Final report

Southern Beef Technology Services

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Abstract

The third iteration of the Southern Beef Technology Services (SBTS) project aimed to maximise the understanding and use of genetic technologies in the Southern Australian beef industry. The five project objectives were (1) facilitating a 50% increase in genetic progress for stakeholder breed associations, providing (2) genetics extension, (3) technical support, (4) training of external providers, and (5) facilitating collaboration in support of the overall project aim. To meet these objectives, SBTS project personnel contributed over 400 articles, 802 social media posts and 43 videos and webinars. Personnel also contributed to 143 in-person and online events and numerous other unquantified activities of the project (e.g. technical support or collaboration). During this iteration of the project, the rate of genetic change in the stakeholder breed associations increased from $1.58 to $6.78 per year. In conclusion, the SBTS project has provided a seamless transfer of information in support of the use of BREEDPLAN and related genetic technologies in the Southern Australian beef industry. In turn, the use of these technologies, with SBTS support, have facilitated a large genetic change which benefits the whole beef value chain from bull breeders to the end consumers.

Executive summary

Background

The Southern Beef Technology Services (SBTS) project, which commenced on 1 July 2016, was a joint initiative between Meat and Livestock Australia (MLA), the Agricultural Business Research Institute (ABRI) and 14 (later 13) breed associations representing temperate cattle breeds that are predominately run in Southern Australia. The SBTS project employed 2.5 FTEs who continued the work of the two preceding SBTS project iterations, delivering a range of innovative extension and technical support activities to maximise the use and understanding of BREEDPLAN and related genetic technologies in the Southern Australian beef industry. These initiatives were undertaken in support of facilitating a 50% increase in the rate of genetic progress for SBTS stakeholder breed associations. In conjunction with the Tropical Beef Technology Services project (TBTS) and Angus Australia extension program, the SBTS project provided an efficient and effective national extension and technical support network for the Australian beef breeding industry with particular emphasis on the seedstock sector.

Objectives

The objectives of the SBTS project were:

1. *Genetic Progress* - Facilitate a 50% increase in the rate of genetic progress as measured by the weighted rate of change (3 year rolling average) for the selection indexes of the stakeholder breed associations.
2. *Extension Initiatives* - Undertake a range of broad and targeted extension initiatives with a focus on the application of genetic improvement technologies (e.g. BREEDPLAN, Genomics) for Southern Australia.
3. *Technical Advancement and Support* - Provide support to assist the implementation of new, and increase the uptake of existing, genetic improvement technologies in Southern Australian seedstock herds and associated breed societies.
4. *Capacity Building* - Undertake capacity building in extension and support of genetic improvement technologies, primarily in the use of the BREEDPLAN products in the commercial breeding sector.
5. *Collaboration* - Facilitate structured collaboration with relevant industry bodies on extension initiatives and messages related to genetic improvement technologies.

All five project objectives were met successfully.

Methodology

SBTS project personnel undertook a wide range of extension initiatives and technical support activities throughout the duration of the project. These included the provision of workshops for both seedstock and commercial beef producers, one-on-one herd consultations with seedstock producers, and the provision of technical information (written and e-media formats) on a wide range of beef breeding and genetics topics. The SBTS project team also provided day-to-day technical support and advice regarding BREEDPLAN and related genetic technologies to SBTS stakeholder breed associations and their members. To support those undertaking genetics extension in the commercial sector (e.g. private consultants and state agricultural department staff), the SBTS project team formed a Beef Genetics Champions Network and provided annual events for this group. Finally,

SBTS project personnel also collaborated with a number of industry organisations in regard to extension messaging, extension events and the development of new extension tools.

Results/key findings

The SBTS project successfully facilitated a greater than 50% increase in the rate of genetic progress for SBTS stakeholder breed associations, with a $6.78 (per cow mated per year) rate of genetic change (three-year rolling) for the 2018 to 2020 drop calves, compared to the average increase of $1.58 for the three years to 2015 (the project base). The average weighted selection index value for the 2020 drop calves was $99.61, an increase of $26.43 from the average weighted selection index value of $73.19 for the 2015 drop calves. To facilitate this achievement, SBTS project personnel successfully completed a wide range of extension initiatives and technical support activities, with a particular emphasis on the seedstock sector, throughout the duration the project.

Benefits to industry

Genetic improvement in the seedstock sector, which has been successfully facilitated by the SBTS project, has significant flow-on effects for the whole beef value chain. New technologies, such as genomically enhanced breeding values and revised BreedObject selection indexes, enhance the ability for commercial producers to select genetically superior bulls; in turn, this will produce better commercial progeny for the feedlot and processor components of industry.

Future research and recommendations

With beef genetics an evolving and technically complex space, a strong requirement exists for extension projects that provide a seamless transfer of information between the research and technical operations of the BREEDPLAN genetic evaluations, and those who use genetic improvement technologies in their herds. Thus, the ongoing support of an efficient and effective national extension and technical support network for the Australian beef industry should be prioritised. This would enable the continued utilisation of genetic technologies, and associated rates of genetic improvement, which would lead to significant flow on benefits for the entire beef supply chain.

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1. Background

The Southern Beef Technology Services (SBTS) project, which commenced on 1 July 2016, was a joint initiative between Meat and Livestock Australia (MLA), the Agricultural Business Research Institute (ABRI) and 14 (later 13) breed associations representing temperate cattle breeds that are predominately run in Southern Australia. These breed associations were the Blonde d'Aquitaine Society of Australia and New Zealand, the Charolais Society of Australia, the Devon Cattle Breeders' Society of Australia, the Australian Gelbvieh Association, Herefords Australia, the Australian Limousin Breeders' Society, the Murray Grey Beef Cattle Society, the Red Angus Society of Australia, the Australian Red Poll Cattle Breeders Inc., the Australian Salers Association, Shorthorn Beef (involvement ceased in 2020), Simmental Australia, Speckle Park International and the Australian Wagyu Association (AWA).

The SBTS project employed 2.5 full time equivalents (FTEs) to continue the work of two successful prior SBTS project iterations, BFGEN.032 (March 2005 to June 2010) and P.PSH.0533 (July 2010 to June 2016). The project provided a range of innovative extension and technical support activities to maximise the use and understanding of BREEDPLAN and related genetic technologies in the Southern Australian beef industry. These activities included the provision of technical support to stakeholder breed associations (via technical committees, boards and/or association staff) and one-on-one support to their seedstock producer members (both remotely and on-property), who were located across the breadth of the country (Fig. 1). Other activities, delivered to a mix of seedstock producers, commercial producers and beef industry personnel, included the facilitation of in-person (e.g. workshops, forums and field days) and electronic (e.g. webinars) events, the provision of written documentation (e.g. bi-annual magazine and individual technical articles) and the production of electronic media (e.g. short videos) on a wide range of cattle breeding and genetics topics. These initiatives were undertaken in support of facilitating a 50% increase in the rate of genetic progress for stakeholder breed associations.

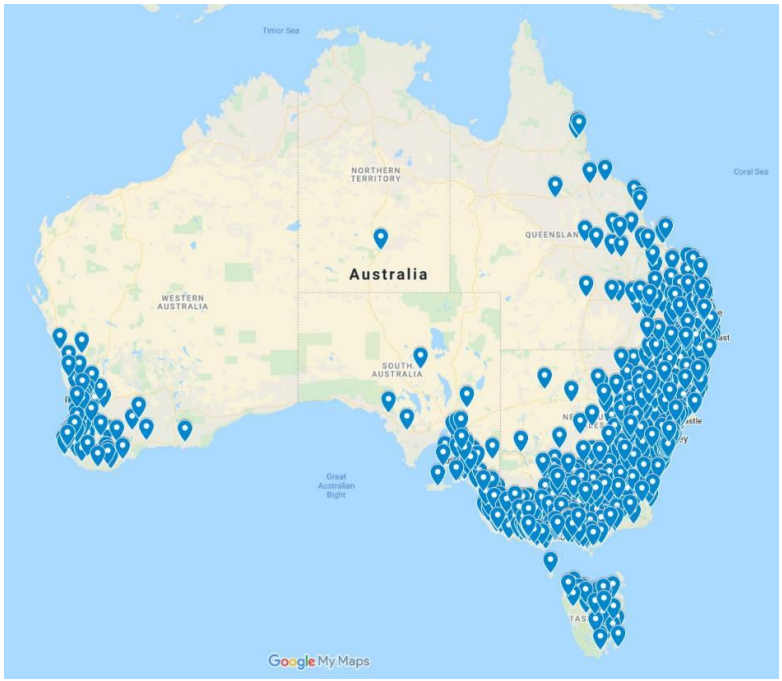

Figure 1. Location of Australian members of SBTS stakeholder breed associations (as at February 2021). Map created using Google My Maps (https://www.google.com.au/maps/about/mymaps/).

The stakeholder breed associations involved in the SBTS project registered an average of 65,653 cattle per year between 2016 and 2020 in their primary herdbooks, according to statistics published by the Australian Registered Cattle Breeders Association (ARCBA) in 2020 (Table 1). With an average of 112,804 cattle registered in temperate breed associations in the same time period, the SBTS project involved 58% of the Australian temperate cattle seedstock industry (Table 1). In a similar manner, the SBTS project involved 46% of the overall Australian seedstock industry (Table 1).

Table 1. The number of cattle registered in SBTS stakeholder, temperate and all breed associations between 2016 and 2020 (ARCBA 2020). SBTS stakeholder breed association registrations are also shown as a percentage of temperate and all breed association registrations.

	Total no. of cattle registered in primary herdbooks				
Year	**SBTS stakeholder breed associations**	**Temperate breed associations[A]**	**All breed associations**	**Percentage of temperate breeds**	**Percentage of all breeds**
2016	67,943	116,163	148,006	58	46
2017	64,529	107996	140,898	60	46
2018	65,418	115690	147,293	57	44
2019	64,960	111112	138,494	58	47
2020	65,417	113,059	145,751	58	45
Average	**65,653**	**112,804**	**144,088**	**58**	**46**

[A] All breed types (British, European, Other) except Tropical.

In conjunction with the Tropical Beef Technology Services project (TBTS; P.PSH.0786) and the Angus Australia extension program, which together represent a further 51% of the Australian seedstock cattle industry (ARCBA 2020), the SBTS project provided an efficient and effective national extension and technical support network for the Australian beef breeding industry with particular emphasis on the seedstock sector.

2. Objectives

The project objectives were:

1. *Genetic Progress* - Facilitate a 50% increase in the rate of genetic progress as measured by the weighted rate of change (3 year rolling average) for the selection indexes of the stakeholder breed associations. This will compare the average weighted annual change for the 2012 to 2015 drop calves (base year) to the average annual change for the 2017 to 2020 drop calves. At the time of defining this objective the 3-year average rate of genetic change (excluding Angus) between the 2012 to 2014 drop calves was $1.22 per cow mated per year. A 50% increase in the average rate of genetic progress for the 2018 to 2020 drop calves equates to $1.83 per cow mated per year. Note that this metric will be reviewed and possibly changed or expanded once the National Genetics Consortium is established.
2. *Extension Initiatives* - Undertake a range of broad and targeted extension initiatives with a focus on the application of genetic improvement technologies (e.g. BREEDPLAN, Genomics) for Southern Australia. This will include the utilisation of on-property consultations with influential seedstock herds, webinars, social media, websites, bi-annual newsletters and monthly technical articles.

3. *Technical Advancement and Support* - Provide support to assist the implementation of new, and increase the uptake of existing, genetic improvement technologies in Southern Australian seedstock herds and associated breed societies e.g. BREEDPLAN EBVs, Internet Solutions, BreedObject Selection Indexes, MateSel, Completeness of Performance and genomic advances such as the single step BREEDPLAN analysis. This will include facilitating the structured coordination of BREEDPLAN related R&D and implementation priorities with timelines (annually updated) involving the stakeholder breed societies, ABRI and AGBU. In addition, the project will work closely with the University of New England Animal Science group who are involved in the Sheep CRC and the AbacusBio group in New Zealand to take advantage of new genetic technologies including tools for the optimisation of genomic testing and collection of phenotypic data.
4. *Capacity Building* - Undertake capacity building in extension and support of genetic improvement technologies, primarily in the use of the BREEDPLAN products in the commercial breeding sector. This will be based around identifying and training a core group of industry individuals to deliver the BullSELECT workshop programme and form a genetic improvement champion's network. This core group will be provided with regular updates on the BREEDPLAN technology from year two of the project via twice yearly webinars, an annual face to face workshop and inclusion on the distribution list for all SBTS broad extension initiatives.
5. *Collaboration* - Facilitate structured collaboration with relevant industry bodies on extension initiatives and messages related to genetic improvement technologies. This will involve groups such as Angus Australia, Tropical Beef Technology Service (TBTS), the Animal Genetics & Breeding Unit (AGBU) and Sheep Genetics Australia (SGA). It will include the development of extension messages, material and strategy to communicate to industry the benefits of new genetic improvement technology such as the single step BREEDPLAN analysis. The project will work closely with Angus Australia and the New Zealand Beef and Lamb Genetics group to share communication strategies and on farm consultation kits. The project will provide "train the trainer" courses for NZ genetics consultants.

All five project objectives were met successfully.

3. Methodology

3.1 Genetic progress

The SBTS project has used a weighted selection index as a measure of genetic progress in the project's stakeholder breeds. Since the beginning of the current SBTS project (1 July 2016) there have been numerous changes that have affected the average weighted selection index value for the SBTS stakeholder breed associations. These include:

- Changes to the genetic parameters used within the BREEDPLAN analyses for individual SBTS stakeholder breed associations.
- The implementation of a Single-Step BREEDPLAN analysis for several SBTS stakeholder breed associations.
- The implementation of new version 6 BreedObject Selection Index software for several SBTS stakeholder breed associations.

- The cessation of a BREEDPLAN analysis for Shorthorn Beef, meaning that BREEDPLAN Estimated Breeding Values (EBVs) and Selection Index values are no longer updated for this breed.
- New animals and additional performance data coming into the BREEDPLAN analyses for individual SBTS stakeholder breed associations over time. This influences not only the most recent calving year (2020), but also previous years as performance data is collected on older animals.

Consequently, to ensure a valid comparison of the average weighted selection index values across time, all statistics in this report that relate to objective one were calculated using the most recent BREEDPLAN analyses (collated 30 June 2021). Furthermore, as not all SBTS stakeholder breed associations publish BreedObject Selection Indexes, results were only collated for those SBTS stakeholder breed associations (n=7) that published BreedObject Selection Indexes (Table 2). Consequently, care should be taken if comparing the results in this report to those reported elsewhere, including those reported in previous P.PSH.07614 milestone reports, as they may not be directly comparable.

Table 2. Genetic progress statistics for the SBTS project were calculated using the latest BREEDPLAN genetic evaluation results (as at 30 June 2021) for the seven SBTS stakeholder breed associations that published BreedObject Selection Indexes.

SBTS Stakeholder Breed Associations that Publish[A] BreedObject Selection Indexes	No. of Selection Indexes	Names of Selection Indexes
Charolais Society of Australia	3	Domestic, Export, Northern Terminal
Herefords Australia	4	Southern Self-Replacing, Northern Self-Replacing, Southern Baldy Maternal, Northern Baldy Terminal
Australian Limousin Breeders' Society	3	Domestic Maternal, Export Maternal, Northern Export
Murray Grey Beef Cattle Society	3	Vealer Terminal, Supermarket, Heavy Grass Fed Steer
Red Angus Society of Australia	3	Supermarket, Vealer, Northern Steer
Simmental Australia	4	Domestic Maternal, Export Maternal, Northern Terminal, Vealer Terminal
Australian Wagyu Association	4	Wagyu Breeder, Self Replacing, Fullblood Terminal, F1 Terminal

[A] As at 30 June 2021.

The calculation of the average weighted selection index values for SBTS stakeholder breed associations involved a number of steps. Firstly, the average selection index value was calculated for each SBTS stakeholder breed association, by calving year. Where more than one selection index was published for the given breed association, an average of these was used. The average selection index values for each breed were then combined, weighted relative to the number of animals in each breed as a percentage of the total animals in that calving year. These weightings varied across calving years, as the proportion of calves represented by a breed association varied from year to year.

The yearly change was calculated by taking the difference in the average weighted selection index values between the given calving year and the preceding calving year. For example, the yearly change for the 2016 year was calculated by subtracting the 2015 average weighted selection index value from the 2016 average weighted selection index value.

The average rate of change (3 year rolling average) was calculated by averaging the yearly rate of change in the weighted selection index for the given year and the preceding two. For example, the average rolling change (3 year rolling average) for the 2016 year was calculated by averaging the yearly rate of change in the weighted selection index from 2014 to 2016.

3.2 Extension initiatives

A wide range of broad and targeted extension initiatives were undertaken over the duration of the SBTS project. These extension initiatives focused on improving the use and understanding of BREEDPLAN and related genetic improvement technologies across the Southern Australian cattle industry.

Extension initiatives undertaken in the SBTS project are described in more detail below. The priority placed on undertaking each of the extension activities varied across the duration of the project, to reflect the priorities of SBTS stakeholder breed associations and their members.

3.2.1 Regional forums

Three single-day regional forum programs were developed by the SBTS project and delivered at multiple locations around Australia by SBTS and TBTS project personnel. These regional forum programs were designed for seedstock beef producers and covered a range of topics relevant to BREEDPLAN and related genetic technologies. Each regional forum program was designed to be interactive, with discussion encouraged throughout the day. This allowed producers to learn not just from the facilitators but also from each other, and to share their own experiences on how to best utilise BREEDPLAN in their businesses.

Electronic feedback devices were used at each regional forum to collect a range of demographics, feedback and also to measure learning outcomes. These learning outcomes were obtained by asking attendees a number of questions both before and after each regional forum and measuring the percentage of attendees who correctly answered each question at each time point.

With members of SBTS stakeholder breed associations located across much of Australia (Fig. 1), regional forum locations were selected to ensure that the majority of stakeholder breed association members were within a three hour drive of a regional forum venue.

3.2.1.1 2017 & 2018 regional forums

The first of these regional forum programs was offered at a number of locations around Australia throughout 2017 and early 2018. While initially regional forums were only offered throughout the 2017 year, several of the regional forums scheduled for 2017 had to be cancelled due to a lack of registrants. With several BullSELECT workshops (Section 3.2.2) organised for Western Australia in early 2018, the SBTS team took the opportunity to re-offer regional forums to the Western Australian audience in 2018.

The 2017 and 2018 regional forum program was designed for seedstock producers and covered a wide range of BREEDPLAN topics (Table 3). The regional forum was designed with a broad range of

seedstock producers in mind; from those that had recently joined BREEDPLAN through to those who had been using BREEDPLAN within their businesses for some time.

Table 3. Topics covered at the 2017 & 2018 regional forums.

Order	Topic	Duration (minutes)
1	Welcome	15
2	BREEDPLAN 101: Recording Performance Information in Your Herd.	45
3	BREEDPLAN Contemporary Groups & Genetic Linkage.	45
4	Making BREEDPLAN Work For You: Common Performance Recording Problems and How to Avoid Them.	60
5	How Much Performance Data Do You Collect? Interpreting Your Completeness of Performance Report.	45
6	Are You Making Progress: Interpreting Your Genetic Progress Report.	45
7	Single-Step BREEDPLAN: What Does Genomics Mean For You?	60
8	Closing Remarks.	15

3.2.1.2 2019 regional forums

Following the success of the single-day regional forum program delivered in 2017 and 2018, two single-day regional forums were developed by the SBTS project. The decision to offer two distinct programs was made following feedback from a number of stakeholder breed association members. These programs were delivered across two consecutive days at multiple locations around Australia in 2019, with the first day covering BREEDPLAN fundamentals and the second day focusing on DNA technologies.

The BREEDPLAN Fundamentals program on day one was designed for seedstock beef producers who were new to BREEDPLAN recording or who wished to refresh their BREEDPLAN knowledge. It covered a range of topics (Table 4), including the role of genetics in beef breeding and the data collection and submission process. Attendees also learnt how to interpret BREEDPLAN reports for their herds.

Table 4. Topics covered at the BREEDPLAN Fundamentals regional forum.

Order	Topic	Duration (minutes)
1	Welcome.	15
2	The Role of Genetics in Beef Breeding.	30
3	BREEDPLAN: From Paddock to EBVs.	60
4	BREEDPLAN: Analysis and Beyond.	45
5	Making BREEDPLAN Work For You.	45
6	BREEDPLAN Resources.	30
7	BREEDPLAN Completeness of Performance.	60
8	Utilising BREEDPLAN to Improve Your Herd.	60
9	Feedback & Closing Remarks.	15

The Getting the Most Out of BREEDPLAN: DNA Technologies program on day two was designed for seedstock beef producers who wished to gain a deeper understanding of the application of DNA technology for beef breeding. A range of topics were covered (Table 5), including parentage verification, genetic conditions and the use of DNA information in BREEDPLAN analyses. Attendees were also provided with a genetic progress report, which allowed them to benchmark their herd's current genetic position and to identify their level of genetic progress for each trait.

While SBTS strongly encouraged beef producers to attend both days of the 2019 regional forum program, attendees could opt to attend a single day only (either day one or day two) if they preferred. SBTS also encouraged multiple attendees from a single beef operation to attend. This was encouraged through pricing incentives.

Table 5. Topics covered at the Getting the Most Out of BREEDPLAN: DNA Technologies regional forum.

Order	Topic	Duration (minutes)
1	Welcome.	15
2	BREEDPLAN Refresher.	30
3	Benchmarking Your Herd: CoP and Genetic Progress.	60
4	DNA Technology for Beef Breeders: Parentage Verification.	45
5	DNA Technology for Beef Breeders: Genetic Conditions.	45
6	DNA Technology for Beef Breeders: Single-Step BREEDPLAN.	75
7	What Does DNA Technology Mean for You?	45
8	Feedback & Closing Remarks.	15

3.2.1.3 Regional forum follow-up survey

In 2020, the SBTS team conducted a follow-up survey with participants of at least one of the SBTS & TBTS regional forums held in 2019 (Section 3.2.1.2). This survey was undertaken to identify any practice change that a regional forum attendee may have undertaken in the six-to-12-month period following their attendance at a 2019 SBTS & TBTS regional forum. Those surveyed were also asked a number of questions to assist with future planning of SBTS & TBTS regional forums. This included how often they believed a regional forum should be held, how far they were willing to travel, whether they were prepared to listen to preparatory material prior to the event and their interest in a range of potential topics.

The follow-up survey was undertaken using Qualtrics (https://www.qualtrics.com), a web-based survey program. Responses were anonymous unless the individual chose to identify themselves.

3.2.2 BullSELECT workshops

The single-day BullSELECT workshop was designed by SBTS primarily for commercial beef producers and explored how BREEDPLAN information could be utilised, in conjunction with other selection tools (e.g. visual appraisal), in bull selection decisions. These were delivered at multiple locations around Australia by members of the SBTS and TBTS project teams. The BullSELECT workshops were typically delivered at the property of a seedstock producer, as the package included a number of practical yard sessions where cattle with EBVs were required. BullSELECT workshops were delivered

on a request basis, either at the instigation of a seedstock producer who wished to provide their clients with education regarding best practice use of BREEDPLAN information in bull selection and purchasing decisions, or at the request of a beef industry organisation that wished to educate commercial producers in the local area.

The BullSELECT workshop incorporated a mix of easy to understand practical discussions and yard demonstrations (Table 6). Topics included discussion on the effective selection of breeding cattle, an overview of the genetic selection tools available and practical demonstration of how to use BREEDPLAN information, including EBVs and selection indexes, when choosing bulls for purchase. A mock helmsman auction concluded the day, allowing attendees to put all they had learnt throughout the workshop into action.

Table 6. The BullSELECT workshop program focused on the use of BREEDPLAN information in bull selection decisions. The program incorporated a mix of practical discussions (presentations) and yard demonstrations (yard).

Order	Topic	Description
1	Welcome.	Welcome by Stud Principal, outline of stud policy and breeding program. Introduction of the speakers and program for the day.
2	Effective Selection of Breeding Cattle (Presentation).	A discussion on the value of genetics, traits of importance, selection methods and an introduction to breeding values.
3	Non-Genetic Influences on Animal Performance (Yards).	A practical demonstration on how non-genetic effects on animal performance can complicate bull selection decisions.
4	Interpreting Breeding Values (Presentation).	A guide to interpreting EBV information provided in bull sale catalogues.
5	Do Breeding Values Work? (Presentation).	A discussion on trials and case studies that demonstrate selection with EBVs and the production outcomes.
6	Understanding Breeding Values (Yards).	An overview of the available BREEDPLAN EBVs, and how each is interpreted.
7	Simplifying Selection with Indexes (Presentation).	Introduction to Selection Indexes - what they are and how to interpret them.
8	Best Practice Guide to Bull Selection (Presentation).	A discussion on using EBVs and other genetic technologies in bull selection with a practical demonstration of how to use the online EBV search facility.
9	The Bull Buyer and BREEDPLAN (Yards).	A mock helmsman auction where workshop attendees are divided into groups and given a buying scenario and budget. At the sale's conclusion each group discusses their bull purchase decision and whether they got value for money.
10	Feedback & Closing Remarks.	Summary of learnings from the day.

While the BullSELECT workshop package was initially created in previous iterations of the SBTS project, the material to be presented was revised by SBTS personnel throughout the first 18 months of the current SBTS project. This was done to ensure that the material presented was current and included modifying presentations to incorporate the most recent proof of concept information and the arrival of Single-Step BREEDPLAN. Additionally, presentations were modified to allow the

collection of demographics, feedback and also to measure learning outcomes via electronic feedback devices. Learning outcomes were collected in the same manner described for regional forums (Section 3.2.1). These electronic feedback devices were used at all BullSELECT workshops conducted from 2018 onwards.

3.2.3 Webinars

In 2016, SBTS personnel ran a webinar series in conjunction with TBTS personnel. The 2016 webinar series included six webinars of between 40 and 70 minutes (average 55 minutes) in length, which each covered a different topic related to the use of BREEDPLAN information in breeding decisions and/or collection of performance data for BREEDPLAN (Table 7). The webinars were run on a fortnightly basis and were scheduled for the evening to allow those in Western Australia to join once they had finished work for the day. They were delivered using the online webinar platform GoToWebinar (https://www.gotomeeting.com/en-au/webinar). Feedback was gathered from attendees at the conclusion of each webinar. Each webinar was recorded, and the recording was made available for viewing via the SBTS & TBTS YouTube channel (Section 3.2.8.3).

As discussed in more detail in the results section (Section 4.2.3), following the 2016 Webinar Series SBTS personnel concluded that webinars were of more value as a recorded resource than they were as a live event. This led the SBTS team to switch their focus to the development of shorter videos which were generated specifically for online viewing (Section 3.2.10.3).

However, with the advent of COVID-19, the SBTS team did run a stand-alone 60 minute webinar in 2020 (Table 7). This was run in conjunction with Animal Genetics and Breeding Unit (AGBU) staff. The webinar was delivered using the videoconferencing platform Zoom Cloud Meetings (https://zoom.us/). As evening webinars had not been highly attended previously, the webinar was run during the day. The webinar time and platform were chosen as they had become increasingly familiar to the target audience (seedstock producers and extension personnel) since the start of the COVID-19 outbreak, as many other extension organisations had been running daytime webinars during COVID-19. This webinar was also recorded and made available for viewing via the SBTS & TBTS YouTube channel.

Table 7. Seven webinars were run by SBTS project personnel over the duration of the project.

Webinar	Year	Webinar Topic	Webinar Presenter (Organisation)
1[A]	2016	Choosing Bulls to Suit Your Program	Catriona Millen (SBTS) & Paul Williams (TBTS)
2	2016	Getting It Right: Management Groups & Contemporary Groups	Alex McDonald (SBTS) & Catriona Millen (SBTS)
3[A]	2016	Making BREEDPLAN Work For You: Performance Recording Problems to Avoid	Catriona Millen (SBTS) & Paul Williams (TBTS)
4[A]	2016	Fertility Matters: Recording Fertility Information with BREEDPLAN	Paul Williams (TBTS) & Alex McDonald (SBTS)
5	2016	Collecting Abattoir Carcase Information for BREEDPLAN	Alex McDonald (SBTS) & Catriona Millen (SBTS)
6	2016	Where to With Genomics?	Catriona Millen (SBTS) & Boyd Gudex (SBTS)
7[B]	2020	Novel reproduction traits for genetic evaluation	Boyd Gudex (SBTS) & Matthew Wolcott (AGBU)

[A] Run in conjunction with TBTS project personnel. [B] Run in conjunction with AGBU staff.

3.2.4 Presentation at industry events

Throughout the duration of the project, SBTS personnel were invited to present at a number of beef industry events. This allowed the SBTS team to present genetics extension messages to a wide audience, including seedstock producers, commercial producers, agents and youth groups. Throughout most of the project, these presentations were typically presented in-person. However, with the advent of COVID-19, the SBTS project team adapted to presenting at these events via electronic means. COVID-19 had other impacts on the SBTS project team's ability to present at industry events, with a number of events that the team had been invited to speak at cancelled throughout 2020 and 2021 due to COVID-19 travel restrictions.

Industry events where SBTS personnel presented in-person included:

- *Events run by SBTS stakeholder breed associations:* These included conferences, annual general meetings (AGMs) and youth events, and were typically attended by members of the relevant association. Consequently, these types of events were usually focused on extension to seedstock beef producers of a particular breed.
- *Events run by individual members of a SBTS stakeholder breed association:* These included field days run by an individual seedstock producer and were typically attended by commercial producer clients and agents. Consequently, these types of events were usually focused on extension to commercial beef producers.
- *Events run by industry organisations:* These included events run by extension personnel working for state government organisations such as New South Wales Local Land Services (NSW LLS) and state Departments of Primary Industries (DPI), genetic service providers, processors, and breeder groups, and were typically attended by commercial beef producers. Consequently, these types of events were usually focused on extension to commercial beef producers.
- *Scientific conferences:* These were attended by a range of researchers, extension personnel and, in some cases, where industry days were included on the program, seedstock beef producers. Presentations at these types of events were either focused on extension to seedstock producers or focused on the role of the SBTS project in extension messaging.

Industry events where SBTS personnel presented via electronic means included:

- *Webinars run by SBTS stakeholder breed associations:* As was the case with in-person events of this type, these webinars were typically attended by members of the relevant association. Consequently, extension messaging was targeted at seedstock beef producers.
- *Webinars run by industry organisations:* As was the case with in-person events of this types, these webinars were typically attended by commercial beef producers. Consequently, extension messaging was targeted at commercial beef producers.

3.2.5 Attendance at industry events

In addition to attending beef industry events where they had been invited to present (Section 3.2.4), SBTS personal attended a number of other industry events throughout the duration of the project, including beef industry workshops and scientific conferences. SBTS attendance at these industry events served a dual purpose; firstly, attendance at these events allowed SBTS project personnel to keep updated on developments and research relevant to the beef industry. This had obvious

implications for the development of timely and relevant extension messaging to the wider beef industry. Secondly, attendance at these events allowed SBTS personnel to forge stronger relationships with SBTS stakeholder breed association staff and their seedstock producer members, as well as others in attendance at these events, such as those also involved in extension and adoption activities. While difficult to quantify, the benefits of maintaining strong professional relationships with those who are also directing extension messaging cannot be overstated.

