INDUSTRY CONSULTATION

Beef Genetics RD&E Priorities 2016 - 2021

An industry consultation paper prepared by the

Genetics RD&E Steering Group

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For dissemination by Meat & Livestock Australia Limited

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NOTE: ***Opinions on the subject matter contained in this document vary widely across the industry and the views expressed are not necessarily consensus views of all members of the Steering Group, but a consolidation of various points of view.***

1. PURPOSE

These priorities have been drafted by a steering group of individuals chosen for their knowledge of the national beef genetics RD&E system (BREEDPLAN) and its developmental history, the science underpinning genetic improvement, the practical application of that science at breed society, seedstock and commercial levels and for their varying perspectives as researchers, co-investors, users on different levels and both as advocates and critics of the current system.

The purpose of this document is two-fold. Firstly, to stimulate industry discussion and debate on where R&D levies should be invested in future to increase the already-substantial return on investment that the industry has derived from developing nationally-coordinated genetic evaluation systems for beef cattle. A comprehensive investment plan for the period July 2016 – June 2021 will be required by 31 March 2016 to enable budget planning by co-investors and ensure retention of key RD&E staff and resources. That plan may be expanded in scope to include co-investments with application to the sheep and/or dairy industries.

Secondly, to inform discussions between owners of the BREEDPLAN software (MLA, UNE and NSW DPI) with the licensee (ABRI), breed societies and interested parties, to determine whether the operational and contractual issues around BREEDPLAN licensing and service provision are appropriate to provide optimal future industry benefit.

Feedback can be emailed to livestockgenetics@mla.com.au by 31 January 2016.

2. SUMMARY

A cross-sectoral industry scoping meeting in May identified that both development of a high level list of RD&E priorities and a separate review of current operational concerns pertaining to genetic evaluation and service provision should occur before any major consideration of establishing a nationally-coordinated program for beef genetics RD&E. MLA established the Genetics RD&E Steering Group comprising representatives of key investors in, and users of, genetics research in the beef industry in July to lead the identification of potential RD&E priorities (initially beef-specific) that should be addressed over the next 5 years. The initial focus was on the beef genetics/genomics RD&E investments needed to improve beef genetic evaluation, shorten the time from development to delivery and increase adoption rates.

Within the timeframe allowed, the Genetics RD&E Steering Group focussed on a draft list of high-level activities and deliverables needed to increase the return on investment to further RD&E for more detailed industry and co-investor consideration and feedback. If research and industry organisations see merit in co-investing in a national effort to deliver this program, the detailed project plans, structure and governance framework for a nationally-coordinated program need to be developed once the program and likely budget are known. In addition to identifying the RD&E priorities for further consideration by co-investors, the Steering Group has listed the major system impediments to increasing return from future investment that need to be resolved.

Major opportunities to increase return on past and future investment

If the industry, public and private investors in beef genetics RD&E wish to increase the total industry-wide ROI, then they need to determine ways to take advantage of the following opportunities:

1. Maintain and further improve the current genetic evaluation engine, but with greater emphasis on increasing profit, not just output and income.

2. Develop a data-sharing culture and transparent exchange mechanism for data from all segments along beef supply chains (feedlot performance, carcase value, eating quality, animal health) and from similar international evaluation schemes that enhances the value of local genetic data and encourages increased data supply and integration.

3. Expand the focus from the current stud- and breed-centric model, by developing tools that allow non-stud bull breeders to increase their genetic gain other than by buying performance bulls (composite EBVs, multi-breed comparisons, genomic selection).

4. If the industry wishes to capture greater benefit from genomics and maintain the genetic diversity of breeds currently available, develop and implement a lower cost multi-breed analysis system that includes minor breeds and composites herds, and increases the benefits from structured crossbreeding.

5. Develop systems to reward breeders for submitting hard-to-measure phenotypes (based on both "industry value" and quality), either through a payment/trading system or enhanced services that optimise their breeding programs.

6. Ensure all players in the beef value chain understand the genetics value proposition for their business and increase education and focus on the unconverted parties (agents, processors, financiers, influencers).

7. Improve coordination and communication to beef genetics stakeholders on decisions involving the priorities and resource requirements for research, development, implementation and adoption activities. Greater transparency and accountability back to the co-investors and end users will encourage greater participation, recognising that these decisions impact on the timeliness of research implementation and adoption, which ultimately affects bull selection decisions, commercial producer profitability and the return on RD&E investment.

Structural and system Impediments that need to be addressed:

1. The structure and transactional operations of the current national beef genetic evaluation system are perceived by some users (the critics) to be inflexible and inefficient when compared to similar systems in other industries, but also significantly under-resourced by others (the advocates). Cost of participation and perceived lack of a value proposition is a disincentive to participation by some breeders and producers. Ways in which software maintenance and upgrading, data handling and transaction costs can be reduced should be investigated, and benchmarked against other systems.

2. There is a view by some stakeholders that the commercialisation and delivery sectors of the current national beef genetic evaluation system are not optimised to maximise the rate of genetic gain in segments of the industry.

3. There are perceptions that the development and delivery pathway of the BREEDPLAN service lacks transparency, and also that simplification of language and interfacing may increase understanding

and acceptance by commercial producers. The BREEDPLAN brand may also need a significant makeover if further adoption is to be achieved.

3. INTRODUCTION

It is clear that the meat industry's long term investments in beef and sheep genetics since the 1980s, via MRC/MLA/Beef CRC project funding and facilitating very significant co-investment from both breeders and research organisations, have been outstandingly successful in both building world-class capacity and delivering two of the best genetic evaluation systems in the world.

A 2014 independent analysis[1] commissioned by MLA estimated the combined co-investment of $191m in beef genetics RD&E in the period 2002 to 2012 will return some $487m in additional value by 2040, a benefit/cost ratio of 3.5. Of note was the disparity between the northern and southern beef sectors in both the level of investment ($48m vs $143m) and in the estimated return on that investment (BCRs of 1.0 vs 4.4 respectively) and that the return for beef is lower than that estimated for investment in sheep genetics over the same period (BCR = 5.8).

The Meat Industry Strategic Plan 2020 re-emphasises the need to drive efficiencies and integrity (in terms of both product quality and safety) through the meat value chain to maintain the industry's competitiveness. The above analysis shows that increasing the rate of genetic improvement is one of the most effective ways that the industry can do this, and the national beef genetics evaluation system, based on BREEDPLAN, is the means by which a national beef breeding sector effort has been coordinated.

Although the operational control of this system is largely in the hands of ABRI, as sole licensee of the BREEDPLAN analytical software jointly developed and owned by MLA, UNE and NSW DPI, MLA as a major investor, continues to receive complaints and criticisms from levy payers concerning the operation of both BREEDPLAN and, to a lesser extent, LAMBPLAN and MERINOSELECT. Several breed societies continue to explore the possibility of using alternative (international) evaluation systems, and a number of larger pastoral breeding companies and composite breeders use these alterative systems when needed.

