New Zealand Beef Industry Consultation Survey:

Industry trait preferences and views on genetic tools.

Prepared for:

Beef & Lamb NZ Genetics

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Executive Summary

Background & Objectives

This project comprises an industry survey that was undertaken to capture New Zealand (NZ) beef industry perspectives on traits, trait priorities and selection index requirements to support genetic improvement within the NZ beef industry.

The survey collected industry insights to support:

1. Identification of opportunities to develop new breeding traits, understand views and perceptions that might influence expansion, the scope and relevance of the genetic evaluation system/s utilised by the NZ beef industry.
2. Identification of beef farmer trait preferences (among current and potential future traits) and factors driving these preferences, and potentially grouping farmers accordingly, aiming to inform future development of custom selection indexes for the NZ beef industry.

Methodology & Approach

The online survey consisted of two sections. A **demographic** section asked questions about the respondent's production system and their views and attitudes on cattle selection (and bull purchases). The second section asked questions on respondents' **preferences for traits** through Conjoint Analysis techniques using the 1000Minds' software[1] where respondents make choices based on pairwise comparison of traits to indicate their preferences and the relative importance placed on these traits for beef cattle production in NZ.

Online survey responses were collected between July 1st 2022 and August 12th 2022. The demographics component of the survey received 439 complete responses and 290 partial responses, whilst the 1000Minds component received 311 complete responses and 169 partial responses.

Survey responses were collected from a broad sample of the NZ beef industry. Figure 1 depicts the composition of respondents by beef business activity, highlighting strong engagement from the commercial sector via both commercial breeders (44.5% of respondents) and finishers (24.9% of respondents).

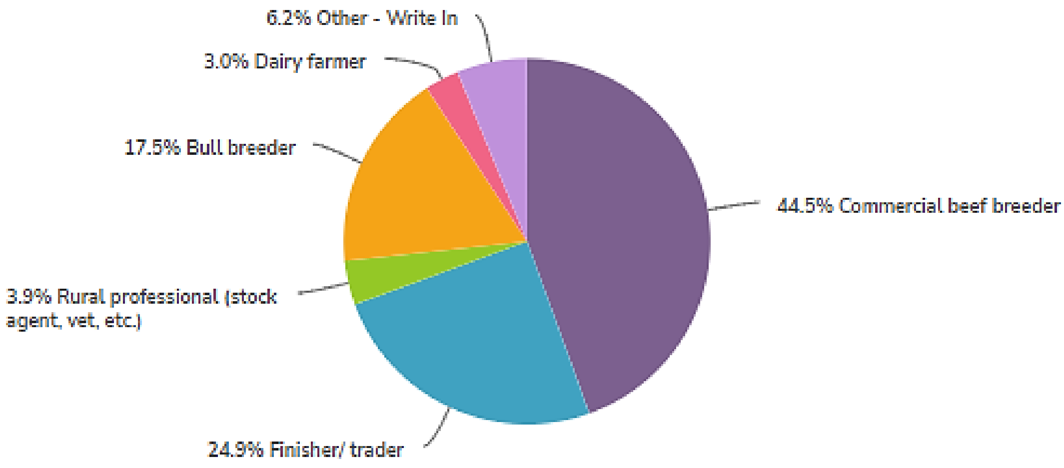

Figure 1: Beef business activity of survey respondents

[1] See https://www.1000minds.com/conjoint-analysis for a description of the techniques

Results

The analysis investigated patterns of trait preferences among respondent groups that were defined based on socio-demographic *a priori* attributes (e.g., business activity, location, herd size, farm class, breed, etc.).

Error! Reference source not found. displays the trait preference rankings across all respondents (from the demographic survey). This step presents all traits together thus respondents can indicate their preferences considering the relativity between them. In general, the most preferred traits were maternal traits, particularly cow fertility, cow functionality (docility and teat/udder scores) and calving ease, with welfare and environmental traits being least preferred.

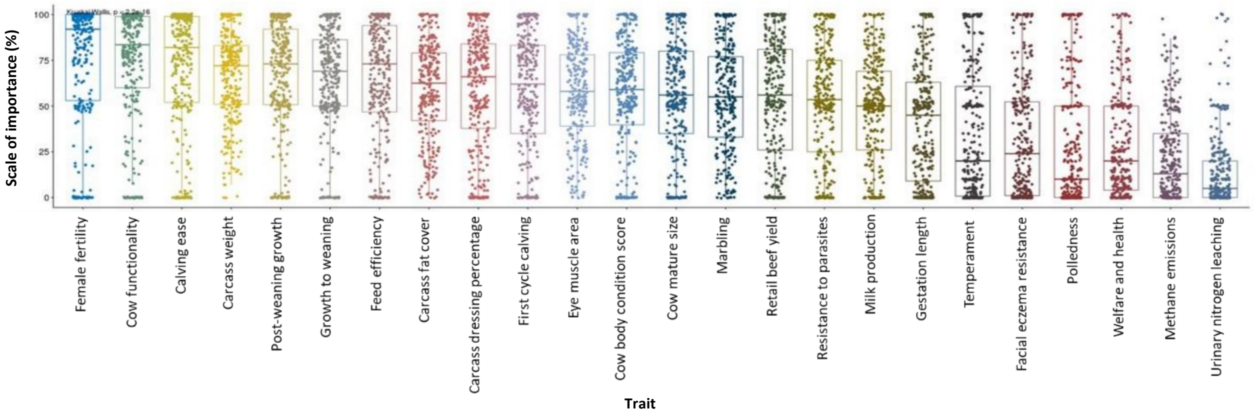

Figure 2: Respondent views on the desired level of selection emphasis that they would place on key traits

A principal components analysis (PCA) and cluster analysis (CA) of trait preferences was performed (from the trait preference part of the survey) to investigate groupings of respondents with similar preferences. These groupings were apparent from the preference data rather than being a priori classified based on demographic question responses. Cluster analysis (CA) showed that most of the variability of beef producers' preferences is found in the relative importance of two groups of traits: production related (i.e., growth, feed conversion efficiency, and carcass weight) and traits associated with maternal performance (i.e., calving ease, fertility, and cow functionality). These are presented in Figure 3.

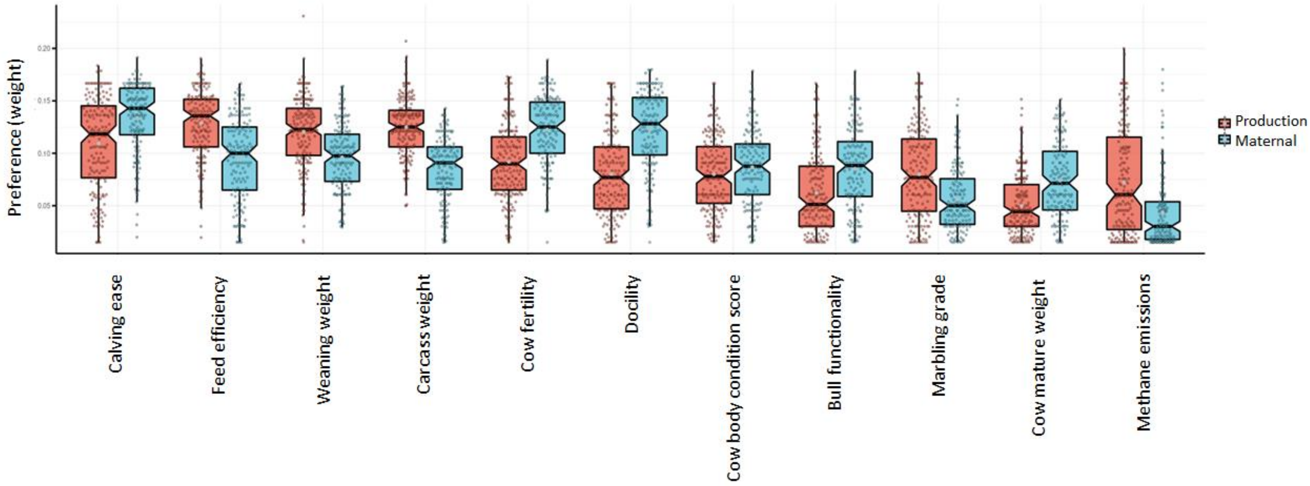

Figure 3: Cluster analysis of trait preferences of beef producers in NZ.

There were no strong demographic differences between the composition of the two clusters aside from a tendency for beef finishers/traders to be more strongly associated with the production cluster. Bull breeders and commercial breeders were relatively evenly distributed across both clusters. Other demographic factors (e.g., breed and farm class) exhibited very minor influence over trait preferences. Despite these results from the 1000Minds survey, there was close similarity between the clusters in relation to the scope and structure of NZ beef selection indexes. Importantly, the maternal cluster believes that maternal selection indexes should incorporate emphasis on carcass traits (including marbling) alongside maternal traits (26.3% agree/strongly agree). Whilst this is a lower level of agreement than the production cluster (47.4% agree/strongly agree), it does highlight that both clusters believe that indexes require a combination of both maternal and production traits (including carcass traits such as marbling).

In general, NZ beef producer respondents of the survey strongly support use of estimated breeding values (EBVs) and indexes as tools to inform their selection and bull purchasing decisions, and almost 75% of respondents somewhat agree, agree, or totally agree that NZ farm systems and supply chain require specialised selection indexes.

Key Findings & Recommendations

The survey has identified several key areas for BLNZ and other key stakeholders to improve the scope and delivery of genetic tools to the NZ beef industry. Table 1 provides an overview of key recommendations for BLNZ based on the results and findings from this report.

Table 1: Recommendations

#	Recommendation	Description
1	Survey results and breed society consultation	Survey results should be shared with breed societies and the broader industry. Breed societies play a significant role in the delivery of key genetic tools to industry and can benefit from the insights contained within these results.
2	Industry extension priorities	Results from this survey have highlighted the importance of ongoing extension programs to improve adoption and understanding of genetic tools.
3	New trait development – Structural traits	Results from this survey highlight strong industry priority placed upon structural soundness and functionality traits. BLNZ should engage with breed societies to understand how it can support implementation of new traits (e.g., foot/leg structure and teat/udder scores) either within existing BREEDPLAN evaluations, or as standalone evaluations.
4	New trait development – Feed conversion efficiency	The survey has identified feed conversion efficiency as a high priority trait for development. BLNZ needs to assess the cost-benefit of integrating feed intake testing into its progeny test programs, likely in conjunction with collection of methane phenotypes. In addition to scoping the feasibility of collecting phenotypic data, BLNZ should also engage with breed societies to assess feasibility of implementing relevant traits within existing BREEDPLAN evaluations, or as a new external evaluation.
5	Feasibility/scoping of new cow fertility traits	BLNZ should evaluate options for complementary and alternate female fertility traits, particularly options (such as segmenting DTC by cow/heifer age) that can be recomputed from existing DTC datasets. New/alternate traits and trait expressions could support increased heritability and enhanced farmer/breeder understanding, particularly if traits can be expressed in language and units that are more consistent with NZ industry terminology.
6	Selection index development	Survey results have identified several potential enhancements to industry selection indexes. These comprise inclusion of functional and structural traits within industry selection indexes, simplification of current index portfolios, and development of sub-indexes to break up and summarise animal genetic merit across trait groups. These enhancements would allow development of interfaces to allow users to rank animals within customised 'indexes' based on desired sub-index weightings. BLNZ must engage with breed societies to secure collaboration and identify preferred approaches for implementation.

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Introduction

Background

Beef & Lamb New Zealand (BLNZ) has implemented the Informing New Zealand Beef (INZB) program, a 7-year partnership between BLNZ and the Ministry for Primary Industries (MPI).

Currently the NZ beef industry relies on the BREEDPLAN genetic evaluation system that was originally developed to support genetic improvement within the Australian beef industry. INZB is seeking to establish a beef genetic improvement capability and infrastructure that can better align with the needs and priorities of the NZ industry.

INZB comprises four key phases:

1. Establishing progeny test herds to meet industry phenotyping requirements and support development of future across-breed evaluation capability.
2. Developing breeding objectives and selection indexes that better reflect the production systems, markets, and environments applicable to the NZ beef industry.
3. Building an NZ beef genetic evaluation that will incorporate core traits relevant to the NZ industry.
4. Developing a data infrastructure to optimise data inflows/outflows to maximise benefits to users.

To support INZB, BLNZ has engaged AbacusBio to undertake parallel projects to assess the development of new traits for integration into industry phenotyping programs to support future inclusion in subsequent industry evaluations and to engage on a beef producer consultation to understand views and preferences on existing and new traits.

Objectives

This project comprises an industry survey that was undertaken to capture NZ beef industry perspectives on traits, trait priorities and selection index requirements to support genetic improvement within the NZ beef industry.