3.2.6 SBTS & TBTS Update magazines

The SBTS & TBTS Update magazine was a joint initiative of the SBTS and TBTS projects. Produced on a bi-annual basis, the SBTS & TBTS Update magazine is an effective extension avenue for keeping stakeholder breed associations and their seedstock producer members informed on current developments in the genetic technologies area whilst also providing information on any upcoming extension initiatives.

Each SBTS & TBTS Update magazine was distributed in the following ways:

- A hard copy version was posted to all BREEDPLAN members of SBTS & TBTS stakeholder breed associations.
- An electronic version was distributed via e-news mailing lists to BREEDPLAN and non-BREEDPLAN members of the SBTS and TBTS stakeholder breed associations (with an email address recorded).
- An electronic version was distributed via e-news mailing lists to a list of personnel working in the Australian beef industry. This included ultrasound scanners, staff from beef research institutions (e.g. AGBU, CSIRO and the University of Queensland), beef extension personnel (e.g. private consultants, NSW LLS and state DPI staff), MLA and Sheep Genetics Australia (SGA) staff and genotyping service providers (e.g. Neogen and Zoetis).
- An electronic version was made available on the SBTS and TBTS websites (Section 3.2.10.1) and via the SBTS & TBTS social media platforms (Section 3.2.8). Since 2019, individual stories that had been published in the SBTS & TBTS Update magazines were also shared via the SBTS & TBTS social media platforms.
- In addition, an electronic copy was provided to each stakeholder breed association for wider distribution via their own electronic mailing lists.

A range of statistics relating to the electronic SBTS & TBTS Update magazine distribution to SBTS and TBTS stakeholder breed association members and beef industry personnel were collected. These included the total number of ‘opens’ of each SBTS & TBTS Update magazine, and the total number of ‘reads’ for each individual article. There was no way to collect similar statistics for hard copy distribution.

While all SBTS and TBTS project personnel contributed written articles for each SBTS & TBTS Update magazine, the SBTS project personnel were primarily responsible for the production, including editorial roles, and distribution of each SBTS & TBTS Update magazine.

3.2.7 Articles for SBTS stakeholder breed association publications

Throughout the duration of the SBTS project, a number of articles covering a wide range of topics relating to BREEDPLAN and the use of genetics in cattle breeding were prepared by SBTS personnel for stakeholder breed association publications. Articles were written on a request basis, and

included articles for stakeholder breed association magazines, newsletters, sale catalogues and websites.

Where possible, articles prepared for stakeholder breed association publications were sourced from previously existing documentation (e.g. individual SBTS & TBTS Update magazine articles); however, this was not always possible and a number of these articles were prepared from scratch. In these cases, the SBTS team aimed to maximise the reach of these articles by using them as widely as possible (e.g. in future SBTS & TBTS Update magazines and/or in other stakeholder breed association publications).

3.2.8 Social media

The SBTS project utilised several social media platforms as additional channels to disseminate information relating to the application and utilisation of genetic technologies to beef producers around Australia.

3.2.8.1 SBTS & TBTS Facebook account

A joint Facebook account (https://www.facebook.com/SBTSTBTS) was run in conjunction with the TBTS project. The Facebook channel was used to share a range of content, including:

- Information about upcoming SBTS and TBTS project activities, such as Regional Forums (Section 3.2.1) and BullSELECT Workshops (Section 3.2.2).
- SBTS & TBTS publications and resources, including the SBTS & TBTS Update magazine (Section 3.2.6) and e-media content (Section 3.2.10.3).
- Other information of relevance, such as articles produced by the Australian media which related to the use and understanding of genetic technologies.

3.2.8.2 SBTS & TBTS Twitter account

A joint Twitter account (https://twitter.com/SBTSTBTS) was run in conjunction with the TBTS project and was used to share content similar to that described for the Facebook channel (Section 3.2.8.1).

3.2.8.3 SBTS & TBTS YouTube channel

The SBTS and TBTS projects used a joint YouTube channel (https://www.youtube.com/sbtstbts) to share e-media content produced by the teams. This included both recordings of webinars (Section 3.2.3) and short videos (Section 3.2.10.3).

3.2.8.4 BREEDPLAN Discussion Group

The SBTS project initiated the development of a BREEDPLAN Discussion Group on Facebook. The BREEDPLAN Discussion Group (https://www.facebook.com/groups/BREEDPLAN) was launched on 24 May 2018, with the intention of building an online community where group members could discuss BREEDPLAN, share opinions, ask questions and engage with other beef producers to broaden their use and understanding of BREEDPLAN and related genetic technologies. Individuals did not need to be a BREEDPLAN member to join the BREEDPLAN Discussion Group. The BREEDPLAN Discussion Group was set up as a closed Facebook group (only members could see content) with the group administration roles shared between SBTS project personnel and BREEDPLAN staff at ABRI.

3.2.9 Herd consultations

A structured herd consultation program with individual seedstock herds was conducted during the SBTS project. Herd consultations provided an opportunity for seedstock producers to discuss performance recording and genetic progress in their own herd with a member of the SBTS project team, and to raise any questions they may have had regarding BREEDPLAN and related genetic technologies.

Each herd consultation was typically two to three hours in length. The majority were delivered in person, either on-property or at an event that both SBTS personnel and the producer were attending (e.g. Regional forums (Section 3.2.1) or other workshops (Section 3.2.3)). With the advent of COVID-19, a small number of herd consultations were delivered electronically via video conferencing platforms.

At each herd consultation, the seedstock producer was provided with several reports. These included:

- *A BREEDPLAN Completeness of Performance report:* This report outlined the quantity of pedigree and performance data that the seedstock herd had recorded for the 15 previous calving years. This report was used as a supporting document for discussions on how the seedstock herd could improve their performance recording levels.
- *A Genetic Progress Benchmarking report:* This report contained detailed information about the herd's breeding program and included statistics on the herd's current genetic position, their genetic trends and key genetic improvement drivers, all benchmarked against the relevant breed. This report was used as a supporting document to discuss genetic progress and opportunities for future improvement.

In addition to the benefits that the herd consultation program provided for participating seedstock herds, herd consultation discussions allowed SBTS project personnel to identify common topics raised by multiple seedstock producers. These common topics and questions could then be addressed with a wider seedstock producer audience through the development of targeted extension messaging. For example, common topics were covered by preparing articles for upcoming SBTS & TBTS Update magazine (Section 3.2.6) and/or as a session topic at the SBTS & TBTS regional forums (Section 3.2.1).

3.2.10 Maintenance and expansion of extension material

The SBTS project took responsibility for a wide range of extension material covering BREEDPLAN and related genetic technologies. This included maintenance (including periodic review) of existing extension material, and the creation of new extension material as required.

3.2.10.1 Websites

The SBTS website (http://sbts.une.edu.au/) was maintained for the duration of the project. However, with the website design pre-dating this iteration of the SBTS project, a decision was made to redevelop the SBTS website in the current project. This website redevelopment meant that the SBTS project could include dedicated (but separate) areas for seedstock beef breeder and commercial beef buyer resources. In addition, the website redevelopment meant that the new SBTS website was optimised for viewing via mobile devices (Fig. 2); this had not been the case previously. A further advantage of the redevelopment was the common "back-end" that was developed for

both the SBTS and TBTS project (http://tbts.une.edu.au/) websites. Previously, both project websites had been managed separately; this meant that a considerable amount of time was spent duplicating the content so that it would appear on both the SBTS and TBTS websites. Following website redevelopment, content only needed to be uploaded once.

Following redevelopment, SBTS personnel were responsible for the ongoing maintenance of the SBTS website. This included ensuring that the technical content remained current, and that any upcoming SBTS events (e.g. Regional forums (Section 3.2.1), BullSELECT workshops (Section 3.2.2) and webinars (Section 3.2.3)) were listed. In addition, SBTS personnel also took an active role in maintaining the TBTS website. A Google Analytics account (https://analytics.google.com) was also created to allow a number of statistics for both the SBTS and TBTS websites to be collected.

The SBTS project team also took an active role in ensuring that the technical content on the BREEDPLAN website (https://breedplan.une.edu.au/), such as the BREEDPLAN tip sheets, were maintained. The BREEDPLAN website was redesigned by ABRI during the SBTS project and SBTS personnel were also involved in reviewing technical content and layout during this redevelopment process.

Figure 2. The SBTS website was redeveloped during the current project; this allowed for optimised viewing from mobile devices.

3.2.10.2 Written documentation

In addition to the SBTS & TBTS Update magazine (Section 3.2.6), the SBTS project team collaborated with the TBTS project team to produce a number of short, stand-alone technical articles. These were

made available via the SBTS website. Additionally, a number of these articles were produced in hard copy format and distributed at events that the SBTS and TBTS project teams attended (e.g. Beef Australia 2018 and Beef Australia 2021 (Section 3.2.5)). These technical articles took two main formats, namely the SBTS & TBTS Technical Notes and the 'A Seedstock Producer's Perspective' Case Studies:

- *SBTS & TBTS Technical Notes*

  The SBTS & TBTS Technical Notes are an easy-to-read series of articles that cover a range of topics relating to the use of genetic technologies in cattle breeding. Across the duration of the SBTS project, a number of new SBTS & TBTS Technical Notes were developed. These included articles that had been previously written for the SBTS & TBTS Update magazine (Section 3.2.6); re-producing these articles in a stand-alone format made them accessible to a wider audience as they could be found without having to search through the entire magazine.

  In addition, all existing SBTS & TBTS Technical Notes were updated into a new format in the first year of the SBTS project. The SBTS project team took primary responsibility for this reformatting, and also maintained the SBTS & TBTS Technical Notes for the duration of the project.

- *'A Seedstock Producer's Perspective' Case Studies*

  The 'A Seedstock Producer's Perspective' Case Studies were developed from 2020 onwards, as a response to requests for extension material that included seedstock producer case studies. While a specific member of the SBTS and TBTS project teams took primary responsibility to work with an individual seedstock producer to produce the case study, all members of the SBTS and TBTS project teams were involved in identifying case study topics. Each of these case studies was initially published in the SBTS & TBTS Update magazines (Section 3.2.6); however, for similar reasons to those discussed above for the SBTS & TBTS Technical Notes, they were subsequently published as stand-alone articles.

SBTS project personnel also took primary responsibility for maintaining the comprehensive set of BREEDPLAN tip sheets. These can be found in the Help Centre on the BREEDPLAN website, and cover a wide range of topics, including the interpretation of BREEDPLAN EBVs and Selection Indexes and the recording and submission of performance data to BREEDPLAN. Thus, they are a valuable resource for beef producers who wish to utilise BREEDPLAN information in their businesses.

Throughout the project, SBTS project personnel developed new BREEDPLAN tip sheets as required. In addition, SBTS project personnel led two major reviews of the BREEDPLAN tip sheets. These were:

- A review of, and where required, an update of the technical content of each BREEDPLAN Tip Sheet. Reviewed BREEDPLAN tip sheets were then updated into a new format. This occurred in the fourth and fifth years of the SBTS project and was done in conjunction with members of the BREEDPLAN team at ABRI and the TBTS project team.
- A review of how technical content relating to BreedObject Selection Indexes was presented to both seedstock and commercial beef producers. This led to a major rework of all BREEDPLAN tip sheets that covered BreedObject Selection Indexes. This review was done in conjunction with staff at AGBU and the TBTS project team and took place in the fifth year of the SBTS project.

3.2.10.3 E-Media (videos)

The development of short videos (i.e. videos that were less than ten minutes in length) was a new initiative for the current iteration of the SBTS project. This methodology was prioritised following the 2016 webinar series (Section 3.2.3), where results indicated that webinars were of more value as a recorded resource than they were as a live event (Section 4.2.3). With those watching recorded webinars typically not watching the entirety of the recording, the SBTS team opted to develop a range of short extension videos specifically for viewing via websites (Section 3.2.10.1) and the SBTS & TBTS social media channels (Section 3.2.8). With the COVID-19 outbreak leading to many in-person extension events being postponed and/or cancelled, the SBTS team was able to prioritise the development of these short videos in the last 18 months of the project.

Some short videos (i.e. the 'Recording for BREEDPLAN' video series) were developed in conjunction with the TBTS project team and members of the BREEDPLAN team at ABRI. While all of these teams contributed to the scripting, all other video development work was conducted by the SBTS project team.

3.3 Technical advancement and support

For the duration of the SBTS project, SBTS project personnel provided technical support and advice to assist with the implementation of new genetic improvement technologies and increase the uptake of existing technologies for SBTS stakeholder breed associations and their seedstock members.

Each SBTS stakeholder breed association was assigned a specific member of the SBTS project team to act as a Technical Officer for their staff and their seedstock producer members (Table 8). The SBTS Technical Officer allocations did vary throughout the five years of the SBTS project; these changes are reflected in Table 8.

Table 8. Each SBTS stakeholder breed association was assigned a member of the SBTS project team to act as a Technical Officer for them and their seedstock producer members.

SBTS Stakeholder Breed Association	Assigned SBTS Technical Officer
Blonde d'Aquitaine Society of Australia and New Zealand	Catriona Millen
Charolais Society of Australia	Catriona Millen
Devon Cattle Breeders' Society of Australia	Catriona Millen
Australian Gelbvieh Association	Catriona Millen (Years 1-4) & Boyd Gudex (Year 5)
Herefords Australia	Catriona Millen
Australian Limousin Breeders' Society	Alex McDonald (Year 1) & Boyd Gudex (Years 2-5)
Murray Grey Beef Cattle Society	Catriona Millen (Years 1-4) & Boyd Gudex (Year 5)
Red Angus Society of Australia	Catriona Millen (Years 1-4) & Boyd Gudex (Year 5)
Australian Red Poll Cattle Breeders Inc.	Catriona Millen (Years 1-4) & Boyd Gudex (Year 5)
Australian Salers Association	Catriona Millen
Shorthorn Beef	Catriona Millen
Simmental Australia	Alex McDonald (Year 1) & Boyd Gudex (Years 2-5)
Speckle Park International	Catriona Millen
Australian Wagyu Association	Carel Teseling

3.3.1 Technical advancement and support for SBTS stakeholder breed associations

Throughout the duration of the SBTS project, SBTS project personnel provided dedicated technical support and advice to stakeholder breed associations. This was done through the provision of technical papers and articles (including those written for stakeholder breed association publications (Section 3.2.7)), telephone and/or email consultation and attendance at breed association board and/or technical meetings.

Technical support and advice provided by SBTS project personnel included, but was not limited to:

- *Support and advice regarding upgrades to the stakeholder breed association BREEDPLAN analysis:* Upgrades made to some stakeholder breed association BREEDPLAN analyses during the SBTS project included:
    - New BREEDPLAN traits.
    - Revised analytical software and/or parameters.
    - The importation of foreign genetic evaluation results.
    - Revisions to how crossbred animals are handled within the BREEDPLAN analysis (e.g. changing from a purebred BREEDPLAN analysis to a crossbred BREEDPLAN analysis).

  SBTS Technical Officers worked with BREEDPLAN staff and stakeholder breed associations to ensure that the implications of these changes were understood by stakeholder breed association staff and boards, and also provided technical explanations which were disseminated to SBTS stakeholder breed association members.

- *Support and advice in utilisation of DNA technologies*: This included discussions around parentage verification and advice on genetic testing for disease and/or qualitative traits. Support was also provided to SBTS stakeholder breed associations as they transitioned towards Single-Step BREEDPLAN, including advice on the development of a reference population and considerations to maintain a reference population into the future.
- *Support of and advice on additional ABRI products relating to genetic improvement:* This included advice on Completeness of Performance, GeneProb and MateSel. Advice took the form of assistance in the interpretation of results and the provision of technical information to be disseminated to stakeholder breed association members.
- *Support and development of BreedObject Selection Indexes*: This included development of Selection Indexes using new version 6 BreedObject software for SBTS stakeholder breed associations and the creation of associated extension material for dissemination to stakeholder breed association members.

3.3.2 Technical advancement and support for SBTS stakeholder breed association members

SBTS project personnel provided technical support and advice to members of SBTS stakeholder breed associations for the duration of the SBTS project. In the majority of cases, support was provided via day-to-day telephone and email consultation. In person support was also provided in some situations, including at events run by or attended by SBTS project personnel (Sections 3.2.1 and 3.2.3) and at herd consultations (Section 3.2.9). Technical support and advice provided to members of SBTS stakeholder breed associations covered a wide variety of topics, as outlined in Section 4.3.2.

3.4 Capacity building

The Beef Genetics Champions Network was an initiative of the SBTS project, which was designed to provide support and training on BREEDPLAN and related genetic technologies to a core group of extension and other beef industry personnel who were providing beef genetics information to the commercial beef sector.

3.4.1 Beef Genetics Champions Network membership

Membership of the Beef Genetics Champions Network was by invitation, with individuals who were private agricultural consultants, in government extension roles (e.g. state agricultural department employees), DNA service provider company employees, software provider company employees and BREEDPLAN accredited ultrasound scanners amongst those prioritised for membership. There was no cost to be involved in the group.

Invitations to join the Beef Genetics Champions Network were first sent out in late 2017, with the majority of members joining at that time. However, with individuals moving in and out of industry roles over the duration of the five-year SBTS project, membership of the Beef Genetics Champions Network has been fluid and a number of additional individuals have joined the group more recently.

3.4.2 Beef Genetics Champions Network events

An organising committee, which included representative from ABRI, AGBU, MLA and TBTS, along with SBTS project personnel, was set up to oversee Beef Genetics Champions Network events. While SBTS project personnel were primarily responsible for the planning and administration of Beef Genetics Champions Network events, the organising committee provided input into event location and content. All organisations represented on this committee also provided support (either financial or in-kind) for Beef Genetics Champions Network events.

3.4.2.1 2019 Beef Genetics Champions Network event

The first Beef Genetics Champions Network event took the form of a two-day workshop, which was held in Armidale on 8 and 9 February 2019. The two-day event covered a range of topics, including an introduction to BREEDPLAN, where to find beef genetics resources, genomics, recent BREEDPLAN developments and current research. Attendees also heard from two beef producers (Ian Locke, Wirruna Poll Herefords and Brett Coombe, Roxborough Brahmans) who outlined their experiences of using BREEDPLAN on farm. Representatives from the Australian sheep and dairy industries also provided their perspectives on extension and adoption within these industries. A networking dinner was also held at the conclusion of the day one proceedings. The full program can be found at: http://sbts.une.edu.au/media/1131/beefgeneticchampionsnetwork_feb2019.pdf.

To quantify the value of the workshop to those that attended, each attendee was asked to rank their knowledge of BREEDPLAN and confidence in answering questions from beef producers on specific topics on a scale of one to ten at the start and conclusion of the workshop. A number of feedback questions (one to ten scale) were also asked at the conclusion of the workshop, and included overall satisfaction, value of workshop content, presenter interaction and likelihood of attending a future workshop.

3.4.2.2 2020 Beef Genetics Champions Network event

A second Beef Genetics Champions Network event was planned for Adelaide in March 2020. This workshop was to be held over 1.5 days, with a full day program planned for 24 March and a half day program planned for the morning of 25 March. As was the case in 2019, the 2020 workshop was to cover a range of topics, and a number of invited speakers had been asked to present on their recent research findings. A full program can be found at: http://sbts.une.edu.au/media/1176/beef-genetics-champions-network-program-2020.pdf

The dates and location of the 2020 event had been chosen in consultation with MLA, as MLA were planning to hold a 1.5 day Livestock Breeding and Genetics Forum in Adelaide on 25 (afternoon) and 26 March. This would enable Beef Genetics Champions Network members to attend both events. To ensure no overlap in the topics presented at the Beef Genetics Champions Network and the MLA Livestock Breeding and Genetics Forum, SBTS project personnel had been involved in program discussion for the MLA event.

By mid-March 2020, it was clear that the worsening COVID-19 situation was going to impact on the ability to run the Beef Genetics Champions Network workshop. With both federal and state governments discussing and beginning to implement shut-down measures, it was decided, in consultation with MLA, that the Beef Genetics Champions Network workshop would not go ahead in Adelaide on the 24 & 25 March but would instead be postponed. Those Beef Genetics Champions Network members who had already registered to attend were notified by email of the cancellation on 13 March 2020, while the wider group of Beef Genetics Champions Network members were notified on 17 March 2020. While the decision to postpone was a disappointing one, especially given the large amount of work that SBTS team members had already undertaken in the lead up to this event, in hindsight the SBTS team believe the correct decision was made.

Following the decision to postpone the Adelaide event, MLA and SBTS project personnel discussed the possibility of instead offering several of the workshop sessions as interactive webinars. While several of the sessions were not suited to this format (e.g. those sessions that were interactive and/or involved group work), several sessions were identified as suitable to be presented by webinar. Beef Genetics Champions Network members were polled to gauge interest in these webinar sessions, and, following high levels of interest, two 90 minute webinars were planned (Table 9). Due to challenging circumstances (SBTS did not have webinar technology readily accessible and SBTS staff were out of the office (travelling back from an additional training event) on those dates), both webinars were hosted by MLA using the videoconferencing platform Zoom Cloud Meetings (https://zoom.us/).

Table 9. Two webinars were offered to the Beef Genetics Champions Network group in 2020.

Webinar	Webinar Topic	Webinar Presenter (Organisation)
1	Resilience and wellbeing.	Toby Ford (Ford Health)
2	Proof of profit for EBV selection tool.	Michael Wellington (Bush Agribusiness)

3.4.2.3 2021 Beef Genetics Champions Network event

With the ongoing COVID-19 restrictions making an in-person workshop for the Beef Genetics Champions Network in 2021 unlikely, the SBTS project team surveyed Beef Genetics Champions Network members in late 2020 to gauge their interest in an online event. To assist in the selection of webinar topics, survey respondents were also asked to rate their level of interest in a range of

potential webinar topics. Following this, four 60 minute webinars (on the highest ranked topics) were offered to the Beef Genetics Champions Network (Table 10). All webinars were hosted by the SBTS project team using the videoconferencing platform Zoom Cloud Meetings (https://zoom.us/). Three webinars were recorded (webinar two was not recorded due to technical difficulties), and the recordings made available to the group.

Beef Genetics Champions Network members were also invited to attend an informal networking dinner during Beef Australia at Rockhampton in May 2021.

Table 10. Four webinars were offered to the Beef Genetics Champions Network group in 2021.

Webinar	Webinar Topic	Webinar Presenters (Organisations)
1	BREEDPLAN & AGBU Research Update	Matt Wolcott (AGBU), Brad Crook (ABRI) & Catriona Millen (SBTS)
2	Fertility Research Update	Boyd Gudex (SBTS) & Matt Wolcott (AGBU)
3	Selection Indexes: Advice for Bull Buyers	Boyd Gudex (SBTS), Alastair Rayner (RaynerAg), David Greenup (Rosevale Santa Gertrudis) & Paul Williams (TBTS)
4	Breeding for Efficiency	Catriona Millen (SBTS) & Lucinda Corrigan (Rennylea Angus)

3.4.3 Additional support of the Beef Genetics Champions Network

To ensure that Beef Genetics Champions Network members were kept up to date on BREEDPLAN developments and general beef genetics news between Beef Genetics Champions Network events (Section 3.4.2), an electronic mailing list was set up to communicate information to members. This mailing list was used to communicate a variety of information to Beef Genetics Champions Network members over the duration of the SBTS project. This included, but was not limited to:

- Information about upcoming Beef Genetics Champions Network events (Section 3.4.2).
- Information about other upcoming SBTS events, including regional forums (Section 3.2.1) and webinars (Section 3.2.3).
- Information about other upcoming events, including animal breeding and genetics conferences, events and webinars hosted by MLA and service provider workshops hosted by breed associations.
- Information from MLA and other industry organisations, including expressions of interest for various MLA and/or MDC funded programs.
- BREEDPLAN news and developments.
- Electronic copies of the bi-annual SBTS & TBTS Update magazine (Section 3.2.6).

3.4.4 Evaluation of the Beef Genetics Champions Network

To evaluate the success of the Beef Genetics Champions Network over the duration of the SBTS project, Beef Genetics Champions Network members were surveyed in April 2021 following completion of the final 2021 webinar (Section 3.4.2.3). Beef Genetics Champions Network members were asked to answer a range of questions to gauge whether they felt that their involvement in the Beef Genetics Champions Network had been beneficial to them and/or to their clients (through their

ability to provide more informed genetics advice). Survey respondents were also asked whether they were keen to be involved in the Beef Genetics Champions Network into the future, and for feedback on future activities and topics.

3.5 Collaboration

Throughout the duration of the SBTS project, SBTS project personnel regularly collaborated with staff from a number of industry organisations, including both researchers and extension personnel. This allowed the SBTS team to keep abreast of developments for BREEDPLAN and other technologies in the genetics space, ensuring that any extension messages delivered by the SBTS team to the wider Australian beef industry remained current. In addition, collaboration with others involved in extension messaging allowed the SBTS team to assist in the utilisation of common extension messaging, both within the Australian beef industry and across other Australian livestock industries (e.g. sheep).

3.5.1 Collaboration in extension messaging and material

Throughout the SBTS project, SBTS personnel have collaborated with a range of other organisations regarding extension messaging and material. In particular, SBTS personnel worked closely with TBTS project staff; conducting regular meetings and collaborating to produce a range of shared extension messages and materials.

The SBTS team also attended quarterly meetings of the BREEDPLAN Technical Liaison Group (BTLG); this group regularly discussed BREEDPLAN developments and associated extension messaging. BTLG meetings involved staff from a number of organisations including ABRI, AGBU, MLA, SBTS, TBTS, New Zealand Beef and Lamb and several breed associations, namely Angus Australia, Herefords Australia, and the Australian Wagyu Association.

SBTS personnel also collaborated with a range of extension personnel at the quarterly Beef and Sheep Extension Group (BSEG) meetings. These meetings were coordinated by MLA and included extension staff from a number of organisations including SBTS, TBTS, Sheep Genetics and Angus Australia. In later years, BSEG meetings have also included scientific research staff from AGBU and the University of New England. These meetings were a way for extension personnel to exchange ideas on the messages given and the resources used to provide genetics extension to the Australian beef and sheep industries.

Finally, SBTS personnel also undertook collaboration regarding specific extension messaging and materials on a need's basis. This included working closely with staff at ABRI and/or AGBU to develop extension messaging and material for specific topics (e.g. introduction of Single-Step BREEDPLAN for individual SBTS stakeholder breed associations).

3.5.2 Collaboration in extension events and workshops

The SBTS project team collaborated with a number of industry organisations in the promotion and delivery of extension events and workshops. In particular, SBTS personnel worked closely with the TBTS project team to deliver a range of extension events and workshops. SBTS personnel also worked with a range of other organisations to support and/or deliver extension events, both in-person and electronic, to beef producers around Australia.

3.5.3 Collaboration and support of the MLA Genetics Campaign

SBTS personnel actively supported the MLA Genetics Campaign, both prior to and after the launch in June 2019. Prior to the launch this support involved both assistance with video scripting and seeking feedback on videos from producers. After the launch, the SBTS team actively promoted MLA Genetics Campaign resources to seedstock producers and the wider beef industry via a number of channels. SBTS personnel also assisted MLA in sourcing material for future MLA Genetics Campaign videos.

3.5.4 Collaboration in development of new extension tools

Throughout the duration of the project, SBTS personnel have worked with other organisations to support the development of new extension tools that can be used to extended BREEDPLAN and other related genetic technologies to the Australian beef industry. Specifically, this included working with ABRI staff involved in the development of the 'ILROnline' web services product and working with NSW DPI staff involved in the development of the 'DeSireBull' product. SBTS personnel also supported the MLA Genetics Campaign (see Section 3.5.3).

4. Results

4.1 Genetic progress

The average weighted selection index value and the weighted rate of change (three year rolling average) for the 2015 to 2020 calving years for SBTS stakeholder breed associations, as at 30 June 2021, are reported in Table 11. The average weighted selection index for the 2015 calving year was $73.19 per cow mated; this had increased by $26.43 to $99.61 for the 2020 calving year.

Care should be taken when interpreting the values for the 2020 born animals as the number of 2020 born animals being analysed will continue to increase as performance is submitted for animals born late in 2020 and are included in future analyses. Similarly, the relative breed proportions in each year have also changed thereby affecting the weighting from year-to-year. It is likely that these will realign with the past two years as more data are included. The average weighted selection index for the 1991 to 2019 calving years, and associated three year rolling average change, is shown in Fig. 3.

The three-year average genetic change between the 2012 to 2014 drop calves was $1.58 per cow mated per year. Therefore, to achieve the objective of a 50% increase in the average weighted selection index (three-year rolling average), the average genetic change between the 2018 to 2020 drop calves would need to be $2.37 per cow mated. With the average rate of change for the 2018 to 2020 drop calves being $6.78 (Table 11), objective one of the SBTS project has been successfully achieved.

Given the lag time that exists between extension activities and seedstock producers making mate selection decisions for the next calving drop, it is likely that some of the early improvements in genetic progress seen in this iteration of the SBTS project can be attributed back to the previous SBTS project (P.PSH.0533). Equally, it is likely that the current SBTS project will influence the rate of genetic progress seen in upcoming calving drops (e.g. 2022 and 2023 calving drops). In this manner, it was pleasing to see that the yearly change between the 2019 and 2020 calving drops was $10.87 (Table 1), which is double the yearly change observed for both the 2018 and 2019 calving drops.

Table 11. Summary of genetic progress for the SBTS stakeholder breed associations for the calving years 2015 to 2020 (as at June 30 2021).

Date	No. Animals	Avg. Weighted Selection Index	Yearly Change	Avg. Weighted Change
2015 (Base)	70,416	$73.19	$3.00	$4.03
2016	72,520	$77.12	$3.94	$3.06
2017	72,394	$79.27	$2.15	$3.03
2018	69,009	$84.48	$5.21	$3.77
2019	58,344	$88.74	$4.26	$3.87
2020	45,180	$99.61	$10.87	$6.78

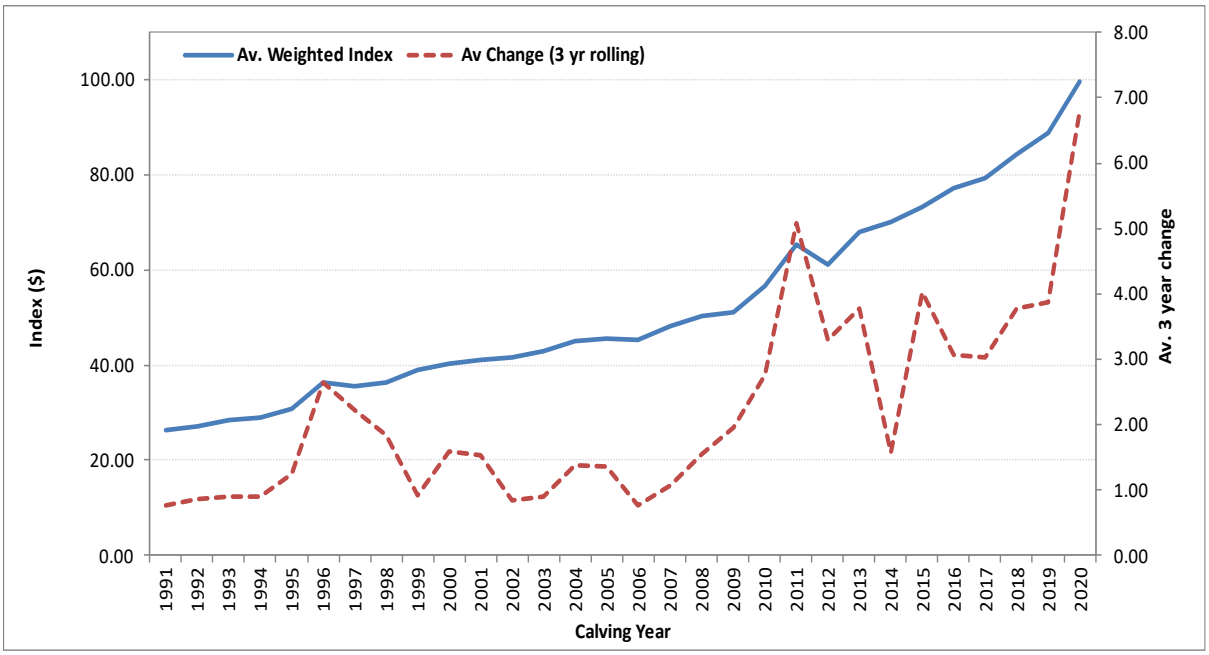

Figure 3. The average weighted selection index and average rate of change (three-year rolling) for SBTS stakeholder breed associations with BreedObject Selection Indexes published (as at 30 June 2021).