The main concerns identified were distilled down to five main issues in the recent Industry discussion paper exploring changes to the current BREEDPLAN commercialisation model:

1. The overall rate of genetic progress in some segments of the industry is too slow.
2. Costs associated with utilising BREEDPLAN are considered to be too high (which may in part be due to lack of transparency).
3. Lack of clear priorities or processes for influencing industry-funded R&D investment.
4. Long time lag from an identified need through research to implementation.
5. Improved communication and coordination is required throughout the pipeline.

These concerns mean that the structural arrangements and capacity of the beef genetic evaluation service that have served us so well over the last 30 years might not be sufficient to fully capture future opportunities.

[1] MLA Report B.EVA.0001 and B.EVA.0002 P. Fennessy, T. Byrne, P. Amer, and G. Martin Evaluating the impact of animal genetics and genomics RD&E investment 2014

The key drivers behind the current status and trends are:

1. The move towards incorporating genomic information into Estimated Breeding Values;
2. Research into, and development of, hard-to-measure traits, such as Net Feed Intake and carcase traits, which increase cost and complexity in phenotyping;
3. Increasing investment by breed societies into Information Nucleus populations, and in fully embedding BREEDPLAN evaluations into their services to members;
4. Increasing complexities for AGBU and ABRI in meeting increasing demands associated with servicing BREEDPLAN for a wider range of users and market end points;
5. Demands to link genetic and genomic databases to NLIS, MSA and other databases to potentially enhance genetic evaluation and selection.

4. PROCESS

Following concerns expressed by some levy-payers, industry intermediaries and breed societies with the performance of BREEDPLAN and associated services over several years, MLA proposed the development of a national livestock genetics RD&E consortium as a way to address the issues and achieve a more unified approach to genetic improvement in the beef industry. Because the basic requirements for nationally-coordinated genetic evaluation are similar in both cattle and sheep, and the software for both has been developed by AGBU, MLA envisaged that efficiencies may be possible if similar aspects of both systems can be more closely integrated.

A workshop “Exploring New Models for the Genetic Improvement of Beef Cattle and Sheep” was convened in May 2015 to identify the key issues and plan a way forward. Approximately 50 invitations were sent out, with 26 people attending, along with another seven people joining by teleconference. Both the industry attendees and the discussion were primarily focused on beef genetic improvement, reflecting where most concerns originated from.

The workshop was structured around developing a shared vision of what an ideal future genetic improvement RD&E pipeline may look like, followed by a gap analysis and future options for progression. Feedback from both the earlier consultation process and workshop clearly identified that it is unlikely that the structural arrangements and capacity that have served the industry well for the past 30 years will be sufficient for the future, especially a future involving:

- Routine use of genomic information in Breeding Values
- Research into, and the development of, hard-to-measure traits which increase the cost and complexity in phenotyping
- Increasing investment by breed societies into Information Nucleus herds, and fully embedding BREEDPLAN evaluations into their services to members
- Massive increases in available data from information nucleus herd investments held in multiple unconnected databases
- The potential to connect the genetic and genomic databases to NLIS, MSA and other databases to generate new or more accurate genetic information
- Capturing across-breed genetic information and using international data that will generate datasets of sufficient size to provide useful genomic predictions for a number of smaller beef and sheep breeds.

All of this has contributed to increasing workloads for AGBU and ABRI staff in servicing the additional and more complex demands to service BREEDPLAN.

The key outcomes from the Workshop in May were:

1. There was strong agreement from participants that the status quo is not an option.
2. There was a strong desire to change BREEDPLAN to across-breed analyses incorporating as much domestic and international information as possible, so that bulls can be compared on the same scale, regardless of breed.
3. There was a strong desire to change the way in which BREEDPLAN is licensed to providers and delivered to end users. As points 2 and 3 are a substantial change to the current business model, the need to engage fully and openly with all stakeholders, including breed societies and R&D organisations through any change process was acknowledged.
4. There was not strong concern expressed about the quality of the R&D pipeline but there was concern that it has been substantially under-funded, and hence is missing important activities, particularly since the wind-up of the Beef CRC.
5. There was some agreement from researchers to establish a "low-cost" national livestock genetics RD&E co-ordination and information "process," but little support for a formally structured national R&D consortium. The principal objection to a formally structured consortium was that, in the absence of a significant increase in funding above current allocations to beef genetics R&D, the substantial additional transaction costs could not be justified..
6. It was agreed that the initial focus for this process should be on guiding development of a 5 year RD&E investment plan for livestock genetics & genomics.

Two distinct but related activities were then initiated in parallel before consideration of forming a Livestock Genetics Consortium could begin. The first was discussions by the owners of the BREEDPLAN software (MLA, UNE and NSW DPI) with the licensee (ABRI), breed societies and interested parties, to determine whether the operational and contractual issues around BREEDPLAN licensing and service provision, which may be impeding further uptake and efficient use of the system and resulting in suboptimal benefits to industry, can be resolved.

The second established a Genetics RD&E Steering Group comprising representatives of key investors in, and users of, genetics research in the beef industry (see member list Appendix 1 and Terms of Reference Appendix 2) in July to lead the identification of RD&E priorities (initially beef-specific) that should be addressed over the next 5 years. The initial focus was to be on the beef genetics/genomics RD&E investments needed to improve beef genetic evaluation, shorten the time from development to delivery and increase adoption rates.

Within the timeframe allowed, the Genetics RD&E Steering Group focussed on a draft list of high-level activities and deliverables for more detailed industry and co-investor consideration and feedback. If research and industry organisations then see merit in co-investing in a national effort to deliver this program, the budget, structure and governance framework for a nationally-coordinated program can be developed in the next phase, during which possible synergies and efficiencies where the R&D or E may also

be of value to improving sheep and possibly dairy genetic evaluation services can be identified in more detail, together with opportunities for international collaboration.

The priorities listed in this consultation paper were developed over a series of meetings based on 5 activities:

1. direct consultation with AGBU and ABRI senior managers;
2. drafting of five Industry Discussion Papers to promote feedback on key questions and options under consideration via MLA's website;
3. inviting key researchers to suggest ideas on genetics R&D that would, if successful, "provide the Australian beef breeding sector (both stud and commercial) with the capacity to double the current average annual rate of genetic gain within 10 years," (Appendix 3),
4. inviting the major beef breed societies to provide feedback on R&D, structural and system issues specifically relevant to their business models; and
5. consideration of the 2014 review of beef extension services completed by Lee & Pitchford[2] and the concurrent development of a plan to establish a national beef extension network.

5. FACTORS SHAPING THE PRIORITIES for future RD&E investment

The five industry Discussion Papers developed to help the Steering Group summarise their discussions on key issues, and allow other stakeholders to provide feedback, covered the following topics:

1. Significant changes in both technology and to the beef breeding sector that need to be considered in developing livestock genetic RD&E investment priorities for the next five years.
2. Moving to multi-breed and crossbred BREEDPLAN analyses.
3. Improving data infrastructure and exchange to increase beef genetic gain and industry benefit
4. Increasing the relevance of genetic RD&E for bull breeders.
5. Who benefits from genetic evaluation and improvement?