The survey will collect industry insights to support:

1. Identification of opportunities to develop new breeding traits, understand views and perceptions that might influence expansion, the scope and relevance of the genetic evaluation system/s utilised by the NZ beef industry.
2. Identification of beef farmer trait preferences (among current and potential future traits) and factors driving these preferences, and potentially grouping farmers accordingly, aiming to inform future development of custom selection indexes for the NZ beef industry.

The project complements a parallel initiative that comprised an independent assessment of potential new traits that could be developed by BLNZ based on a review of breeding traits utilised within major global beef evaluations, and research programs.

In combination, both parallel projects will initially support BLNZ to develop future phenotyping and reference/training population strategies that will align with subsequent phases of INZB. In addition, outcomes will also inform the future development of NZ beef industry selection indexes that reflect the priorities of NZ beef industry stakeholders.

Methodology

Survey Overview

An on-line survey was conducted from 1st of July to 12th of August 2022 and was distributed by BLNZ to NZ beef industry stakeholders.

The survey was predominately targeted toward beef farmer respondents (bull breeders, commercial breeders, and finishers), however responses from rural professionals and other key stakeholders were also sought.

The on-line survey consisted of two sections. A demographic section asked questions about the respondent's production system and their views and attitudes on cattle selection (and bull purchases). The second section asked questions on respondents' preferences for traits through Conjoint Analysis techniques using the 1000Minds' software[2] where respondents make choices based on pairwise comparison of traits to indicate their preferences and the relative importance placed on these traits for beef cattle production in NZ.

The survey was used to address several key questions relating to stakeholder views on traits, selection indexes and genetic tools:

1. What new traits could be developed for the NZ beef industry and how important are these traits to industry stakeholders?
2. What traits do respondents prioritise, and what traits are considered important to be included in NZ beef indexes?
3. What are respondents' views on the importance of environmental and health/welfare traits, and how much progress in productivity traits are farmers willing to forgo to enable progress in environmental and health/welfare outcomes?
4. Are trait priorities similar between bull breeders and commercial herds, or are there significant clustering of respondents with different priorities across segments?
5. Are trait preferences influenced by breed, beef enterprise, farm class/system, geographical distribution, and other attributes? How is segmentation and clustering of respondents influenced by these attributes and the preferences of beef producers?
6. What is the optimal scope and range of indexes that are required for the NZ beef industry?

The full set of questions included in the survey is presented in the Appendix of this report.

Survey Approach – Trait Preferences

The survey contained two distinct approaches to allow respondents to identify trait priorities, using either direct ranking questions (implemented within the demographics component of the survey), or a Conjoint Analysis approach implemented via the trait preference component. In the first part, the preference for traits was asked on a scale from 1 to 100 with the question displaying all traits jointly (Figure 4) from which answers were converted to a relative weight of importance of each trait.

[2] See https://www.1000minds.com/conjoint-analysis for a description of the techniques

Figure 4: Example of trait preferences question within the demographic component of the survey

Trait priorities were also captured through the Conjoint Analysis (1000Minds) which asked repeated questions on the outcomes (impacts) of the trade-off between two traits at a time, and respondents were required to choose one trait outcome (Figure 5). This pairwise comparison is practical and requires less effort from participants than other methods, making choice decisions simpler and nearer to respondents' "true" preferences.

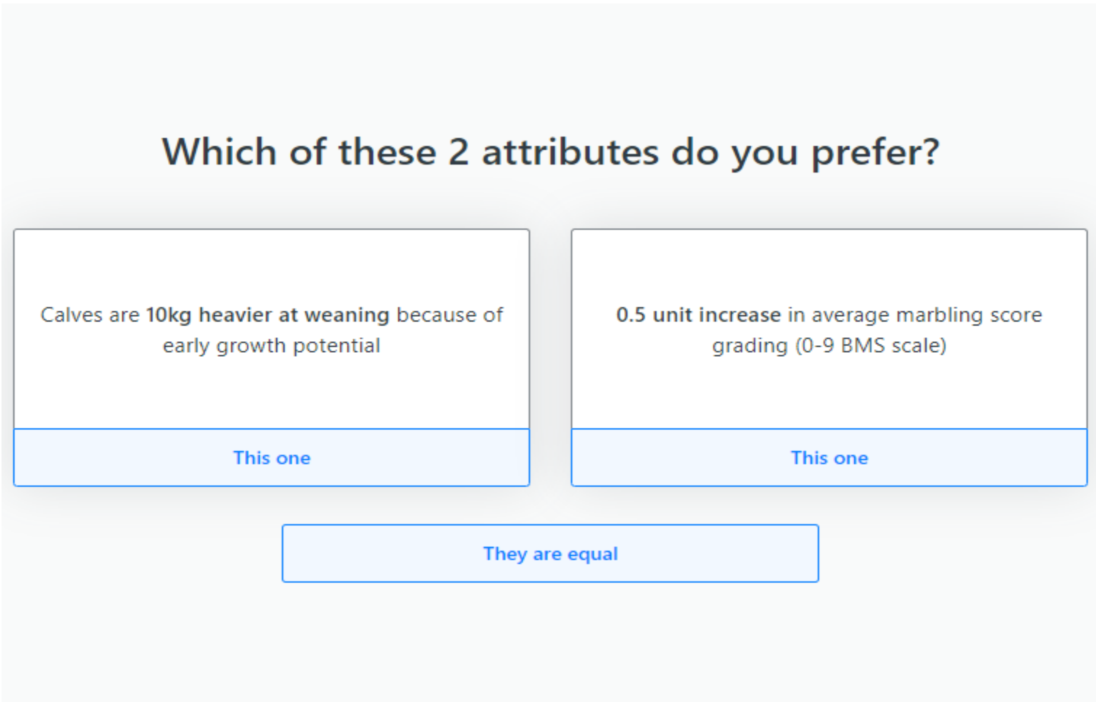

Figure 5: Example of trait preferences trade off within the 1000Minds component of the survey

Table 2 summarises the traits and trait trade-off values utilised within the 1000Minds component of the survey. Trade-offs were estimated by AbacusBio and BLNZ to reflect broadly equivalent economic values.

Table 2: 1000Minds traits and trait trade-offs

Trait	Proposed trade-off
Weaning Weight	Calves are **10 kg heavier at weaning** because of early growth potential
Carcass Weight	Carcases are **12 kg heavier** because of post-weaning growth potential
Calving ease	**5 fewer heifers** per 100 require assistance at calving
Cow fertility	**3 less cows** per 100 culled per year due to low fertility
Bull functionality	**1 additional mating** season over a bull's lifetime
Cow mature weight	**20 kgs less** cow mature weight
Cow body condition score	**0.5 additional unit** of cow condition score at weaning
Methane emissions	**5 % less** methane (CH4) emissions
Docility	**3 fewer cows** (per 100) culled because of bad temperament
Feed efficiency	**5% increase** in feed conversion efficiency (kg beef per unit of feed)
Marbling grade	**0.5 unit increase** in average marbling score grading (0-9 BMS scale)

Survey Responses and Respondent Demographics

The demographics component of the survey received 439 complete responses and 290 partial responses, whilst the 1000Minds component received 311 complete responses and 169 partial responses.

Survey responses were collected from a broad sample of the NZ beef industry. Figure 6 depicts the composition of respondents by beef business activity, highlighting strong engagement from the commercial sector via both commercial breeders (44.5% of respondents) and finishers (24.9% of respondents).

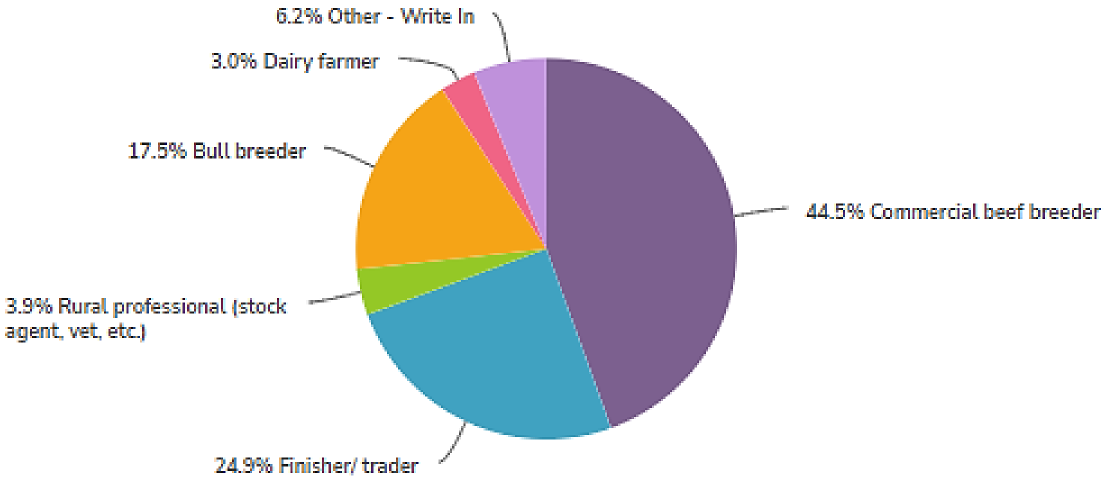

Figure 6: Beef business activity of survey respondents

In addition, survey respondents also represented a broad cross-section of farming regions as depicted below (Figure 7).

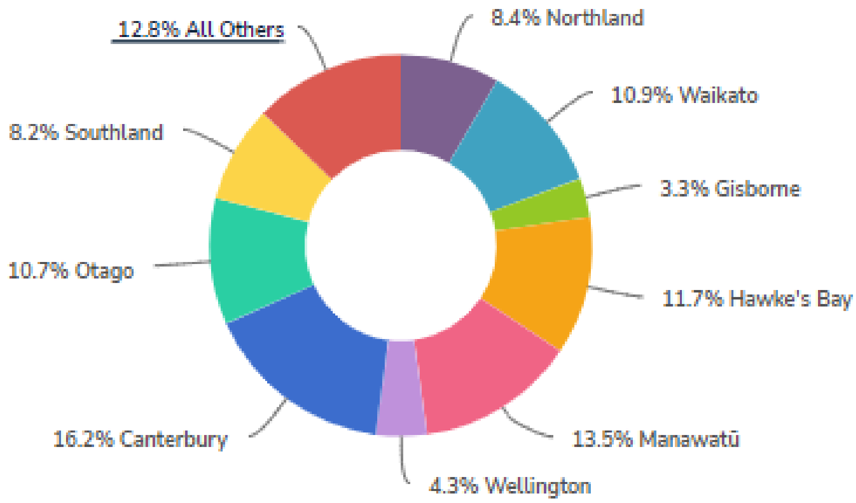

Figure 7: Primary location of survey respondents

Approximately 15% of respondents were specialist beef producers (beef cattle comprised 100% of farm stock units), whilst on average respondents reported that 56% of farm stock units were beef cattle. The primary cattle breed of survey respondents was dominated by Angus herds (Figure 8), however this is likely reflective of the underlying breed composition of the national beef herd. For this question, respondents could indicate all the breeds they farm in their operations.

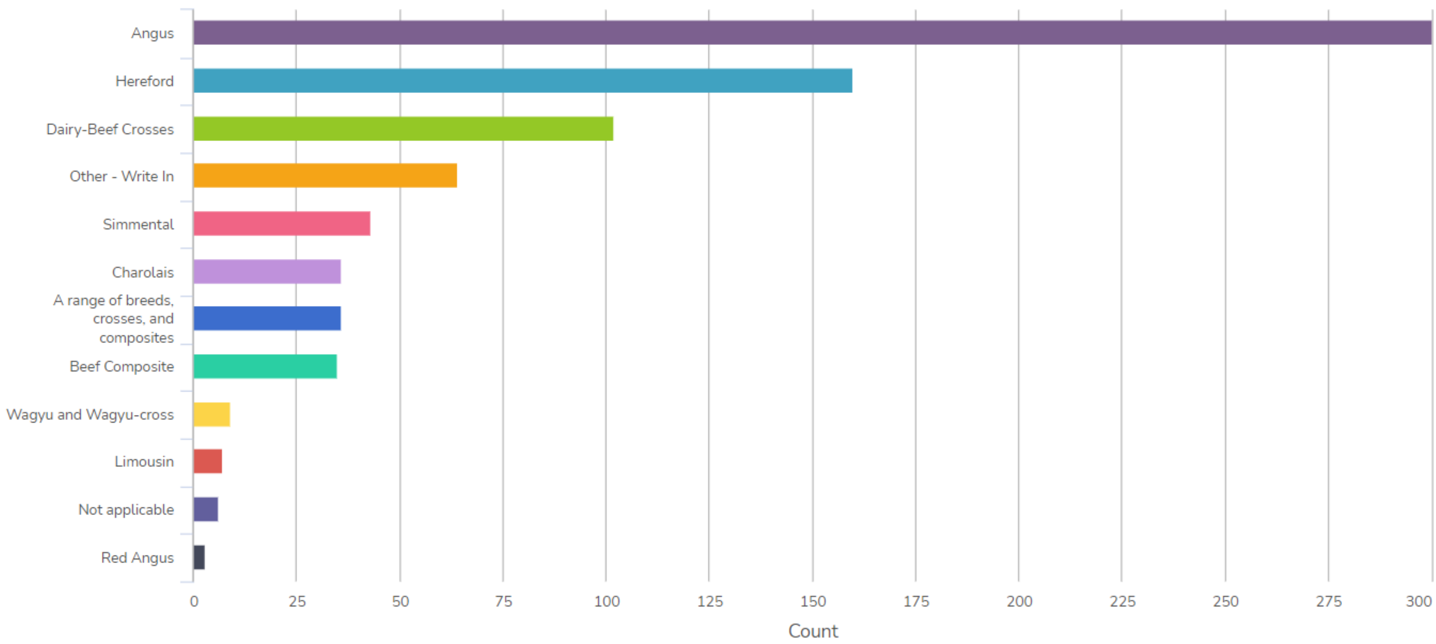

Figure 8: Primary beef breed of survey respondents

Results

Cow and Heifer Management – Maternal System

Respondents were asked a series of questions about their maternal breeding system to understand potential interest in development of new maternal traits (e.g., cow body condition score) and influences of maternal system on overall trait preferences.