4.2 Extension initiatives

With a range of broad and targeted extension initiatives that focused on the application of genetic improvement technologies undertaken for Southern Australia throughout the project, objective two of the SBTS project has been successfully achieved. Further details on the completion of these extension initiatives are described below.

4.2.1 Regional forums

4.2.1.1 2017 & 2018 regional forums

In the 2017 calendar year, ten regional forums were conducted in the Eastern states (Fig. 4). A further four regional forums were offered in South Australia and Western Australia but were cancelled due to insufficient registrations (Fig. 4). In conjunction with other SBTS activities (BullSELECT workshops; Section 4.2.2), three regional forums were conducted in Western Australia in the 2018 calendar year (Fig. 4), including at two locations that had been cancelled in the previous year. The success of the rescheduled Western Australian regional forums may illustrate that the time of year was an important factor in attendance (May 2017 versus January 2018). Furthermore, a targeted but resource heavy marketing push to encourage those based in Western Australia to attend the 2018 regional forums may also have impacted on registration levels.

Figure 4. Thirteen regional forums were held around Australia in 2017 (light blue markers) and 2018 (dark blue markers). Four regional forums were cancelled (red markers). Map created using Google My Maps (https://www.google.com.au/maps/about/mymaps/).

A total 141 individuals registered, and 132 individuals attended, the 13 regional forums held in 2017 and 2018. Overall feedback indicated that these 13 regional forums were well received, with 91% of attendees rating these regional forums as excellent (56%) or very good (35%). In addition, 95% of attendees said that they felt they had a better understanding of BREEDPLAN following their attendance at the regional forum.

Learning outcome data shows that attendees displayed an average 36% increase in knowledge as a result of their attendance at the regional forum. With levels of prior knowledge varying greatly for the learning outcome questions (from 12% to 68%), in general, the biggest gains in knowledge were seen in areas where prior knowledge was lower. The two areas with the biggest improvements in

knowledge were understanding contemporary group formation for maximising effectiveness of data (56% improvement) and understanding genomics (50% improvement). This illustrates the importance of delivering interactive workshops that cover both the fundamentals of BREEDPLAN (e.g. contemporary groups) and new developments (e.g. genomics).

A more detailed breakdown of registrations, attendance, feedback and learning outcomes from the 2017 and 2018 regional forums can be found in Appendix 1.

4.2.1.2 2019 regional forums

Twelve two-day regional forums were conducted around Australia in the 2019 calendar year (Fig. 5). Two further regional forums were offered in South Australia and Victoria but were cancelled due to insufficient registrations (Fig. 5). A total of 168 individuals registered, and 153 individuals attended, the 12 regional forums. When compared to the 2017 and 2018 regional forums, this represents a 14% increase in attendance (despite one less regional forum conducted in 2019). Of the 153 attendees, 73% opted to attend both days, 8% opted to attend Day One (BREEDPLAN Fundamentals) only and 17% selected to attend Day Two (DNA Technology: Getting the Most from BREEDPLAN) only (Fig. 6). With SBTS project personnel having strongly encouraged beef producers to attend both days of the 2019 regional forum program during the promotion stages, this was a pleasing result.

Figure 5. Twelve regional forums were held around Australia in 2019 (blue markers). Two regional forums were cancelled due to insufficient registrations (red markers). Map created using Google My Maps (https://www.google.com.au/maps/about/mymaps/).

Overall feedback on the 2019 regional forums was very positive. At the completion of Day One, 91% of attendees rated the BREEDPLAN Fundamentals program as excellent (55%) or very good (36%). When asked, 96% of attendees said that they felt they had a better understanding of BREEDPLAN as a result of their attendance at Day One of the regional forum. Similar results were achieved for Day

Two, with 90% of attendees rating the DNA Technology: Getting the Most from BREEDPLAN program as excellent (53%) or very good (37%). A total 98% of Day Two attendees also agreed that they felt they had a better understanding of the use of DNA technologies in cattle breeding after attending the regional forum.

Learning outcome data shows that attendees displayed an average 31% and 28% increase in knowledge as a result of their attendance at Day One and Day Two of the regional forum, respectively. As was the case for the 2017 and 2018 regional forums (Section 4.2.1.1), levels of prior knowledge varied greatly for the learning outcome questions on both Day One (from 25% to 94%) and Day Two (from 14% to 77%). Consequently, the biggest knowledge gains were typically seen for questions that had a lower starting base. On Day One, the biggest knowledge gains were in understanding Completeness of Performance reports (49%) and applying breeder defined management groups (47%), while for Day Two the biggest knowledge gains were observed for understanding of the parentage verification process (56%) and Single-Step BREEDPLAN (36%).

A more detailed breakdown of registrations, attendance, feedback and learning outcomes from the 2019 regional forums can be found in Appendix 1.

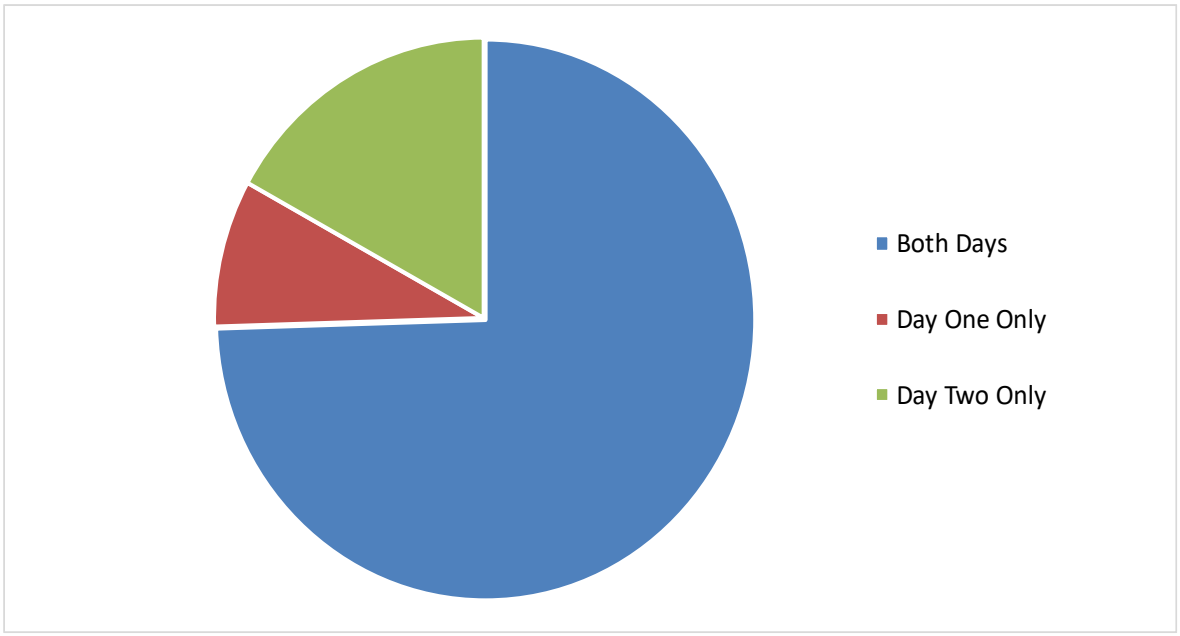

Figure 6. 153 individuals attended a 2019 regional forum; 73% attended both days, 8% attended Day One only and 17% attended Day Two only.

4.2.1.3 Regional forum follow-up survey

The regional forum follow-up survey was sent to 118 unique email addresses belonging to those that had attended a 2019 SBTS & TBTS regional forum (in some cases, one email address belonged to multiple attendees). A total of 26 responses (23%) were received from the 113 email addresses still in use. Of these 26 respondents, 85% of had attended both days, while 4% had attended Day One only and 12% had attended Day Two only.

A total of 96% of survey respondents agreed that the 2019 SBTS & TBTS regional forums were value for money. Some of the highlights of the 2019 SBTS & TBTS regional forums as identified by survey

respondents included the ability to learn from presenters and the ability to hear other attendee's points of view. The importance that attendees placed on hearing from others illustrates the benefits of hosting live events where participants can freely interact. Other attendee highlights included learning about the role of DNA in cattle breeding and the overall purpose of BREEDPLAN. Those that had received Completeness of Performance and Genetic Progress reports also found these to be valuable. In addition, 100% of those that had attended both days enjoyed the two-day format.

When asked whether they have enacted practice change within their herd as a result of attending a 2019 SBTS & TBTS regional forum, 81% of the survey respondents stated that they had. Examples of practice change undertaken in survey respondents' herds include recording more and/or better quality data for BREEDPLAN, management group allocation, better sire selection and commencing DNA testing of their animals.

Most respondents (46%) agreed that regional forums should be held every two years, with the next most popular frequency being annually (35%). Distance that individuals were prepared to travel to attend a regional forum varied widely. While travelling up to two hours to attend a regional forum was the most popular response (32%), this varied from those that were prepared to travel up to one hour (16%) to those who were prepared to travel over four hours (20%) to attend a regional forum. Listening to preparatory material prior to the event did not receive any negative feedback; 58% of respondents were prepared to do so and the remaining 42% might. Of the ten potential future topics presented in the survey, all were popular, with between 55% and 82% of respondents interested in each (Appendix 1). Several respondents also suggested other potential topics; these included multi-breed EBVs and using BREEDPLAN as a small herd.

4.2.2 BullSELECT workshops

Eight BullSELECT workshops were delivered around Australia over the duration of the SBTS project (Table 12); of these, 75% were run at the request of an organisation, while the remaining 25% were run at the request of an individual stud producer. These eight BullSELECT workshops were attended by 200 individuals (average 25 attendees per workshop).

Demographic information (collected since 2018) indicated that cattle producers represented 94% of BullSELECT workshop attendees (56% commercial producers only, 17% seedstock producers only and 21% running both seedstock and commercial herds). Beef industry personnel (e.g. stock agents) made up the remainder. The majority of BullSELECT workshop attendees (62%) ran British breeds, with those running European breeds, tropical breeds and Wagyu also in attendance. Herd sizes of BullSELECT workshop attendees varied greatly, ranging from less than 50 head (12%) to greater than 900 head (9%). Half of BullSELECT workshop attendees had herds of between 101 and 600 cattle in size.

The feedback received on the BullSELECT workshops run over the duration of the SBTS project was positive, with 92% of attendees rating the BullSELECT workshop as either excellent (42%) or very good (50%). A total of 96% of attendees agreed that they had a better understanding of how to use BREEDPLAN information when making purchasing decisions as a result of attending the BullSELECT workshop, while 87% of attendees agreed they were more likely to use BREEDPLAN information when making purchasing decisions. Verbal feedback was also positive; one stud principal reported that he had sold an additional three bulls as a result of the BullSELECT workshop he hosted, while several stock agents in attendance at BullSELECT workshops reported that they were keen to share their learnings with their colleagues.

Learning outcome data shows that BullSELECT workshop attendees displayed an average 23% increase in knowledge as a result of their attendance at the workshop. Prior knowledge of learning outcome questions did vary greatly (from 46% to 88%). While high prior knowledge had obvious implications for the outcomes when measuring average increase in knowledge, it was pleasing to see that this audience, containing a large proportion of commercial beef producers, where largely well aware that BREEDPLAN information should not be the only consideration in bull selection (88% prior knowledge). The two areas with the biggest improvements in knowledge were in understanding how EBVs related to realised progeny differences (48%), and in understanding how selection indexes should be used (42%).

A more detailed breakdown of audience demographics, feedback and learning outcomes from the BullSELECT workshops can be found in Appendix 2.

Table 12. Eight BullSELECT workshops were delivered over the duration of the SBTS project.

Date	Host Organisation(s)	Host Stud Breed(s)	Location
1 September 2016	Agriculture Victoria & More Beef from Pastures (MBfP)	Angus	Mudgegonga, Victoria
2 September 2016	Agriculture Victoria & More Beef from Pastures (MBfP)	Angus	Acheron, Victoria
19 February 2017	Individual stud producer	Murray Grey	Western Flat, South Australia
15 January 2018	Western Beef Association Inc.	Charolais & Murray Grey	Boyup Brook, Western Australia
16 January 2018	Western Beef Association Inc.	Red Angus	Benger, Western Australia
18 January 2018	Western Beef Association Inc.	Angus & Murray Grey	Manypeaks, Western Australia
23 November 2018	Individual stud producer	Limousin	Colac, Victoria
4 May 2019	Herefords Northern New South Wales Branch	Hereford	Coolatai, New South Wales

4.2.3 Webinars

4.2.3.1 2016 webinar series

A total of 334 registrations were received for the 2016 webinar series; these represented 191 unique individuals who had registered to attend one or more of the six webinars. There were 152 webinar attendees; these represented 99 unique individuals who attended one or more of the six webinars. The majority of these 99 individuals were beef producers (95%), with the remainder working in beef industry roles (e.g. extension personnel and DNA service providers). Of the beef producers that attended at least one webinar, 60% were BREEDPLAN members.

Feedback from the 2016 webinar series attendees was largely positive. Averaged across all six webinars, 86% of webinar attendees strongly agreed (12%) or agreed (74%) that they had found the webinar useful. Additionally, across all six webinars, an average 85% of attendees agreed that they had a greater understanding of the topics presented as a result of their webinar attendance.

Recordings of each webinar were made available for viewing via the SBTS & TBTS YouTube channel. As at 30 June 2021, the six webinars had a combined 1,316 post-webinar views. This translates to a

nearly nine-fold increase in views compared to all live webinar attendees (n=152), and a 13-fold increase in views compared to unique webinar attendees (n=99). These results show that the value of webinars is not so much as a live event but as a recorded resource that can be accessed at a time that suits the individual producer. However, while there were 1,316 post-webinar views, those viewing the webinar recordings did not watch the webinar recording in its entirety. Rather, the average view duration for these six webinar recordings ranged from 8% to 22% (average 15%) of the entire webinar. With these results indicating a strong preference for online viewing of short media content, SBTS personnel prioritised the development of short videos over webinars for the remainder of the SBTS project (Section 3.2.10.3).

A more detailed breakdown of registrations, attendance, Youtube views and feedback for the 2016 webinar series can be found in Appendix 3.

4.2.3.2 2020 webinar

A total of 191 individuals registered for and 73 individuals (38%) attended the 2020 webinar. Of the 73 attendees, 27% were beef producers, while the remainder were industry personnel (e.g. service providers, extension personnel and researchers). This is in direct contrast to the results seen for the 2016 webinar series (Section 4.2.3.1), where the majority of attendees were beef producers. While these results are only from a small number of webinars (n=7), and as such should not be considered conclusive, they may highlight potential differences in webinar timing preference across different attendee types. It would be logical that industry personnel are more likely to attend webinars during their daytime working hours, while producers are more likely to attend webinars outside of typical work hours (i.e. after off-farm work or daylight farm work).

The webinar recording was made available for viewing via the SBTS & TBTS YouTube channel, where it has been viewed 182 times. When compared to attendees who viewed the webinar live, there is a 2.5-fold increase in reach for the webinar recording. As was the case for the 2016 webinar series, this result highlights the value of webinars as a resource which can be viewed after the live event.

A more detailed breakdown of audience demographics for the 2020 webinar can be found in Appendix 3.

4.2.4 Presentation at industry events

Over the duration of the project, SBTS personnel presented in-person at 42 events around Australia (Fig. 7). The majority of these events (57%) were organised by SBTS stakeholder breed associations, with the remainder including events run by industry organisations (31%), members of SBTS stakeholder breed associations (7%) and scientific conferences (5%; Fig. 8). Presentations by SBTS personnel at these 42 events reached a combined audience of just over 3,000 individuals (average reach of 72 individuals per event).

SBTS personnel were invited to speak at five additional events which were cancelled due to the COVID-19 outbreak. These included four events that were to take place in Australia (Fig. 7); these were the 2020 WagyuEdge Conference organised by the Australian Wagyu Association, the Red Angus Society of Australia AGM and youth events for Herefords Australia and the Australian Limousin Breeders' Society. SBTS personnel were also scheduled to attend the New Zealand Limousin AGM (a regional group of the Australian Limousin Breeders' Society).

With the advent of COVID-19, SBTS personnel also presented at nine webinars in the final year of the project (Table 13). All but one of these was organised by SBTS stakeholder breed associations; the

other was run by NSW LLS. A total of 406 individuals attended these webinars (average reach of 45 individuals per webinar; Table 13). With recordings of seven of these webinars made available for viewing after the event, there were a further 855 post-webinar views (Table 13).

While the average in-person event had a greater reach than the average webinar, webinars had the advantage of being a resource which could be viewed after the event. Indeed, the post-webinar views were approximately double the number of live attendees. This result is similar to the one observed for SBTS-run webinars (Section 4.2.3), reinforcing the value of electronic webinar recordings as a resource for beef producers.

Figure 7. SBTS personnel presented in-person at 42 industry events around Australia over the duration of the project (blue markers; please note multiple events were run at the same location). Some events were cancelled due to COVID-19 restrictions (red markers). Map created using Google My Maps (https://www.google.com.au/maps/about/mymaps/).

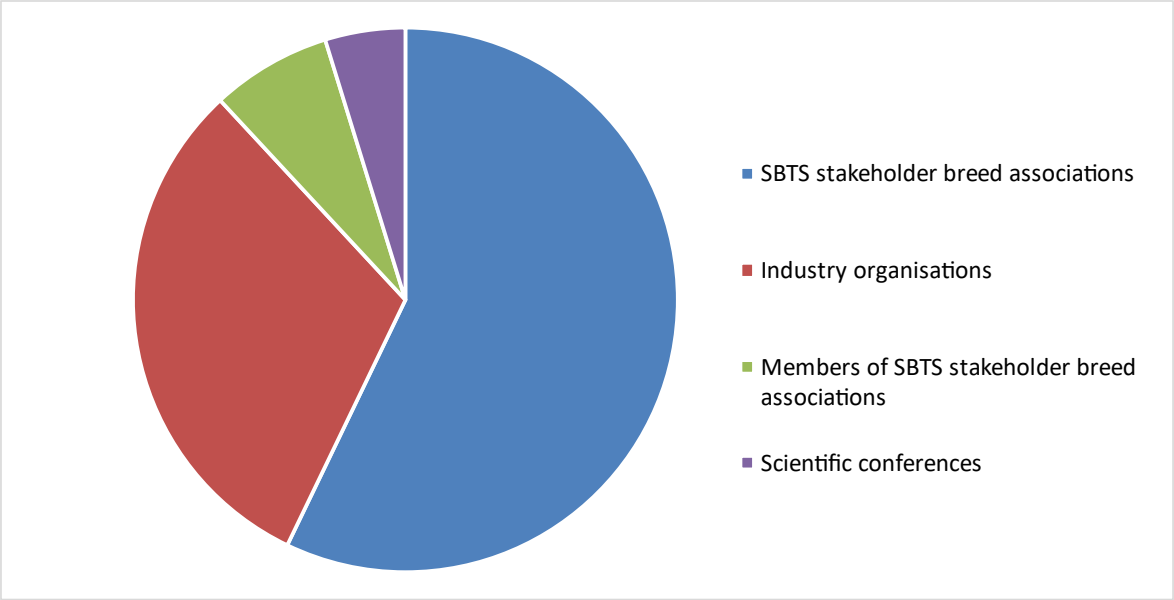

Figure 8. SBTS personnel presented at 42 industry events over the duration of the project. These events were organised by a range of different organisations, which fell into four broad groups.

Table 13. SBTS personnel presented at nine industry webinars over the duration of the project. These were organised by the Red Angus Society of Australia, NSW LLS and the Australian Wagyu Association.

Organisation	Webinar Topic	No. Attended	Post-Webinar Views[A]
RAS	GeneProb & Genetic Conditions	15	N/A
RAS	BREEDPLAN	12	N/A
NSW LLS	Breeding for Efficiency	55	165
AWA	The new Wagyu Breeder $Index webinar	90	212
AWA	Genetic Diversity Initiatives	59	120
AWA	Data to EBVs (Part 1)	52	120
AWA	Data to EBVs (Part 2)	44	71
AWA	Website and Wagyu Portal	24	47
AWA	Wagyu trends and genetic impact	55	120
	TOTAL	**406**	**855**

[A] As at 30 June 2021.

4.2.5 Attendance at industry events

SBTS personnel attended 49 industry events over the duration of the project. The majority (88%) of these were beef industry events attended by beef producers, while the remainder were scientific conferences attended by researchers (12%).

The COVID-19 outbreak had a surprising impact on the ability of SBTS project personnel to attend industry events. While the number of in-person events that SBTS personnel attended in the fourth

and fifth years of the project was reduced (Table 14), the number of industry events that SBTS personnel attended increased dramatically when compared to previous project years (Table 14). This was due to a number of industry organisations offering online events, either as webinars or online conferences.

While online events offered the advantage of allowing SBTS personnel to keep up to date on developments and research relevant to the beef industry (without the need to travel), one limitation was the reduced ability to develop and maintain strong professional relationships with beef producers and other industry personnel in attendance. Instead, professional relationships were maintained via attendance at in-person events; the opportunities to attend these types of events in the fourth and fifth years of the SBTS project were severely limited due to the COVID-19 outbreak.

Table 14. SBTS project personnel attended 49 industry events over the duration of the project.

Project Year	No. Industry Events Attended In-Person	No. Industry Events Attended Online	Total No. Industry Events Attended
Year 1	6	0	6
Year 2	5	0	5
Year 3	3	0	3
Year 4	6	12	18
Year 5	2	15	17
TOTAL	**22**	**27**	**49**

4.2.6 SBTS & TBTS Update magazines

Ten editions of the SBTS & TBTS Update magazine, containing 149 articles (average 15 articles per magazine) were published over the duration of the project (Table 15). A combined 44,507 copies (average 4,451 copies per magazine) were distributed to members of SBTS and TBTS stakeholder breed associations and beef industry personnel (Table 15). This included a total 13,569 hard copies (average 1,357 hard copies per magazine) and a total 30,938 electronic copies (average 3,094 electronic copies per magazine; Table 15).

Table 15. Ten editions of the SBTS & TBTS Update magazine were published during the project.

SBTS & TBTS Update Edition	Publish Date	No. of Stories	No. Hard Copies	No. Electronic Copies	Total No. Copies
Winter 2016	September 2016	17	1,258	2,925	4,183
Summer 2016	February 2017	14	1,244	2,681	3,925
Winter 2017	August 2017	13	1,358	3,084	4,442
Summer 2017	March 2018	10	1,465	3,096	4,561
Winter 2018	July 2018	19	1,416	3,365	4,781
Summer 2018	March 2019	14	1,370	3,030	4,400
Winter 2019	September 2019	16	1,450	3,303	4,753
Autumn 2020	February 2020	13	1,458	3,039	4,497
Spring 2020	September 2020	15	1,256	3,230	4,486
Autumn 2021	March 2021	18	1,294	3,185	4,479
AVERAGE		**15**	**1,357**	**3,094**	**4,451**
TOTAL		**149**	**13,569**	**30,983**	**44,507**

Averaged across all ten editions, 37% of the entire audience opened the electronic versions of the SBTS & TBTS Update magazine. Very similar results were obtained when considering members of SBTS stakeholder breed associations only; on average, 37% of this audience also opened the electronic versions of the SBTS & TBTS Update magazine. Interestingly, no significant difference in open rate was observed between BREEDPLAN members and non-BREEDPLAN members of SBTS stakeholder breed associations (37% versus 38% respectively). Pleasingly, this appears to indicate that the SBTS & TBTS Update magazine content was of interest to a wide range of seedstock producers, regardless of whether they were actively submitting performance data to BREEPDLAN.

The top ten most popular articles (by unique electronic 'reads') covered a wide range of cattle breeding and genetics topics (Table 16). With no clear pattern in article types revealed by the top ten most popular articles, this highlights the importance of the SBTS and TBTS projects covering a variety of topics in the SBTS & TBTS Update magazines. Furthermore, the top ten most popular articles were from all but one of the ten SBTS & TBTS Update magazine editions (Table 16), with only 15% front page stories. This indicates that individuals who read the SBTS & TBTS Update Magazine are actively engaged and searching through the magazine for content of interest, rather than just opening the first article they see and ignoring the rest.

Table 16. The top ten most popular articles (by unique electronic 'reads') from the SBTS & TBTS Update magazines published over the duration of the project.

Most Popular Articles	SBTS & TBTS Update Edition	Article Title
1	Winter 2018	The Maternal Female: What Makes A Good Cow?
2	Spring 2020	Trans-Tasman Study Finds Half of *Bos taurus* Heifers Pre-Pubertal at Mating
3	Winter 2019	ET Flush Siblings Are Not Identical Twins
3	Autumn 2020	The Case for Genotyping Females
4	Summer 2016	An Introduction to Genomics
4	Autumn 2021	BREEDPLAN Top Tips: Understanding Milk EBVs
5	Winter 2016	Making Bull Selection Decisions for Heifer Matings
6	Autumn 2021	A Seedstock Producer's Perspective On: Breeding for Fertility
7	Autumn 2021	Genotyping the Keepers: It's All in the Timing
8	Summer 2017	Moving Towards SNP Parentage Verification
8	Spring 2020	A Seedstock Producer's Perspective On: Using BREEDPLAN in a Smaller Herd
9	Winter 2018	Performance Recording in Drought Conditions
10	Winter 2017	Alex McDonald Steps Down

Since 2019, SBTS personnel have been actively sharing individual stories that had been published in the SBTS & TBTS Update magazine via the SBTS & TBTS social media platforms (Section 3.2.8). This led to an increase in the percentage of SBTS & TBTS Facebook posts that included SBTS & TBTS Update magazine content; from just 3% of posts in the first year of the project to 16% of posts in the fifth year of the project (Table 17). An additional advantage of sharing individual stories from the SBTS & TBTS Update magazine on social media is that this gives the individual articles more exposure, and thus makes it more likely for SBTS stakeholder breed associations and/or individual

seedstock producers to share the articles within their own social media networks. Individual articles can also be re-shared via social media at appropriate times (e.g. bull sale season).

All previous editions of the SBTS & TBTS Update magazine, including those published in this iteration of the SBTS project, can be accessed via the SBTS website: http://sbts.une.edu.au/seedstock-breeding-better-cattle/resources/sbts-tbts-updates/.

Table 17. The percentage of SBTS & TBTS Facebook account posts that referenced material from the SBTS & TBTS Update magazines.

Project Year	Percentage (%) of SBTS & TBTS Facebook Account Posts Referencing SBTS & TBTS Update Magazine Content
Year 1	3%
Year 2	4%
Year 3	9%
Year 4	14%
Year 5	16%
AVERAGE	**10%**

4.2.7 Articles for SBTS stakeholder breed association publications

The SBTS project prepared a total of 143 articles (average 28.6 articles per project year) for stakeholder breed associations over the duration of the project. The total number of articles prepared by project year is shown in Table 18.

These 143 articles covered a wide variety of cattle breeding and genetics topics, which included:

- Collection of performance data for the BREEDPLAN analysis.
- Benchmarking the levels of performance recording for BREEDPLAN within the breed.
- BreedObject Selection Indexes, including both how these could be utilised in animal selection and explanations to assist with the understanding of new version 6 BreedObject Selection Indexes.
- Breeding objectives (e.g. MSA compliance, heifer bulls and maternal females).
- Genomics, including introductions to Single-Step BREEDPLAN, selection of animals for genotyping and case studies outlining the impacts of genomics within a breed.

Table 18. Articles on a wide range of cattle breeding and genetics topics were prepared for SBTS stakeholder breed associations over the duration of the project.

Time Period	No. of Articles Prepared
1 July 2016 - 30 June 2017	12
1 July 2017 - 30 June 2018	36
1 July 2018 - 30 June 2019	37
1 July 2019 - 30 June 2020	20
1 July 2020 - 30 June 2021	38
TOTAL	**143**

4.2.8 Social media

4.2.8.1 SBTS & TBTS Facebook account

The number of individuals who engaged with the SBTS & TBTS Facebook page grew substantially over the duration of the project. This is shown by the increase in "page likes", which rose from 429 at the start of the project (1 July 2016) to 860 at the conclusion of the project (30 June 2021). This equates to a two-fold increase in the number of "page likes" over the five year project.

There were 359 posts on the SBTS & TBTS Facebook page over the five years of the project, which equates to one post every 5.1 days (Table 19). Given SBTS project personnel had a working week of five days, this equates to an average of one post per working week. A full breakdown of posts on the SBTS & TBTS Facebook page by project year is provided in Table 19.

Table 19. The number of posts on the SBTS & TBTS Facebook account and the average number of days between these posts, is shown for the overall project and by each project year.

Project Year	Total No. of Facebook Posts	Average No. of Days Between Posts
Year 1	60	6.1
Year 2	56	6.5
Year 3	100	3.7
Year 4	64	5.7
Year 5	79	4.6
TOTAL	**359**	**5.1**

4.2.8.2 SBTS & TBTS Twitter account

In a similar manner to that seen for the SBTS & TBTS Facebook account (Section 4.2.8.1), the number of individuals who engaged with the SBTS & TBTS Twitter account also grew over the duration of the project. This is shown by the increase in account "followers"; these rose from 203 at the start of the project (1 July 2016) to 341 at the conclusion of the project (30 June 2021). This equates to a 1.7-fold increase in the number of Twitter "followers" over the five year project.

There were 309 "tweets" on the SBTS & TBTS Twitter account over the five years of the project, which equates to one "tweet" every 5.9 days (Table 20). A full breakdown of activity on the SBTS & TBTS Twitter account by project year is provided in Table 20.

Table 20. The number of "tweets" on the SBTS & TBTS Twitter account and the average number of days between these, is shown for the overall project and by each project year.