The first of these papers outlines the major changes in both technology and industry structures and processes that will potentially affect future needs of stakeholders, and alter what is technically possible in future genetic evaluation and improvement programs. These changes are summarised below.

1. Various technologies are increasing our ability to measure "hard-to-measure" traits, such as net feed intake and carcase traits. These will contribute to more complete estimates of the true commercial value of individual animals, but will also likely change the cost and complexity of phenotyping.

2. Data capture and communication technologies are creating new "Big Data" opportunities, particularly where large volumes of data that are traditionally captured and housed in independent databases can be efficiently linked. This allows extraction of new information that can create potential benefits to all data owners. This may also allow data to be captured on many more relatives of animals that are currently being evaluated for genetic improvement, though the value of this approach is in proportion to how closely related these animals are to the next generation of breeding stock.

[2] MLA Final Report Lee, S, J and Pitchford,W. S. 2014 E.INV.1416 National Beef Genetics Extension Strategy.

3. There is increasing interest in the application of international genetic evaluations to increase the size of genomic reference populations for individual breeds, as well as facilitate the trading of germplasm (animals, semen, embryos) internationally

4. Demand from breeders to have evaluation systems for crossbred and composite animals, as well as across-breed genetic evaluations (referred to as multi-breed evaluations) is increasing. This is to improve the profitability of crossbreeding through breed selection to maximise heterosis and breed complementarity, and also to increase rates of genetic gain by selecting across breeds.

5. The role of breed societies is changing. Some societies may become even more involved in facilitating genotype and phenotype data collection for their members, and/or fully embed BREEDPLAN evaluations into their services, while others may reduce or eliminate most of their current roles in data management, outside of pedigree registrations.

6. The increasing number of breed societies and individual breeders/companies actively embracing BREEDPLAN and related technologies is increasing the demand for greater expertise and flexibility in servicing for AGBU and ABRI to meet the demands of the increasing number and complexity of breed genetic evaluations, many of which are customised.

7. Continued improvement of the accuracy of genomic EBV requires ongoing collection of phenotypes for key traits (including traits for which genomic EBV are not yet available) on large numbers of animals. Genotypes must also be collected on a sub-set of several thousand animals that have good phenotypes. Reference herds (BINs) have been established by some larger breed societies, with initial MDC funding support, to provide these data, but will need to be much larger to achieve high accuracies, and maintained to ensure BV predictions remain accurate, either through amalgamation across breeds and/or through international data exchange.

8. Genomic EBVs are currently breed specific. This means that only breeds with large amounts of data and the resources to develop genomic EBVs and invest in BINs can use this technology effectively. A key research goal is to determine whether multi-breed genomic EBVs be developed with sufficiently accuracy to be useful in several breeds, allowing smaller breeds to access the benefits of genomic evaluation?

9. There is likely to be a point where price is sufficiently low and accuracy sufficiently high that genotyping will become a practical selection tool in commercial herds. That could have significant impacts on commercial delivery systems and data flows, and the need to record pedigree, potentially threatening current breed society business models.

10. New technologies such as electronic ID, smart data acquisition applications, carcase scanning, objective measurements in processing plants, and others could reduce the cost of phenotype collection. That could impact on the design of traditional and genomic data collection for genetic evaluation systems

11. There could be increasing competition from alternative genetic evaluation systems. Some larger companies will undertake genetic evaluations and improvement entirely (or largely) in-house. Some breeders are already using overseas genetic evaluations services. A substantial movement to

independent genetic evaluation systems could push up the costs of delivery to remaining clients on the BREEDPLAN system and create confusion in the marketplace as EBVs from different evaluation systems will not be comparable.

12. There is widespread adoption of genetic evaluations and genetic improvement in southern regions, but less penetration amongst the northern tropical breeds, where average rates of genetic gain is also much lower, there is less reliance on the stud sector, and more scepticism about the value of objective performance measurement. Consideration is needed for moving from the current range of breed-centric genetic services to supporting and integrating either different approaches to genetic evaluation or several versions of the current system to better meet the diverse needs of different users.

6. DESIRED OUTCOMES from further RD&E investment

Given that Australia has some breeds and breeders making very high rates of gain when compared to international benchmarks, but there are very large differences in average rates of gain between breeders, an objective of doubling the average rate of gain over the next decade and thereby significantly increasing the return on further investment in genetics RD&E should be achievable. A significant part of this gain can come from identifying and overcoming the impediments and constraints in the current system that add complexity and limit adoption, as well as from new R&D to improve the system itself.

The following are aspirational goals that should guide future RD&E investment priorities:

1. All users within the Australian beef industry have a clear understanding of the value of their appropriate investment in genetic improvement and its utilisation.
2. Better capture, integration and analysis of data allows additional value to be created along the supply chain, facilitating development of value-based payment that more transparently rewards investment in genetic improvement.
3. There are viable beef genetic improvement services that can service the differing needs of bull breeders and the broader beef industry.
4. Bull breeders have a suite of effective tools and technologies available to assist them to increase genetic gain,
5. Funding of genetics RD&E is transparent and reflects both the total magnitude and distribution of the benefits.
6. There are coordinated and effective extension services that increase the use and demand for genetic investment by seedstock and commercial producers, and focus on building market demand in feedlots, corporates, processors, and brand owners.
7. The genetics pipeline is transparent, collaborative and constructive in its approach to R&D priority setting, introduction of new technology and problem identification and resolution.

7. WHAT IS NEEDED to achieve these outcomes?

Achievement of the desired outcomes will potentially address a number of the major concerns raised about the current beef genetic evaluation system based on BREEDPLAN and enable the industry to capture more of the potential from continued investment in genetic improvement.

Plans to achieve each of these objectives require detailed discussion with the parties involved, once level of interest and likely investment is known, and a comprehensive process of program development to ensure all required steps are included and various RD&E alternatives evaluated. In this section, a number of the likely activities in the next 5 years are included to provide further understanding of likely requirements.

1. All users of beef genetics within the beef supply chain have a clear understanding of how to value and determine their appropriate investment in either achieving further genetic improvement or paying for genetic merit.

Rationale:

A common reason given for not adopting BREEDPLAN and related evaluation systems is a lack of evidence of sufficient return for the investment, either in terms of prices received and/or increases in genetic gain. In addition to simplifying the language used to describe genetic merit (DO #6 below), the degree to which genetic merit can influence product value needs to be determined and demonstrated along the supply chain.

What we need to do to achieve outcomes

i. Identify how much value is added by knowledge of genetic merit in each segment of the supply chain and develop case studies to demonstrate that value and encourage transmission of both product description and price signals
ii. Through an expanded extension effort and simplification of language (see below) ensure both seedstock and commercial breeders have a much better understanding of the value proposition for investment in objective measurement and data collection.