Approximately 82% of respondents (excluding N/A responses) first mate their heifers as R2's to calve as a 2YO, with over half of the respondents first mating heifers between 300-350kg live weight.

Figure 9 depicts the range of responses received on the frequency of calving difficulty within maiden heifers. The overall frequency of calving difficulty averaged 3.71% (standard deviation of 8.12%) and is broadly consistent with published literature[3].

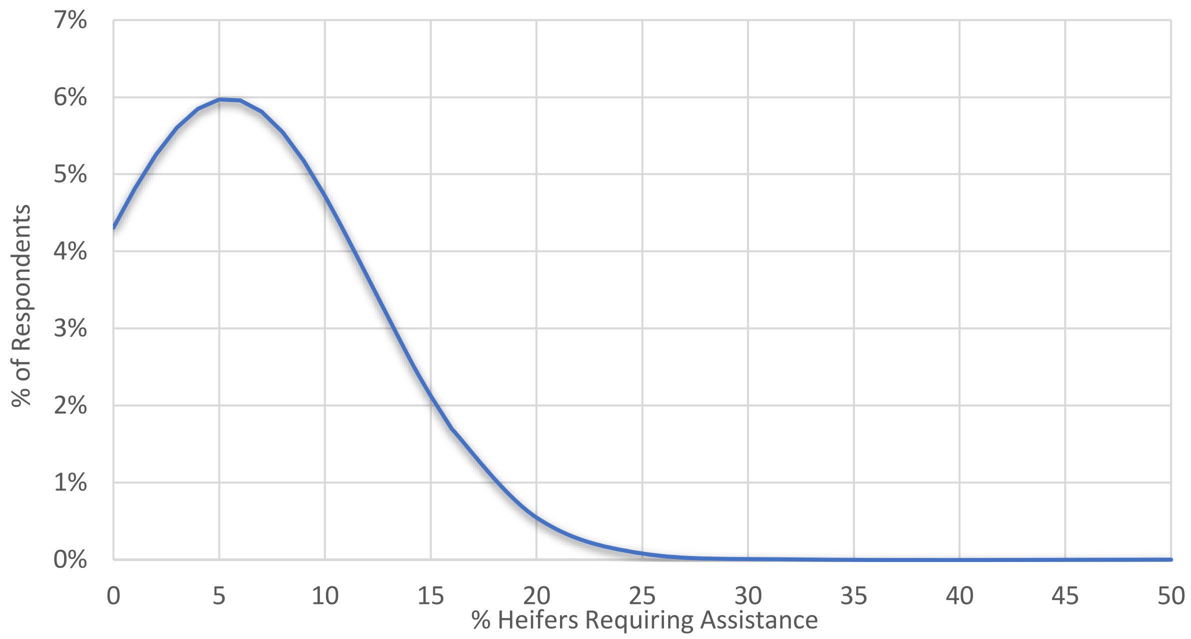

Figure 9: Frequency of calving difficulty amongst first calf heifers

Figure 10 depicts respondents views on cow size and composition. Respondents estimated that the average weight of cows at weaning was 548kg (SD[4] ± 94kg) versus an optimum weight of 555kg (SD ± 81kg).

Figure 10: Respondent views of cow size, structure, and composition

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[3] Beef + Lamb New Zealand guide to New Zealand cattle farming (2017), https://beeflambnz.com/knowledge-hub/PDF/guide-new-zealand-cattle-farming

[4] Standard deviation

Figure 10 demonstrates that generally, respondents agree that cow size and composition is important and more descriptive traits (beyond cow weight) could be beneficial. This could provide a case for the development of additional traits for describing cow size and composition such as cow body condition score and cow height (as an indicator of frame size).

Use of Genetic Tools

Respondents were asked about their use of genetic tools (EBVs, economic selection indexes, etc). This consisted of a series of questions associated with general views on the use of genetic tools (Figure 11), views on economic selection indexes for the NZ beef industry(Figure 12) and selection criteria when purchasing breeding bulls (Figure 13).

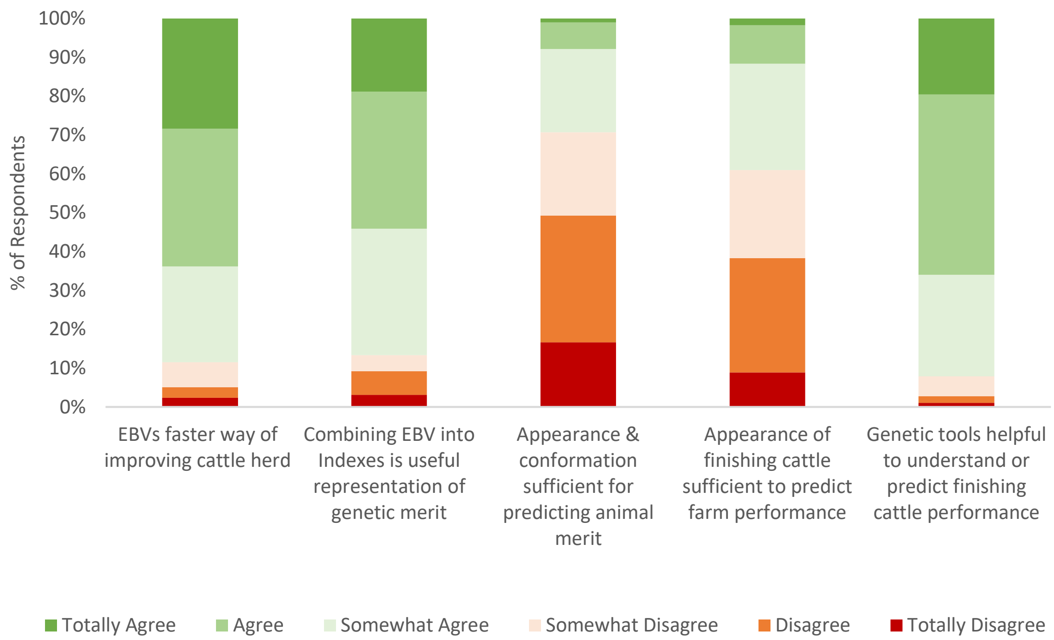

Figure 11: Views and attitudes toward the use of genetic tools

Figure 11 highlights that most respondents believe that EBVs (64% agree or totally agree) and economic selection indexes (54% agree or totally agree) are useful tools for representing animal genetic merit and improving herd performance.

However, these results also demonstrate that significant proportions of respondents possess relatively neutral (somewhat agree/agree/totally agree) to negative views on the use and value of genetic tools, e.g., appearance is sufficient to predict merit and performance, highlighting the importance of ongoing investment in extension activities to improve understanding and adoption across the industry.

Figure 11 also highlights strong industry interest in the potential availability of genetic tools to understand or predict the performance of finishing cattle. Several genomic and non-genomic technologies are in development across Australia and the US that seek to deliver solutions within this space.

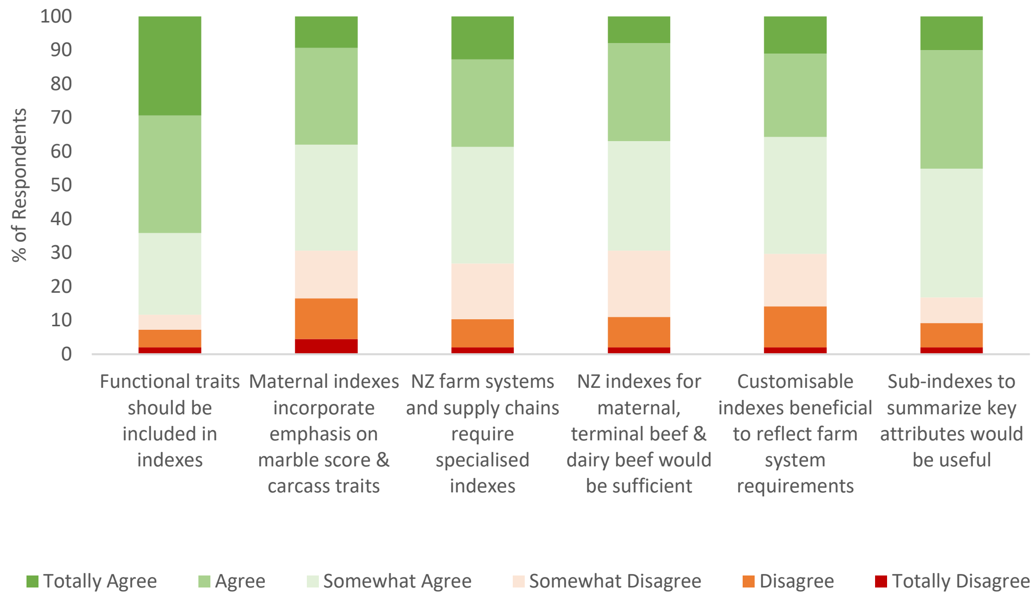

Figure 12: Views on economic selection indexes for the NZ beef industry

Figure 12 depicts respondent views on economic selection indexes. Respondents generally support a simplified portfolio of selection indexes covering maternal, terminal beef and dairy-beef systems (69% somewhat agree/agree/totally agree). Respondents also believed (69% somewhat agree/agree/totally agree) that maternal selection indexes should include emphasis on carcass and eating quality traits alongside maternal traits. There is also very strong support for inclusion of functional traits (structure, docility, etc.) within selection indexes - these traits are currently omitted from most industry selection indexes. It is particularly important to notice that almost 75% of respondents somewhat agree, agree, or totally agree that NZ farm systems and supply chain require specialised selection indexes.

Whilst respondents supported a simplified portfolio of selection indexes, there is support for development of sub-indexes to summarise animal merit and customisability to adapt indexes to specific requirements. This represents a key area of opportunity for BLNZ and other stakeholders to support greater adoption and use of economic selection indexes.

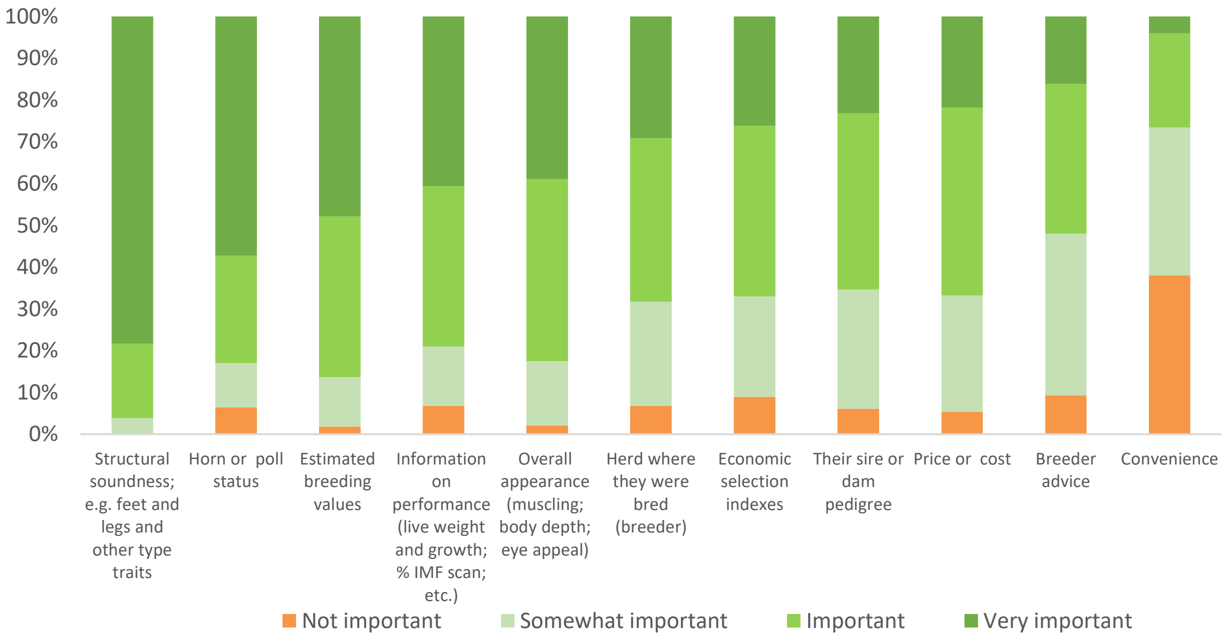

Figure 13: Selection criteria for purchasing breeding bulls

[Figure 13](#) demonstrates that respondents apply genetic tools (EBVs and economic selection indexes) alongside a broad range of criteria when selecting bulls for purchase. Whilst industry does consider genetic tools to be important for bull purchase decisions, their importance is lower than visual appraisal (overall appearance), structural soundness, and horn/poll status. Similar levels of importance are placed on genetic tools and raw performance information (animal live weight, and other phenotypic measurements).