Project Year	Total No. of "Tweets"	Average No. of Days Between "Tweets"
Year 1	66	5.5
Year 2	49	7.4
Year 3	70	5.2
Year 4	62	5.9
Year 5	62	5.9
TOTAL	**309**	**5.9**

4.2.8.3 SBTS & TBTS YouTube channel

A total of 30 new videos were published on the SBTS & TBTS YouTube channel over the duration of the project (Table 21). These included both recording of SBTS & TBTS webinars (Section 4.2.3) and specifically developed short e-media videos such as the 'Recording for BREEDPLAN' video series (Section 4.2.10.3). With a number of videos from previous project iterations already published on the SBTS & TBTS YouTube channel, the publication of these 30 videos took the total number of videos on the SBTS & TBTS YouTube channel developed by the two projects to 71. A further three playlists, which contained content developed by external organisations, were also created over the duration of the project (Table 22). These included 16 videos created by MLA as part of the MLA Genetics Campaign, and a webinar recording delivered by SBTS project personnel for NSW Local Land Services (Table 22).

Table 21. The number of views, watch time (hours) and videos published on the SBTS & TBTS YouTube channel is shown for the overall project and by each project year.

Project Year	Total Views	Watch Time (hours)	No. Videos Published
Year 1	4,176	405.8	6
Year 2	3,471	246.5	0
Year 3	2,741	202.3	2
Year 4	2,841	196.9	1
Year 5	6,290	334.0	21
TOTAL	**19,519**	**1,385.5**	**30**

Table 22. The SBTS & TBTS YouTube channel had three playlists which contained 17 videos developed by external organisations.

Playlist	No. Videos	External Organisation
MLA Genetics Campaign - Temperate Cattle	13[A]	MLA
MLA Genetics Campaign - Tropical Cattle	13[A]	MLA
High Steaks: Using Performance Data in Breeding Decisions	1	NSW Local Land Services

[A] Ten videos were published in both playlists as they were applicable for both tropical and temperate cattle producers.

The 71 videos on the SBTS & TBTS YouTube channel were viewed a total of 19,519 times over the duration of the five-year project (Table 21). These 19,519 views equated to 1,385.5 hours of watch time (Table 21). Interestingly, the way in which individuals viewed the SBTS & TBTS YouTube channel content has changed over the duration of the project. The use of mobile phones to view the SBTS & TBTS YouTube channel content has increased over the project; accounting for just 16% of total views in the first project year to 38% of total views in the final project year (Fig. 9). At the same time, the use of computers to view the SBTS & TBTS YouTube channel content has decreased, from 76% of total views in the first project year to 53% in the final project year (Fig. 9). While these trends likely reflect changes to the way in which individuals are choosing to engage with social media content, the increased use of mobile devices to observe e-media content on the SBTS & TBTS YouTube

channel goes some way to validating the decision by the SBTS project team to concentrate efforts on the production of shorter e-media content (Section 3.2.10.3).

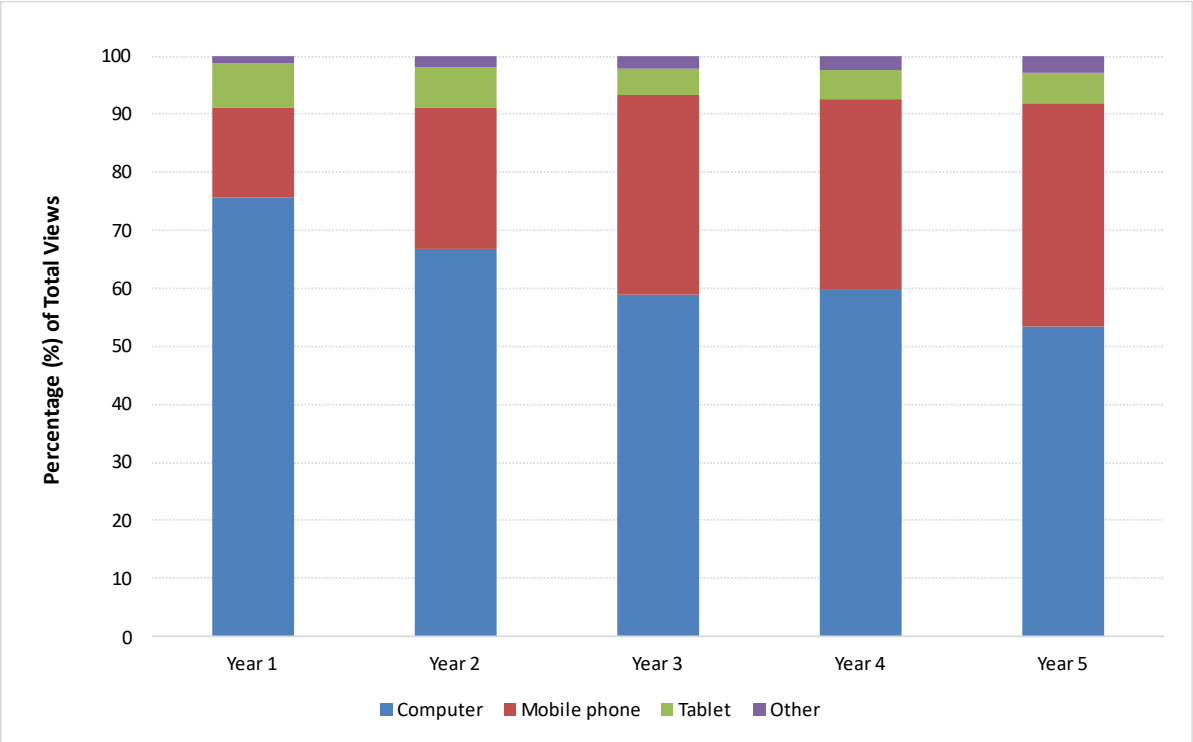

Figure 9. The percentage (%) of total views of the SBTS & TBTS YouTube channel by device type for each year of the project.

The number of individuals who subscribed to the SBTS & TBTS YouTube Channel increased four-fold over the duration of project, from 57 at the start of the project (1 July 2016) to 228 at the conclusion of the project (30 June 2021; Fig. 10). The rise in new subscribers was tracking along steadily between the start of the project and the conclusion of the fourth project year (30 June 2020); however, the number of new subscribers in the final year of the project was double that seen in previous years (Fig. 10). This may reflect the dramatic increase in published content and/or the move to shorter, more accessible videos on the SBTS & TBTS YouTube channel during this time (Table 21).

4.2.8.4 BREEDPLAN Discussion Group

Since the launch of the BREEDPLAN Discussion Group on 24 May 2018 membership has grown steadily, with 775 members at the conclusion of the project (30 June 2021). The majority (61%) of members are male, with 38% female and 1% other. Ages range from between 13-17 years to over 65 years. A full breakdown of BREEDPLAN Discussion Group members by age and gender is shown in Fig. 11. Members of the BREEDPLAN Discussion Group are located in ten different countries, with 81% located in Australia (Fig. 12).

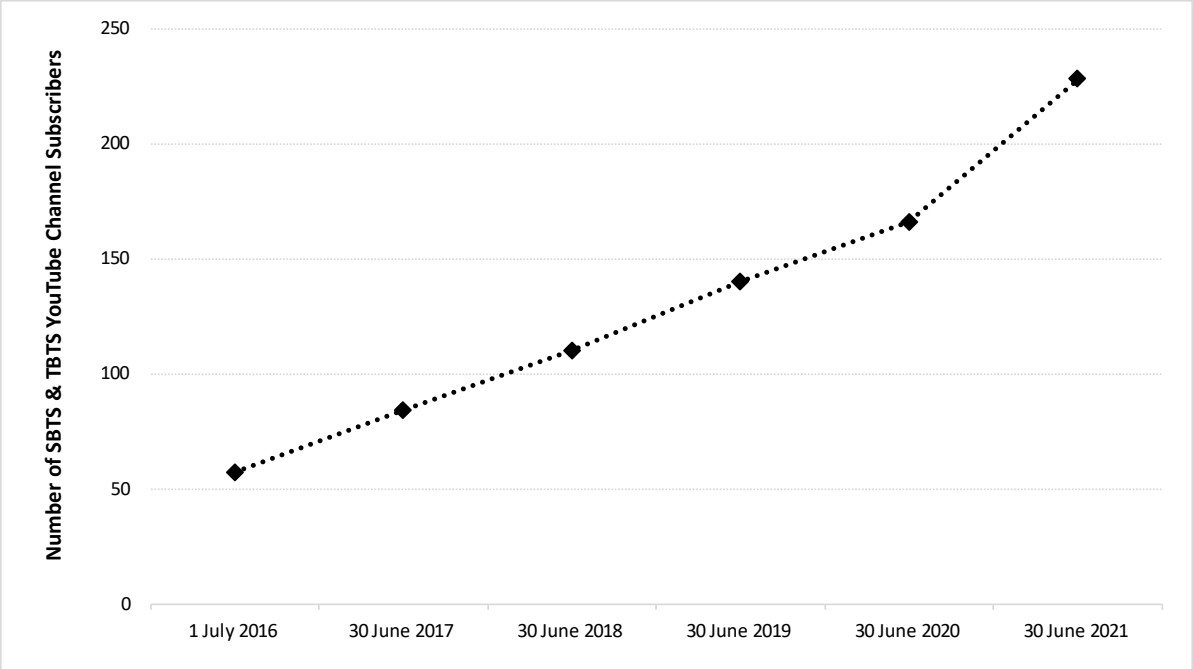

Figure 10. The number of SBTS & TBTS YouTube channel subscribers across the duration of the SBTS project.

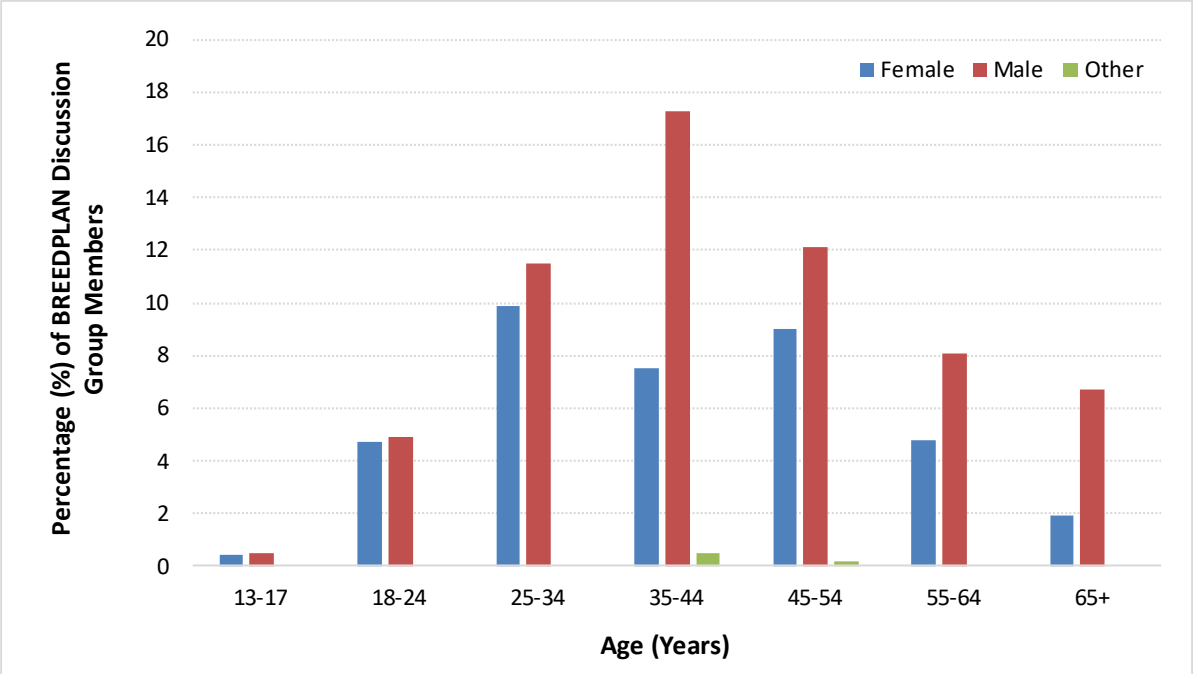

Figure 11. The percentage (%) of BREEDPLAN Discussion Group members by age range and gender.

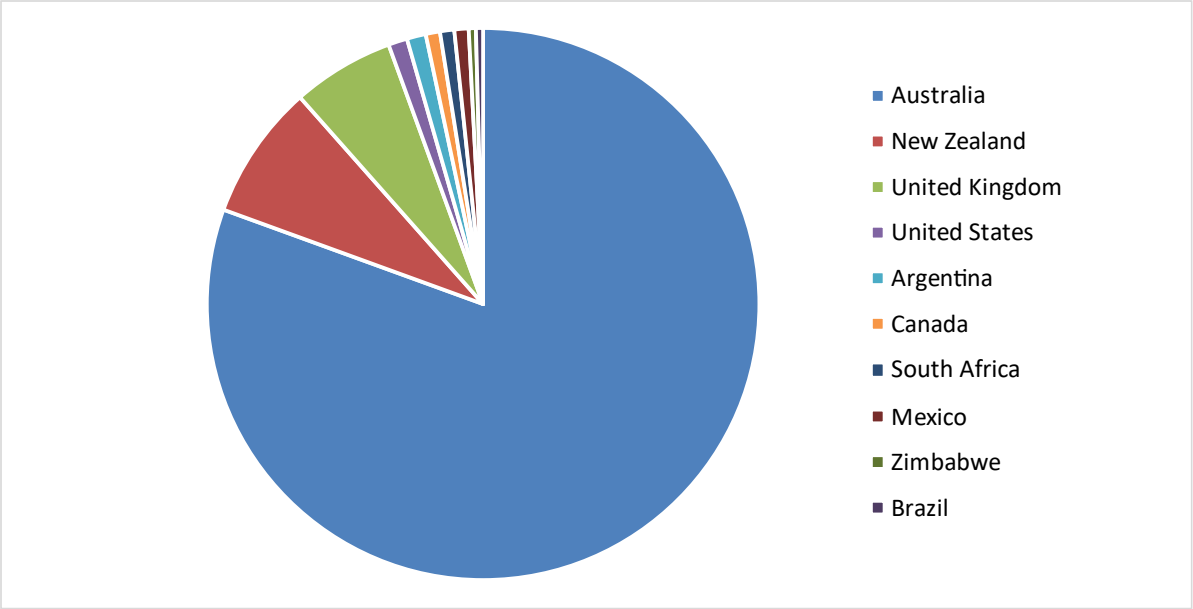

Figure 12. Members of the BREEDPLAN Discussion Group were located in a range of countries.

4.2.9 Herd consultations

SBTS project personnel conducted 205 herd consultations over the duration of the project (Table 23), of which 146 were conducted as part of the SBTS & TBTS regional forums (Section 4.2.1). These 205 herd consultations involved herds located across the country (Fig. 13). With the onset of COVID-19 in early 2020, the SBTS project team's ability to offer herd consultations via on-property visits was severely constrained. While the SBTS project team transitioned to conducting herd consultations via video conferencing platforms, this change in delivery method did impact on the number of herd consultations that could be delivered. As shown in Table 23, only 16 herd consultations were conducted in the final year of the project, compared to around 40 in the preceding years.

Table 23. The number of herd consultations that were conducted, and offered but declined, is shown for the overall project and by each project year.

Project Year	No. of Herd Consultations Conducted	No. of Herds That Declined Consultations
Year 1	62	6
Year 2	42	5
Year 3	41	1
Year 4	44	0
Year 5[A]	16	3
TOTAL	**205**	**15**

[A] Due to COVID-19 travel restrictions, all herd consultations undertaken in the fifth year of the SBTS project were conducted via video conferencing platforms.

A further 15 herds were offered a herd consultation but declined (Table 23). Of these 15 herds, 54% were interested in a herd consultation but were unavailable on the day that it was scheduled. The remainder were either not interested in a herd consultation (20%) or did not respond to the offer despite multiple attempts to contact them (26%).

A full breakdown of the number of herd consultations offered to and conducted for members of each SBTS stakeholder breed association is shown in Appendix 4.

Figure 13. Location of the 205 herds that had a herd consultation conducted over the SBTS project.

Map created using Google My Maps (https://www.google.com.au/maps/about/mymaps/).

4.2.10 Maintenance and expansion of extension material

4.2.10.1 Websites

New websites for the SBTS and TBTS projects were released on 30 November 2018. Whilst this release took place partway through the SBTS project, SBTS personnel had spent many hours in the lead up to these website releases working on this website redevelopment.

A Google Analytics account (created in August 2019; https://analytics.google.com) revealed that, from August 2019 to June 2021, there were 1,347 active users of and 2,316 sessions on the SBTS website. The majority (66%) of SBTS website users accessed content via desktop, the remainder used either mobile (29%) or tablet (5%) devices. 67% of those using the SBTS project website were based in Australia; the remaining one-third of SBTS project website users were from a variety of continents (Fig. 14).

Google Analytics also revealed that there had been 4,540 page views of the SBTS website from August 2019 to June 2021. Just over half of these views (53%) were of the home page; the next most utilised sections were those containing seedstock producer resources (22%) and SBTS technical officer contact details (11%; Fig. 15). It should be noted that a number of web pages in both the seedstock producer and commercial producer sections of the SBTS website redirected to external websites (namely the SBTS & TBTS YouTube channel (Section 4.2.8.3), the BREEDPLAN website and

the MLA Genetics Campaign website (Section 4.5.3)); as such, views for these pages could not be tracked.

A new version of the BREEDPLAN website was released on 23 June 2020; SBTS personnel had assisted both with the technical content and its layout.

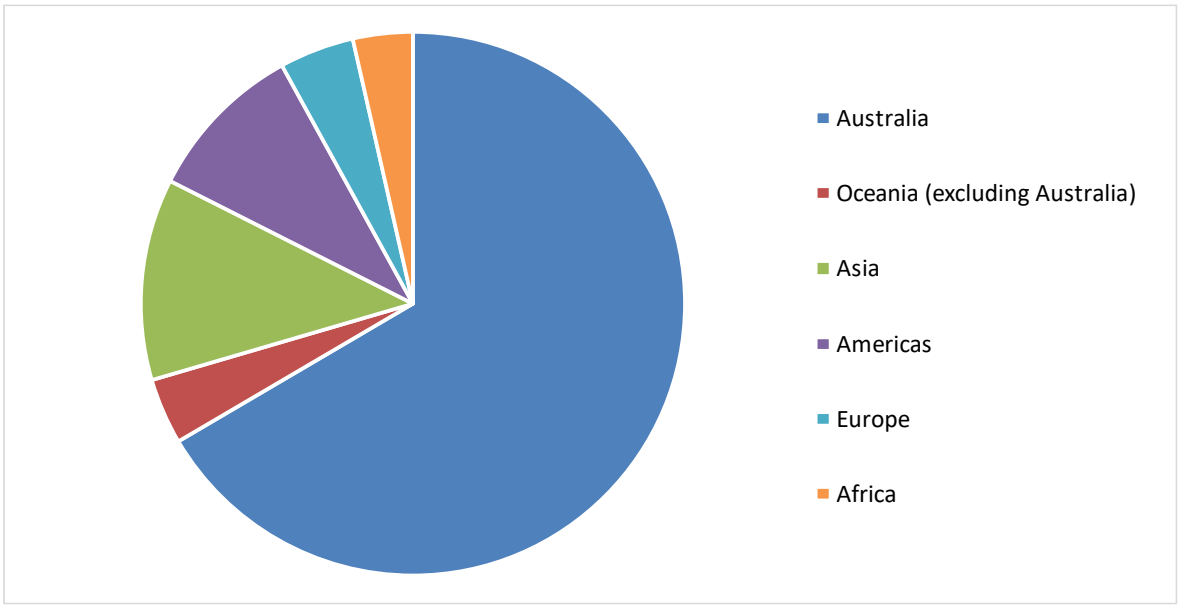

Figure 14. Those using the SBTS project website (from August 2019 to June 2021) were located across a range of continents.

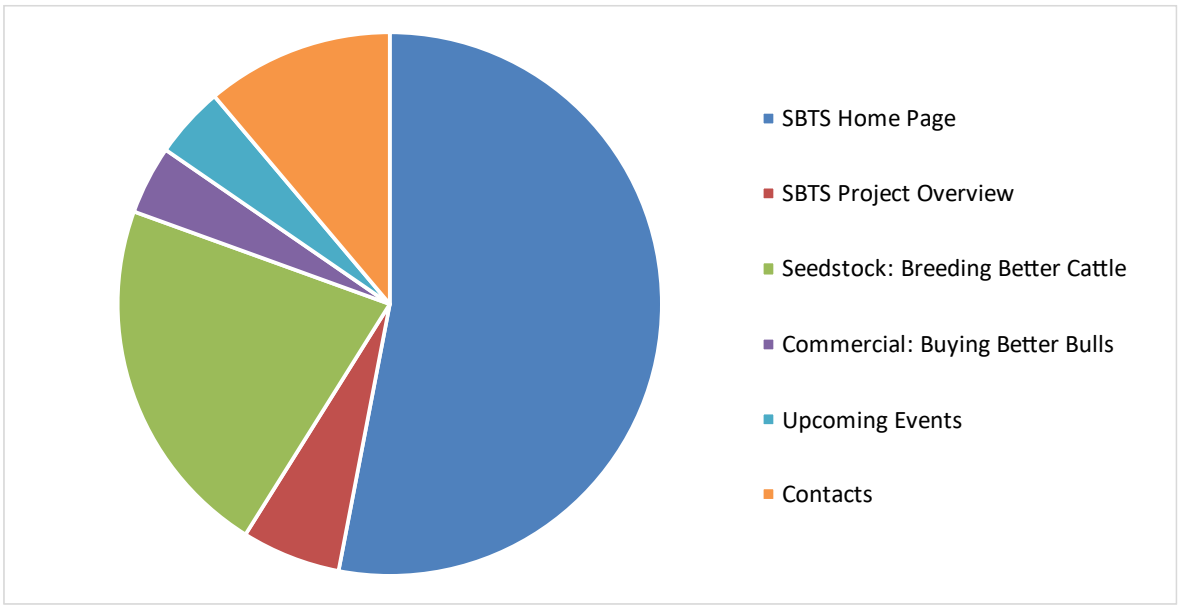

Figure 15. All SBTS project website sections were viewed in the 4,540 website views (from August 2019 to June 2021).

4.2.10.2 Written documentation

A variety of written documentation was created and/or maintained throughout the duration of the SBTS project. This included:

- *SBTS & TBTS Technical Notes*

  Seventeen new SBTS & TBTS Technical Notes (Table 24) were developed over the duration of the SBTS project, bringing the number of available SBTS & TBTS Technical Notes to 32. In addition, the 15 existing SBTS & TBTS Technical Notes (developed in prior iterations of the SBTS project), were reviewed and updated into a new format during the first year of the SBTS project. One of these ('Searching for Genetics Online') was further updated in the fifth year of the SBTS project to reflect additional changes to this process. All 32 of the available SBTS & TBTS Technical Notes can be accessed via the SBTS project website: http://sbts.une.edu.au/seedstock-breeding-better-cattle/resources/technical-notes/.

Table 24. 17 new SBTS & TBTS Technical Notes were developed over the duration of the project.

SBTS & TBTS Technical Note Title	Publication Date
An Introduction to Genomics	December 2016
Do Estimated Breeding Values (EBVs) Really Work?	December 2016
Identifying Curve Bender Animals	March 2018
Importance of Recording the Performance of Your Cattle	March 2018
Making Bull Selection Decisions For Heifer Matings	March 2018
Meat Standards Australia: Breeding for Improved MSA Compliance and Increased MSA Index Values	March 2018
Moving Towards SNP Parentage Verification	March 2018
Performance Recording For Small Herds	March 2018
Scan Data for Heifers is Valuable	March 2018
The Importance of Whole Herd Recording	March 2018
Where Does This Animal Rank? Introducing the EBV Percentile Graph	March 2018
The Maternal Female What Makes A Good Cow	July 2018
ET Flush Siblings Are Not Identical Twins	September 2019
Breeding For Production System Efficiency	February 2020
Re Building Herds After Adversity	February 2020
The Case For Genotyping Females	February 2020
Breeding For Environmental Efficiency	September 2020

- *'A Seedstock Producer's Perspective' Case Studies*

  Three versions of the 'A Seedstock Producer's Perspective' case studies were created during the current iteration of the SBTS project (Table 25). All three versions can be accessed via the SBTS project website: http://sbts.une.edu.au/seedstock-breeding-better-cattle/resources/technical-notes/.

Table 25. The 'A Seedstock Producer's Perspective' articles were a new innovative for the SBTS project developed in 2020. Three of these were published during the SBTS project.

'A Seedstock Producer's Perspective' Articles	Publication Date
Using MateSel	February 2020
Using BREEDPLAN In A Smaller Herd	September 2020
Breeding for Fertility	March 2021

- *BREEDPLAN Documentation*

The SBTS team assisted with the development of eight new BREEDPLAN tip sheets over the duration of the SBTS project (Table 26). The majority of these new BREEDPLAN tip sheets related to the collection of performance data, particularly for newer BREEDPLAN traits.

The SBTS team also assisted with a review of BREEDPLAN tip sheets in the fourth and fifth years of the SBTS project; 83 BREEDPLAN tip sheets were reviewed and updated into a new format as part of this process. While many of the changes made to BREEDPLAN tip sheets in this review were minor, the review process also included a major restructure of BREEDPLAN tip sheets that presented technical content relating to BreedObject Selection Indexes. Two of these, 'An Introduction to Selection Indexes' and 'A BREEDPLAN Guide to Animal Selection' were totally reworked. In addition, each breed specific BreedObject Selection Indexes tip sheet was split into two new breed specific tip sheets. The first of these, 'Using Breed-Specific Selection Indexes', provided seedstock producers and their commercial clients with a reference guide to assist in the identification and use of the most relevant BreedObject Selection Index for their production system(s). The second, 'Breed-Specific Selection Indexes: Technical Specifications' was designed for seedstock producers who wished to gain a deeper understanding of the technical specifications for each available BreedObject Selection Index. The review process for the BreedObject Selection Index tip sheets was a major undertaking for SBTS project personnel.

All BREEDPLAN tip sheets can be accessed via the Help Centre on the BREEDPLAN website: https://breedplan.une.edu.au/help-centre/

Table 26. The SBTS project team assisted with the development of eight new BREEDPLAN tip sheets over the duration of the project.

'A Seedstock Producer's Perspective' Articles	Publication Date
Collecting Abattoir Carcase Information	July 2016
Collecting Feed Intake Information for BREEDPLAN for Post Weaning and Finishing Tests	December 2016
Maximising Genetic Improvement in a Seedstock Beef Breeding Enterprise	December 2016
Recording Buffalo Fly Lesion Scores	February 2017
Recording Coat Scores	February 2017
Recording Tick Resistance Scores	February 2017
Understanding Percent Normal Sperm EBVs	September 2020
Recording Structural Soundness Information	October 2020

The written documentation created and/or maintained throughout the duration of the SBTS project was used for a number of different extension activities. In addition to electronic copies, which were available for beef producers and industry personnel to access via the relevant website, hard copies were used as handouts at a variety of extension events. These included Regional Forums (Section 4.2.1), BullSELECT workshops (Section 4.2.2), industry events where SBTS personnel presented (Section 4.2.4) or attended (Section 4.2.5), and herd consultations (Section 4.2.9). Written documentation was also regularly used to provide technical support and advice, both for SBTS stakeholder breed associations (Section 4.3.1) and their beef producer members (Section 4.3.2). They remain an effective method for disseminating technical information and extension messaging to a wide audience.

4.2.10.3 E-media (videos)

In addition to seven webinars (Section 4.2.3), recordings of which were made available via the SBTS & TBTS YouTube channel (Section 4.2.8.3), 23 short videos were recorded during the SBTS project (Table 27). These 23 short videos ranged from 0:32 to 11:35 minutes in length (average length 4:46 minutes), and together represent a total 109:50 minutes of video footage.

The short videos created over the duration of the SBTS project were utilised in a number of ways. While all were made available for viewing via the SBTS & TBTS YouTube channel (Section 4.2.8.3), where they have been viewed a combined total of 4,032 times (average 175 views per video; Table 27), most were also used in various other capacities. The 19 'Recording for BREEDPLAN' videos were specifically developed to complement the written BREEDPLAN tip sheet documentation (Section 4.2.10.2). They were shared via the social media channels (Section 4.2.8), the BREEDPLAN website (Section 4.2.10.1) and also utilised at industry events, such as Beef Australia 2021, that were attended by members of the SBTS project team (Section 4.2.5).

The 'Introducing Southern (SBTS) & Tropical (TBTS) Beef Technology Services' short video was also used at industry events attended by members of the SBTS project team (Section 4.2.5); it was also utilised on both the SBTS and TBTS project websites (Section 4.2.10.1) and combined social media channels (Section 4.2.8). Finally, the 'A BREEDPLAN Guide to Animal Selection Promo' video was specifically developed to advertise the 'BREEDPLAN Guide to Animal Selection' tip sheet (Section 4.2.10.2) to a seedstock and commercial beef producer audience via social media and was shared on the combined SBTS and TBTS social media channels (Section 4.2.8). With short videos used in a number of ways across the SBTS project, their value as an extension tool is apparent. Short videos can be utilised to successfully promote extension messaging to a varied audience.

The combined average view duration for these 23 short videos is 48% (Table 27). When compared to the combined average view duration of the seven webinars (15%; Section 4.2.3), it is clear that those viewing the SBTS & TBTS e-media content are more engaged with shorter videos. This further validates the decision by the SBTS project team to concentrate efforts on the production of shorter e-media content. However, it should be noted that there is still a large spread in the average view duration for these 23 short videos; from 24% to 87% (Table 27). With the two shortest videos having a much higher average view duration that the two longest videos (combined average view duration of 79% versus 27%, respectively), it is clear that the length of short videos should remain a key consideration in the development of these as future extension resources, to ensure that target audience engagement is maximised.

Table 27. In addition to seven recorded webinars, 23 short videos were developed as e-media resources over the duration of the SBTS project.

Video Title	First Published	Video Duration (minutes)	YouTube Views[A]	Average View Duration (%)
Understanding BREEDPLAN Completeness of Performance	September 2018	11:04	272	24%
Improving Your Completeness of Performance Star Rating	September 2018	11:35	106	30%
Introducing Southern (SBTS) & Tropical (TBTS) Beef Technology Services	May 2020	0:50	401	72%
Recording Data for BREEDPLAN	August 2020	4:29	448	47%
Recording Post-Birth Management Groups	August 2020	6:22	76	39%
Recording Calving Difficulty Scores	August 2020	3:56	235	54%
Recording Birth Weights	August 2020	3:29	432	59%
Recording Performance Data from Pregnant Heifers	August 2020	3:34	145	55%
Recording Weights	August 2020	6:15	169	48%
Recording Birth Management Groups	August 2020	4:34	155	39%
Recording Scrotal Circumference Measurements	August 2020	3:46	710	36%
Recording Ultrasound Scan Data	August 2020	6:06	189	47%
Recording Gestation Length Data	August 2020	2:20	156	62%
Submitting Performance Data to BREEDPLAN	August 2020	5:48	153	41%
Recording Data for Milk EBVs	August 2020	4:16	196	55%
Recording Docility Scores	June 2021	5:21	26	57%
Recording Coat Scores	June 2021	3:15	16	25%
Recording Buffalo Fly Lesion Scores	June 2021	4:00	11	30%
Recording Tick Scores	June 2021	3:50	11	46%
Recording Mature Cow Weights	June 2021	5:51	48	50%
Recording Flight Time	June 2021	4:20	16	52%
Recording Structural Soundness Information	June 2021	4:17	33	44%
A BREEDPLAN Guide to Animal Selection Promo	June 2021	0:32	28	87%
AVERAGE		**4:46**	**175**	**48%**
TOTAL		**109:50**	**4,032**	**N/A**

[A] As at 30 June 2021.