Priorities for next 5 years

i. Develop easy-to-use tools that allow seedstock and commercial breeders to determine the appropriate level of investment to maximise their return on recording and genotyping, and in purchasing breeding stock (and semen and embryos) based on genetic merit.
ii. Identify where phenotypic prediction in commercial cattle or beef cuts is of value to making better management decisions and develop tools to enable cattle/beef buyers to better understand the relationship between genetic merit and enterprise profitability – case studies or apps
iii. Develop and promote relevant case studies for commercial producers with greater emphasis on increasing profit, not just output and income.

2. Better capture, integration and analysis of data allows additional value to be created along the supply chain, facilitating development of value-based payment that more transparently rewards investment in genetic improvement.

Rationale:

For breeders, the more phenotypic data related to a breeding animal that can be combined to predict genetic merit the more accurate that prediction. For buyers, knowledge of the genetic merit of cattle to be purchased will usually have more value when it is combined with data from their own business to predict which animals will provide more profit. At present, data on individual animal performance and that of their progeny (and the resulting product ie carcase and eating quality) is held in multiple databases and usually commercial in confidence, limiting ready access by other parties. A more open access system and exchange rules would potentially unlock greater value from these data.

What we need to do to achieve outcomes

i. Change in the ways in which genetics data is collected, stored, exchanged and potentially combined with other data, both with other sectors along the supply chain and with overseas genetics evaluation systems,

Priorities for next 5 years

i. Participate actively with initiatives to create precompetitive data repositories (see below).
ii. Combine (virtual or actual) current genetics databases as an initial demonstration of value creation and determine potential benefits.
iii. If needed draw on commercial experience in managing data exchange along supply chains.

3. There are viable beef genetic improvement services that can service the differing needs of bull breeders and the broader beef industry.

Rationale:

The promotion of BREEDPLAN has primarily focused on increasing the genetic gain of breed-specific seedstock herds at the top of the “breeding pyramid,” relying on the trickle down process of purchase of genetically superior bulls by either multiplier or commercial herds to lift the overall genetic performance of the beef industry. There has been relatively little effort invested in customising EBVs for non-stud bull-breeding herds, particularly those breeding crossbred or composite cattle, or in promoting best genetics, irrespective of breed, to optimise efficient crossbreeding systems that can be significantly more profitable than purebred herds in certain environments. Furthermore, alternative evaluation systems to BREEDPLAN are now becoming available and have the potential to create confusion in terms of producing EBVs that will not be comparable. If a common language is not maintained, there will need to be a considerable extension effort to explain differences and how to determine equivalency.

What we need to do to achieve outcomes

i. Maintain and regularly upgrade BREEDPLAN analytical software but identify where savings can be made.
ii. Increase the ability of beef producers to evaluate animals for traits affecting income and cost through the entire value chain, and for specific sub-sectors (ie feedlot, live export), particularly including traits related to profitability of the commercial production sector, and traits affecting product value, and the balance between these two for particular markets.
iii. Move to multi-breed analyses where practicable to reduce the number of evaluation analyses and to ultimately provide more relevant information to commercial breeders.
iv. Establish common base for all breeds for future multi-breed analysis
v. Develop a different analytical approach to estimating the EBV of a cohort of bulls, rather than an individual bull

Priorities for next 5 years

i. Utilise existing data sets to initiate trial multi-breed analyses in parallel with current within-breed analyses
ii. Determine potential value in terms of reduced analysis costs and value to both stud and commercial breeders
iii. Prioritise research into combining haplotype mapping of DNA samples with commercial measurement of performance traits (meat samples, feedlot performance) to determine feasibility as a lower cost alternative to maintaining reference herds.
iv. If needed, design a national multi-breed development program based on integrating reference herds that combine young sire testing, gEBV calibration for HTM traits and encourages/rewards private sector data submission and establishes a base for across breed comparison.
v. If needed simplify data entry requirements to run multi-breed analyses to encourage data submission.

4. Bull breeders have a suite of effective tools and technologies available to assist them to increase genetic gain

Rationale:

Bull breeders have several opportunities to improve genetic gain other than through use of high EBV bulls, based on measurement of performance. Genomic prediction of breeding value (gEBVs) is likely to replace phenotypic prediction to a large extent as costs decline, leading to a significant decline in performance measurement – this may require breed societies and industry to increase investment in both reference herds and systems whereby those breeders who do supply valuable phenotypes are appropriately rewarded by members using this information to calibrate their gEBVs.

What we need to do to achieve outcomes

i. In anticipation of declining costs, increase development and accuracy of genomics tests for all current HTM traits and establish reference herds to maintain accuracy.

ii. Develop tools to assist commercial bull breeders (ie those breeding bulls for own use) to make additional gain to that possible by buying in nucleus bulls
iii. Develop genomic predictions of structural, fitness, fertility, temperament, polledness and visual traits valued by northern breeders – an ability to screen large numbers of animals at an earlier age for suitability to a specific environment
iv. Develop a version for MATESEL for composite cattle.

Priorities for next 5 years

i. Develop better tools to estimate the appropriate economic weighting of expensive or hard-to-measure traits in specific supply chains
ii. Support greater customisation of selection indices than currently available for tropical breeds (to enable inclusion of saleable meat yield, eating quality, disease resistance, FCE etc for integrated supply chains with grain finishing and specific market specs)
iii. Investigate novel reproductive technologies to allow increased selection differential and/or reduced generation interval
iv. Investigate novel remote and automated measurement technologies that enable key data for genetic improvement to be captured.

5. Funding of genetics RD&E is transparent and reflects both the total magnitude and distribution of the benefits.

Rationale:

The evidence suggests breeders only capture a small portion of the total benefit created by their investment in genetic improvement, primarily through the increased prices received for high merit bulls. However, the price signals are poor, given that bull prices are primarily determined by the slaughter cattle price and competition means any advantage is quickly transferred to consumers. There is benefit to industry to lift overall genetic merit, but not to individual breeders, and certain technologies such as genomic prediction and multi-breed analysis may disrupt current business models of some breed societies (ie pedigree recording) and/or primarily benefit non-stud breeders or commercial cattle producers.

What we need to do to achieve outcomes

i. Evolve to a funding model that provides appropriate continuity, based on a rolling 5 year program to be reviewed every 3 years.
ii. Achieve a funding mechanism that appropriately reflects the flows of benefits from genetic information and in a transparent manner.
iii. Agree a relative value for hard-to-measure phenotypic traits and reward leading breeders with personalised services.

Priorities for next 5 years

i. Analyse, consult and agreed on an appropriate funding model that reflects benefit distribution.
ii. Encourage and engage with all sectors of the supply chain to consider an appropriate level investment in a collaborative, coordinated RD&E program.