Key implications from these results are discussed later in this report.

Respondent Trait Preferences and Priorities

Figure 14 displays respondent rankings of a diverse range of existing and potential new traits. These results were generated within the demographic survey (all traits presented jointly) and reflect the level of selection emphasis that respondents would place on specific traits (given where their herd is now).

These results reflect the explicit beliefs held by respondents about the relative importance of key traits and can be contrasted with the trait priorities identified via the 1000Minds survey (presented later).

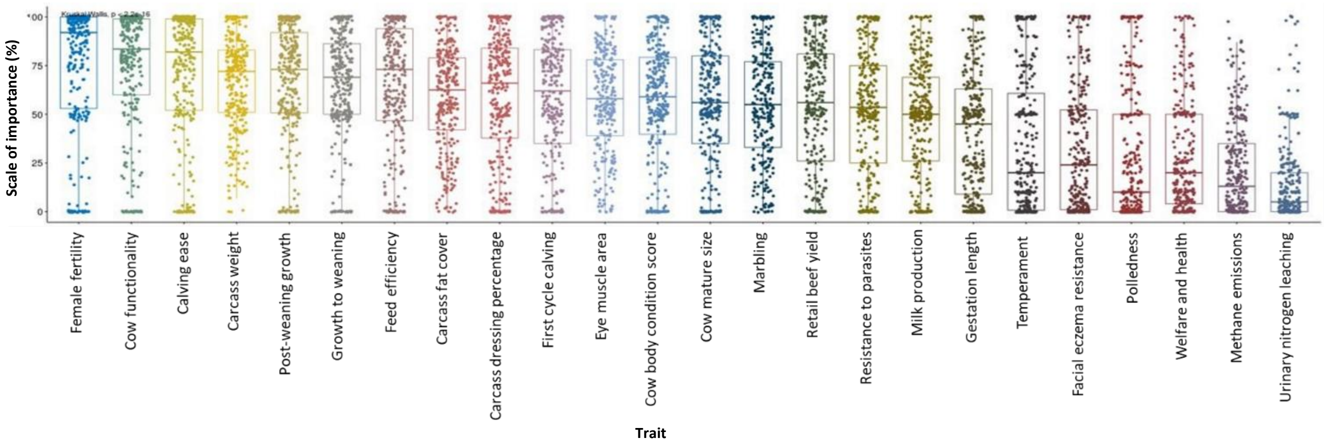

Figure 14: Respondent views on the desired level of selection emphasis that they would place on key traits

Key highlights from Figure 14 comprise the following:

- Respondents placed greatest emphasis on maternal traits – fertility, cow functionality (foot/leg structure, teat and udder scores, docility) and calving ease – ahead of all other traits.
- Depending on cattle breed, EBVs already exist for cow fertility (days to calving and gestation length), docility (including flight time and docility EBVs) and calving ease. This indicates opportunities to improve understanding of these existing EBVs and encourage greater phenotypic data collection for docility and calving ease where published EBVs can be patchy in some breeds.
- Growth traits, carcass weight and feed efficiency represent the next highest priority traits.
- Feed efficiency represents the only novel/new trait among the highest priority traits.
- Animal health, welfare, and environmental traits (methane emissions and nitrogen leaching) were ranked as the lowest priority. Figure 15 (below) highlights limited willingness amongst respondents to trade off genetic progress in production traits to enable gains in welfare and environmental traits.

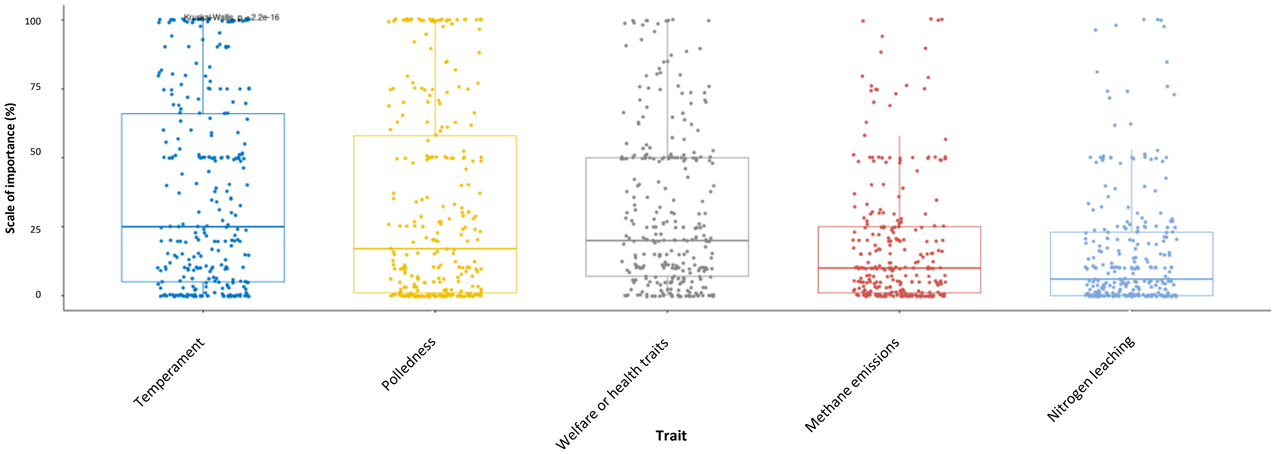

Figure 15: Level of genetic progress in production traits that respondents would be willing to trade off to generate progress in welfare and environmental traits

Trait preference results from the 1000Minds survey are presented in Figure 16. These results reflect the levels of preferences obtained when asking respondents to consider trade-offs between levels of specific traits as presented earlier in Table 2. Because the levels were chosen to be approximately economically equal, differences in priority shown here in show the traits which respondents tend to prefer beyond what normal economic criteria would indicate they should. These preferences could reflect farming convenience associated with the trait, but also could reflect the degree to which respondents' situations do not align with the a priori industry average assessment.

The 1000Minds survey was simplified by using a subset of the traits that were presented in Figure 15 and which were considered in the demographic component of the survey. The subset was selected to ensure representation of the key trait groups reflected in Figure 14, as well as combinations of both existing and novel traits, while substantially reducing the survey effort required by respondents.

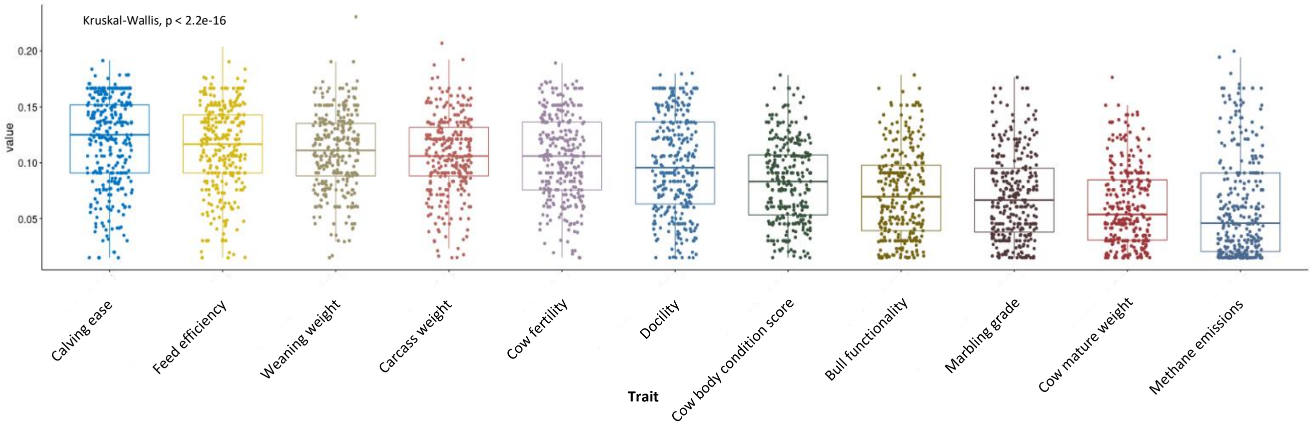

Figure 16: 1000Minds trait preference weightings

Trait preferences from the 1000Minds survey (Figure 16) broadly reflected similar preferences to those presented in. Cow fertility was the key exception, ranking as the highest priority trait in Figure 16 but only 5th highest (out of 11 traits) in based on the 1000Minds methodology. This could reflect either an overestimation by respondents of the relative importance of fertility within Figure 16, or the nominated trade-off for fertility within the 1000Minds survey (3 less cows per 100 culled due to low fertility) did not adequately reflect an appropriate value for cow fertility relative to the other trait trade-offs.

Table 3 displays correlations between respondent trait preferences from the 1000Minds survey. Respondent preferences for feed efficiency were positively correlated with weaning weight and carcass weight, whilst cow fertility, docility and calving ease also exhibited correlated preferences among the respondents. However, these correlations were generally weak indicating weak relationships between respondent preferences across traits.

Table 3: Trait preference correlations from 1000Minds survey

	Calving ease	Feed efficiency	Weaning weight	Carcass weight	Cow fertility	Docility	Cow BCS	Bull functionality	Marbling	Cow mature weight	Methane emissions
Calving ease	1	-0.201	-0.088	-0.151	0.013	0.154	-0.168	-0.087	-0.307	-0.059	-0.155
Feed efficiency	-0.201	1	0.034	0.176	-0.197	-0.277	-0.173	-0.228	0.084	-0.245	0.064
Weaning weight	-0.088	0.034	1	0.273	-0.146	-0.28	-0.052	-0.108	-0.113	-0.166	-0.083
Carcass weight	-0.151	0.176	0.273	1	-0.279	-0.244	-0.099	-0.235	0.047	-0.263	-0.041
Cow fertility	0.013	-0.197	-0.146	-0.279	1	0.097	-0.021	0.101	-0.211	0.083	-0.311
Docility	0.154	-0.277	-0.28	-0.244	0.097	1	-0.103	-0.03	-0.22	-0.032	-0.249
Cow body condition score	-0.168	-0.173	-0.052	-0.099	-0.021	-0.103	1	0.042	-0.088	-0.024	-0.114
Bull functionality	-0.087	-0.228	-0.108	-0.235	0.101	-0.03	0.042	1	-0.178	0.055	-0.279
Marbling	-0.307	0.084	-0.113	0.047	-0.211	-0.22	-0.088	-0.178	1	-0.089	0.117
Cow mature weight	-0.059	-0.245	-0.166	-0.263	0.083	-0.032	-0.024	0.055	-0.089	1	-0.118
Methane emissions	-0.155	0.064	-0.083	-0.041	-0.311	-0.249	-0.114	-0.279	0.117	-0.118	1

These results reflect the overall trait preferences across the entire respondent group. Further analysis is presented below exploring trait preferences within demographic groups and identification/ characterisation of respondent clusters with similar preferences.

Trait Preferences - Demographic Differences

Trait preferences exhibited minor differences attributable to respondent demographics. Figure 17 to Figure 19 display the 1000Minds trait preferences by primary business activity (Figure 17), primary cattle breed (Figure 18) and farm class (Figure 19).

