into two groups; those selected for AI and those that were not. Bulls in this age group were old enough to be selected on the basis of BPI (introduced in 2015) and selected for use in AI. The difference between groups in average breeding value and BPI is described in Table 1.

Over the past two years, bulls selected for BPI have been about half a standard deviation greater than the average of bulls selected for genomic testing but not selected for AI. In relative terms, there was more pressure applied to daughter fertility compared to production. The "Feed Saved" trait received the least pressure.

Interestingly, Feed Saved was introduced in 2015 so it is the newest ABV trait. Feed Saved is derived from maintenance requirements and residual feed intake (for bulls with genotypes). It has the lowest average reliability (29%) of all the traits in the index. Feed efficiency clearly contributes to farm profit and therefore should be included in an index. However, its lower reliability can lead to some instability in the BPI. In consultation with industry, farmers and researchers, this was mitigated by conservatively applying a half weight in the index when released in 2015 and will be revisited in the next National Breeding Objective Review.

*Table 1. Difference in trait/index between Holstein bulls selected for AI in three year of birth cohorts*

| | Difference in standard deviation units | |
|---|---|---|
| Trait/Index | 2015 | 2016 |

| | | |
|---|---|---|
| Balanced Performance Index (BPI) | 0.56 | 0.52 |
| Australian Selection Index (ASI) | 0.20 | 0.25 |
| Daughter Fertility | 0.60 | 0.46 |
| Feed Saved | 0.05 | 0.18 |

## Acceptance through extension

As a new trait, Feed Saved required its own extension activities to explain how to use it in breeding programs. A Feed Saved extension plan was initiated in 2015 alongside the release of the trait. Feed Saved's first year of extension included an industry launch, fact sheet for farmers, industry briefing, video and social media plan, consultation meetings with nutritionists, media articles and inclusion in a number of industry conferences. In a busy dairy extension marketplace, it takes time and significant resources to introduce new traits to advisors and farmers. In Australia, it is estimated that a sustained period of 2-3 years of extension activity is required for each new trait or tool. Sufficient resources are required to ensure a new trait is well explained and accepted. This is amplified if the trait is included in an index that also needs to be explained to be accepted. This will present challenges as the rate of new traits is expected to increase in the short to medium term.

## Building trust through validation

As a new trait, the Feed Saved ABV has some advantages in its explanation because 'kilograms of feed saved per cow per year' is a concrete unit of expression with which to describe an ABV. However, the underlying residual feed intake phenotype is not practical to measure on commercial farms which makes it difficult for farmers to validate the difference between animals in their own herd. The ability to validate the trait through on-farm measurement helps build trust in breeding values and encourages alignment with the indices in which it is included. The challenge for research teams and evaluation units will be to find novel ways of validating traits that both farmers and industry can relate to. This may be by delivering tools that enable farmers to validate on-farm or by proactively extending validation research outcomes.

## Index stability

Australian sire analysts suggest that index instability caused by lower reliability traits is a leading cause of frustrations with genetic evaluations (P. Thurn and B. Ronalds, pers. comms. 2017). In a highly competitive environment, small movements in an EBV can result in significant re-ranking. This is exacerbated by relatively high economic values in an index if the trait is an important contributor to profit. The result is instability in index values and bull ranking between proof runs. The use of bull teams is a sound strategy to minimize the impact of instability. While this is effective at a breeding program level, it doesn't minimize the negative impact of instability on index trust and acceptance. Carefully testing the stability of a new trait to ensure models are sufficiently robust when subjected to variable phenotypic data will benefit new trait acceptance while preserving trust in any indices it contributes to.

## Conclusion

To ensure indices remain well accepted and meet the challenge of the 'ideal cow' for the future, there are several practical approaches available to genetic evaluation units when deciding how to incorporate a new trait. For example;

1. Include the new trait at its full economic value or
2. Include the new trait with a smaller economic value in an index to 'ease' it in to an index or
3. Release and extend a new trait until it is well accepted before including in the index or
4. Do not include a trait in an index, but rather leave farmers and bull companies to apply their own level of selection pressure based on their own requirements.

Making decisions about which option is most suitable is made easier with ongoing measurement and monitoring of industry and farmer views.

A new generation of traits presents an opportunity to advance the quest for the 'ideal cow'. When making decisions about the relationship between new traits and indices, it is important to consider both farmer and industry acceptance of indices so that innovations support rather than interrupt increasing rates of genetic gain for profit.

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