6. **There are coordinated and effective extension services that increase the use and demand for genetic investment by seedstock and commercial producers, and focus on building market demand in feedlots, corporates, processors, and brand owners.**

Rationale:

Surveys suggest that adoption has largely plateaued in the south and is far lower in the north, with common reasons for non-use being lack of a value proposition, lack of inclusion of important performance traits (structural soundness, disease resistance, conformation) or lack of applicability in harsh environments. SBTS and TBTS have been important investments by the breed societies and MLA Donor Company but primarily service existing members and their clients, and are under-resourced to expand these services, particularly for the tropical breeds. In addition to demonstrating the value proposition and improving price signals (DO #1), the language used to rank animals on merit needs to be greatly simplified for commercial clients and key influencers, who need to be systematically educated to increase their understanding of what genetic merit means contributes to their bottom line. The activities under this outcome need to incorporate recommendations from the yet-to-be completed development of a nationally-coordinated extension network.

What we need to do to achieve outcomes

i. Increase the adoption of genetic evaluation services by bull breeders (seedstock and commercial)
ii. Simplify the language used to distinguish genetic merit based on responses from focus groups of current non-users (as has been done overseas) and the interface whereby buyers can access genetic information to improve their purchasing decisions (as has been done with the development of the RAMSELECT app)
iii. Use key consultants to focus on “converting the unconverted” influencers (agents, financiers, feedlot & abattoir buyers).

Priorities for next 5 years

i. Develop a 3 tier coordinated and systematic extension program via the proposed national extension network, including the private sector
ii. Leading breeders – work on optimisation of breeding programs with AGBU, either on fee-for-service basis or value-adding services in return for “rare” or hard-to-measure phenotypes (eg MATESEL, BREEDPLAN Validation model, Influential Breeder Workshops and potentially other services)
iii. Continue SBTS and TBTS to maintain focus on seedstock breeders, and increase capacity in north.

iv. Contract private consultants and leading breeders to systematically target key influencers, particularly for tropical breeds in the northern beef industry
v. Customise, and where needed simplify, both language and tools for different users.

7. The genetics RD&E pipeline is transparent, collaborative and efficient in its approach to priority setting, development and introduction of new technology and problem identification and resolution.

Rationale:

A number of the criticisms of the current process concerning RD&E prioritisation, resource allocation and problem solving could be largely overcome by involving more stakeholders in decision making and increasing the communication of these decisions and the rationale behind them, thereby improving both transparency and accountability. This will require more structured effort and more resourcing than has been allocated in the past, and will need to be led by the co-investors. The core funding needs to be sufficient to support maintenance and routine upgrading of the analytical software and related activities. The funding of new R&D should be structured in a way that encourages collaborative input using expertise in organisations other than AGBU, providing IP issues do not complicate or delay delivery to industry (ie a "virtual," rather than an actual, centre of excellence).

What we need to do to achieve outcomes

i. **E**stablish a coordination entity of investors and users to oversee and report to industry on priority setting, problem resolution and to drive innovation.
ii. Establish a Technical Committee that can consider concerns from users and determine priority and mechanisms for resolution.

Priorities for next 5 years

i. Establish the coordination entity and Technical Committee mentioned above.
ii. Encourage AGBU and ABRI to further develop integrated workplans
iii. Provide breed societies and lead users greater opportunity to provide feedback via regular forums/workshops

8. STRUCTURAL AND SYSTEM IMPEDIMENTS to increasing genetics ROI

As outlined in the Introduction, this paper originated from feedback over several years from stakeholders identifying structural and system constraints in the national beef genetics improvement system that result in the average annual genetic gain achieved being far from optimal.

In developing the RD&E priorities outlined in this report, the Steering Group recognises that the pursuit of these will not directly address many of the constraints previously identified, and importantly that the benefits possible from many of these research areas will not be fully realised unless changes are made to the commercialisation and delivery model.

A crucial issue that requires urgent resolution concerns genetic data ownership, management, and rules for exchange and sharing, as a much more open and commercial model will be needed if a number of the opportunities identified are to be developed.

The dairy industry has recently proposed that repositioning dairy data exchange into a precompetitive setting is essential to support research, improve genetic evaluation and underpin information product innovation across that industry[3].

The main challenges identified with the current dairy industry infrastructure and data exchange identified are similar to those identified as impeding progress in beef genetic improvement, namely:

1. Lack of industry leadership to address data issues and realise productivity gains
2. Multiple animal ID processes and numbers with calls for implementing a unique recognised animal ID system
3. Gaps in data; value adding constrained
4. Fragmented systems, difficulties in data transfer and sharing
5. Less than optimal data collection processes and adoption of new technologies
6. Reduced data flows through the data value chains
7. Improvements in reliability of genetic evaluation
8. Data not valued by all stakeholders
9. Incentives for data collection not aligned with benefits of data use.

The dairy industry vision to “create a centralised industry-owned repository where quality-assured data from all sources are available for industry-wide use” has already largely been achieved for sheep industry genetics data by the Sheep Genetics model within the meat industry.

There are a number of similar data repository and data management concepts under active consideration within the meat industry, including by CSIRO and ABRI (the “Livestock Information Platform”) and by MLA whose “Information Integration Program” which is investigating whether benefits could be achieved by:

- generating real time feedback and advice within value chains to improve efficiencies and reduce costs
- facilitating the effective exchange of regulatory and industry traceability and integrity information
- enhancing the commercial offerings of red meat processors to deliver to customer specifications

[3] National Herd Improvement Association Dairy Industry Data Working Group Report for NHIA Dairy Industry Data Project Final Report July 2010

- creating better connections between commercial producers and processors to underpin branded products
- providing the opportunity to directly link measures of carcase quality and yield into the industry genetic improvement programs
- facilitating more collaborative relationships between value chain partners and identifying new innovation opportunities, underpinning new value chain business models and payment systems.

Given the crucial importance of this issue, the Genetics Steering Group recommends that the co-investors in the genetics delivery system consider drawing on commercial experiences in developing systems and processes to protect and share data between businesses in multinational food supply chains[4].

A further important consideration by MLA and co-investors, in terms of who should fund what aspects of genetic improvement programs, is the proposition that adoption of the new genomic-based technology may actually compromise the future success of genetic improvement programs.[5] While genomic approaches promise faster rates of genetic gain and a more effective way to deal with, and make improvement in, *hard-to-measure* traits, they are also potentially disruptive to the current business models of breed societies. The lack of progress in implementing multibreed analyses over recent years suggests that breed societies may also have the same concern over this technology.

Structural and system Impediments:

1. The structure and transactional operations of the current national beef genetic evaluation system are perceived by some users (the critics) to be inflexible and inefficient when compared to similar systems in other industries, but also significantly under-resourced by others (the advocates). Cost of participation and perceived lack of a value proposition is a disincentive to participation by some breeders and producers. Ways in which software maintenance and upgrading, data handling and transaction costs can be reduced should be investigated, and benchmarked against other systems.

    - Costs of maintaining and further developing the current system appear to be unsustainable, unless MLA is willing to significantly increase levy funding and a substantially cheaper alternative design for reference herds and gEBV calibration can be developed.
    - There has been no systematic analysis of system efficiency, and there are examples where the business operations appear to be more academic than commercial in terms of cost/benefit. In particular, customisation and regular updating of breed-specific genetic parameters, running different versions of the analysis software for each of 28 different breeds and maintaining over 40 different selection indexes need to questioned in terms of additional cost, complexity and marginal value to selection accuracy and decision-making.
    - The delivery of beef genetic evaluation services occurs through a variety of relationships between ABRI and the breed societies. Thus changes in the national system need approval by multiple service providers, delaying the speed of new innovation.