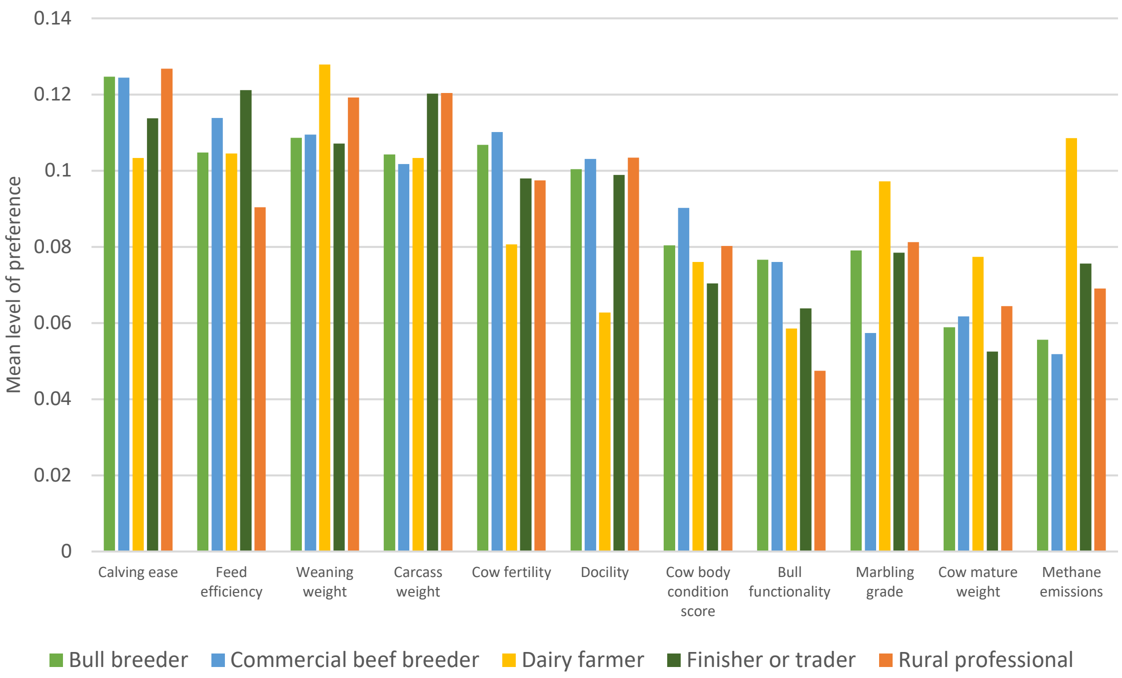

Figure 17: 1000Minds trait preferences by primary beef business activity

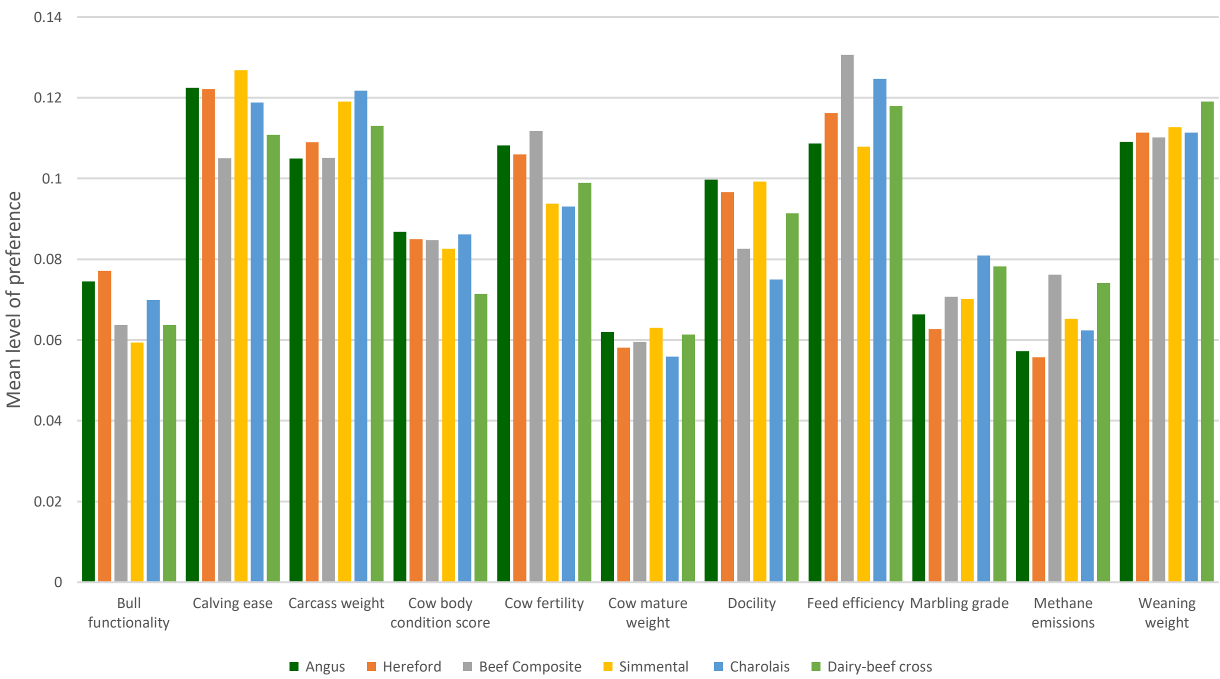

Figure 18: 1000Minds trait preferences by primary cattle breed

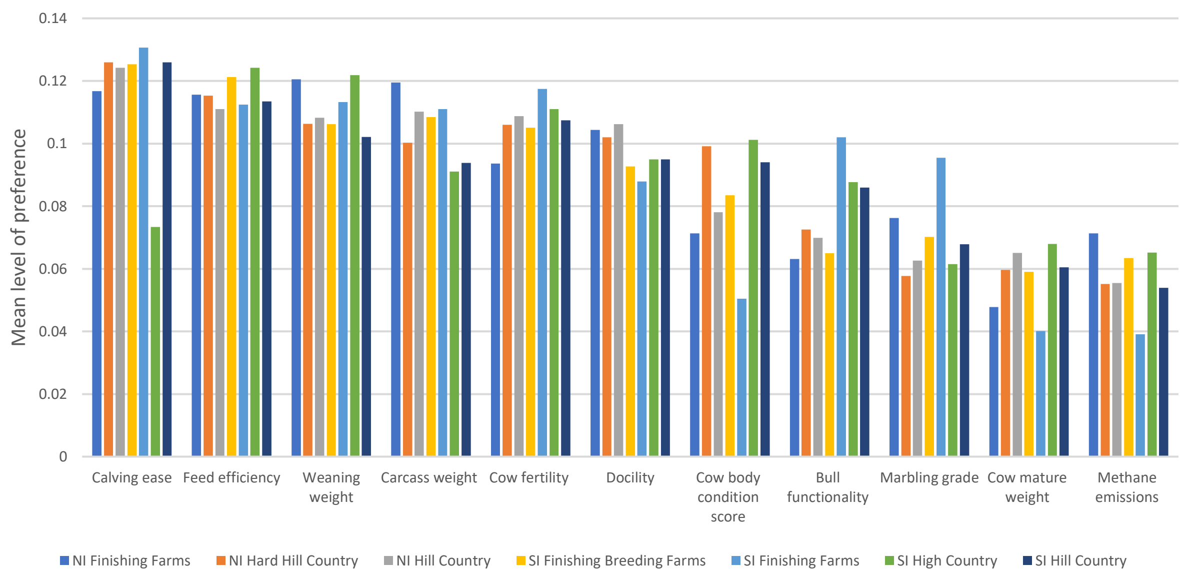

Figure 19: 1000Minds trait preferences by farm class

Whilst overall trait preferences are quite similar across demographic segments, Figure 17 to Figure 19 contain several interesting observations:

- The dairy farmer segment (only 3% of respondents) is the most clearly differentiated segment within Figure 17 with a greater priority placed on methane emissions, marbling and weaning weight, and lower priority placed on docility, cow fertility and calving ease than the other respondents, albeit with very low numbers of respondents.
- Trait preferences of bull breeders and commercial breeders are generally very closely aligned (Figure 17) with marbling (higher priority for bull breeders) and cow body condition score (higher priority for commercial breeders) presenting as the key areas of divergence. The tendency for bull breeders to place higher priority on marbling is a likely reflection of sourcing genetics from overseas (particularly US and Australia) and the use of the combined TACE evaluation with Angus Australia[5].
- Differences between breeds are negligible (Figure 18).

Trait preferences across farm class (Figure 19) provided some interesting results. Key highlights comprised the following:

- Calving ease received significantly lower priority among South Island high country farms (BLNZ Class 1). This is believed to reflect the lack of visibility of calving difficulty within these extensive systems, as well as potentially lower incidence due to a greater tendency to first mate heifers as R3s.
- Despite the above, bull functionality received highest preference among the South Island finishing farms.
- Preference for cow body condition score was lower within the North and South Island finishing systems (BLNZ Class 5 and Class 7/8). This could reflect the greater proportion of beef finishing (as opposed to breeding) within these environments and/or the higher productivity of these environments creating less tendency for cows to slip into marginal body condition.
- Marbling was most preferred among the finishing farm classes and particularly the South Island finishing systems. This response is intuitive, reflecting the greater proportion of finishing/trading enterprises within these classes, whilst the higher preference in the South

[5] Marbling and IMF is increasingly prominent within Angus Australia indexes and sought after by Australian Angus breeders, reflecting increased use of marbling as a beef brand differentiator and source of price premiums.

Island potentially reflects the influence of the marbling incentives and differentiated brand programs offered by Alliance Group[6].

Cluster Analysis

A cluster analysis was undertaken to identify groups of respondents with similar 1000Minds trait preferences. Subsequent analysis was undertaken to characterise these clusters and understand whether differences in trait preferences reflected potential demographic differences or differences in breeding philosophy.

The cluster analysis identified two distinct clusters. **Cluster 1** (comprising 136 respondents) represented a cluster with preference for both maternal/functional traits alongside growth and carcass traits and is referred to as the **'production focussed cluster'**. **Cluster 2** (comprising 168 respondents) represented a cluster with stronger focus on maternal and functional traits and is referred to as the '**maternally focussed cluster'**.

Figure 20 displays the differences in 1000Minds trait preferences between the two clusters whilst Figure 21 displays a principal component analysis of the trait preferences of the two clusters.

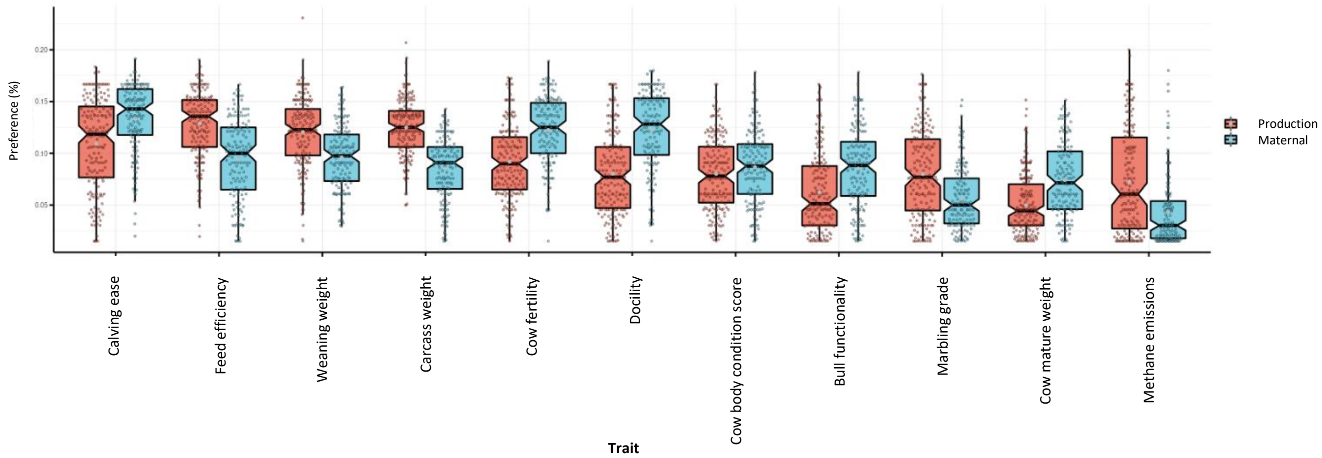

Figure 20: Cluster analysis of 1000Minds trait preferences (cluster 1 = production cluster, cluster 2 = maternal cluster)

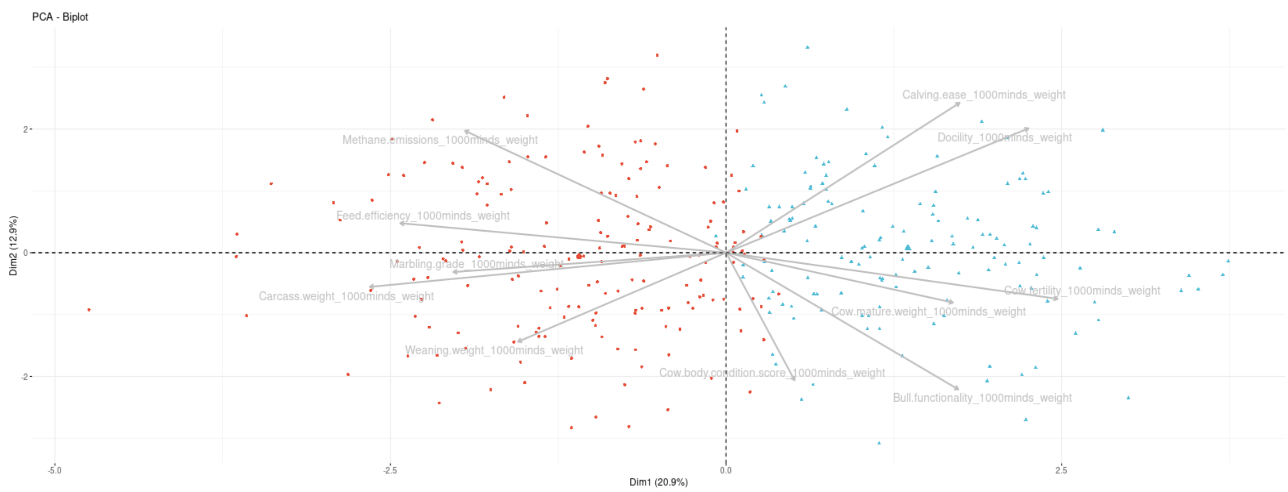

Figure 21: Principal component analysis of 1000Minds clusters (cluster 1 = red, cluster 2 = blue)

6 Alliance Group are the first major NZ processor to offer direct premiums for carcass marble score and are one of the major South Island processors.