4.3 Technical advancement and support

With SBTS project personnel having provided a range of technical support and advice to stakeholder breed associations and their members over the life of the project, objective three of the SBTS project

has been successfully achieved. As outlined below, a range of new genetic improvement technologies have been implemented for SBTS stakeholder breed associations over the duration of the project, and the SBTS project has supported the rollout of these whilst also providing support for existing genetic improvement technologies.

4.3.1 Technical advancement and support for SBTS stakeholder breed associations

SBTS project personnel provided a range of technical advice and support to SBTS stakeholder breed associations over the duration of the project. General support provided to all SBTS stakeholder breed associations included:

- Representation of SBTS stakeholder breed associations at quarterly BTLG meetings. These took place until the fifth year of the SBTS project, with SBTS personnel attending 15 BTLG meetings.
- Review of preliminary results from BREEDPLAN analyses for SBTS stakeholder breed associations and provision of associated permission to release the results on their behalf.
- General liaison and advice with staff, technical committees and boards of SBTS stakeholder breed associations. This included attendance at approximately 60 board and/or technical committee meetings over the duration of the project. SBTS personnel regularly provided technical papers and/or presentations at these meetings, in addition to general advice.
- Compilation of 143 technical articles for SBTS stakeholder breed association publications (Section 4.2.7).

More specific technical advice and support provided to SBTS stakeholder breed associations over the duration of the project is described below.

Support and advice regarding upgrades to the stakeholder breed association BREEDPLAN analyses.

SBTS personnel provided support to a number of stakeholder breed associations as they received upgrades to their BREEDPLAN analyses over the duration of the project. Specifically, this included:

- Providing support to three stakeholder breed associations as they transitioned to the newer generation of ABRI's breed registry software, known as ILR2. The new software included several new features, including the running of monthly BREEDPLAN analyses, production of enhanced BREEDPLAN reports and access to the mating optimisation tool MateSel.
- Providing support and assistance to a number of stakeholder breed associations as revised analytical software and/or parameters were implemented for their BREEDPLAN analyses.
- Providing support and assistance to a stakeholder breed association as it transitioned from a partial crossbred BREEDPLAN analysis to a full crossbred BREEDPLAN analysis.
- Providing support and assistance to a number of stakeholder breed associations as foreign genetic evaluation results were imported into their BREEDPLAN analysis.

SBTS personnel also worked with BREEDPLAN staff to provide advice on the reportability of EBVs, including reporting additional BREEDPLAN EBVs (i.e. new traits). Where data recording was not sufficient to switch on a new trait, SBTS personnel provided advice on how the stakeholder breed association could collect additional performance information for the relevant trait. This included providing information that could be disseminated out to members to encourage trait recording.

Support and advice in utilisation of DNA technologies.

SBTS personnel provided technical advice and support on the utilisation of DNA technologies to a number of stakeholder breed associations over the duration of the project. This advice covered the three main applications of DNA technology in cattle breeding: parentage verification, management of qualitative traits and genetic conditions and the use of genomics information in the BREEDPLAN analysis (i.e. Single-Step BREEDPLAN).

As many SBTS stakeholder breed associations were transitioning from microsatellite technologies to Single Nucleotide Polymorphism (SNP) technologies, SBTS personnel attended a number of meetings with SBTS stakeholder breed associations and DNA service providers (e.g. Neogen, Zoetis). This allowed SBTS personnel to provide advice on 'bundle' test options for SBTS stakeholder breed association members (i.e. SNP genotype panels that covered parentage, qualitative traits and/or genetic conditions, and would be suitable for genomics), as these would have multiple applications for cattle producers whilst also allowing stakeholder breed associations to prepare for the genomics era.

To assist SBTS stakeholder breed associations as they prepared for genomics, SBTS personnel, in conjunction with AGBU staff, provided a detailed explanatory document for all stakeholder breed associations. In addition, SBTS personnel worked in a one-on-one capacity to provide tailored advice to individual stakeholder breed associations. This advice often focused on how to build a reference population (animals with both genotypes and phenotypes), and, once that reference population was in existence, how to maintain it into the future. Thus, breed-specific advice provided by SBTS personnel to stakeholder breed associations included genotyping strategies to increase the number of animals with genotypes, and assistance in prioritising animals for genotyping. Strategies to increase the number of animals with phenotypes, including considerations for society run progeny test programs, were also discussed with several stakeholder breed associations.

Finally, SBTS personnel provided support and advice to a number of stakeholder breed associations in relation to managing qualitative traits and/or genetic conditions. In addition to providing general advice, SBTS personnel also provided breed-specific advice on management (e.g. testing) and elimination (where possible) strategies.

Support of and advice on additional ABRI products relating to genetic improvement.

SBTS personnel provided technical advice and support on the implementation and use of additional ABRI products that related to genetic improvement, including the Completeness of Performance product, GeneProb and MateSel. This included providing stakeholder breed associations with assistance in interpreting and disseminating results to members.

Support and development of BreedObject Selection Indexes.

SBTS personnel provided significant support and assistance to a number of SBTS stakeholder breed associations in regard to their BreedObject Selection Indexes throughout the duration of the project

Following the introduction of version 6 BreedObject software in late 2016, SBTS personnel spent a considerable amount of time testing the software to develop an understanding of how it might be utilised across different production environments. This included collating necessary background information that is applicable across a range of Australian production systems and breeds.

Three stakeholder breed associations implemented version 6.2 BreedObject selection indexes during the SBTS project; these were the Australian Limousin Breeders' Society, the Australian Wagyu

Association and Herefords Australia. SBTS personnel provided assistance to these societies in the development phase and in extension messaging. Specifically, this included:

- Providing support to the Australian Limousin Breeders' Society before, during and after the release of their four (later three) new BreedObject selection indexes in November 2020. SBTS personnel attended meetings prior to the release to discuss the development and implementation of these new Selection Indexes. SBTS personnel also provided technical documentation prior to and after the release of the new Selection Indexes, including articles for Australian Limousin Breeders' Society publications and a BREEDPLAN tip sheet.
- Providing support to the Australian Wagyu Association before, during and following the release of their new BreedObject selection indexes. The Australian Wagyu Association first released three new version 6 BreedObject selection indexes in September 2018; a fourth selection index was subsequently released in June 2020. SBTS personnel have provided support in the form of written documentation, assistance in developing a webinar for members and fielding member queries.
- Providing support to Herefords Australia before, during and following the implementation of their new BreedObject selection indexes. Herefords Australia first released four new BreedObject version 6 selection indexes in September 2019. These were revised in October 2019. SBTS personnel attended meetings prior to the release, along with AGBU and Hereford Australia staff, to discuss the development and implementation of new selection indexes. SBTS personnel also attended several meetings with key breeders (as identified by Herefords Australia) prior to the release to gather producer feedback. SBTS personnel provided technical documentation in the form of articles for the Hereford newsletter, Hereford magazine and BREEDPLAN tip sheets, prior to and after the release of the new selection indexes.

In addition, SBTS personnel provided assistance with development of version 6 BreedObject selection indexes for the additional four SBTS stakeholder breed associations that have existing version 4 BreedObject selection indexes (Table 2). This involved attending meetings with technical committees and/or liaison with several breeders for each breed association over the duration of the project, which led to several iterations of BreedObject selection indexes being generated. At the conclusion of this SBTS project, draft BreedObject selection indexes remain under review for these breed associations.

4.3.2 Technical advancement and support for SBTS stakeholder breed association members

SBTS project personnel provided technical support and advice to members of SBTS stakeholder breed associations for the duration of the SBTS project. This technical support and advice included, but was not limited to:

- Support in understanding, interpreting and utilising BREEDPLAN EBVs.
- Support in understanding, interpreting and utilising BreedObject Selection Indexes.
- Provision of general advice on performance recording and assistance in assigning management groups in complex situations.
- Support in utilising the 'Internet Solutions' search facility and the tools available (e.g. the Mating Predictor).

- Provision of EBV diagnostics (e.g. explanation of why a particular animal had a particular EBV and/or why a particular EBV had changed between BREEDPLAN analyses). These enquiries had the potential to get quite complex and often took up a significant amount of time for the investigating SBTS Technical Officer. Some complex diagnostic enquiries also required the investigating SBTS Technical Officer to collaborate with BREEDPLAN and/or AGBU staff.
- Support in the interpretation of GeneProb results, and the provision of advice on how to use GeneProb results in mate selection. This also included discussions on management of genetic conditions, including how to best manage genetic conditions while making genetic gain in production traits.
- Assisting producers to understand and interpret their BREEDPLAN Completeness of Performance reports. Often this included advice on how an individual herd could collect additional performance data to improve their Completeness of Performance star rating.
- Support in understanding and interpreting the MateSel product. This included the provision of advice to those that were considering using MateSel, and, for those that had used MateSel, assistance in interpreting MateSel results.
- For members of SBTS stakeholder breed associations that had not yet implemented genomics, assistance in understanding how genomics would work, test options and the benefits that genomics was expected to bring to producers.
- For members of the two SBTS stakeholder breed associations that had implemented genomics (Australian Wagyu Association and Herefords Australia), advice and support in deciding which animals to genotype and in understanding the effect that genomics was having on their EBVs. For some producers, support was also provided to explain why genotypes were not included in the analysis.

4.4 Capacity building

With SBTS project personnel successfully developing a Beef Genetics Champions Network for a core group of industry individuals who provide genetic extension advice to the commercial beef sector, and the provision of three annual events for this group, objective four of the SBTS project has been achieved. Further information on the achievements that relate to objective four are outlined below.

4.4.1 Beef Genetics Champions Network members

At the conclusion of the SBTS project, there were 92 members of the Beef Genetics Champions Network. Of the 92 individuals, 83% located in the Eastern Australian states of New South Wales, Queensland and Victoria (Fig. 16). A further 14% were located in the remaining Australian states and territories, while the additional 3% were located in New Zealand (Fig. 16). Please note that the New Zealand participants invited into the group were BREEDPLAN accredited ultrasound scanners.

The 92 members of the Beef Genetics Champions Network worked across a variety of industry roles; all were involved in provided beef genetics information and/or advice to the commercial beef sector. Of these 92 members, 61% regularly provided advice to beef producers through their roles as beef extension officers or private agricultural consultants (Fig. 17). A further 15% were BREEDPLAN accredited ultrasound scanners, while an additional 12% worked for service provider companies (Fig. 17). The remaining 12% worked in other beef industry roles (e.g. MLA employees; Fig. 17).

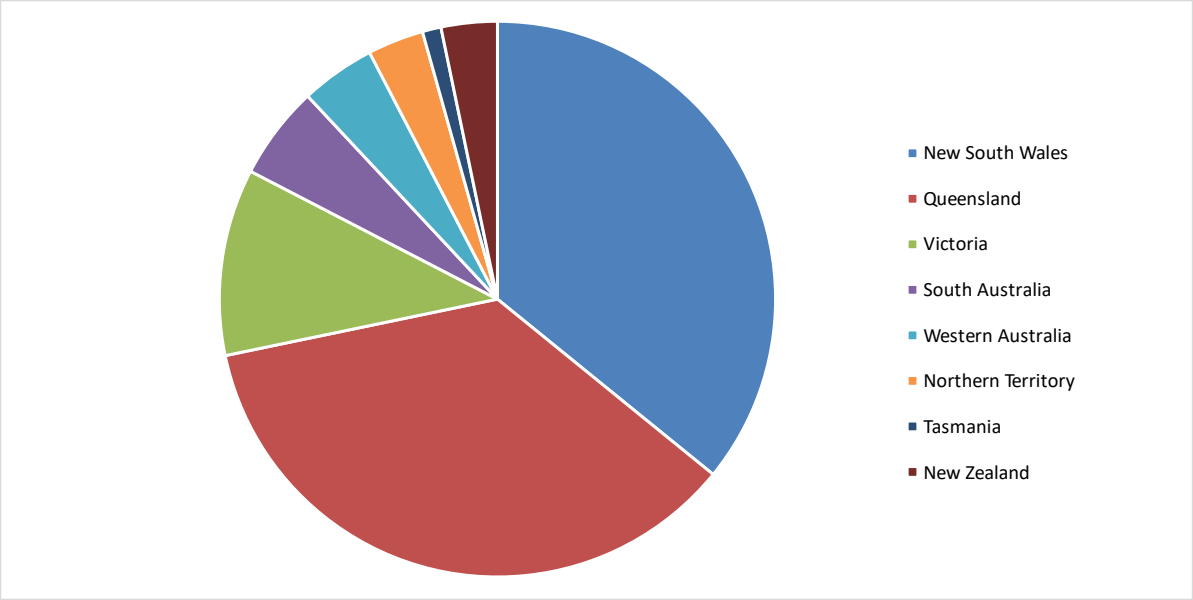

Figure 16. Members of the Beef Genetics Champions Network were located around Australia and New Zealand.

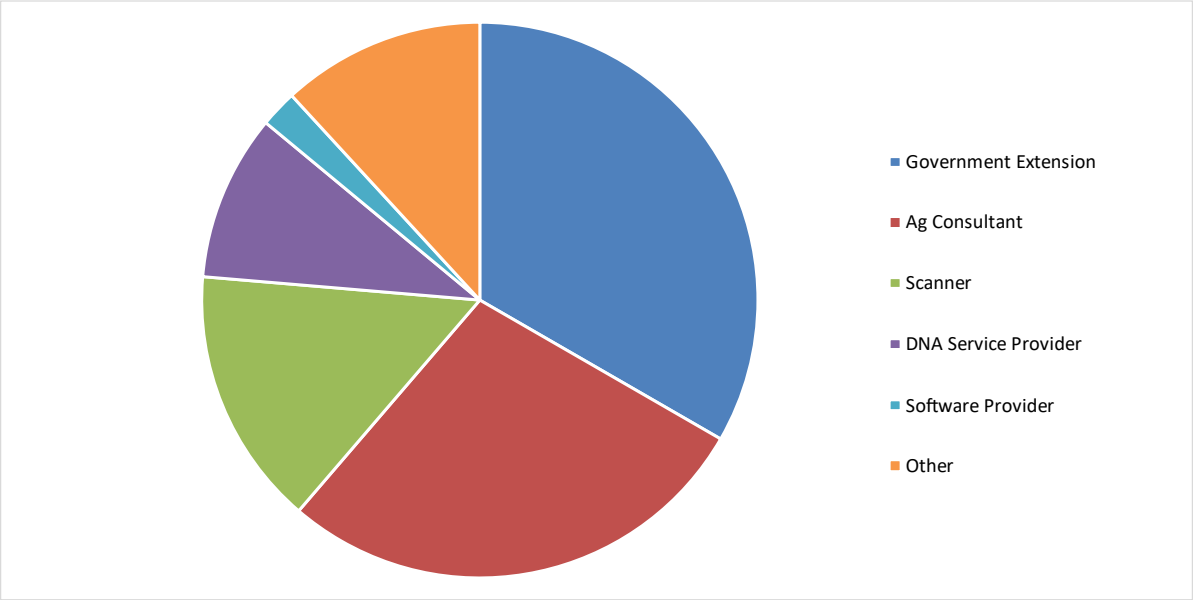

Figure 17. Members of the Beef Genetics Champions Network worked in a range of extension and other industry roles where they provided beef genetics information to the commercial beef sector.

4.4.2 Beef Genetics Champions Network events

4.4.2.1 2019 Beef Genetics Champions Network event

A total of 54 individuals registered for, and 52 individuals attended, the 2019 Beef Genetics Champions Network event (including speakers). A further 12 members of the Beef Genetics Champions Network were unable to attend the 2019 event but expressed their interest in attending

future events. The 52 individuals that attended had travelled from around Australia and New Zealand, with those from New South Wales and Queensland making up the majority (80%) of the audience (Fig. 18). This is not surprising, given both the event location (northern NSW) and that the majority of Beef Genetics Champions Network members lived in these two states (Fig. 16).

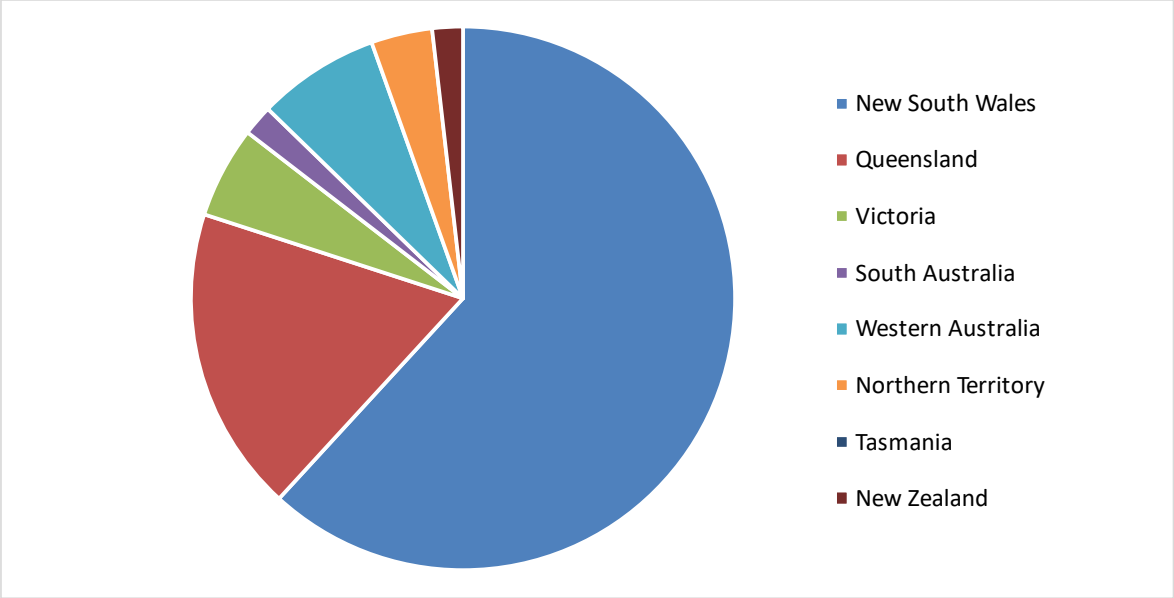

Figure 18. Those that attended the 2019 Beef Genetics Champions Network event had travelled from around Australia and New Zealand.

The two day workshop format appeared to be well received by attendees. When asked, attendees gave an average 8.3 rating for overall satisfaction, and an average 8.2 rating for value of the workshop content. Presenter interaction was given an average rating of 8.7, and an average 9.1 score was given when attendees were asked the likelihood that they would attend a future workshop. Verbal feedback was also positive, with one attendee providing voluntary email feedback that said *"I did really enjoy the Champions Network and it hopefully reflected in my feedback sheet. I know others felt the same."* The same attendee also went on to say that they *"came to the workshop with a list of things I wanted to learn, questions to be answered etc. and I ticked all but one of them, so I thought that was excellent."* Verbal feedback received at the conclusion of the 2019 event also indicated that attendees considered the networking opportunities provided at this type of event to be just as valuable as the opportunity to acquire new knowledge. The networking dinner at the conclusion of day one was therefore a highlight for many of the attendees.

Feedback also indicated that on average, following the 2019 Beef Genetics Champions Network event, attendees had increased their knowledge of BREEDPLAN and were more confident in answering questions on genetics topics from beef producers. This was particularly true for their likelihood to refer to resources on the BREEDPLAN, SBTS and TBTS websites, and their confidence in discussing BREEDPLAN developments with breeders. A more detailed breakdown of these results can be found in Appendix 5.

4.4.2.2 2020 Beef Genetics Champions Network event

Prior to its cancellation, a total of 30 individuals registered for the 2020 Beef Genetics Champions Network event (including speakers). While these are lower numbers than those that registered for

the 2019 event (Section 4.4.2.1), they are likely to reflect an unwillingness to travel due to the emergence of the COVID-19 pandemic (two of the 30 individuals registered had withdrawn prior to event cancellation). Additionally, with cancellation of this event occurring nine days out, registration numbers may have been lower as some individuals may still have been deciding whether to attend.

Those that had planned to attend were located around Australia (Fig. 19). Interestingly, while New South Wales was still the most represented state (33%), there was an increased representation amongst those located in Victoria (11%), South Australia (22%) and Western Australia (11%), when compared to the 2019 Beef Genetics Champions Network event (Section 4.4.2.1; Fig. 18). With audience composition varying between the two events, this may reflect the influence of venue location and indicate a need to offer physical events for the Beef Genetics Champions Network members at a range of locations around Australia.

While two webinars were held for the Beef Genetics Champions Network group in 2020 (Section 3.4.2.2, Table 9), and SBTS personnel assisted in the planning of these, the two webinars were ultimately run by MLA personnel. When asked, attendees gave an average 7.5 rating for overall satisfaction, and an average 7.8 rating for value of the workshops. Attendees noted they had increased their understanding of the topics presented an average of 77% after completing the webinars, and 92% of attendees agreed they had learned something from attending the webinars.

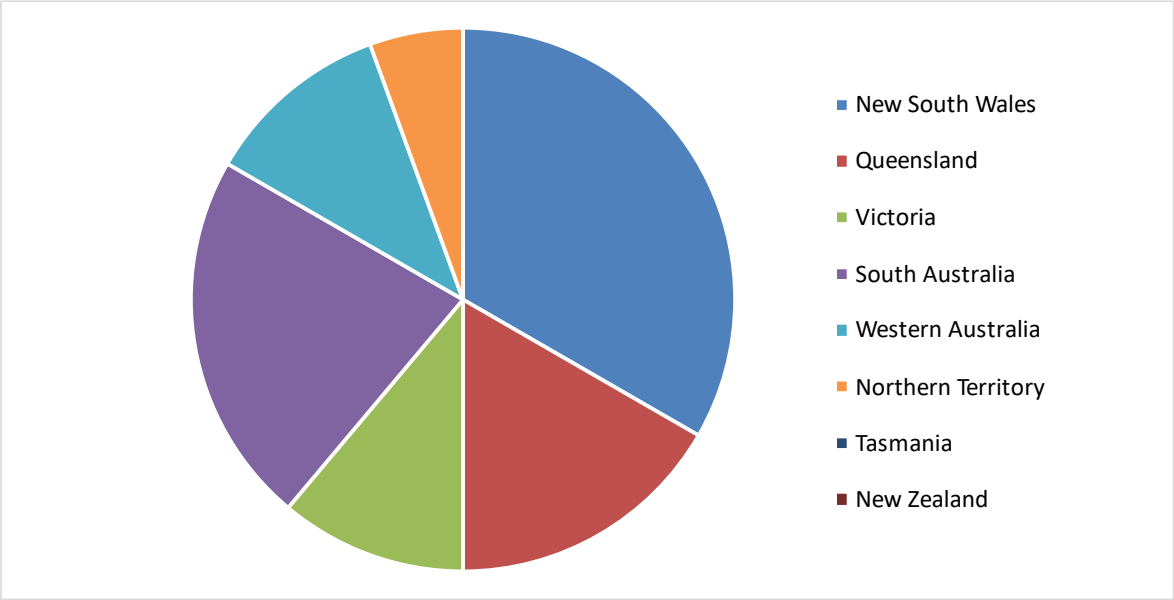

Figure 19. Those that had registered to attend the 2020 Beef Genetics Champions Network event were located around Australia.

4.4.2.3 2021 Beef Genetics Champions Network event

A total of 194 registrations were received for the 2021 Beef Genetics Champions Network webinar series; these represented 67 unique Beef Genetics Champions Network members who had registered to attend one or more of the four webinars. There were 97 webinar attendees; these represented 45 unique Beef Genetics Champions Network members who attended one or more of the four webinars. While webinar attendees were located around Australia, the majority (89%) were from New South Wales and Queensland (Fig. 20).

Recordings of webinars one, three and four were made available for the Beef Genetics Champions Network members to view. As of 30 June 2021, these three webinars had received a combined total of 22 post-webinar views.

While no formal feedback was collected after the 2021 Beef Genetics Champions Network webinars, SBTS project personnel did receive voluntary feedback via email from several webinar participants. Examples of feedback received includes *"Just wanted to say a quick thanks for organising and hosting these. They were really beneficial. Topics and speakers were great."* and *"Thank you, Catriona and presenters, for your efforts re the 2021 webinars. Very much appreciated."* This feedback indicated that these Beef Genetics Champions Network members had found the webinars to be beneficial to them in their own beef extension roles.

A more detailed breakdown of registrations, attendance and post-webinar views for the 2021 Beef Genetics Champions Network webinar series can be found in Appendix 5.

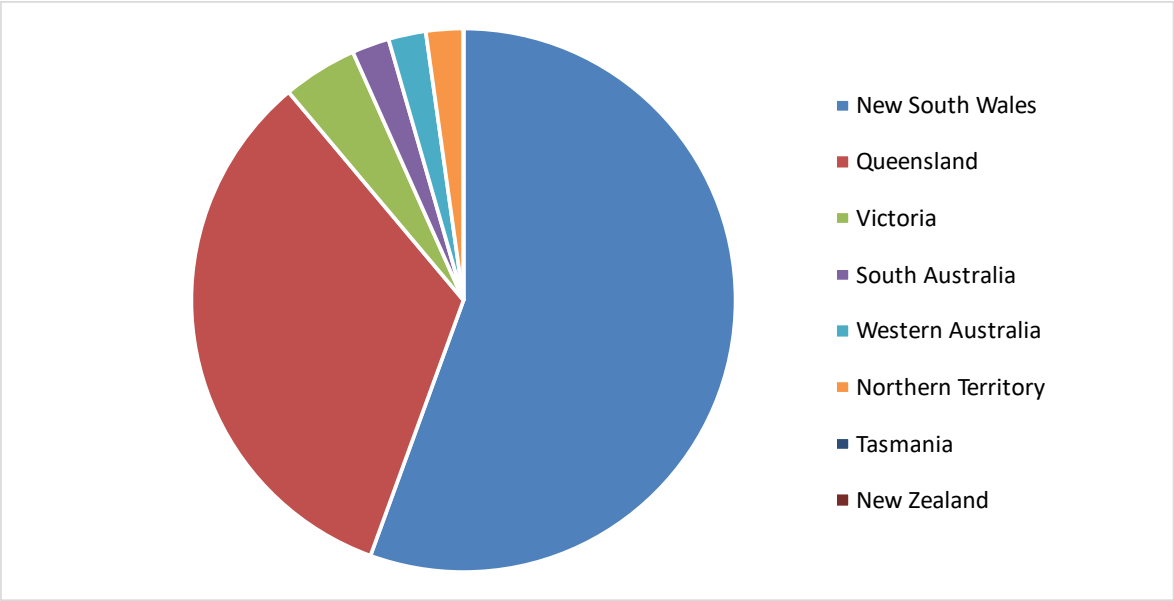

Figure 20. Those that attended the 2021 Beef Genetics Champions Network webinar series were located around Australia.

4.4.3 Additional support of the Beef Genetics Champions Network

An electronic mailing list was used successfully throughout the duration of the SBTS project to provide regular news and information to the Beef Genetics Champions Network members. Information provided to Beef Genetics Champions Network members via the electronic mailing list included:

- Information about upcoming Beef Genetics Champions Network events (Section 4.4.2).
- Information about other upcoming SBTS events. Specifically, this included:
    - Invitations to attend the 2017 & 2018 SBTS & TBTS Regional Forums (Section 4.2.1.1), along with a discount code for those that chose to do so.
    - Invitations to attend the 2019 Regional Forums (Section 4.2.1.2), along with a discount code for those that chose to do so.

    - Invitations to attend any BullSELECT workshops (Section 4.2.2) that were being held in the state that individual Beef Genetics Champions Network members resided.
    - An invitation to attend the 2020 webinar (Section 4.2.3).
- Information about other upcoming animal genetics and breeding events of relevance to the group. Specifically, this included:
    - The Association for the Advancement of Animal Breeding and Genetics (AAABG) 2019 Conference.
    - The MLA Livestock Breeding and Genetics Forum, scheduled for Adelaide in March 2020 (later cancelled).
    - The MLA 'Engaging Remotely with Your Clients' webinar, held in April 2020.
    - The MLA 'Producer Demonstration Site (PDS)' webinar, held in March 2021.
    - The Angus Australia Genetics and Service Provider workshop, held in Melbourne in December 2019.
    - The Angus Australia 'Genetics Technology Update for Northern Australia' events, held in conjunction with MLA and TBTS in December 2020 and June 2021.
- Information from MLA and other industry organisations. Specifically, this included:
    - Calls for Expressions of Interest for the Beef and Sheep Combined Technical Committee and the BREEDPLAN Advisory Committee.
    - Calls for Expressions of Interest for the MLA Producer Demonstration Sites Program.
    - Call for sire nominations information from the Southern Multi-Breed Project.
    - Request for assistance with identifying commercial producers who may be suitable as case studies for new MLA Genetics Campaign material (Section 4.5.3).
    - Industry surveys, including the Australian Beef Sustainability Framework Survey and DeSireBull feedback survey.
- BREEDPLAN news and developments. Specifically, this included:
    - Information on BREEDPLAN, SBTS and TBTS services following the COVID-19 outbreak, where staff from these organisations moved to work from home.
    - A press release regarding the release of 12 'Recording for BREEDPLAN' short videos in August 2020 (Section 4.2.10.3.).
    - A press release regarding the release of 7 'Recording for BREEDPLAN' short videos in June 2021 (Section 4.2.10.3).
    - A press release regarding the publication of BREEDPLAN tip sheets that presented technical content relating to BreedObject Selection Indexes in May 2021, following a major restructure (Section 4.2.10.2).
- Electronic copies of the bi-annual SBTS & TBTS Update magazine (Section 4.2.6).

4.4.4 Evaluation of the Beef Genetics Champions Network

The evaluation survey was sent to all 92 members of the Beef Genetics Champions Network (Section 4.4.1); 10 responses were received. Of those that responded, 70% had attended the 2019 Beef Genetics Champions Network event (Section 4.4.2.1), 80% had attended the 2020 webinars (Section 4.4.2.2) and 80% had attended the 2021 webinar series (Section 4.4.2.3). When asked whether their involvement in the Beef Genetics Champions Network group had been beneficial, 100% of survey respondents agreed that it had.

When asked to further quantify the benefits of their involvement in the Beef Genetics Champions Network group, 100% of survey respondents agreed that their involvement in the group had allowed them to improve their own knowledge of BREEDPLAN and related genetic technologies, while 90% agreed their involvement in the group had allowed them to provide more informed genetics advice to their clients and/or the wider beef industry. A further 50% agreed that their involvement in the Beef Genetics Champions Network group had allowed them to assist clients to select better (genetically superior) animals, while 90% found their involvement in the group had allowed them to network with other industry professionals. When asked if there were additional benefits, one survey respondent said that their involvement in the Beef Genetics Champions Network had allowed them to be *"confident in my own expertise and knowledge"*, while a second survey respondent (who worked in an extension role as well as owning their own seedstock business) stated that their involvement in the group had allowed them to *"improve application of genetic selection and guidance to buyers within my own business"*.