[4] An example is F4F Agriculture (www.f4f.com) which provides both expertise and a technology solutions framework that is integrates all parts of the agricultural supply-chain and providing custom data-management business solutions.
[5] MLA Report B.EVA.0001 and B.EVA.0002 P. Fennessy, T. Byrne, P. Amer, and G. Martin *Evaluating the impact of animal genetics and genomics RD&E investment* 2014

- Because breeders must become breed society members in order for their cattle to be benchmarked in the same genetic evaluation and base, breed societies have monopoly positions and some members argue that there is little competitive pressure to reduce costs or improve services to members.

2. There is a view by some stakeholders that the commercialisation and delivery sectors of the current national beef genetic evaluation system are not optimised to maximise the rate of genetic gain in segments of the industry.

    - There is insufficient reward/incentive to those breeders who invest in, and achieve, above average rates of genetic gain.
    - Innovations are only accessible through the BREEDPLAN service model
    - There is insufficient rewards/incentive to breed societies to share/exchange data.
    - By their nature, breed societies are associations of members with very divergent views on the value of performance recording and maximising genetic gain. Breed societies may then, to varying extents, retard the gain achievable by leading producers by maintaining their role as a monopoly retailer of genetic evaluation services and "owner" of members' genetic data. Members who contribute the most data and pay the most fees may have no more say than members who are not interested in improving objective genetic evaluation.
    - Breed societies have multiple and sometimes conflicting objectives, and are not necessarily driven by, or rewarded by, maximising genetic gain by their members. They do have an increasing role in brand development and management to create differentiation in product offering.
    - In competing industries, breeders do not have to be members of breed societies to participate in across breed genetic evaluation nor to maximise their own genetic gain. In the strongest rival industries to beef, breed composition per se is no longer relevant to maximising genetic gain.

3. There are perceptions that the development and delivery pathway of the BREEDPLAN service lacks transparency, and also that simplification of language and interfacing may increase understanding and acceptance by commercial producers. The BREEDPLAN brand may also need a significant makeover if further adoption is to be achieved.

    - Producer surveys and feedback from consultants and some breed society executive officers indicate that a significant proportion of non-users have an active dislike for BREEDPLAN (ie not just lack of knowledge), suggesting that increasing resources to promote the current messages and language will not succeed.
    - Alternative approaches such as simple star grading for ranking bulls for specific selection indexes against a common base, regardless of breed, have been used overseas, particularly with commercial producers.

9. NEXT STEPS

1. MLA to release this consultation draft and the Industry Discussion Papers to industry and co-investors and encourage feedback via the MLA website in the period November 2015 – February 2016.
2. The owners of the BREEDPLAN analytical software and related IP explore further with ABRI, the licensee, and with breed societies and other major users the options to improve the current commercialisation and delivery model.
3. The Genetics RD&E Steering Group, with changes to membership if required, proceeds to develop a consultation document examining options for improving the collaboration among genetics RD&E providers under various funding and participation scenarios.
4. If a collaborative approach is supported in principle by major co-investors and industry feedback, MLA and those co-investors jointly determine by 31 March 2016 the structural, funding and governance arrangements best suited to a nationally-coordinated RD&E program to support over the longer term a holistic genetics evaluation and improvement system, and the efficiencies possible in expanding/integrating some or all of the program activities to other livestock species. Any role for the Steering Group in this phase needs to be determined by the co-investors.

APPENDIX 1: Membership - Genetics RD&E Steering Group

Ian Johnsson	Independent Chairman. Director of Sheep CRC and formerly GM of Livestock Production Innovation in MLA
Alex Ball	GM of Red Meat Innovation in MLA with role in linking industry databases, member of Sheep CRC Executive.
Delia Dray	Director Livestock Systems, NSW DPI; Director of AGBU and Dairy NSW
Gerard Davies	GM of Innovation & Technology at AACo, representing the Northern Pastoral Group of companies.
John Gibson	Director of Centre of Genetics Analysis and Applications at UNE; Director of AGBU, Director Sheep CRC.
Ian Locke	NSW seedstock breeder (Wirruna Poll Herefords), Chairman of ABRI and International Beef Recording Scheme sub- committee.
Tom Gubbins	Director of Team Te Mania, representing large performance recording herds.
Peter Parnell	Chief Executive Officer of Angus Australia; formerly Beef Genetics Research Leader in NSW DPI.
Sam Gill	Executive Officer to Genetic Steering Group. MLA Project Manager Beef and Data Insights | Livestock Productivity.

APPENDIX 2: Terms of Reference - Genetics RD&E Steering Group (GSG)

Objective:
To identify genetics and genomics RD&E investments that will improve beef genetic evaluation, shorten the time from research to delivery and increase adoption rates in the next 5 years and lead to at least a doubling of the current rate of genetic gain across the beef industry.

The intention is to also look for synergies and efficiencies where the R&D or E may also be of value to improving sheep genetic evaluation services (currently delivered through Sheep Genetics) and possibilities for integration with current RD&E managed through the Sheep CRC, funding for which will finish in 2019.

Participants:
BREEDPLAN licensors and major investors (MLA, NSW DPI, UNE), BREEDPLAN licensee (ABRI), major breed society use/investor(s); major independent user(s) of genetic evaluation systems, plus independent Chairman.

Term of Operation and Deliverables

1. A draft list of high-level investment outputs will be released in October for initial industry consideration and feedback.
2. Recommendations for the development, budget, structure and governance framework for a nationally-coordinated program will be developed by 31 March 2016 (although this may involve some changes in membership after October 2015).

Reporting:
The GSG has a responsibility to report directly to all key stakeholders and indirectly via the MLA website to the entire beef Improvement sector and wider commercial Industry throughout the process. In addition, the SG will report to the Board of MLA, as the organising entity.

Values:

1. To operate in a transparent manner
2. To consult with stakeholders as widely as possible
3. To represent all sectors of the industry and ensure effective communication
4. To work towards outcomes that are in the common interest and maximise industry benefit
5. To develop and maintain a culture of open communication/collaboration around genetic RD&E investment.

Principles:

1. Genetic improvement is vital to the profitability of the Australian livestock industries.
2. Australian evaluation and research capability is vital to genetic improvement in Australia.
3. Broad based producer support/understanding of Australian evaluations is vital to the Australian evaluation and research capability.
4. Industry wide extension/marketing and advocacy/leadership is vital for broad based producer support/adoption of Australian evaluations.
5. Acceptance/understanding of GxE is vital for industry wide extension and support.
6. Measurement of animal performance is vital to managing animal performance.

Member Responsibilities:

Each member will be expected to communicate with other stakeholders in their sector. This is a key commitment of this steering group. In addition, each member should operate in an independent manner with a view towards industry good.