Key highlights from Figure 20 and Figure 21 comprise the following:

- The maternal cluster (Cluster 2) ranks calving ease, cow fertility and docility as its three highest priority traits and methane emissions, marbling, and cow mature weight as its three lowest priority traits. By contrast, the production cluster (Cluster 1) ranks feed efficiency, weaning weight and carcass weight as its three highest priority traits, and cow mature weight, bull functionality and methane emissions as its lowest priority traits.
- Figure 21 highlights the segregation of the trait preferences into maternal/cow traits (right side) and production/carcass traits (left side). There is very limited preference for production traits evident for Cluster 2 indicating the cluster is almost entirely focussed on maternal/cow traits.
- The quadrants within Figure 21 also highlight key relationships among the traits from a respondent preference perspective. Interestingly, methane emissions, feed efficiency and marbling separate from the other production-focussed traits into a sub-cluster of novel, progressive traits.

Despite these results from the 1000Minds survey, Figure 22 (below) highlights close similarity between the clusters in relation to the scope and structure of NZ beef selection indexes. Importantly, Cluster 2 believes that maternal selection indexes should incorporate emphasis on carcass traits (including marbling) alongside maternal traits (56% somewhat agree to strongly agree). Whilst this is a lower level of agreement than Cluster 1 (86% somewhat agree to strongly agree), it does highlight that both clusters believe that indexes require a combination of both maternal and production traits (including carcass traits such as marbling).

The results from the 1000Minds trait preferences indicate that the clusters potentially differentiate in terms of the perceived value of the individual traits and the trait equivalence trade-offs that were offered within this component of the survey as opposed to philosophical biases regarding the importance of growth/carcass traits. These results highlight general support for the development of balanced selection indexes, but underline the challenges associated with ensuring good adoption of these indexes. Key outcomes and recommendations relating to future index development are discussed later in this report.

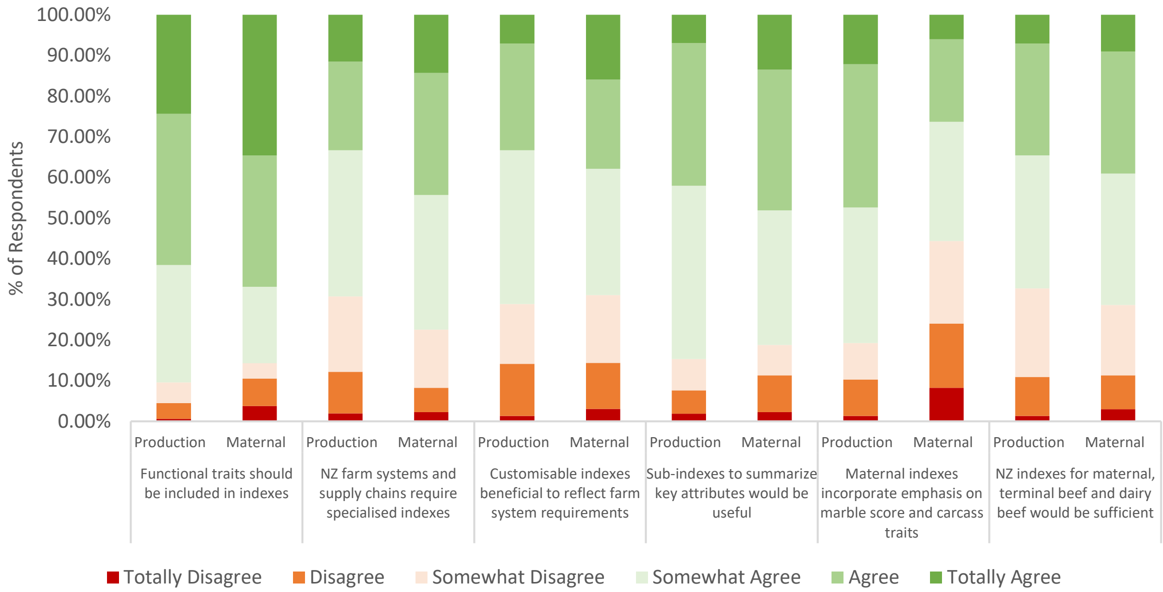

Figure 22: Respondent views on NZ beef selection indexes (Cluster 1 = production, Cluster 2 = maternal)

As previously described, trait preferences exhibited weak demographic signals. This is also reflected within the identified clusters. Demographic analysis of the two clusters is presented in Figure 23. This highlights that respondent demographics may only explain a small component of the divergent trait preferences of the two clusters:

- Bull breeders and commercial beef breeders are almost equally split between Cluster 1 and Cluster 2.
- There is much stronger representation of finishers/traders within Cluster 1, reflecting the lack of relevance of maternal/cow traits to their enterprise. However, there are still approximately 25% of these respondents aligned with Cluster 2.
- Other categories (dairy farmers, rural professionals, and other respondents) are more heavily represented in Cluster 1.

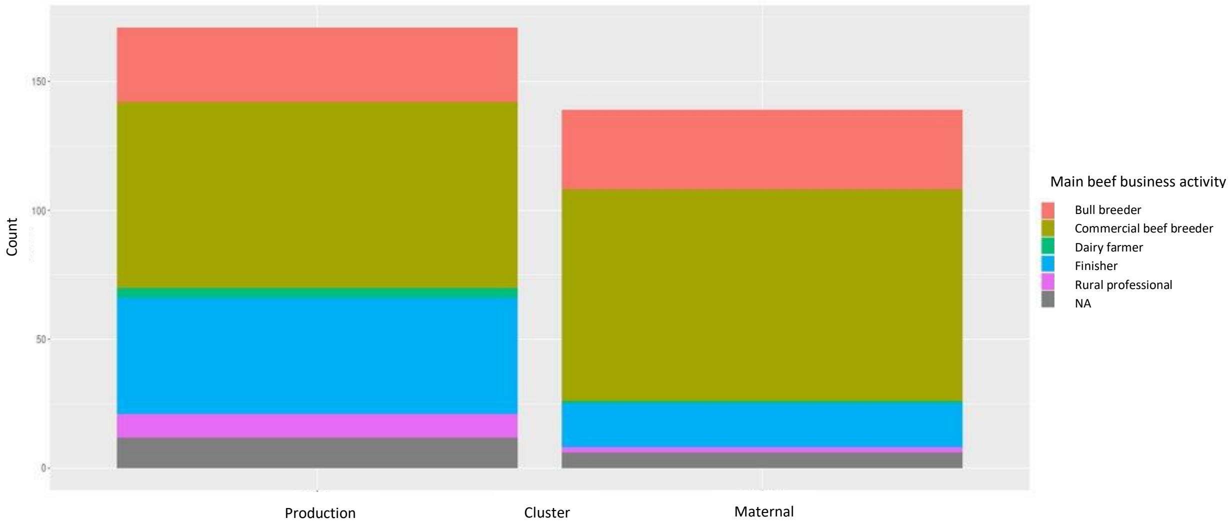

Figure 23: Demographic composition of 1000Minds clusters by beef business activity (cluster 1 = production cluster, cluster 2 = maternal cluster)

The lack of a strong demographic divergence between the clusters suggests that the clusters reflect differences in breeding philosophy that is predominantly driven by factors that can only partly be explained by respondent demographics.

In addition to trait preferences there are subtle differences in behavioural traits and attitudes between the clusters. As depicted below (Figure 24 to Figure 25), respondents from Cluster 1 generally place greater importance on genetic tools than Cluster 2, however overall patterns of response are quite similar between the two clusters.

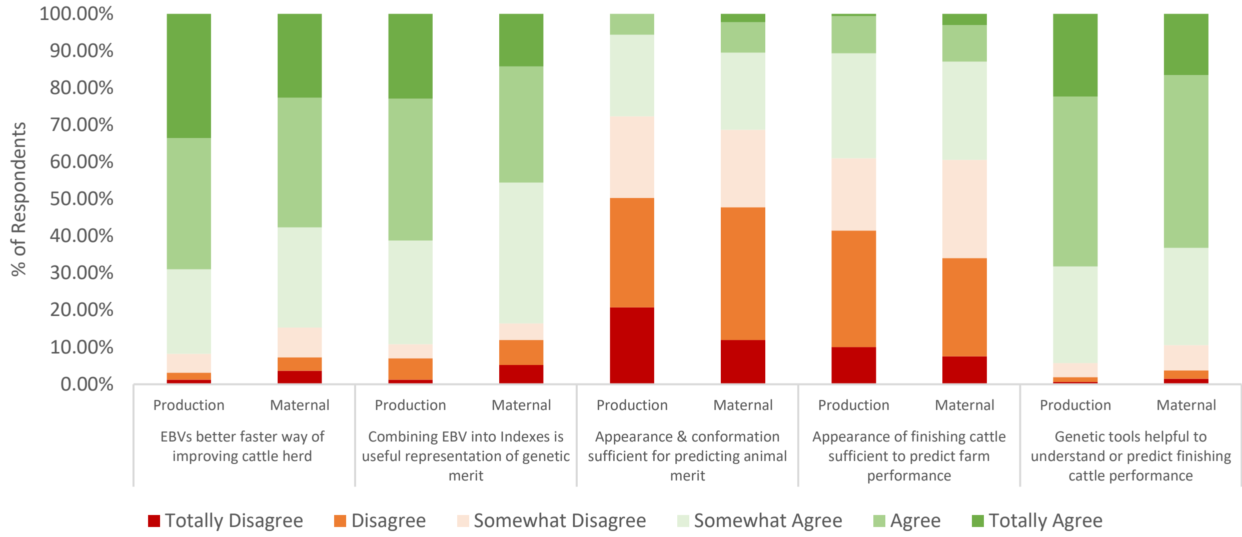

Figure 24: Respondent views on the importance of genetic tools (Cluster 1 = production, Cluster 2 = maternal)

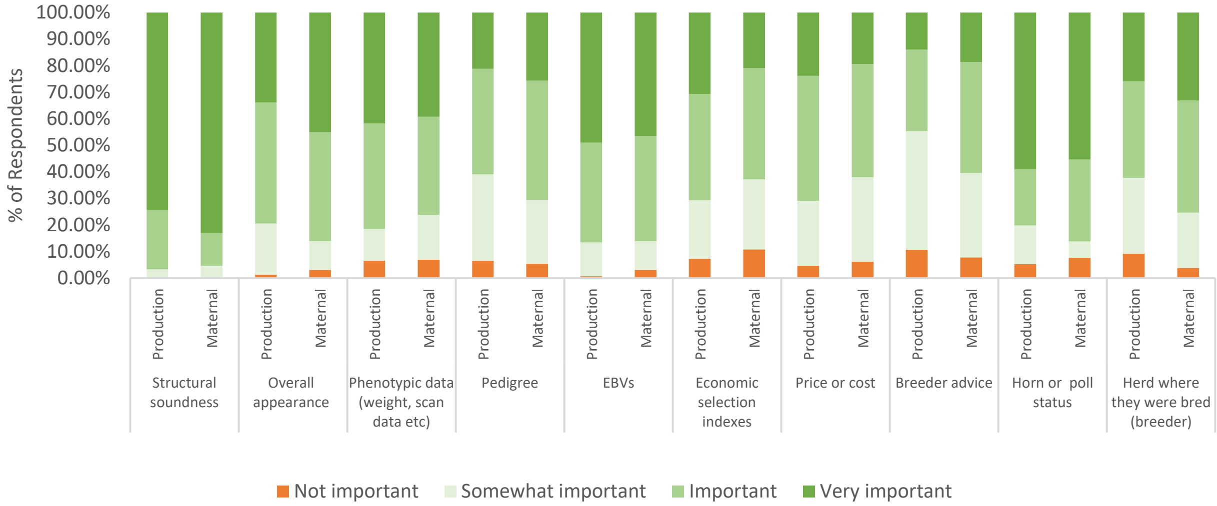

Figure 25: Respondent views on bull purchase criteria (Cluster 1 = production, Cluster 2 = maternal)

Key Messages and Findings

Traits and EBVs – Farmer Priorities

Results from this industry survey have underlined the importance of maternal and functional traits to most segments of the industry.