The evaluation survey also explored the level of usage of genetics resources amongst the Beef Genetics Champions Network members. These resources included the BREEDPLAN, SBTS and TBTS websites (Section 4.2.10.1), written documentation (4.2.10.2), e-media such as the 'Recording for BREEDPLAN' video series (4.2.10.3), SBTS & TBTS social media accounts (Section 4.2.8), SBTS and TBTS technical officers and the MLA Genetics Campaign resources (Section 4.5.3). While all resources were being used to varied levels prior to the commencement of the Beef Genetics Champions Network (Appendix 5), a number of survey respondents reported that they had started to use each of the resources since they became involved in the Beef Genetics Champions Network. In particular, 40% of survey respondents said that they had started to contact SBTS and TBTS technical officers for support. Furthermore, when asked whether they were referring their own clients to any of these genetics resources following their involvement in the Beef Genetics Champions Network, 20% of survey respondents agreed that they had started referring clients to the SBTS and TBTS resources (including written documentation, e-media, social media, websites and technical officers) as well as the MLA Genetics Campaign resources.

When asked whether they were keen to remain involved in the Beef Genetics Champions Network into the future, 100% of survey respondents agreed that they were. All were keen to see events held at least once per year and for events to be a mix of in-person workshops and electronic webinars. It was noted by one survey respondent that electronic events were a *"great opportunity to update and keep training"*, especially when ability to travel interstate was limited. It was pleasing to see such keen interest in the Beef Genetics Champions Network, and it was clear, both from survey responses and voluntary feedback via email, that members really valued the opportunity to be involved in the group. As one member said in an email to SBTS project personnel *"The champions network is really important. Some of us were CRC champions for various topics but after CRC stopped it was evident the communication, networking and ongoing training/updating of extension folk needed to be facilitated. This role SBTS are undertaking in the network really has positive ramifications for those delivering extension in beef genetics."*

A more detailed breakdown of survey responses can be found in Appendix 5.

4.5 Collaboration

SBTS project personnel have successfully collaborated with a range of relevant industry bodies in regard to extension initiatives and messages related to genetic improvement technologies. Thus,

objective five of the SBTS project has been achieved. Further details on the collaboration activities undertaken in the SBTS project are described in the following sections.

4.5.1 Collaboration in extension messaging and materials

The SBTS project team collaborated with a range of other organisations in regard to extension messaging and material. In particular, SBTS personnel worked closely with BREEDPLAN staff to identify topics that required specific extension messaging (based on common FAQs received from breeders), and with the TBTS project team to develop joint extension messages and materials. Specific examples of joint extension messages and materials include:

- SBTS & TBTS Update magazines (Section 4.2.6). While SBTS personnel were primarily responsible for the production and distribution of these magazines, all SBTS and TBTS project personnel contributed written articles.
- SBTS & TBTS social media platforms (Section 4.2.8). The Facebook, Twitter and YouTube channels were shared between the two projects.
- Websites (Section 4.2.10.1). While each project had its own website, they shared a common "back-end" and content.
- Written documentation (Section 4.2.10.2). Both SBTS and TBTS personnel were involved in the development of SBTS & TBTS Technical Notes. In addition, personnel from both project teams worked with BREEDPLAN staff to review and, where required, update the technical content of the BREEDPLAN tip sheets.
- E-media (Section 4.2.10.3). While the SBTS project team were primarily responsible for video editing, TBTS project personnel and BREEDPLAN staff were involved in script development.

SBTS personnel also attended a number of organised collaborative meetings with staff from a range of other industry bodies. These provided opportunities to discuss genetics extension, both within the beef industry and across Australian red meat industries, with a range of individuals. Specifically, SBTS personnel attended:

- 15 BTLG meetings. These meetings allowed the SBTS team to discuss BREEDPLAN developments and associated extension messaging.
- 12 BSEG meetings. These meetings allowed the SBTS team to exchange ideas and experiences regarding messaging and the resources used to provide genetics extension to the Australian red meat industries.

SBTS personnel also worked with a number of industry organisations at a one-on-one level, to exchange ideas and experiences regarding extension messaging and materials. These included:

- Angus Australia. SBTS personnel met with Angus Australia extension staff throughout the duration of the SBTS project to discuss a range of extension messages and materials for the wider Australian beef industry. This included meetings about the results and extension implications of an Angus Australia Stakeholder Survey, and meetings about the materials used to extend BreedObject Selection Indexes to the wider beef industry. Angus Australia also provided advice to SBTS personnel about the use of digital technologies in extension, which was instrumental to SBTS developing short videos (Section 4.2.10.3).
- AGBU. SBTS personnel attended relevant AGBU seminars throughout the duration of the SBTS project. SBTS personnel also liaised with AGBU staff regarding a range of technical

support issues for SBTS stakeholder breed associations (Section 4.3.1). This included liaising with AGBU staff to develop a detailed explanatory document for all SBTS stakeholder breed associations as they prepared for the genomics era. AGBU staff were also involved in a review of how technical content relating to BreedObject Selection Indexes were presented to both seedstock and commercial beef producers, which led to a major rework of all BREEDPLAN tip sheets that covered BreedObject Selection Indexes (Section 4.2.10.2).

- DataGene. SBTS personnel attended meetings with DataGene staff to discuss extension messaging in the beef and dairy industries. This allowed for an exchange of ideas about and experiences with different extension techniques, which could be applied across industries.
- DNA service providers (e.g. Neogen and Zoetis). SBTS personnel attended a number of meetings with DNA service providers to discuss beef genetics extension and future product development. This allowed SBTS to develop extension messaging for SBTS stakeholder breed association members regarding DNA testing of their animals (with a particular focus on genomics).
- MLA. SBTS personnel provided material for the MLA Breeding Edge course notes in February 2018.
- Overseas extension groups. SBTS personnel met periodically with overseas extension personnel who were based in New Zealand, Southern Africa and the United States of America. This allowed for an exchange of ideas about and experiences with different extension techniques, which could be applied across countries.

Finally, SBTS personnel kept in regular contact with the MLA National Adoption Manager – Genetics throughout the duration of the project.

4.5.2 Collaboration in extension events and workshops

The SBTS project team collaborated with a number of industry organisations in the promotion and delivery of extension events and workshops. Many of the extension events and workshops that SBTS personnel ran during the project were undertaken in conjunction with the TBTS project. Specifically, this included:

- SBTS & TBTS Regional Forums (Section 4.2.1). While SBTS personnel developed the Regional Forum programs, TBTS project personnel were involved in the delivery; co-presenting alongside SBTS personnel at a number of Regional Forums.
- BullSELECT workshops (Section 4.2.2). TBTS personnel co-presented alongside SBTS personnel at a subset of BullSELECT workshops.
- Webinars (Section 4.2.3). The 2016 webinar series was co-presented by SBTS and TBTS personnel.

SBTS personnel also worked with a range of other organisation to deliver extension events and workshops. Specifically, this included:

- Working with Angus Australia extension staff to provide Completeness of Performance and Genetic Progress reports to Angus Australia BREEDPLAN members that attended SBTS & TBTS Regional Forums (Section 4.2.1).
- Working with AGBU personnel to hold a 2020 webinar (Section 4.2.3.2). This webinar was facilitated by SBTS and presented by AGBU staff member Dr. Matthew Wolcott.

- Working with Beef and Lamb New Zealand (B&L NZ) staff to present at a virtual conference run by the B&L NZ Genetics team in August 2018. SBTS personnel provided a pre-recorded video which was made available for attendees to view over two evenings. The video was also later uploaded to the B&L NZ YouTube channel.
- Working with NSW LLS staff to deliver a 'Breeding for Efficiency' webinar in October 2020 (Section 4.2.4). SBTS personnel attended several meetings prior to the webinar and presented at this NSW LLS event.
- Working with a range of organisations to deliver events for the Beef Genetics Champions Network group in 2019, 2020 and 2021 (Section 4.4.2). Along with SBTS project personnel, the organising committee for these events included representatives from ABRI, AGBU, MLA and TBTS. A number of other organisations were also represented as invited speakers for the three events.

SBTS personnel also provided support to a number of other organisations that were delivering extension events and workshops to beef producers and industry personnel around Australia. Specifically, this included:

- Supporting the AAABG 2019 conference. This included promoting the conference, in particular the Breeders Days, to a wider audience via the SBTS & TBTS Update magazines (Section 4.2.6) and the SBTS & TBTS social media platforms (Section 4.2.8). In addition, SBTS personnel reviewed several conference papers, chaired a session at the conference and provided insights on communication of scientific information at the student workshop.
- Providing support and equipment (including audience feedback devices) to the organisers of the ARCBA Young Breed Leaders 2019 workshop, to assist with the running of the event.
- Promoting the Angus Australia 'Genetics Technology Update for Northern Australia' events, held in conjunction with MLA and TBTS in December 2020 and June 2021, via SBTS social media channels (Section 4.2.8) and to the Beef Genetics Champions Network group (Section 4.4.2.3).

Finally, while SBTS did not run extension events with these organisations in the current project, discussions were held to explore opportunities to work together with several other organisations. Specifically, this included:

- Discussions with staff from the Muresk Institute in Western Australia about the potential to collaborate on future extension events for the Western Australian beef industry.
- Discussions with MLA staff regarding the possibility of SBTS personnel presenting at the Red Meat Forum.

4.5.3 Collaboration and support of the MLA Genetics Campaign

Prior to the launch of the MLA Genetics Campaign, SBTS personnel assisted in the review of scripts for a number of the beef videos. Specifically, this included attending meetings in August 2018 and follow up discussion via emails. In addition, at the request of MLA staff, SBTS personnel gathered feedback on the videos from a number of beef producers prior to the launch.

Following the launch of the MLA Genetics Campaign, SBTS promoted the campaign to seedstock producers and the wider beef industry via a number of channels. This was done to assist in educating seedstock producers and industry about the existence of the campaign, with the expectation that

information about the MLA Genetics Campaign would be disseminated out to commercial clients. Specific promotional activities included:

- Promoting the launch of the MLA Genetics Campaign in SBTS & TBTS Update magazines (Section 4.2.6). This included a front page article in the Winter 2019 SBTS & TBTS Update magazine.
- Promoting the launch of the MLA Genetics Campaign via e-mailout to BREEDPLAN members of SBTS stakeholder breed associations and encouraging them to share the available resources with their commercial clients.
- Providing links to the MLA Genetics Campaign 'Temperate Beef' resources via the SBTS website (Section 4.2.10.1). This included dedicated links in both the seedstock producer and commercial producer areas of the SBTS website.
- Making the MLA Genetics Campaign videos available via dedicated playlists (one each for Tropical and Temperate cattle) on the SBTS & TBTS YouTube channel (Section 4.2.8.3). These playlists linked directly back to the MLA YouTube channel.
- Sharing a number of MLA Genetics Campaign resources via the SBTS & TBTS Facebook (Section 4.2.8.1) and Twitter (Section 4.2.8.2) accounts.
- Promoting the MLA Genetics Campaign to beef producers at the 2019 SBTS & TBTS Regional Forums (Section 4.2.1.2).
- Promoting the MLA Genetics Campaign to the Beef Genetics Champions Network via the electronic mailing list (Section 4.4.3) and at the 2021 events (Section 4.4.2.3).

SBTS project personnel also aided MLA staff to source material for future MLA Genetics Campaign videos. This included:

- Providing MLA staff with a list of seedstock producers who may be suitable as case studies for new MLA Genetics Campaign material.
- Contacting Beef Genetics Champions Network members via the electronic mailing list (Section 4.4.3) to request assistance in identifying commercial producers who may be suitable as case studies for new MLA Genetics Campaign material.

4.5.4 Collaboration in development of new extension tools

Throughout the duration of the project, SBTS personnel have worked with other organisations to support the development of new extension tools that can be used to extended BREEDPLAN and other related genetic technologies to the Australian beef industry. This included:

- Attending meetings with representatives from AGBU, MLA, NSW DPI, TBTS, the University of Adelaide and the University of New England (UNE) to discuss the development of the 'DeSireBull' product. This included providing feedback on the functionality of the 'DeSireBull' product and reviewing feedback from beef producers.
- Attending discussions with ABRI and SBTS stakeholder breed associations regarding the functionality and display of BREEDPLAN information for the 'ILROnline' web services product that is current being developed by ABRI.

SBTS personnel also supported the MLA Genetics Campaign, having assisted in the development of video scripts and actively promoted the campaign following its launch (Section 4.5.3).

5. Conclusion

5.1 Key findings

The Australian beef breeding sector is very diverse, not just in geographical spread, but also in breeding objectives and target market endpoints, individual learning styles, and levels of prior knowledge about and experience of genetic evaluation systems such as BREEDPLAN. There are also individual breed nuances and localised production system differences to contend with. Thus, a wide range of extension activities that cater to the diversity within the sector are required to maximise the uptake and understanding of genetic improvement technologies in the Australian beef industry.

Throughout the duration of the SBTS project, the delivery of extension services and technical support has evolved due to a range of factors, including demand and extraordinary circumstances. For example, the delivery of BullSELECT workshops (Section 4.2.2) waned over the last few years of the project, due to limited demand for this service and the emergence of alternative programs. In addition, the emergence of COVID-19 meant that face-to-face extension activities, such as presentations at industry events (Section 4.2.4) and herd consultations (Section 4.2.9), had to be modified to suit electronic delivery while vast areas of the country were in lockdown and travel between state boundaries was limited. The SBTS project also moved to incorporate new delivery methods, such as e-media (Section 4.2.10.3), as technological advances allowed. Thus, it is important that extension projects such as SBTS are designed with a certain amount of flexibility built into them. Such project flexibility allows extension personnel to work around extraordinary circumstances and incorporate emerging delivery methodologies, while also ensuring that new research and knowledge can reach industry and benefits can be realised as promptly as possible.

As discussed above, the emergence of COVID-19 did lead to extension programs such as SBTS adapting to operate almost entirely in a virtual capacity. This had the flow on effect of allowing beef producers to take control of their learning and access extension material at their leisure, often from the comfort of their own homes. Whilst the delivery of virtual content has many advantages, there has also been a noticeable lack of peer-based learning and opportunities for group discussion as a consequence of online-only content delivery during COVID-19. In addition, with many other sectors also providing online extension during this time, the ability to stand out from the crowd while also battling webinar fatigue in the target audience emerged as a major challenge. Thus, it remains the strong opinion of SBTS project personnel that a mix of in-person and electronic extension delivery options should continue to be used in future extension programs, as both delivery methods offer unique learning experiences for beef producers and industry personnel.

Finally, the SBTS project has demonstrated the need for beef genetics extension to be delivered from within the beef genetic evaluation pipeline. It is critical that extension personnel have access to and are able to work with those who are involved in the research and day-to-day technical operations of the BREEDPLAN genetic evaluation system. This ensures that commonality of messaging is achieved across the entire beef genetic evaluation pipeline, while also allowing a seamless transfer of information from genetic evaluation researchers and service providers via extension personnel to the end users of genetic improvement technologies.

5.2 Benefits to industry

The SBTS project has successfully delivered a wide range of extension activities that were designed to maximise the uptake and understanding of genetic improvement technologies in the Australian

beef industry. With the rate of genetic change in the stakeholder breed associations rising from $1.58 per year to $6.78 per year over the duration of the project, the flow on effects will be felt across the entire beef industry value chain.

The introduction of genomically enhanced (Single-Step) breeding values and revised (version 6.2) BreedObject selection index software are high profile examples of new and/or revised technologies that had significant flow on effects for the whole beef value chain. While the initial effect of these technologies is in the seedstock sector, they enable the selection of genetically superior bulls better suited to commercial production systems. In turn, this will produce better commercial progeny for the feedlot and processor components of the industry. Given that both Single-Step and BreedObject are based on highly technical methodology, significant SBTS project resources were required for the technical support and extension messaging of these technologies.

While Single-Step and BreedObject represented new developments, the results of numerous surveys, feedback from BREEDPLAN data processors and individual conversations with breeders (both new and experienced) revealed that significant emphasis was still required to educate producers on the BREEDPLAN fundamentals. Some topics frequently covered by extension personnel included explaining why breeding values change, how to interpret EBV accuracy, the recording age ranges for each trait and the importance of correctly assigning management groups. Producer understanding of these fundamentals is required to ensure that the data submitted to and analysed by BREEDPLAN is of high quality, allowing the production of accurate breeding values and facilitating the selection of genetically superior animals.

In conclusion, the SBTS project has provided a wide range of innovative extension and technical support activities to maximise the use and understanding of BREEDPLAN and related genetic technologies in the Southern Australian beef industry. As such the project facilitated the seamless transfer of information from genetic evaluation researchers and service providers to the end users of genetic improvement technologies.

6. Future research and recommendations

With beef genetics being a constantly evolving and technically challenging space, there remains a strong requirement for personnel and projects that operate in the space between the research and technical operations of the BREEDPLAN genetic evaluations, and those who use genetic improvement technologies in their herds. Furthermore, research projects (current and future) require a careful and considered extension program to ensure key research findings are adequately explained and uptake maximised in the wider Australian beef industry. Extension projects such as SBTS are well placed to act as the link between researchers and the wider beef industry and have the necessary experience and contacts to disseminate important extension messages.

The current iteration of the SBTS project has been challenged by the limited resources (e.g. 2.5 FTEs) available to undertake extension work to a diverse and geographically spread beef seedstock sector. The project has also had to juggle these limited resources against expectations and requests from a range of stakeholders. Despite these challenges, the current SBTS project has successfully achieved its five objectives. However, the resourcing available for any future iterations should be carefully considered, as additional resources would give such a project greater flexibility and ability to achieve success.

In addition, while the current iteration of the SBTS project was constrained in its reach due to the objectives set at the start of the project, and thus focussed primarily on the seedstock sector,

opportunities to extend beef genetics extension to a wider audience should also be considered in any future project iterations. This should include messaging and resources for commercial beef producers, and tailored solutions for those involved in wider industry roles, such as agents, processors, veterinarians and those involved in the formal education space (e.g. researchers, lecturers and agricultural teachers). The Beef Genetics Champions Network, which in the current SBTS project iteration attempted to fill the knowledge transfer gap left for extension personnel since the previous Beef CRCs, is a successful example on which such tailored solutions could be modelled. Greater reach of genetics extension across the whole industry supply chain would be of significant benefit to producers and industry personnel around Australia; however, such programs would need to be carefully structured and funded to reach their full potential.

In conclusion, the ongoing support of an efficient and effective national extension and technical support network for the Australian beef industry should be prioritised. This would enable the continued utilisation of genetic technologies, and associated rates of genetic improvement, which would lead to significant flow on benefits for the entire beef supply chain.

7. References

Australian Registered Cattle Breeders Association 2020, *ARCBA 2020 Registration Report*, Armidale, New South Wales.

8. Appendix 1: Regional forums

8.1 2017 & 2018 regional forums

8.1.1 Registrations and attendance

Table 1.1. Summary of registrations and attendance at each of the regional forums.

Location	Date	No. Registered	No. Attended
Armidale	23 March 2017	18	18
Albury	3 April 2017	14	13
Seymour	4 April 2017	6	6
Warragul	5 April 2017	14	12
Hamilton	6 April 2017	7	6
Launceston	7 April 2017	7	7
Dubbo	6 June 2017	4	4
Orange	7 June 2017	6	5
Goulburn	8 June 2017	8	8
Toowoomba[A]	18 July 2017	18	15
Albany	17 January 2018	11	11
Bunbury	19 January 2018	15	14
Perth	22 January 2018	13	13
TOTAL		**141**	**132**

[A] Delivered in conjunction with TBTS project personnel.

8.1.2 Feedback

Table 1.2. Attendees were asked to rate how useful they found each of the regional forum sessions.

Please Rate How Useful You Found Each Session	Extremely Useful	Very Useful	Somewhat Useful	Not Very Useful	Not At All Useful
BREEDPLAN 101: Recording Performance Information in Your Herd.	40%	44%	14%	2%	0%
BREEDPLAN Contemporary Groups & Genetic Linkage.	51%	41%	8%	0%	0%
Making BREEDPLAN Work For You: Common Performance Recording Problems and How to Avoid Them.	36%	51%	12%	1%	0%
How Much Performance Data Do You Collect? Interpreting Your Completeness of Performance Report.	39%	48%	12%	0%	1%
Are You Making Progress: Interpreting Your Genetic Progress Report.	37%	49%	13%	1%	0%
Single-Step BREEDPLAN: What Does Genomics Mean For You?	41%	43%	16%	0%	0%
AVERAGE	**41%**	**46%**	**13%**	**1%**	**0%**

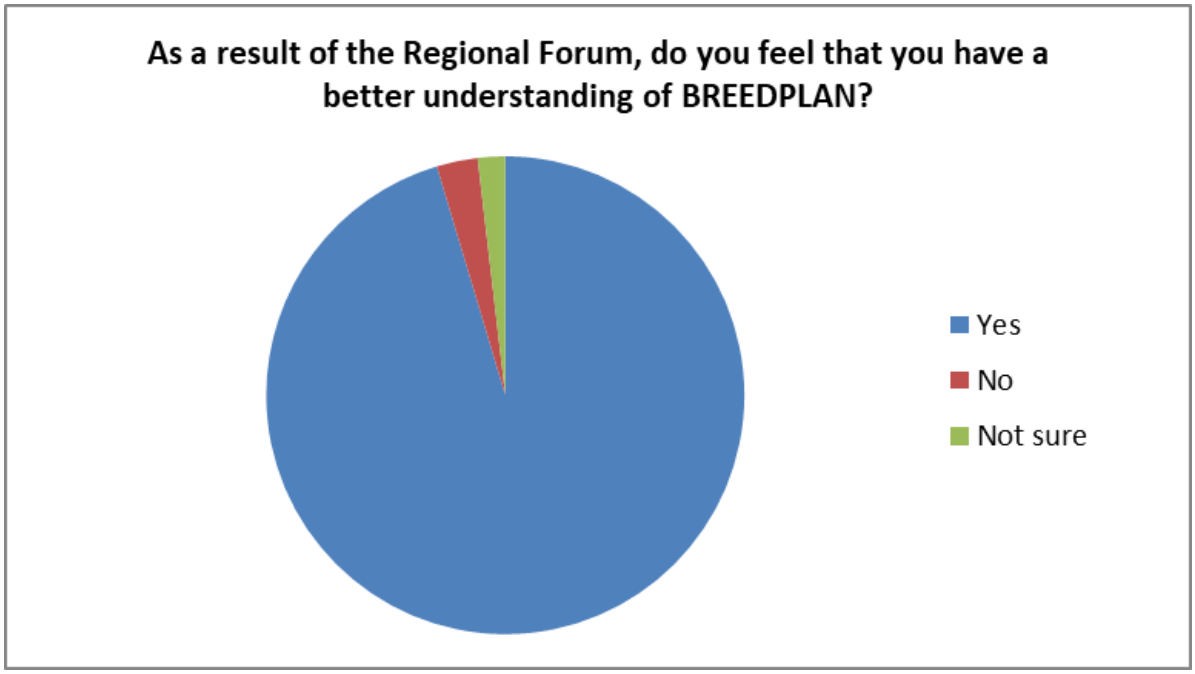

Figure 1.1. Attendees were asked whether they felt they had a better understanding of BREEDPLAN as a result of attending the regional forum.

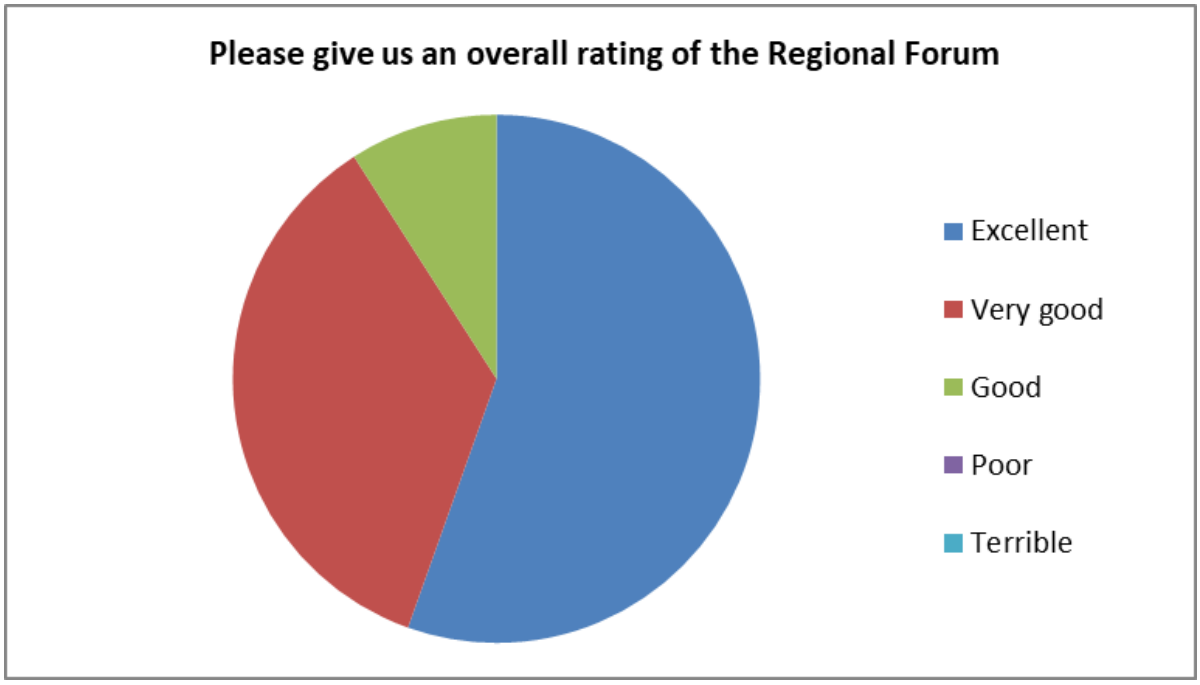

Figure 1.2. Attendees were asked to give an overall rating of the regional forum.

8.1.3 Learning outcomes

Table 1.3. Attendees were asked a number of questions at the start and end of the regional forum, to gauge whether their knowledge of BREEDPLAN increased as a result of their attendance at the regional forum.

Question	Percent attendees with correct answer		Improvement
	Pre-Forum	Post-Forum	
Which Trait(s) Does BREEDPLAN Recommend You Collect at Weaning?	20%	44%	24%
When Should You Record Mature Cow Weight?	50%	90%	40%
Are Bull and Heifer Calves Compared in the Same Contemporary Group?	67%	93%	26%
What Should You Be Aiming For (as a minimum) in Your Contemporary Groups?	12%	67%	56%
What Happens if an Outlier is Not Verified?	45%	85%	40%
Why Is Selective Recording a Problem?	61%	81%	20%
What Does Your Completeness of Performance Report Tell You?	18%	62%	44%
Genomics Works Best When?	30%	80%	50%
Should You Stop Performance Recording When Genomics is Available For Your Breed?	68%	89%	21%
AVERAGE	**41%**	**77%**	**36%**

8.2 2019 regional forums

8.2.1 Registrations and attendance

Table 1.4. Summary of registrations and attendance at each of the regional forums.

Location	Date	Topic	No. Registered	No. Attended
Armidale	26 March 2019	BREEDPLAN Fundamentals	18	16
Armidale	27 March 2019	DNA Technology	21	18
Albury	29 April 2019	BREEDPLAN Fundamentals	11	11
Albury	30 April 2019	DNA Technology	11	10
Toowoomba[A]	20 May 2019	BREEDPLAN Fundamentals	36	35
Toowoomba[A]	21 May 2019	DNA Technology	35	33
Launceston	27 May 2019	BREEDPLAN Fundamentals	7	7
Launceston	28 May 2019	DNA Technology	7	7
Rockhampton[B]	5 June 2019	BREEDPLAN Fundamentals	14	14
Rockhampton[B]	6 June 2019	DNA Technology	19	17
Muswellbrook	8 July 2019	BREEDPLAN Fundamentals	8	7
Muswellbrook	9 July 2019	DNA Technology	9	8
Orange	10 July 2019	BREEDPLAN Fundamentals	10	8
Orange	11 July 2019	DNA Technology	10	8

Albany[A]	25 July 2019	BREEDPLAN Fundamentals	9	8
Albany[A]	26 July 2019	DNA Technology	10	10
Bunbury[A]	29 July 2019	BREEDPLAN Fundamentals	7	6
Bunbury[A]	30 July 2019	DNA Technology	6	6
Perth[A]	31 July 2019	BREEDPLAN Fundamentals	5	3
Perth[A]	1 August 2019	DNA Technology	9	6
Warragul	3 September 2019	BREEDPLAN Fundamentals	8	8
Warragul	4 September 2019	DNA Technology	10	9
Hahndorf	7 November 2019	BREEDPLAN Fundamentals	4	4
Hahndorf	8 November 2019	DNA Technology	8	8

[A] Delivered in conjunction with TBTS project personnel. [B] Delivered by TBTS project personnel.

8.2.2 Feedback

Table 1.5. Attendees were asked to rate how useful they found each session at the BREEDPLAN Fundamentals regional forum.

Please Rate How Useful You Found Each Session	Extremely Useful	Very Useful	Somewhat Useful	Not Very Useful	Not At All Useful
The Role of Genetics in Beef Breeding	45%	42%	12%	1%	0%
BREEDPLAN: From Paddock to EBVs	46%	43%	11%	0%	0%
BREEDPLAN: Analysis and Beyond	40%	41%	18%	0%	0%
Making BREEDPLAN Work For You	46%	43%	11%	0%	0%
BREEDLAN Resources	40%	45%	14%	1%	0%
BREEDPLAN Completeness of Performance	39%	44%	16%	1%	0%
Utilising BREEDPLAN to Improve Your Herd	52%	41%	6$	1%	0%
AVERAGE	**44%**	**43%**	**14%**	**1%**	**0%**

Table 1.6. Attendees were asked to rate how useful they found each session at the DNA Technologies regional forum.