Steering Group Responsibilities:

The GSG will be responsible for overall strategic guidance in developing the Genetics RD&E investment plan. The GSG can request submissions from other sources and set up and manage task forces to enable it to complete its work. It must ensure that the work of any task forces or working groups fit within the agreed overarching industry strategy (Meat Industry Strategic Plan 2015-2020) and will deliver on the agreed strategic priorities.

APPENDIX 3 - Researcher priorities

Unprompted Ideas for new research projects were received from NSW DPI, CSIRO, University of Adelaide, University of Queensland, UNE, AGBU, and Vic DEPI. These have been grouped into broad themes and possible outputs (but with considerable overlap) below for information to potential co-investors in a future national program. There was considerable agreement on the research needed to "provide the Australian beef breeding sector (both stud and commercial) with the capacity to double the current average annual rate of genetic gain within 10 years."

THEME	Proposed Deliverables
Genomics	• High accuracy gEBVs at younger age and on hard-to-measure economically important traits. • Inexpensive DNA tests (based on functional mutations) for polledness, deleterious mutants, improved reproductive performance and product quality. • Accurate GEBVs that allow producers to select the best crossbreeding strategies and the best bulls • More accurate gEBVs for traits that display large GXE eg mature cow weight, survival and rebreeding performance • Continuing improvement of methods for utilising genomic information in genetic evaluation, including for composite populations and/or for using data from different breeds/sub-populations
Reference populations	• Expanding gEBV estimation to include minor breeds • Investment into resource populations focussed on the very hard-to-measure traits (feed intake, methane, disease resistance, fertility and adaptation in the north, eating quality), and on underpinning across-breed genetic evaluations. These resource populations should include linkage with international populations • Further development of genomic tools for breeders - better prediction across breeds, less need of large reference populations for each breed. • Genomic selection and multi-breed EBVs fully implemented in BREEDPLAN
Phenotypes	• Tools to capture a significant return on higher accuracy EBVs for carcass traits (LMY and EQ), using MSA premiums to increase demand for genetic merit • Novel approaches to simplified reproductive EBVs • Novel methods for the collection of new and existing phenotypes • Easier to measure fertility EBVs that will attract more breeders into • BREEDPLAN, reduce generation interval and increase grower ret urns. Increasing BREEDPLAN adoption by simplifying birth date recording. • A rational system of recording and using deleterious mutations that can also enhance productivity in heterozygous cattle. • A long term phenomics strategy for the beef industry developed and implemented. • EBVs for novel traits for longevity, age at puberty, eating quality.

Multi-breed analyses	• Multi-breed genetic evaluation (at least all British breeds; possibly all taurus, plus with a zebu grouping). • Increasing ROI for genetics R&D investment through new tools to better utilise genetic merit by optimising XB programs • Improved prediction of the individual performance of Bos indicus cross progeny. • More directed cross breeding choices based on genomic structure of bulls and cows
Evaluation tools	• Customised range of evaluation tools for tropical breeds - EBVs for lifetime weaning rate, gEBVs, novel reprod traits, across-breed EBVs, incl for composites • Overhaul of the basic computing strategies to enable a step change in the volume of data that can be handled at speeds consistent with ongoing needs of industry • Genetic parameters for the relationships between fertility, body composition, feed costs and carcase merit and eating quality in the major breeds, ideally making use of industry data to allow understanding of the degree and nature of any GxE interactions • A single, low cost DNA test (9K or equivalent) which will - identify the breed composition of the animal, its sire and dam, whether or not it carries recessive genes for abnormalities or horns, and which can be used to calculate EBVs for growth, carcase, meat quality and reproduction traits, with high accuracy in multiple breeds, and high accuracy across generations • A DNA test for meat quality that can be performed on a pooled sample from the group of commercial cattle. • A test using both DNA and observable traits to predict the potential of individual cattle for marbling.
Breeding objectives	• Genetic correlation across market endpoints • Redefined breeding objectives based on updated/sound bio-economic model, incorporating MSA payment system and maternal productivity • Breeding objectives that allow selection of bulls on specific market or environmental suitability. • Breeding objectives that include feed intake on pasture and / or efficiency
Extension	• Implementation and decision support. • Improved adoption through implementing recommendations from Beef Genetics Extension review • Understanding, acceptance and utilisation of genetic technologies (EBVs, indexes, genomics) by the commercial sector increased. • The ability of commercial producers to optimally match management systems with the genetic potential of their herds increased. • A training course to train consultants in the use of genomics in the cattle industry.

APPENDIX 4 - Breed society feedback on major issues.

A questionnaire seeking the views of breed societies on priorities and issues pertaining to their current business models was emailed to fourteen breed societies and nine responded either in writing or by tele-interview. As a number requested confidentiality, the responses have been aggregated for this report. The numbers in brackets indicate the number of mentions - not all respondents answered all questions, and some respondents offered more than one response to some questions.

The input from the Executive Officers or Office Bearers that provided these responses is gratefully acknowledged.

1. **What are your major genetics RD&E investment priorities for the next 5 years?**
    - Collecting more phenotypic data through BINs (5) or alternative structures (2) and improving the accuracy of blended and genomic EBVs; optimising, and determining the value of, investment in genomics (3).
    - Developing/improving international genetic evaluations (2)
    - More accurate EBVs for carcase traits (2) and other HTM traits(4)
    - Simpler measurement methods for carcase and quality/health traits on-line (1)
    - Estimation of domestic and global demand for specific “branded” products (1)
    - Alternative phenotypic data capture and management systems (1)
    - Education and empowerment program for members (2), including convincing “proof-of-profit” messages to increase adoption of profit-based breeding objectives and use of associated selection criteria by seedstock breeders (2).
    - Enhancement of selection indexes to incorporate additional traits influencing herd profitability and creation of sub-indexes for particular sectors of the value chain (1)
    - Collecting more crossbreeding data to improve EBVs(1)
    - Better simpler integrated tools to enable breeders to balance inbreeding and management of known undesirable recessive genes with genetic improvement of profit traits (1).
    - Ongoing revision of genetic parameters and development of improved genetic evaluation models for existing traits (1)
    - Development of genetic parameters and evaluation models required for the incorporation of new traits of economic importance (e.g. cow longevity, disease/parasite resistance)(1)
    - Enhance communication of the value of genetic improvement to all sectors of the supply chain to improve transmission of appropriate price signals to bull breeders (1).