Generally, the industry already has access to some of the key maternal and functional traits identified as high priority within this survey. Most major New Zealand beef breeds (Angus, Hereford, and Simmental) already have access to well established traits for cow fertility (days to calving), docility and calving ease/difficulty.

Table 4 provides an overview of current challenges and issues that may be constraining adoption and use of existing EBVs available for these high priority maternal traits.

Table 4: Challenges associated with key maternal and functional traits

Existing Trait	Current Situation
Cow Fertility	Cow fertility is currently captured through days to calving EBVs (DTC) and to a lesser extent gestation length (GL). DTC EBVs are available across key breeds and are reasonably widely recorded with simple data collection requirements (mating dates, calving dates and basic cow fates). Key limitations are the understanding of the EBV – units and definition tend to be poorly understood at commercial level. Gestation length is also restricted to herds using artificial breeding. Data collection is also constrained by the accuracy and completeness of data collection within breeder herds, particularly birth dates and cow fates.
Calving Ease	Calving ease EBVs are available across key breeds. These comprise both direct (sire) and maternal (daughters) calving ease. EBVs are computed from visual calving difficulty scores collected within breeder herds, in addition to correlated trait data (mostly birth weight records). Key challenge is the perception that collecting birth weights and recording calving difficulty is time consuming and difficult within breeder herds, consequently submission of phenotypic records is often patchy. Calving ease units and definitions may also be poorly understood at commercial level.
Docility/temperament	Most key breeds provide docility EBVs, however the availability of EBVs on individual animals is very patchy and herd-specific based on the adoption of docility scoring by individual breeder herds. Docility phenotypes are simple to record with poor adoption by breeders reflecting lack of awareness or a perceived low value placed on the trait (not included indexes).

Common factors across each of the existing traits identified in Table 4 comprise the completeness of data collection and EBV availability at breeder level, and awareness/understanding of the traits and EBVs at commercial industry level.

There are opportunities for BLNZ to partner with the genetics sector (bull breeders and breed societies) to promote the collection/submission of phenotypes for these priority traits and support breeders with accurate collection of this data. Outcomes from this survey can be promoted to the genetics sector to underline the industry interest in these existing traits as justification for increased data submission by bull breeder herds.

In addition, there is also a key opportunity for BLNZ to target extension initiatives at the commercial industry level to support greater understanding of these existing EBVs. In particular there is a strong need to better align days to calving EBVs with industry reproduction metrics and language, potentially using BLNZ progeny test data to link sire DTC EBVs to pregnancy and weaning rate outcomes measured on daughters of PT sires (if available). It is common for the commercial industry to equate differences in DTC EBVs to differences in gestation length, not appreciating that differences of 1-2 days at sire level can reflect considerable differences in daughter pregnancy rates.

There is also potential for BLNZ to explore alternate descriptors of cow fertility either as new standalone traits (see below) or alternate computations/presentations of the existing DTC EBV. Due to current use of BREEDPLAN across key breeds, this could require external analysis and publication of non-BREEDPLAN EBVs.

In addition to underlining the industry preference for several existing traits, the survey results also highlight several key opportunities for BLNZ and breed societies to progress the development of several new traits.

Table 5 provides an overview of potential new traits that could be explored based on industry preferences captured within this survey. This overview considers whether the trait is compatible with the existing BREEDPLAN genetic evaluation platform used by the industry[7], and whether the development of the trait relies on phenotypes collected by bull breeders ('breeder trait') or from a reference population.

Table 5: Assessment of potential new traits

Trait	Industry Priority	BREEDPLAN Compatible	Breeder Trait	Overview
Feed efficiency	High	Yes	No	Trait has been implemented in BREEDPLAN by Angus Australia and Herefords Australia as a Net Feed Intake EBV. Requires phenotypes collected via specialised measurement devices such as Growsafe. Cost of infrastructure is cost prohibitive for most breeders - typically relies on phenotypes collected from reference populations. Integration into existing BREEDPLAN analyses will require collaboration with NZ beef breed societies.
Structure – Feet & Legs	High	Yes	Yes	Structural soundness traits based on feet and leg structural scores have been implemented in BREEDPLAN by Angus Australia. Phenotype is collected by breeder herds, but BREEDPLAN requires scores to be collected by an accredited technician. Trait is simple to record subject to the availability of technicians. Integration into existing BREEDPLAN analyses will require collaboration with NZ beef breed societies.
Structure – Teats & Udders	High	No	Yes	Trait is not currently implemented in BREEDPLAN and may require delivery outside BREEDPLAN. Phenotype is collected by breeder herds, but best practice may require scores to be collected by an accredited technician. Trait is simple to record subject to the availability of technicians.
Cow fertility	Moderate – High	No	Yes	DTC and GL are the standard BREEDPLAN fertility trait. Alternate descriptors of cow fertility are not currently supported by BREEDPLAN. Development of alternate traits (including alternate computations of DTC) could be required to proceed externally to BREEDPLAN. Depending on the trait and trait definition (eg segmenting DTC by age/status) may not require changes to existing data collection practices and pipelines from breeder herds.
Cow traits (BCS and height/frame)	Moderate	No	Yes	Trait is not currently implemented in BREEDPLAN and may require delivery outside BREEDPLAN as currently occurs with Angus Australia contracting CSIRO to deliver analyses for these traits. Phenotypes can be collected by breeder herds and are relatively simple records to collect.

[7] This considers whether the trait is currently offered either to New Zealand or international users of BREEDPLAN.

The survey sought industry views on the relative priority of a range of animal welfare and environmental traits that included parasite resistance, facial eczema resistance, polledness, methane emissions and urinary nitrogen emissions.

Generally, industry viewed these traits as low to moderate priority with parasite resistance the highest priority trait ranking only 16th out of 24 in Figure 14.

Perceptions about these traits, particularly the environmental traits, may reflect the lack of a current economic signal. However, with pricing of farm-level emissions expected to commence in 2025, and ongoing consumer and social licence pressure, it can be expected that increasingly stronger economic signals for welfare and environmental traits will start to emerge.

Given the time required to develop and implement breeding values for complex, hard-to-measure traits such as methane emissions, and the generations of selection required to generate genetic progress. Industry and BLNZ needs to consider the expected priorities of the future industry landscape when planning investments into strategic phenotyping and genetic evaluation delivery. This supports implementation of phenotyping strategies for these traits despite the limited industry interest at present, instead positioning BLNZ to deliver solutions in these areas based on expected future industry needs.

Indexes and Index Development

Current industry selection indexes are mostly developed and released by the breed societies though some private breeders may utilise their own custom selection indexes. Consequently, BLNZ must engage with the breed societies to seek their support and collaboration for potential changes to the portfolio of industry selection indexes where potential changes seek to complement or build upon existing industry indexes.

Survey results have highlighted several key opportunities to enhance the use and relevance of economic indexes to the NZ beef industry.

Industry strongly supports the inclusion of functional traits (docility and structural traits) within industry selection indexes (see Figure 12) and aligns with the high level of importance placed on structural soundness when purchasing bulls (Figure 13). Current indexes do not include docility, whilst structural soundness is also omitted due to the current lack of structural EBVs. This represents a key area of potential collaboration between BLNZ and the breed societies to evaluate options to incorporate these traits within industry selection indexes.

Industry generally supports a narrower and simpler range of indexes covering maternal, terminal and dairy-beef systems to avoid the complexity and noise of a broader portfolio of indexes. In addition, there is also broad support for maternal indexes to include emphasis on growth and carcass traits alongside maternal traits. However, the implementation of a narrower range of selection indexes includes several key challenges to ensure these indexes are as relevant to the trait preferences and breeding objectives of as many users as possible, these key challenges comprise:

- The relative importance of maternal versus production traits reflects a key area of divergence between key segments/clusters of the industry.
- Whilst industry supports a simplified portfolio of indexes, there is also a strong interest in the ability to customise indexes to meet individual breeding objectives.

Development of sub-indexes to summarise an animal's merit across trait groups (e.g., fertility sub-index, growth, and efficiency sub-index) could be an important development to address the above. Sub-indexes add value by assisting users to understand the broad genetic strengths and weaknesses of a particular animal that drive its index ranking. This information can enable overall index rankings to be reviewed and customised to user requirements based on sub-index thresholds.

In addition, there are also opportunities to implement simple customisable index interfaces similar to those offered to the New Zealand sheep industry via SIL. These customisable interfaces enable animals to be ranked based on user-defined sub-index weightings.

The feasibility of developing these tools will require further consultation given current ownership of industry selection indexes. Compatibility of these potential enhancements with the software used to deliver existing indexes will also require consideration.

Key Extension Opportunities

The survey has identified strong alignment between commercial breeders and bull breeders in trait preferences and attitudes toward genetic tools. Potential opportunities to align genetic tools with industry requirements and enhance understandability have been identified above. These incorporate opportunities to address the following:

- Explore the development of new 'high priority' traits such as feed conversion efficiency.
- Increase the completeness of phenotypic data collection for high priority traits such as calving ease and docility.
- Enhance the suite of index tools to better align these with trait preferences, simplify the range of indexes and enable users to better understand index rankings (via sub-indexes).

Results from the survey highlight ongoing challenges within both sectors around the adoption of genetic tools and their importance relative to visual assessment, raw phenotypic information etc. Whilst the majority of respondents have positive perceptions about these key tools, there are still significant proportions of respondents with relatively neutral (slightly agree) or negative views.

BLNZ, with support from breeders and breed societies, must continue to invest extension resources into improving the understanding across the industry of genetic tools and their application. There are key opportunities to leverage ongoing BLNZ progeny test programs to provide more practical insights into the value of genetic improvement and its application within a commercial context. Validating key EBVs and translating their use into commercial outcomes is critical for priority traits such as DTC.

In addition, the high level of industry priority placed on functionality and structural soundness warrants further investigation.

There is a need to focus on educating industry on the difference between known heritable structural attributes linked to commercial outcomes (e.g., teat and udder structure), from vague 'show ring' attributes and animal appearance/type.

Lastly, there is also a requirement to educate industry on the materiality of divergences from phenotypically optimal ranges for key structural traits. Industry needs to better understand the level of tolerance that can be afforded before structural issues can materially impact animal performance and longevity.

These represent potential areas of collaboration between BLNZ and breeders/breed societies to educate both the commercial industry and key rural professionals (e.g., stock agents).

Recommendations

Table 6 provides an overview of key recommendations for BLNZ based on the results and findings from this report.