Please Rate How Useful You Found Each Session	Extremely Useful	Very Useful	Somewhat Useful	Not Very Useful	Not At All Useful
BREEDPLAN Refresher	33%	44%	18%	2%	2%
Benchmarking Your Herd: CoP and Genetic Progress	46%	48%	4%	0%	1%
DNA Technology for Beef Breeders: Parentage Verification	52%	47%	7%	1%	0%
DNA Technology for Beef Breeders: Genetic Conditions	38%	44%	18%	0%	0%
DNA Technology for Beef Breeders: Single-Step BREEDPLAN	51%	41%	8%	1%	0%
What Does DNA Technology Mean For You?	46%	42%	11%	1%	0%
AVERAGE	**44%**	**44%**	**11%**	**1%**	**1%**

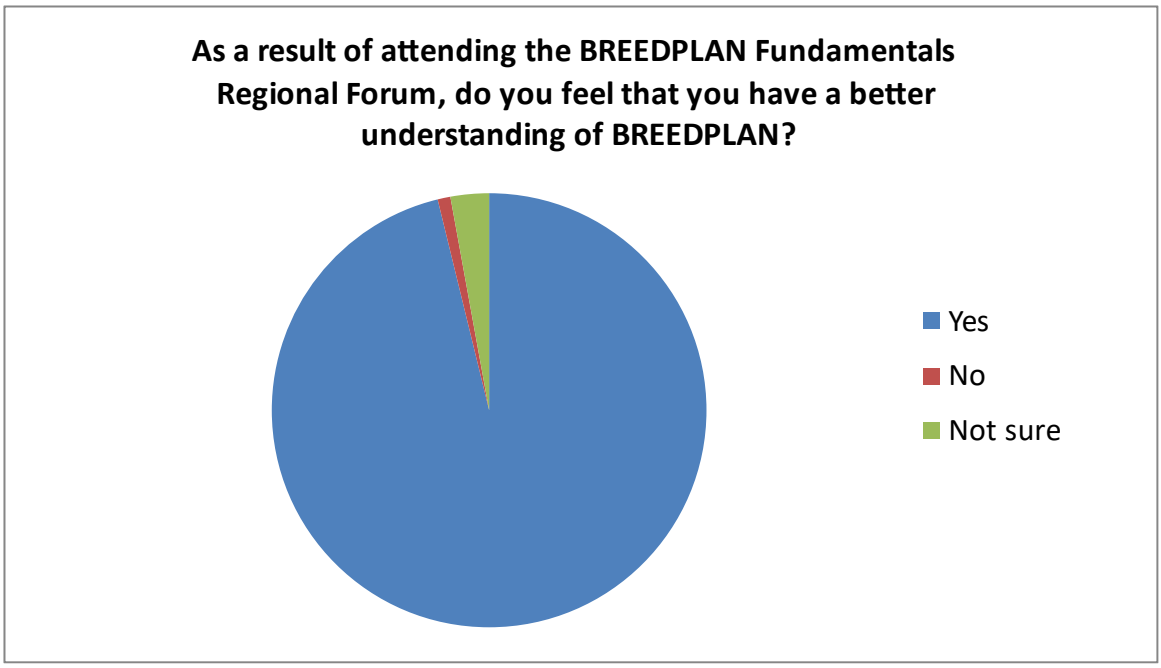

Figure 1.3. Attendees were asked whether they felt they had a better understanding of BREEDPLAN as a result of attending the BREEDPLAN Fundamentals regional forum.

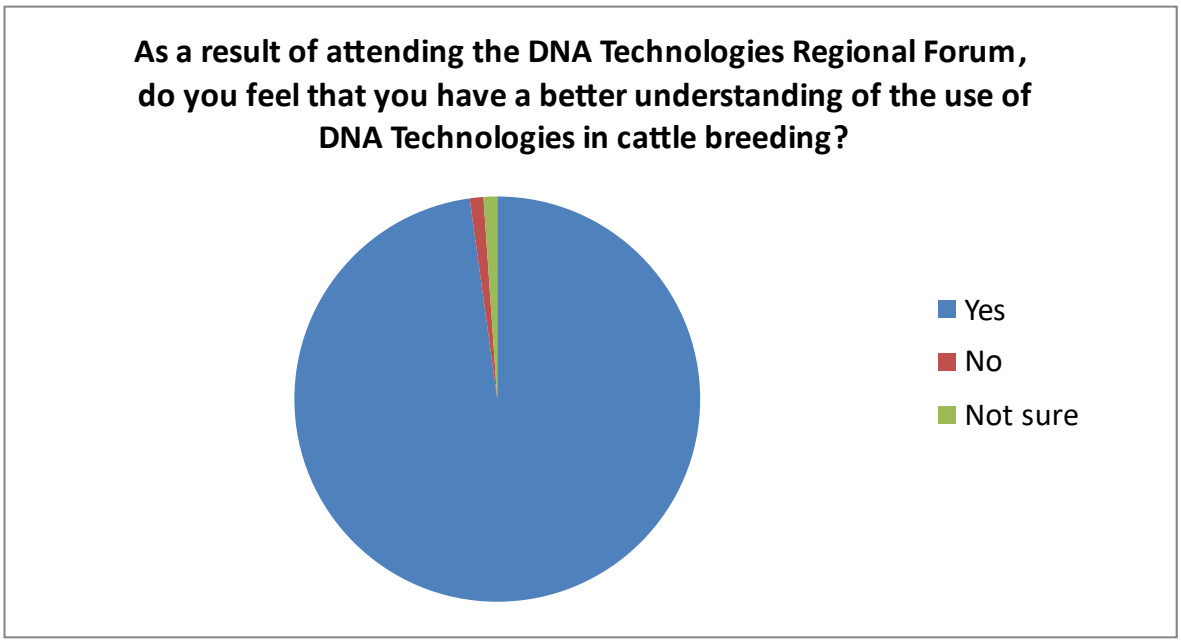

Figure 1.4. Attendees were asked whether they felt they had a better understanding of the use of DNA technologies in cattle breeding as a result of attending the DNA Technologies regional forum.

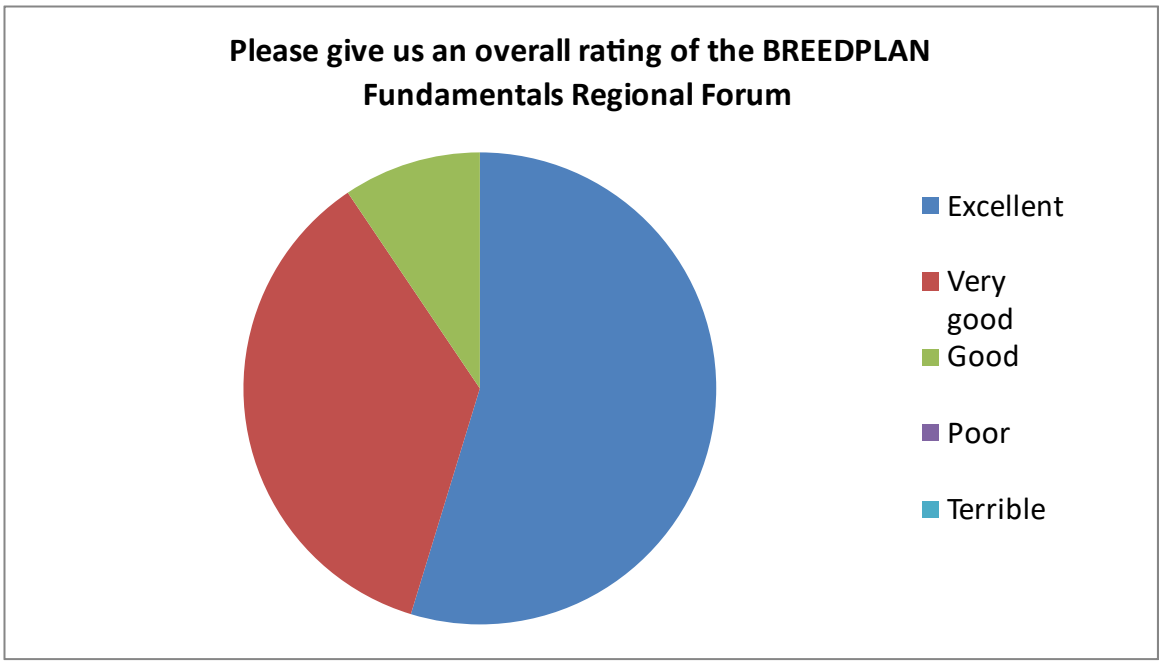

Figure 1.5. Attendees were asked to give an overall rating of the BREEDPLAN Fundamentals regional forum.

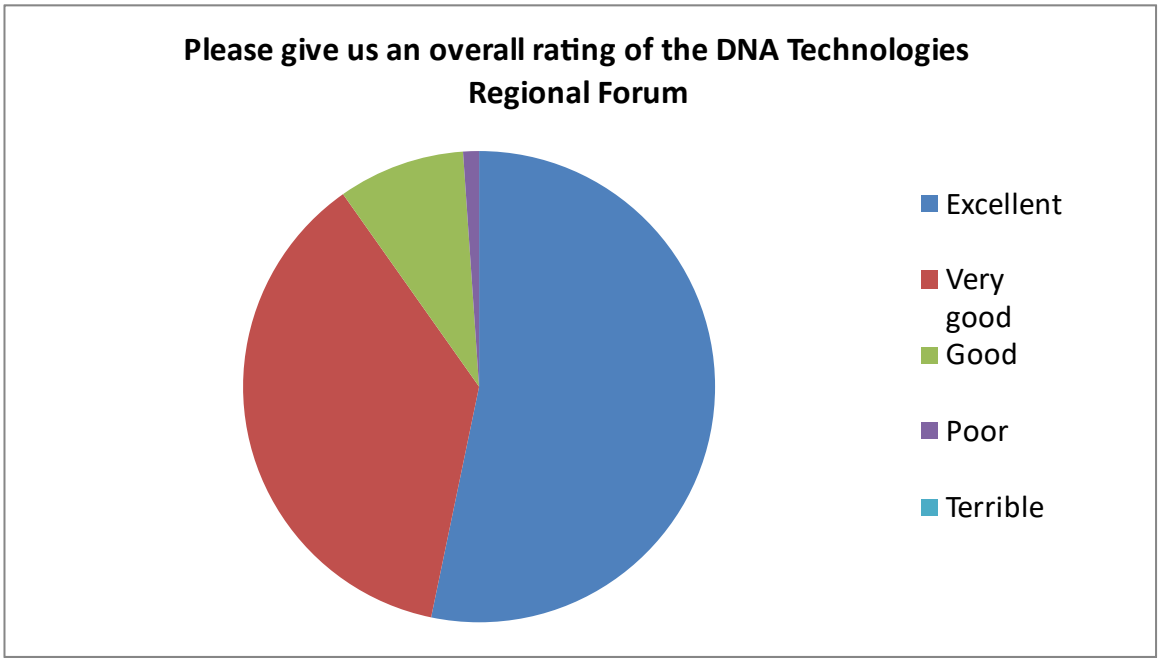

Figure 1.6. Attendees were asked to give an overall rating of the DNA Technologies regional forum.

8.2.3 Learning outcomes

Table 1.7. Attendees were asked a number of questions at the start and end of the BREEDPLAN Fundamentals regional forum, to gauge whether their knowledge of BREEDPLAN improved as a result of their attendance at the BREEDPLAN Fundamentals regional forum.

Question	Percent attendees with correct answer		Improvement
	Pre-Forum	Post-Forum	
What a sire passes on to his progeny is:	42%	67%	26%
Breeder defined management groups:	37%	84%	47%
GROUP BREEDPLAN compares animals across different environments by:	30%	68%	39%
What Happens if an Outlier is Not Verified?	31%	74%	43%
Why Is Selective Recording a Problem?	70%	81%	11%
What Does Your Completeness of Performance Report Tell You?	25%	74%	49%
Select if TRUE - BREEDPLAN EBVs:	94%	97%	3%
AVERAGE	**47%**	**78%**	**31%**

Table 1.8. Attendees were asked a number of questions at the start and end of the DNA Technologies regional forum, to gauge whether their knowledge of DNA technologies improved as a result of their attendance at the DNA Technologies regional forum.

Question	Percent attendees with correct answer		Improvement
	Pre-Forum	Post-Forum	
Which of these will NOT improve accuracy of selection?	51%	75%	24%
Parent Verification Works By:	14%	70%	56%
Which of these options would INCREASE likelihood of genetic conditions appearing?	57%	72%	15%
If a producer wishes to avoid breeding horned animals, they should:	70%	90%	20%
Which of these statements about Single-Step BREEDPLAN is INCORRECT?	28%	64%	36%
Should You Stop Performance Recording once Single-Step BREEDPLAN is Available For Your Breed?	77%	96%	18%
AVERAGE	**50%**	**78%**	**28%**

8.3 Regional forum follow-up survey

Table 1.9. Follow-up survey respondents were asked whether they would be interested in hearing about these topics at a future SBTS & TBTS regional forum.

Potential Topics	Percentage Survey Respondents Interested
BREEDPLAN news and developments	68%
Best practice guide to using BREEDPLAN information in animal selection	82%
Breeding objective – curve bender animals	82%
Breeding objectives – breeding heifer bulls	55%
Breeding objectives – breeding the perfect steer (including MSA compliance)	55%
Breeding objectives – breeding for environmental efficiency	59%
Breeding objectives – breeding maternal cows	68%
Understanding selection indexes	73%
Mate selection – including Mating Predictor, MateSel, inbreeding and genetic diversity	77%
Presenting BREEDPLAN information to your clients	68%

9. Appendix 2: BullSELECT workshops

9.1 Attendee demographics

Table 2.1. BullSELECT Workshop attendees were asked to nominate whether they were a seedstock producer, commercial producer or beef industry representative.

Attendee Type	Percentage of BullSELECT Workshop Attendees
Seedstock producer	17%
Commercial producer	56%
Run both seedstock and commercial herds	21%
Beef industry representative	6%

Table 2.2. BullSELECT Workshop attendees were asked how many head of cattle they owned.

How Many Head of Cattle Do You Own?	Percentage of BullSELECT Workshop Attendees
< 50 cattle	12%
50 – 100 cattle	9%
101 – 300 cattle	25%
301 – 600 cattle	25%
601 – 900 cattle	8%
< 900 cattle	9%
N/A	14%

Table 2.3. BullSELECT Workshop attendees were asked what type of cattle they owned.

What Type of Cattle Do You Own?	Percentage of BullSELECT Workshop Attendees
British breeds	62%
European breeds	16%
Tropical breeds	2%
Wagyu	1%
Other	4%
N/A	14%

9.2 Feedback

Table 2.4. BullSELECT Workshop attendees were asked to rate how useful they found each of the BullSELECT Workshop sessions.

Please Rate How Useful You Found Each Session	Extremely Useful	Very Useful	Somewhat Useful	Not Very Useful	Not At All Useful
Effective Selection of Breeding Cattle	39%	56%	6%	0%	0%
Non-Genetic Influences on Animal Performance	33%	44%	22%	0%	0%
Interpreting Breeding Values	41%	48%	10%	0%	1%
Do Breeding Values Work?	30%	54%	14%	1%	1%
Understanding Breeding Values	38%	49%	11%	0%	1%
Simplifying Selection with Indexes	32%	55%	13%	0%	0%
Best Practice Guide to Bull Selection	38%	53%	9%	0%	0%
The Bull Buyer and BREEDPLAN	38%	39%	17%	4%	2%
AVERAGE	**36%**	**50%**	**13%**	**1%**	**1%**

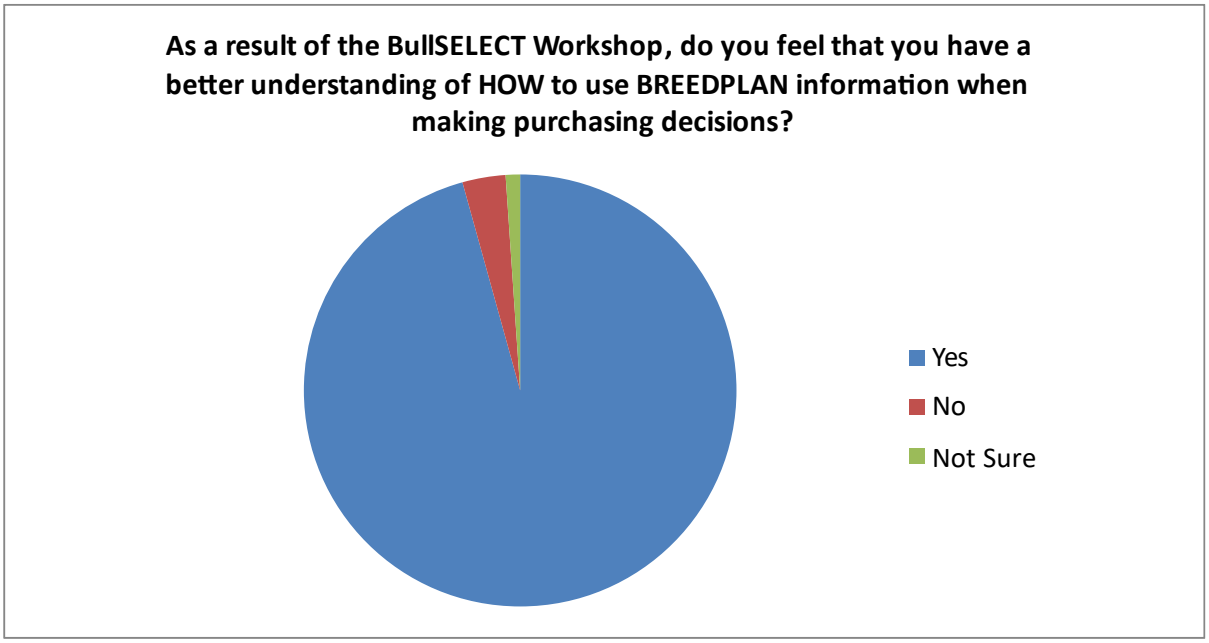

Figure 2.1. Attendees were asked whether they felt they had a better understanding of how to use BREEDPLAN information when making purchasing decisions as a result of attending the BullSELECT Workshop.

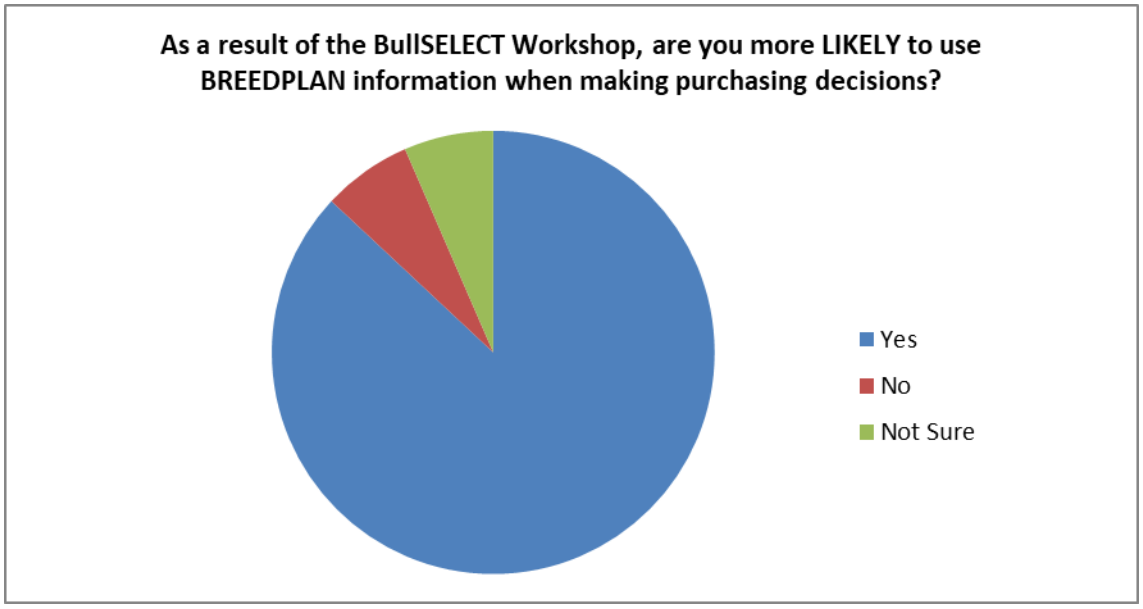

Figure 2.2. Attendees were asked whether they were more likely to use BREEDPLAN information when making purchasing decisions as a result of attending the BullSELECT Workshop.

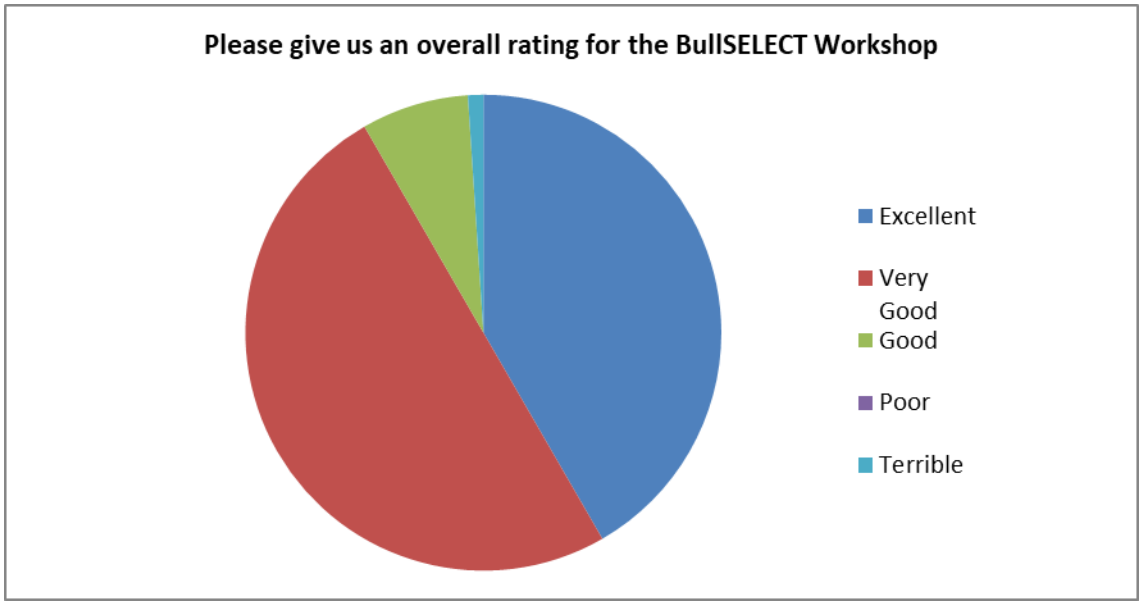

Figure 2.3. Attendees were asked to give an overall rating of the BullSELECT Workshop.

9.3 Learning outcomes

Table 2.5. Attendees were asked a number of questions at the start and end of the BullSELECT Workshop, to gauge whether their knowledge of how to use BREEDPLAN information in animal selection had improved as a result of their attendance.

Question	Percent attendees with correct answer		Improvement
	Pre-BullSELECT	Post-BullSELECT	
If you need a bull that will increase the weight of steers turned off, what is the most appropriate of the following information?	88%	99%	10%
Bull A has a 400 Day Weight EBV which is 50 kg higher than the average 400 Day Weight EBV of a group of bulls. How much heavier would you expect the calves of Bull A to be compared to the calves of an average bull in the group?	46%	93%	48%
Which of the following statements is correct? (Question relating to EBV accuracy)	68%	82%	14%
A selection index is?	71%	97%	25%
A selection index should ONLY be used to:	46%	88%	42%
BREEDPLAN information should be the only information used when selecting animals (True/False statement)	88%	89%	1%
Average	**68%**	**91%**	**23%**

10. Appendix 3: Webinars

10.1 2016 webinar series

10.1.1 Registrations and attendance

Table 3.1. Summary of registrations and attendance at each session of the 2016 webinar series. Total views and average view duration of the webinar recordings (via YouTube) are also shown.

2016 Webinar Series Session	No. Registered	No. Attended	YouTube Views[A]	Average View Duration (%)
Choosing Bulls to Suit Your Program	72	33	414	13%
Getting It Right: Management Groups & Contemporary Groups	39	19	187	19%
Making BREEDPLAN Work For You: Performance Recording Problems to Avoid	55	28	153	8%
Fertility Matters: Recording Fertility Information with BREEDPLAN	48	20	203	16%
Collecting Abattoir Carcase Information for BREEDPLAN	42	17	109	13%
Where To With Genomics?	78	35	253	22%
Total (Unique)	**334 (191)**	**152 (99)**	**1,319**	**15%**

[A] As at 30 June 2021.

10.1.2 Feedback

Table 3.2. Attendees were asked whether they found each of the 2016 webinar series sessions useful.

Did You Find This Webinar Useful?	Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
Choosing Bulls to Suit Your Program	8%	92%	0%	0%	0%
Getting It Right: Management Groups & Contemporary Groups	14%	79%	0%	7%	0%
Making BREEDPLAN Work For You: Performance Recording Problems to Avoid	15%	70%	15%	0%	0%
Fertility Matters: Recording Fertility Information with BREEDPLAN	17%	61%	22%	0%	0%
Collecting Abattoir Carcase Information for BREEDPLAN	0%	71%	29%	0%	0%
Where To With Genomics?	17%	70%	13%	0%	0%
AVERAGE	**12%**	**74%**	**13%**	**1%**	**0%**

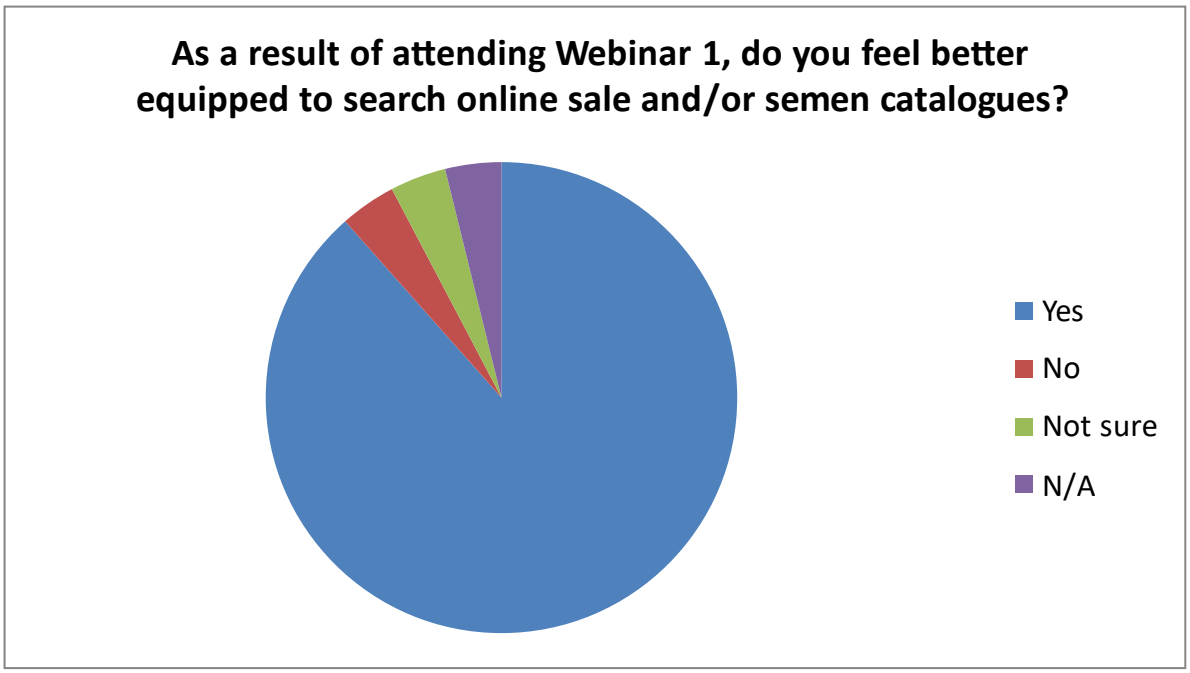

Figure 3.1. Webinar 1 attendees were asked whether they felt better equipped to search online sale and/or semen catalogues as a result of attending the webinar.

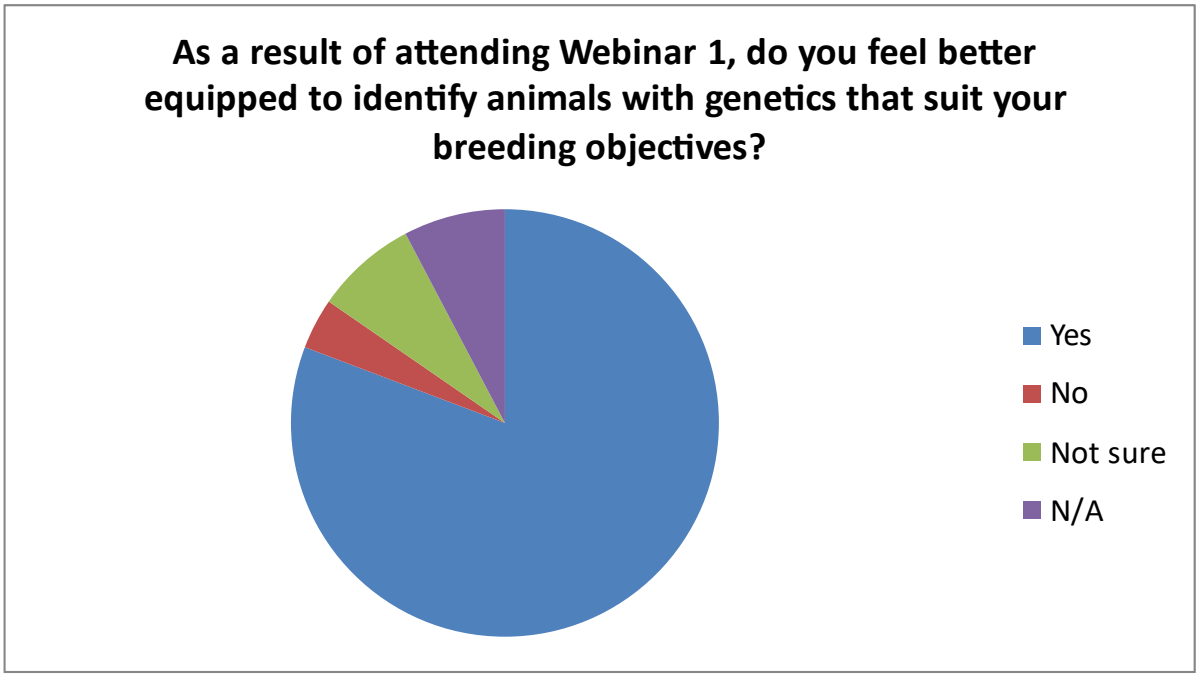

Figure 3.2. Webinar 1 attendees were asked whether they felt better equipped to identify animals with genetics that suit their breeding objectives as a result of attending the webinar.

Figure 3.3. Webinar 2 attendees were asked whether they felt they had a greater understanding of BREEDPLAN contemporary group formation as a result of attending the webinar.

Figure 3.4. Webinar 2 attendees were asked whether they felt had a better understanding of how to maximise their contemporary group size for their herd as a result of attending the webinar.

Figure 3.5. Webinar 2 attendees were asked whether they had a greater understanding of when to provide management groups to BREEDPLAN as a result of attending the webinar.