2. **What significant changes, if any, do you think are needed to improve the delivery of genetics technology and information services to i) bull breeders and ii) commercial cattle producers?**
    - Greater investment on improved communication, education and co-ordination across the beef genetics delivery pipeline, especially to commercial producers (7) and greater emphasis on proof of profit (2) and use in structured crossbreeding (1)
    - Better integration of AGBU and ABRI workplans, and accountable project management (1)
    - More professional profiling of breeder success stories and case studies (1)

- The BREEDPLAN brand is tired and needs to be refreshed, more market-oriented and supported by value-based payments (2).
- Ignore breed pedigree and move all genetic analyses onto a common base, which would be more reliable and easier to adopt across the industry. [The most common question from commercial producers is why all breeds didn't start on the same base, then +/- EBV figures would be better understood}.(1)

3. What significant changes, if any, do you expect in your current business model over the next decade?

- Need to change to model whereby breeders pay for outputs (EBVs etc), not inputs.(1)
- Evolution to achieve continuous improvement of the range and value of services to members, including greater focus on integration of genomic tools (2), decision support systems and modern IT infrastructure (1)
- Reducing emphasis on BREEDPLAN services (1)and increasing emphasis on value-adding services and brand management and market positioning (2)
- None (3)
- More emphasis on maternal efficiency, feed efficiency and dressing % (1)
- More emphasis on international collaboration (1) and crossbreeding (1).

4. What are the biggest challenges to your current business model?

- Maintaining membership through services which are relevant and of value to members.(2)
- MLA forcing changes which undermine the business model (2).
- A minority of members who want the benefits of the breed "brand" but don't want to share in the ongoing costs of promoting the "brand" once they secured their position in the marketplace (2)
- Small size and limited resources (1)
- Multi-breed EBVs have potential to damage breed brands unless the breed has unique characteristics that others want (1)
- Corporatisation of agriculture and hoarding of IP – doing own genetic analyses (1)
- Maintenance of the current self-governance structure of the current member-based small business model from current threats from a central socialised system.(1)
- Ongoing funding of necessary RD&E, requiring ongoing co-investment (1)
- High cost of third-party service providers, requiring more rapid implementation of in-house IT and genomics systems with greater focus and efficiency (1)
- Lack of available pool of human resource expertise to implement necessary RD&E and business model development (1)

5. Will your breed society continue to invest in reference herds (ie BINs) and what, if any, changes would you like to see in either their design or the way they are run?

- Breed societies currently investing in BINs are all likely to continue this investment (6), although for some it will be influenced by the availability of MDC co-funding (2)

- For smaller breeds, a higher level of industry support would be needed to entice them to invest in BINs (2).
- One society invests in a lower cost approach tracking and collecting commercial data, and sees an LDL-type database and haplotype mapping as important R&D priorities to enable a move away from higher-cost reference herds.
- Designs should incorporate more planned crossbreeding comparisons (1).

6. What value do you see in greater sharing of data between breeds and up and down the beef value chain from breeders to consumers, and what incentives are needed to facilitate this?

- There could be value in the sharing of data up and down the beef value chain from breeders to consumers, as proposed for LDL (4), if associated with a yield and quality payment system (1), and ease of uploading (2).
- Happy to support limited sharing of data between breeds and for multi-breed analyses and crossbred evaluations (3), but not unregulated combining of data (1) and benefits of this is overemphasised by some (1).
- Not sure – depends on value proposition (3)
- Not keen to share with supply chain (1), - suspects that without knowledge of contemporary group structures the value for breeders to use in genetic selection would be limited (2).
- International sharing of data is more important for ongoing breed improvement (2).

7. How interested are you in supporting the development of multi-breed evaluations?

- Supportive (8) at least with like breeds (2) to allow benchmarking and possible savings on analysis runs (1) and possibly greater EBV accuracy (1)
- Supportive but low priority in relation to other RD&E needed - industry need and benefit needs to be quantified (1)
- Across-breed data already included in current analysis (3)
- Useful to have common base (4)
- Main concerns/potential disadvantages:
  a. Likely to be very expensive and ongoing cost >> reduced analytical costs(1).
  b. loss of control to make changes when needed (1)
  c. need to continue international analyses uninterrupted (1)
  d. fear of direct comparisons by some members – would need majority support (2)
  e. not all breeds measure the same traits (1)
  f. could lead to loss of diversity (1)
  g. would not want to pay more than for current within-breed analyses (1)
  h. would want to retain breed-specific genetic parameters and adjustment factors (2), and customised indexes (1)
  i. Primary benefit is to commercial buyers, little or no value to mainstream seedstock sector (1)
  j. High cost of implementation may threaten current business model.(1)
- Already have some head-to-head comparisons that can be made available for developing the multi-breed analyses (2) but are they contemporary comparisons?(1)

- Support incorporating into future BINs if EBV estimation not compromised (4) but low priority relative to collection of data required for enhanced within-breed progress (1).
- Would prefer examination of alternative approach (cost and efficiency) using commercial feedlot/abattoir data and current commercial XB data, with widespread genotyping for breed identification and haplotype mapping back to sires (1).

8. **The Australian Dairy industry has recently proposed that repositioning dairy data exchange into a <u>precompetitive setting</u> is essential to support research, improve genetic evaluation and underpin information product innovation across that industry. Their vision is to "create a centralised industry-owned repository where quality-assured data from all sources are available for industry-wide use." Would you support in principle a similar initiative for the beef genetics sector and on what basis would you be willing to transfer your society data to such a repository? Access does not necessarily need to be free or open to all.**

   - Not in favour – prefers retention of IP and linking for analyses as needed. Would threaten current business model (4)
   - Provided benefit can be demonstrated to members in terms of improving genetic selection (3). Would need to recognise data input – depends on the rules (1) and should not be used to narrow breed base (1).
   - Not sure – need a lot more information (2).

9. **Is there a mechanism by which input data (pedigree, genotypes, phenotypes) from individual breeders can be valued and traded for output data from combined analyses provided through the breed society?**

   - No viable model has been proposed. The current mechanism of exchange of data input for value-added EBVs is effective and largely equitable to all stakeholders, albeit continual improvement always possible(2)
   - Interested but can't see it working (2)
   - Currently buying and providing other incentives commercial breeders supplying phenotypes (1) - could possibly extend to members for "rare" phenotypes using discount or rebate system (3).

10. **What additional tools are required to support selection decisions beyond continually improving the current genetic prediction model?**

    - Tools and information to provide greater guidance on long-term breeding program design (1)
    - None - It would be better to put effort behind promoting what is already available than designing more selection support tools (1)
    - Simple way to measure or predict accurate birth dates for extensive production areas (1).
    - Single step analysis (4) and phenotypic prediction of "profitability" from DNA ie for feedlot allocation (1)
    - Bio-economic of production systems x regions x breed combinations, together with future demand market prediction to inform optimum mix for each region (1)
    - Needs to be simplified and brand re-invented (1)

- Structural soundness etc should be left to breeders to add value and differentiate – stick to basics (1)
- Training in the value of visual assessment, especially for breeding females (1).
- Easy to use mating allocation tools to optimise breeding decisions with respect to genetic diversity, inbreeding, management of individual gene effects and overall genetic merit.

11. Does the industry need to maintain a common language of genetic information to service all stakeholders or should it allow customisation across different models?

- Common language is needed to simplify education and extension programs (8)
- Some flexibility needs to be provided to individual businesses/segments to invest in ways to achieve customisation to differentiate services (2)
- Needs to be extended to crossbreds and simplified for commercial producers (2), but not for studs.
- The most common question from commercial producers is why all breeds didn't start on the same base, then +/- EBV figures would have more meaning.