Table 6: Recommendations

#	Recommendation	Description
1	Survey results and breed society consultation	Survey results should be shared with breed societies and the broader industry. Breed societies play a significant role in the delivery of key genetic tools to industry and can benefit from the insights contained within these results. There are opportunities for these results to be used by breed societies to inform priorities for phenotypic data collection and associated support services to members. Results can also inform priorities for ongoing development of genetic evaluations and key tools delivered by breed societies. In addition to the above, BLNZ may seek to develop complementary tools such as new traits (external to BREEDPLAN) and selection indexes. These need to be developed in consultation with the breed societies, incorporating these results as a key component of the case for collaboration with BLNZ.
2	Industry extension priorities	Results from this survey have highlighted the importance of ongoing extension programs to improve adoption and understanding of genetic tools. Survey results have identified several key areas of interest from the industry, particularly fertility/maternal traits. There is opportunity for BLNZ to leverage existing progeny test investments to deliver more specific and commercially focussed messages on the application and impact of genetics. Results have also highlighted strong industry prioritisation of structural soundness and functionality traits. This report has highlighted several key extension topics that can be pursued in this area.
3	New trait development – Structural traits	Results from this survey highlight strong industry priority placed upon structural soundness and functionality traits. BLNZ should engage with breed societies to understand how it can support implementation of new traits (e.g., foot/leg structure and teat/udder scores) either within existing BREEDPLAN evaluations, or as standalone evaluations. This could also incorporate training and information resources to breeders and key stakeholders to facilitate collection of phenotypic data.
4	New trait development – Feed conversion efficiency	The survey has identified feed conversion efficiency as a high priority trait for development. BLNZ needs to assess the cost-benefit of integrating feed intake testing into its progeny test programs, likely in conjunction with collection of methane phenotypes. In addition to scoping the feasibility of collecting phenotypic data, BLNZ should also engage with breed societies to assess feasibility of implementing relevant traits within existing BREEDPLAN evaluations, or as a new external evaluation. Potential development of combined reference populations with Australian breeds may also be feasible and warrant consideration of BREEDPLAN integration.
5	Feasibility/scoping of new cow fertility traits	Cow fertility was identified as a high priority trait. Currently industry has access to Days to Calving EBVs (EBVs) for selection for female fertility. BLNZ should evaluate options for complementary and alternate female fertility traits, particularly options (such as segmenting DTC by cow/heifer age) that can be recomputed from existing DTC datasets. New/alternate traits and trait expressions could support increased heritability and enhanced understanding, particularly if traits can be expressed in language and units that are more consistent with industry terminology. BLNZ should seek to access a sample of existing data to assess its adequacy for computation of new fertility traits. This assessment should also consider data screening/cleaning opportunities to support more robust evaluation of these traits. This assessment should seek to identify key changes that could be required to enhance current data collection protocols and consult with breeders/industry to understand implications for adoption.
6	Selection index development	Survey results have identified several potential enhancements to industry selection indexes, these comprise:

#	Recommendation	Description
		• Inclusion of functional and structural traits within industry selection indexes. • Simplification of current index portfolios into three key indexes – maternal (balanced with growth/carcass), terminal beef and dairy beef. • Development of sub-indexes to break up and summarise animal genetic merit across trait groups. • Potential development of interfaces to allow users to rank animals within customised 'indexes' based on desired sub-index weightings. BLNZ must engage with breed societies to secure collaboration and identify preferred approaches for implementation.

Appendix – Trait Prioritisation Survey

Farm characteristics

1. What is your main beef business activity?

   Commercial beef breeder
   Finisher/trader
   Rural professional (stock agent, vet etc)
   Bull breeder
   Dairy farmer

2. What is your primary beef activity?

   Commercial breeder (selling finished steers/heifers)
   Commercial breeder (selling stores)
   Commercial breeder (producing unregistered bulls for dairy herds)
   Finisher (buying stores)
   Breeder – producing bulls for dairy herds
   Breeder – producing bulls for commercial beef breeders
   Rural professional
   Other (*give them option to write in)*

3. Where is your beef operation located?

   Northland
   Auckland
   Waikato
   Bay of Plenty
   Gisborne
   Hawke's Bay
   Taranaki
   Manawatū
   Wellington
   Tasman
   Marlborough
   West Coast
   Canterbury
   Otago
   Southland
   Not applicable

4. What is the size of your farm? (*leave blank if not applicable*)
   - Total stock units _________

5. Approximately what percentage of your stock units are cattle?
   - 0% to 100% (Slide scale)
   - Not applicable

6. My farming operation can be classed as
   - 1 - South Island high country
     Extensive run country located at high altitude. Diverse mix of operations including breeding sheep, breeding cows and deer. Stocking rate is typically up to 3 stock units per hectare. Located mainly in Marlborough, Canterbury, and Otago.
   - 2 - South Island hill country
     Traditionally store stock producers with a proportion sold prime in good seasons. Carrying between 2 - 7 stock units per hectare, usually have a significant proportion of beef cattle.
   - 3 - North Island hard hill country
     Steep hill country or low fertility soils with most farms carrying 6 - 10 stock units per hectare. While some stock are finished a significant proportion are sold in store condition.
   - 4 - North Island hill country
     Easier hill country or higher fertility soils than Class 3. Mostly carrying between 7 - 13 stock units per hectare. A high proportion of sale stock sold is in forward store or prime condition.
   - 5 - North Island finishing farms
     Easy contour farmland with the potential for high production. Mostly carrying between 8 - 15 stock units per hectare. A high proportion of stock sent to slaughter and replacements are often bought in.
   - 6 - South Island finishing-breeding farms
     Farms which breed or trade finishing stock and may do some cash cropping. A proportion of stock may be sold store, especially from dryland farms. Carrying capacity ranges from 6 – over 12 stock units per hectare. Mainly in Canterbury and Otago, this is the dominant farm class in the South Island.
   - 7 - South Island finishing farms
     High producing grassland farms carrying about 9 - 14 stock units per hectare, with some cash crop. Located in Southland, South and West Otago.
   - 8 - South Island mixed cropping and finishing farms
     Located mainly on the Canterbury Plains. A high proportion of their revenue is derived from grain and small seed production, as well as stock finishing or grazing.
   - Not applicable

Production system

7. What is/are the primary breed(s) within your beef operation? Tick all that apply
   - Angus
   - Hereford
   - Beef composite
   - Red Angus
   - Limousin

- Simmental
- Charolais
- Dairy-beef crosses
- A range of breeds, crosses, and composites
- Wagyu and Wagyu-cross
- Other
- Not applicable

8. What age do you predominately first mate your heifers?
    - R2 (approximately 15 months old)
    - R3 (approximately 27 months old)
    - Combination of R2 and R3
    - Not applicable

9. What is the minimum size/weight of your heifers at first mating?
    - less than 250 kgs
    - between 250 – 275 kgs
    - between 275 – 300 kgs
    - between 300 – 325 kgs
    - between 325 – 350 kgs
    - between 350 – 375 kgs
    - between 375 – 400 kgs
    - above 400 kgs
    - I'm not sure about the size/weight of my heifers at first mating
    - Not applicable

10. Approximately, what percentage of your first-calving heifers require assistance at calving?
    - 0% to 100% (Slide scale)
    - Not applicable

11. What is your level of agreement with statements below on cow size and height? (totally disagree, disagree, somewhat disagree, somewhat agree, agree, totally agree)
    - I consider cow weight to be important.
    - Cow weight is less important than frame size and cow body condition score.
    - Across the industry, cows are getting too heavy.
    - Across the industry, cows are getting too tall.
    - Across the industry, cows are getting too lean.
    - Cow size and frame size are irrelevant so long as they get in calf.
    - Harder environments require a moderate size, lower maintenance cow.

12. What is your level of agreement of the statements below on your farming philosophy with respect to managing cow BCS? (totally disagree, disagree, somewhat disagree, somewhat agree, agree, totally agree)
    - An important management goal in my system is to achieve a target BCS going into winter.
    - An important management goal in my system is to achieve a target BCS going into calving.

- It is not practical/we don't have the ability in my farming system to manage BCS of individual cows.

13. What do you believe to be the average liveweight of your cows at weaning? ____________ kg (*leave blank if not applicable*)
14. What do you believe to be the optimum (or most desirable) liveweight of cows at weaning on your farm? __________ kg (*leave blank if not applicable*)

15. A milk EBV of +17 kg (-4 to +36 kg range) could be considered an average across breeds. What would be the average milk EBV of your cow herd?
    - Less than +5 kg
    - Between +5 and +10 kg
    - Between +10 and +20 kg
    - Between +20 and +30 kg
    - More than +30 kg
    - I don't know the average milk EBV of my cow herd
    - Not applicable

16. What is your opinion on the milk potential of your cow herd?
    - More milk is desirable
    - I'm happy with current milk potential of my cow herd
    - Less milk would be preferable
    - I'm not concerned about the milk potential of my cow herd
    - Not applicable

Views, beliefs, and behaviours (genetics & indexes)

17. What is your level of agreement with statements below on genetics tools? (totally disagree, disagree, somewhat disagree, somewhat agree, agree, totally agree)
    - Using estimated breeding values (EBVs) to select bulls/cows is a better and faster way of improving the performance of the cattle herd compared to other ways of selecting.
    - Combining EBV information from several traits into economic selection indices is a useful way to represent genetic merit information.
    - The appearance and conformation of a bull/cow is sufficient for telling its performance on-farm.
    - The appearance of store and prime finishing cattle is sufficient for telling its performance on-farm.
    - Using genetic tools (e.g., EBVs, breeding indexes) would be helpful to understand/predict performance of finishing cattle.

18. Please indicate how much you agree with the following statements regarding economic selection indexes specifically for beef cattle in New Zealand. (totally disagree, disagree, somewhat disagree, somewhat agree, agree, totally agree)
    - Functional traits such as foot score, docility, and udder conformation should be included in indexes

- Maternal/self-replacing indexes should incorporate emphasis on marble score and carcass traits alongside maternal traits
- New Zealand farm systems and supply chains are unique and require specialised indexes
- New Zealand wide indexes for maternal/self-replacing, terminal beef and terminal dairy-beef indexes would be sufficient. More indexes beyond these add too much complexity.
- I would benefit from the ability to customise indexes to better reflect the requirements of my farming system.
- Sub-indexes to summarise groups of traits (e.g., growth and efficiency sub-index, carcass merit sub-index, maternal performance sub-index etc) would give a useful summary of a bull's key attributes.

19. How important are the following criteria when buying breeding bulls? (not important, somewhat important, important, very important)
    - Structural soundness, e.g., feet and legs and other type traits
    - Overall appearance (muscling, body depth, eye appeal)
    - Information on performance (live weight and growth, % IMF scan, etc.)
    - Their sire/dam pedigree
    - Estimated breeding values
    - Economic selection indexes
    - Price/cost
    - Breeder advice
    - Horn/poll status
    - Herd where they were bred (breeder)
    - Convenience
    - Other (allow them to write in)

20. How important are the following criteria when buying store calves or finishing cattle? (not important, somewhat important, important, very important)
    - Breed composition
    - Structural soundness (e.g., feet and legs and other type traits)
    - Animal condition (frame, condition score, muscle score etc.)
    - Animal management and treatment history (vaccine status, yard weaning etc.)
    - Information on performance (live weight and growth, EMA, Fat, % IMF scan, etc.)
    - Have bought animals previously from the herd of origin
    - Herd of origin and knowledge of its use of bulls/genetics from specific bull breeders
    - Price and market trends
    - Origin/source (farm of origin, stock agent, saleyard, rearer used to source calves from)
    - Feed availability on-farm
    - Cashflow and financial position
    - Convenience
    - Genetic merit of the animal (via EBVs, economic indexes) if these were available
    - Other (write in)

Trait preferences

21. How important are the following functionality traits of breeding cows for your beef cattle operation? (not important, somewhat important, important, very important)

- Body condition score
- Cow mature weight
- Cow fertility
- Docility or temperament
- Feet & legs
- Teat & udder

22. How much genetic progress in productivity traits do you believe could be sacrificed (on a scale of 0 - 100%) to achieve genetic gains in the following traits
    - Methane emissions Slide scale %
    - Nitrogen leaching Slide scale %
    - Polledness Slide scale %
    - Temperament Slide scale %
    - Welfare/health traits (e.g., facial eczema resistance) Slide scale %
        - Please specify the most important health/welfare trait for your herd

23. For future selection decisions (given where you are now) how much emphasis would you place on each of the traits below? Please note, in order to select no importance, you must move the slider and then set it to not important. 0 (not important), 50 (important), 100 (very important) (Slide scale)
    - Female fertility
    - Milk production
    - Growth to weaning
    - Calving ease
    - Gestation length
    - First cycle calving
    - Facial eczema resistance
    - Resistance to parasites
    - Methane emissions
    - Urinary nitrogen leaching
    - Cow body condition score
    - Cow mature size
    - Cow functionality (feet, udder, docility, or temperament)
    - Post-weaning growth
    - Feed efficiency
    - Marbling
    - Eye muscle area
    - Carcass dressing percentage (ratio of carcass weight to slaughter live weight)
    - Retail beef yield (per kg of carcass)
    - Carcass weight
    - Carcass fat cover
    - Other

1000minds draft traits/questions

Name	Unit of trade-off, comparison, and clear trade-off
Weaning Weight	Calves are **10 kg heavier at weaning** because of early growth potential
Carcass Weight	Carcases are **12 kg heavier** because of post-weaning growth potential
Calving ease	**5 fewer heifers** per 100 require assistance at calving
Cow fertility	**3 less cows** per 100 culled per year due to low fertility
Bull functionality	**1 additional mating** season over a bull's lifetime
Cow mature weight	**20 kgs less** cow mature weight
Cow body condition score	**0.5 additional unit** of cow condition score at weaning
Methane emissions	**5 % less** methane (CH_4) emissions
Docility	**3 fewer cows** (per 100) culled because of bad temperament
Feed efficiency	**5% increase** in feed conversion efficiency (kg beef per unit of feed)
Marbling grade	**0.5 unit increase** in average marbling score grading (0-9 BMS scale)