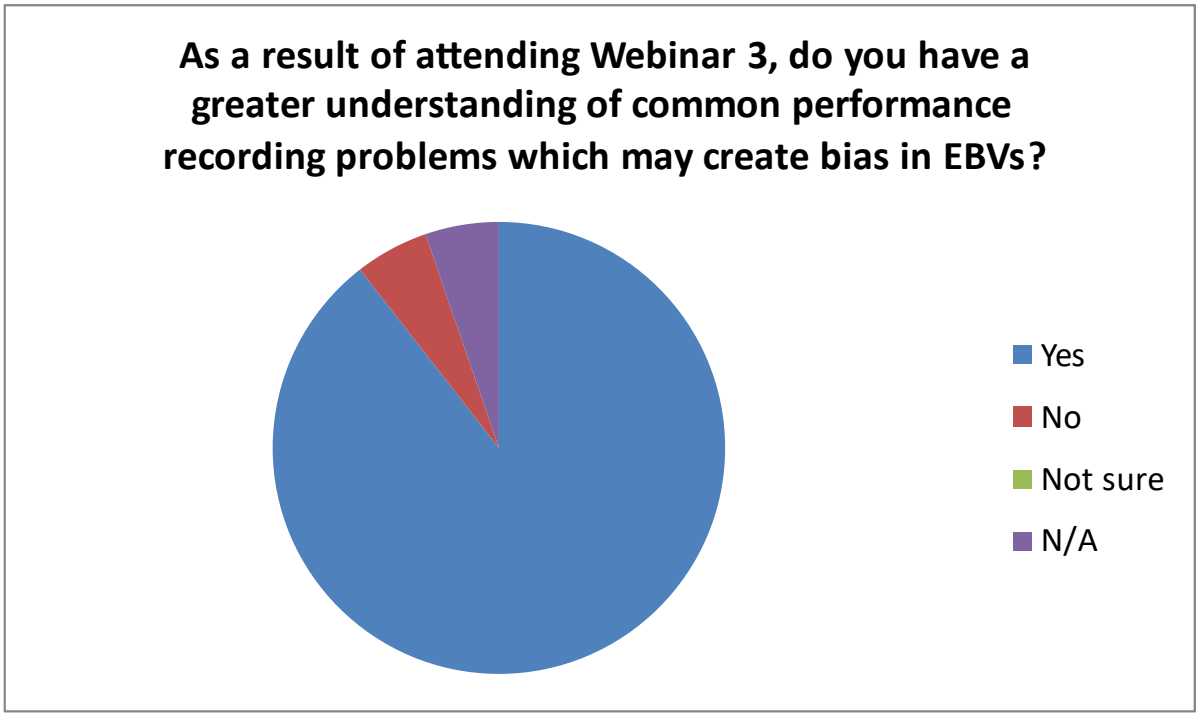

Figure 3.6. Webinar 3 attendees were asked whether they felt they had a greater understanding of common performance problems as a result of attending the webinar.

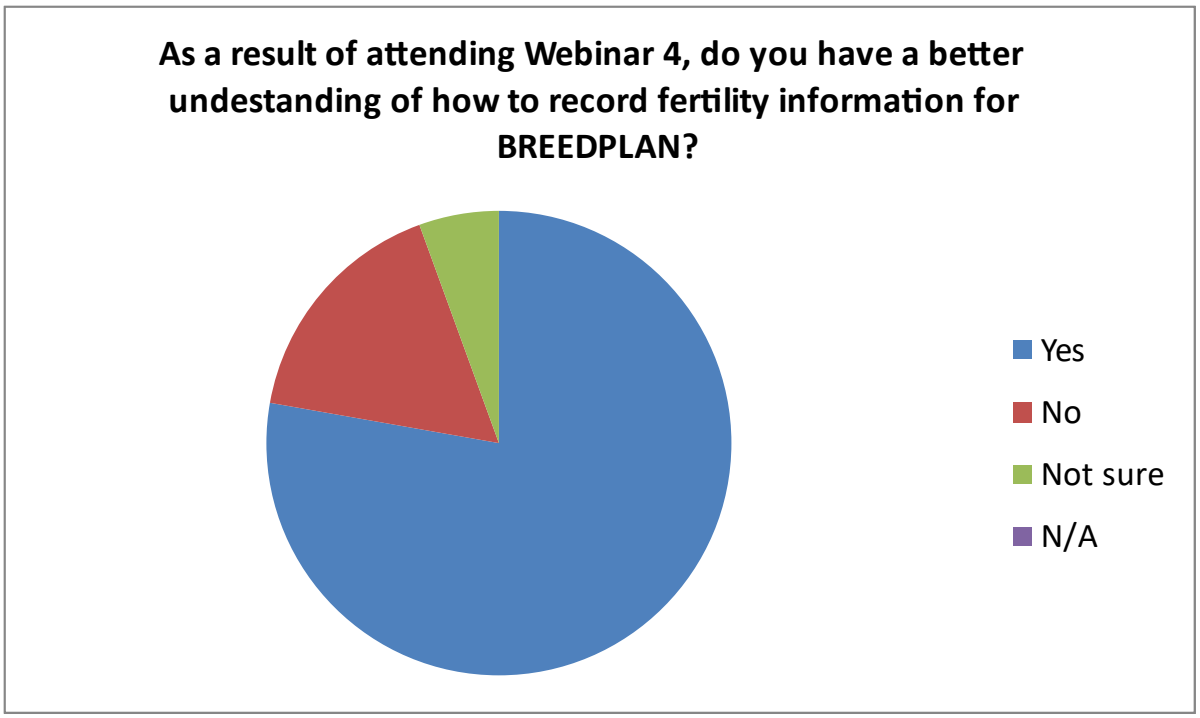

Figure 3.7. Webinar 4 attendees were asked whether they felt they had a better understanding of how to record fertility information for BREEDPLAN as a result of attending the webinar.

Figure 3.8. Webinar 5 attendees were asked whether they felt they had a greater understanding of how to collect good quality abattoir carcase information as a result of attending the webinar.

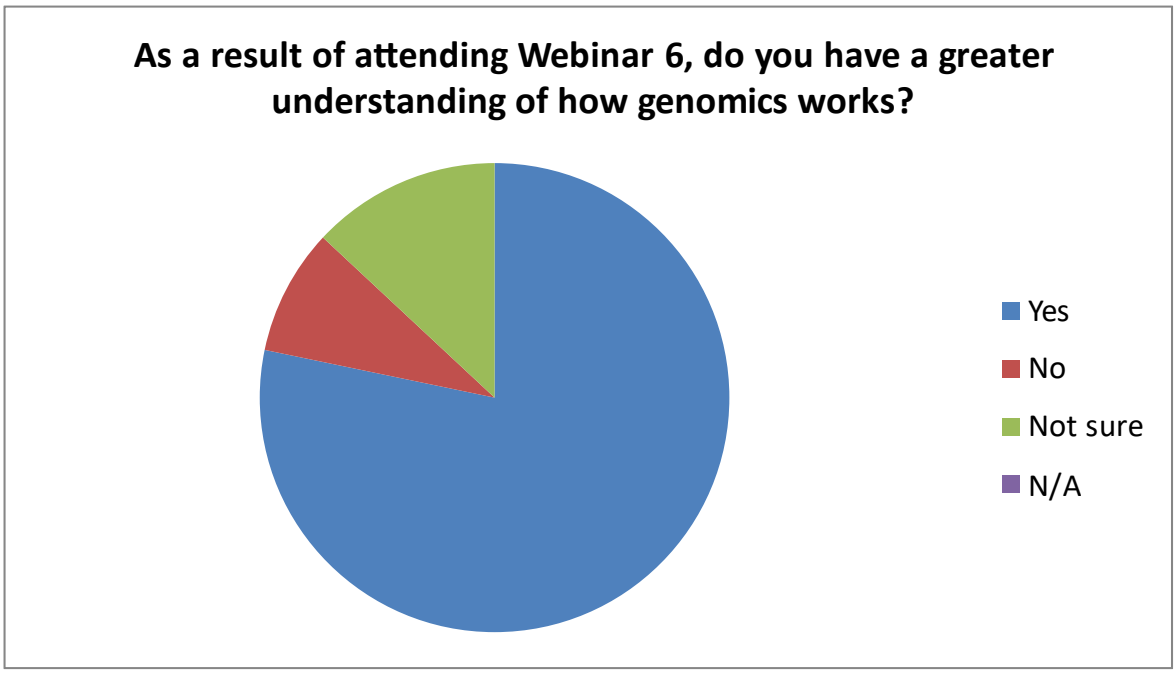

Figure 3.9. Webinar 6 attendees were asked whether they felt they had a greater understanding of how genomics works as a result of attending the webinar.

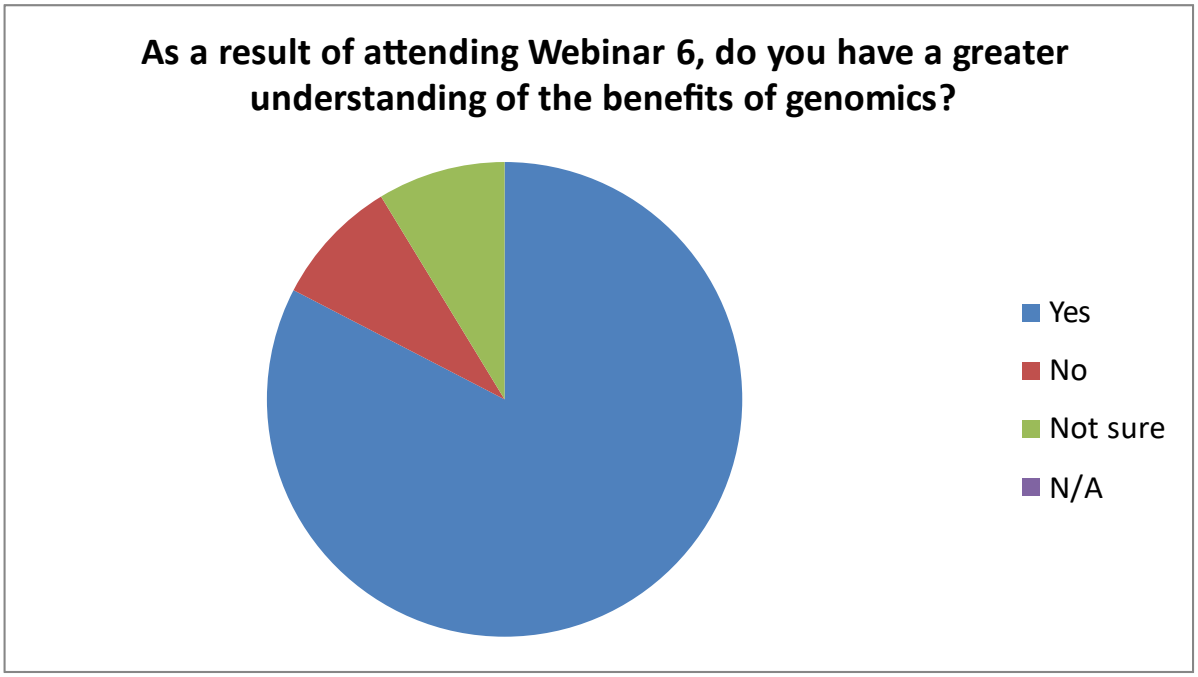

Figure 3.10. Webinar 6 attendees were asked whether they felt they had a greater understanding of the benefits of genomics as a result of attending the webinar.

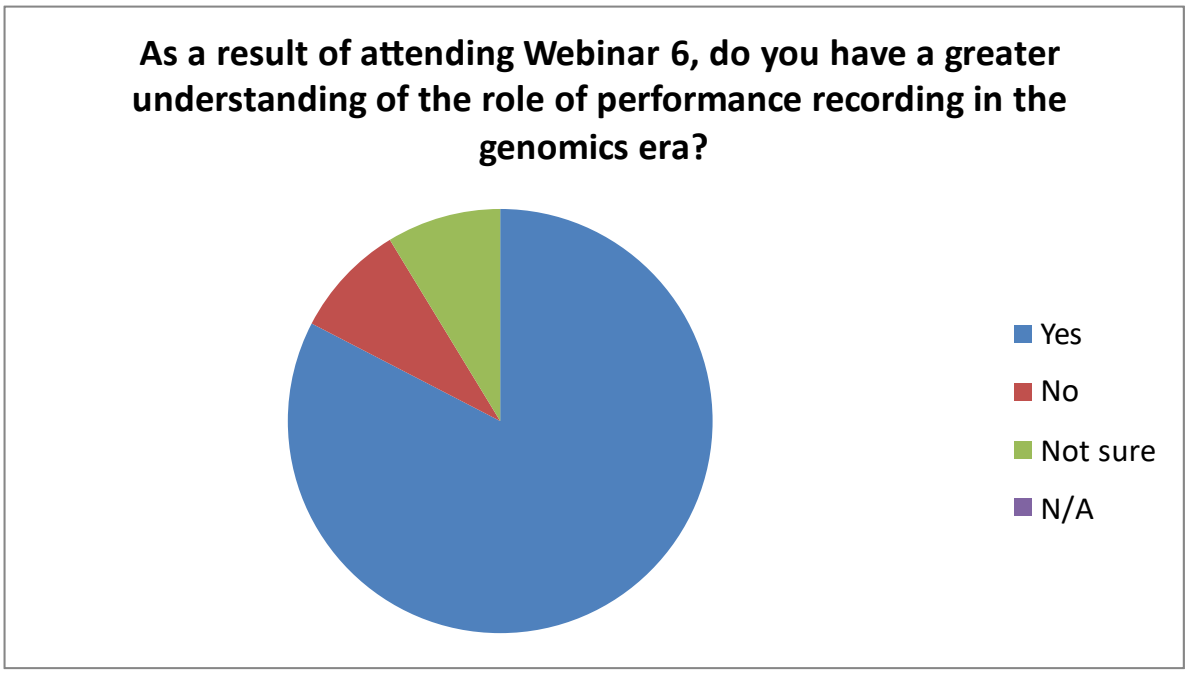

Figure 3.11. Webinar 6 attendees were asked whether they felt they had a greater understanding of the role of performance recording in the genomics era as a result of attending the webinar.

10.2 2020 webinar

10.2.1 Audience demographics

Table 3.3. 2020 webinar attendees were asked to nominate whether they were an industry service provider, extension officer, seedstock producer, commercial producer or researcher.

Attendee Type	Percentage of 2020 Webinar Attendees
Industry service provider	32%
Beef extension officer	17%
Seedstock producer	17%
Commercial producer	10%
Researcher	12%
Other	12%

Table 3.4. 2020 webinar attendees were asked to nominate their location.

Attendee Location	Percentage of 2020 Webinar Attendees
Queensland	45%
New South Wales/ACT	33%
Victoria	10%
South Australia	3%
Northern Territory	3%
Western Australia	3%
Tasmania	3%
New Zealand	3%

11. Appendix 4: Herd consultations

Table 4.1. Herd consultations conducted over the duration of the project, by breed.

Breed	No. of Herd Consultations	Percentage of Herd Consultations
Blonde d'Aquitaine	9	4.1%
Charolais	10	4.6%
Devon	1	0.5%
Gelbvieh	3	1.4%
Hereford	48	22.1%
Limousin	20	9.2%
Murray Grey	19	8.8%
Red Angus	11	5.1%
Red Poll	1	0.5%
Salers	0	0.0%
Shorthorn	9	4.1%
Simmental	18	8.3%
Speckle Park	7	3.2%
Wagyu	33	15.2%
Other[A]	28	12.9%
Total By Breed[B]	**217**	**100%**

[A] Includes herd consultations done with members of TBTS stakeholder breed associations. [B] Total by Breed (n=217) > Total (n=205) as some members are members of more than one breed association.

Table 4.2. Herd consultations offered but declined over the duration of the project, by breed.

Breed	No. of Herds That Declined Consultations	Percentage Declined
Blonde d'Aquitaine	0	0.0%
Charolais	1	6.7%
Devon	0	0.0%
Gelbvieh	0	0.0%
Hereford	5	33.3%
Limousin	2	13.3%
Murray Grey	0	0.0%
Red Angus	2	13.3%
Red Poll	0	0.0%
Salers	0	0.0%
Shorthorn	0	0.0%
Simmental	4	26.7%
Speckle Park	1	6.7%
Wagyu	0	0.0%
Other	0	0.0%
Total By Breed	**15**	**100%**

12. Appendix 5: Beef Genetics Champions Network

12.1 2019 Beef Genetics Champions Network event

Table 5.1. Summary of registrations and attendance at the 2019 Beef Genetics Champions Network event.

Location	No. Registered	No. Attended
2019 Beef Genetics Champions Network event – Day One	53	53
2019 Beef Genetics Champions Network event – Day Two	54	54

Table 5.2. Attendees were asked to rank their knowledge of BREEDPLAN and confidence in answering questions from beef producers on specific topics on a scale of one to ten at the start and conclusion of the 2019 Beef Genetics Champions Network event.

Question	Pre-Event	Post-Event	Difference
Knowledge of Estimated Breeding Values (EBVs)?	7.6	8.5	0.9
Confidence in presenting proof of profit information?	6.5	7.5	1.0
How often do you/likely are you refer to BREEDPLAN, SBTS and TBTS resources?	5.5	8.9	3.4
Confidence in answering questions from breeders on BREEDPLAN trait data collection?	6.5	8.1	1.7
Knowledge of when to apply management groups?	6.2	7.7	1.5
Confidence in explaining how to interpret EBVs to breeders?	7.4	8.5	1.1
Confidence in explaining selection indexes to breeders?	7.2	7.3	0.2
Confidence in explaining the use of DNA information (including genomics) to breeders?	6.7	7.9	1.2
Confidence in discussing BREEDPLAN developments with breeders?	6.0	8.4	2.4
AVERAGE	**6.6**	**8.1**	**1.5**

12.2 2021 Beef Genetics Champions Network event

Table 5.3. Summary of registrations and attendance at each session of the 2021 Beef Genetics Champions Network webinar series. Total views of the webinar recordings are also shown.

Webinar Title	No. Registered	No. Attended	Post- Webinar Views[A]
BREEDPLAN & AGBU Research Update	42	21	9
Fertility Research Update	43	20	N/A
Selection Indexes: Advice for Bull Buyers	48	26	9

Breeding for Efficiency	61	30	4
Total (Unique)	**194 (67)**	**97 (45)**	**22**

[A] As at 30 June 2021.

12.3 Evaluation of the Beef Genetics Champions Network

Table 5.4. Survey respondents were asked which of the three Beef Genetics Champions Network events they had attended.

Beef Genetics Champions Network Event	Percentage (%) Survey Respondents Attended
2019 Beef Genetics Champions Network workshop	70%
2020 Beef Genetics Champions Network webinars	80%
2021 Beef Genetics Champions Network webinars	80%

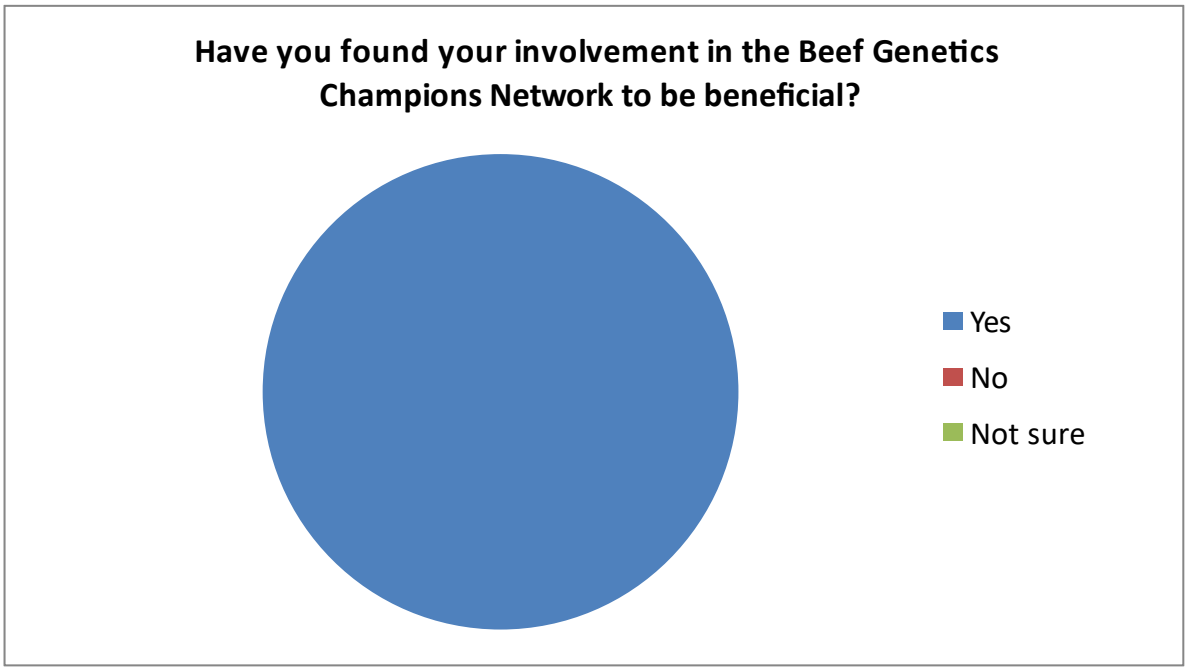

Figure 5.1. Survey respondents were asked whether they had found their involvement in the Beef Genetics Champions Network to be beneficial.

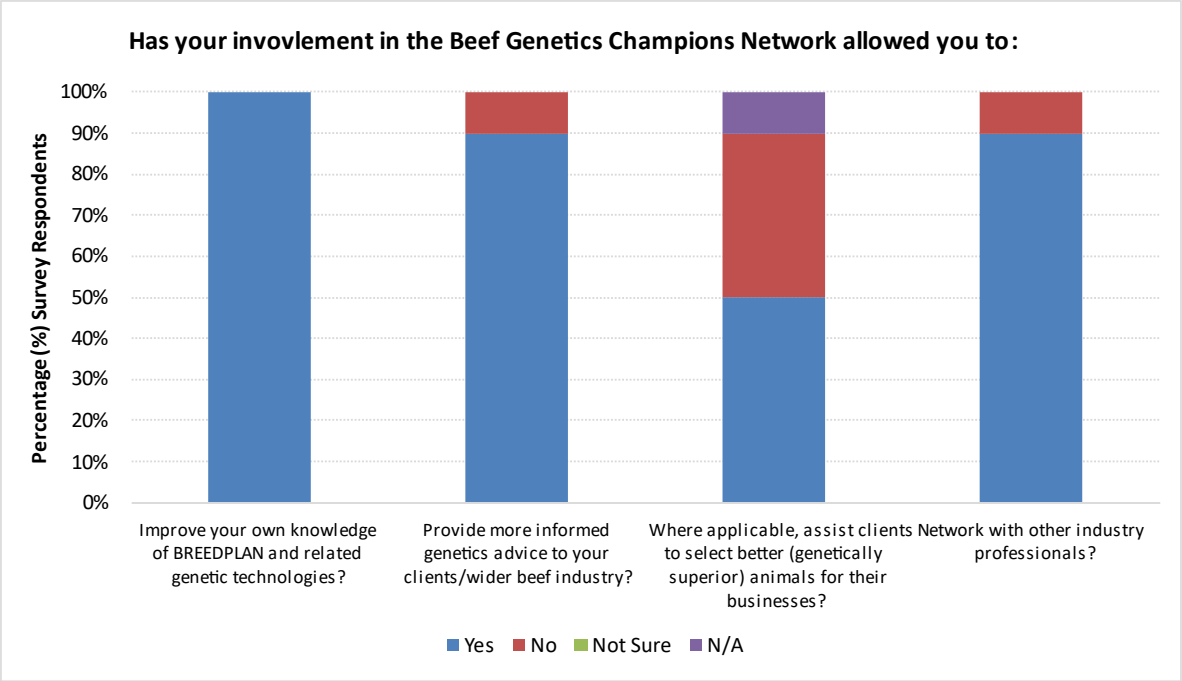

Figure 5.2. Survey respondents were asked whether their involvement in the Beef Genetics Champions Network had allowed them to improve their knowledge and provide more informed advice to clients.

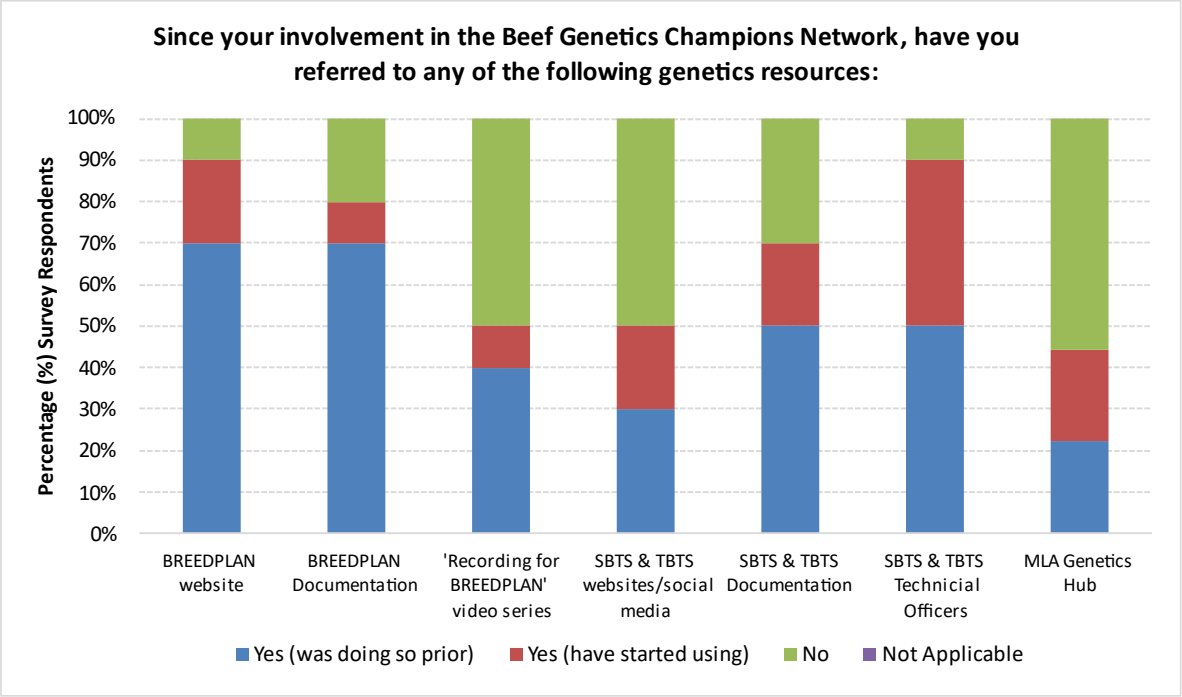

Figure 5.3. Survey respondents were asked whether, since their involvement in the Beef Genetics Champions Network, they had referred to a number of genetics resources.

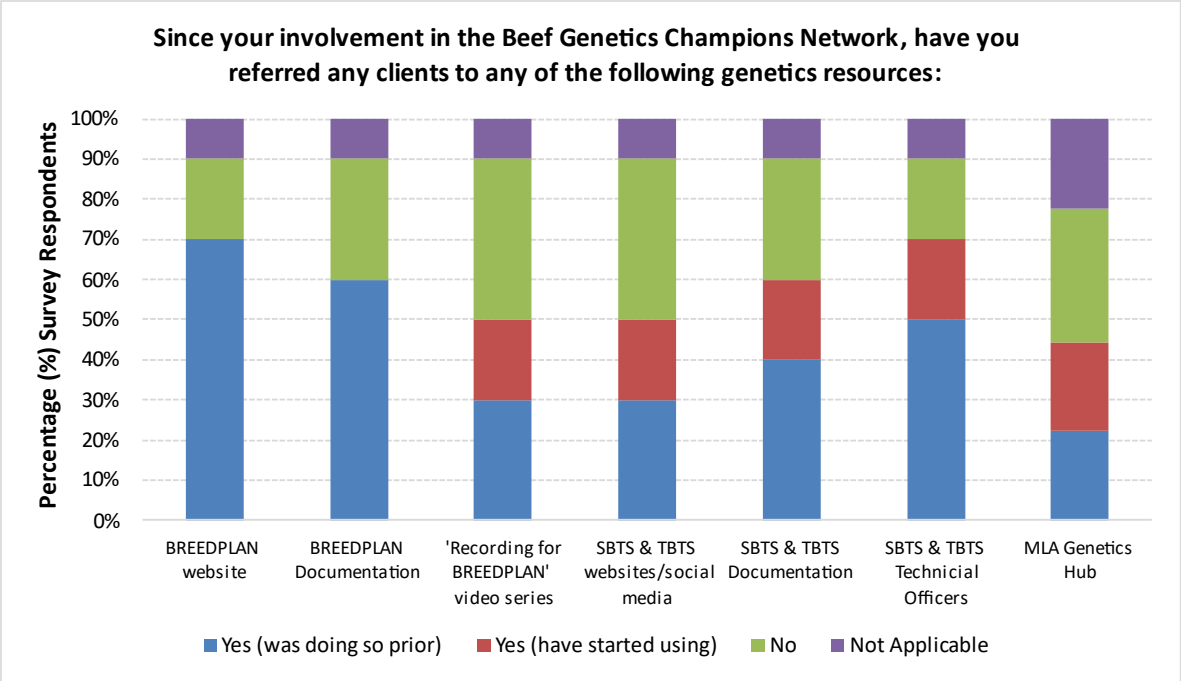

Figure 5.4. Survey respondents were asked whether, since their involvement in the Beef Genetics Champions Network, they had referred clients to a number of genetics resources.

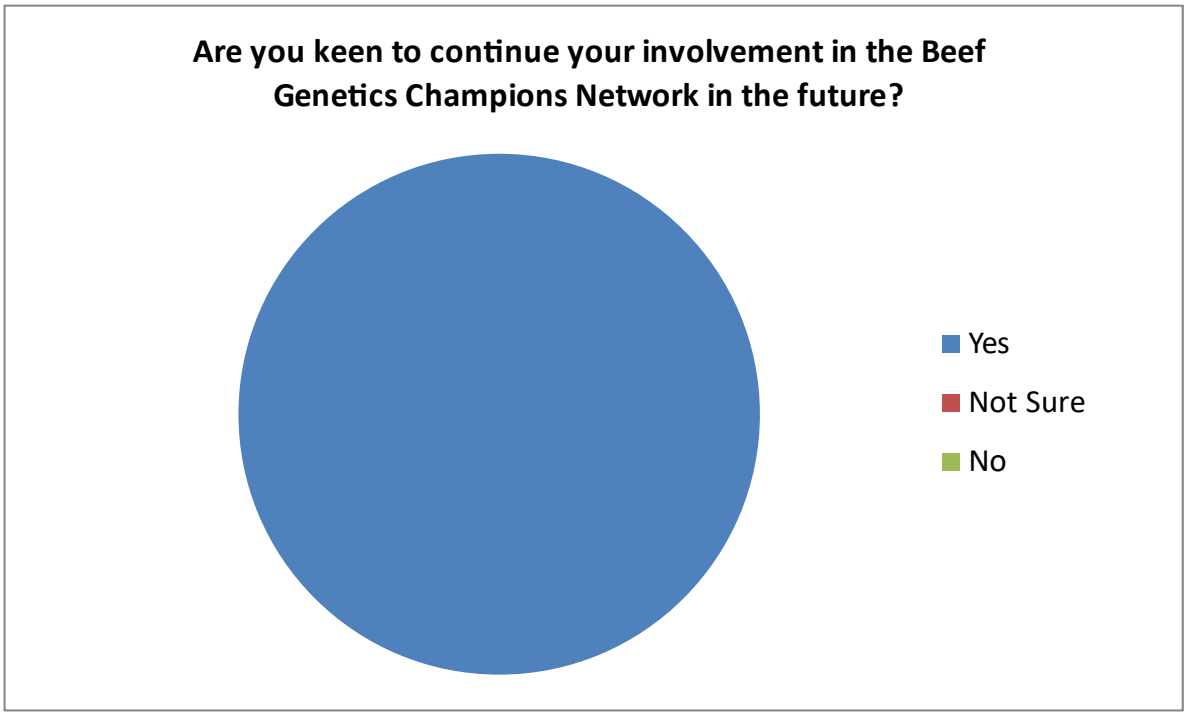

Figure 5.7. Survey respondents were asked whether they were keen to continue their involvement in the Beef Genetics Champions Network in the future.