# final report

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## An Australian Sheep Genetics System - Report Summary

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# An Australian Sheep Genetics Agency (ASGA)

## Study Framework

Meat and Livestock Australia (MLA) and Woolmark Company PL (WM) and predecessors, have long supported research and development into the use Quantitative Genetics for sheep breeding. Over four decades, tens of millions of dollars have been invested from meat and wool industry levies and from Commonwealth (CSIRO, research levy matching, grants) and State governments (via Departments of Agriculture).

**MLA and Woolmark agreed in mid 2000 that was timely to review current arrangements** for genetics databases and to consider the feasibility of a national sheep genetics service.

Issues prompting this study included:

- **Relatively low level of sheep industry use of quantitative genetics** (QG) in Merino breeding and in breeding prime lamb maternal sires.
- **Existence of different genetics databases** operating on different technical and costing bases, and with differing reporting languages, including :

  – *Lambplan*, started in 1988 by the Meat and Livestock industry, focussing on meatsheep breeds and recently, Merinos. Now a division of MLA.

  – *Advanced Breeding Services* (ABS) a NSW Agriculture unit from 1990 concentrating on Merino breeders, including services to *Merino Benchmark*.

  – *Select Breeding Services* (Select) – an advisory unit based at CSIRO Chiswick concentrating on Merino breeders.

  – *Central Test Sire Evaluation* (CTSE), plus wether trials and breeding trials giving quantities of sheep data, for Merinos and meatsheep.

- **Whether current arrangements are the most efficient and effective** or whether a more standardised or co-ordinated approach is warranted.

**Market and commercial baselines**: In preparing this study, it was also understood that –

- Woolmark and MLA have been concerned to achieve a viable and successful Australian sheep genetics system, as marked by usefulness to sheep industry sectors in achieving genetic gain of commercial value to sheep producers.
- Success would be measured mainly by patronage of any system in the sheep industry marketplace and by adoption of QG techniques to achieve commercial gain – there would be no compulsion on breeders to use the service.
- Potential for any genetics service entity to operate in a commercial manner was to be considered.

**Hence, the ASGS report examines, from first principles, a range of the expectations, issues and concerns that characterise an active, competitive marketplace**, with regard to:

– adoption of genetics technology in the Australian sheep industry,
– the market for genetics services and systems for service delivery, and
– improving returns for breeders and commercial wool and sheepmeat producers.

The full ASGS report investigates the changing sheep industry and genetics progress in other industries (Chp 1). Identification of Australia's sheep genetics marketplace (Chp 2) leads into Chapter 3 where Options are considered. Section 3.6 provides a framework for a possible pro-active Genetics Agency. Part 2, Chp 4 contains the technical analysis.

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**Part 2: Chp 4 Genetics Services and Compatibility**

The ASGS report aims to be frank and robust. In addition to information collection (eg. on genetics technology) and analysis, perspective, evidence and colour are provided by quotations, discussion and examples, plus graphs, tables and references to written sources. Most of these are excluded from this summary. Interested readers are referred to the full report (and to the Glossary ending this Summary).

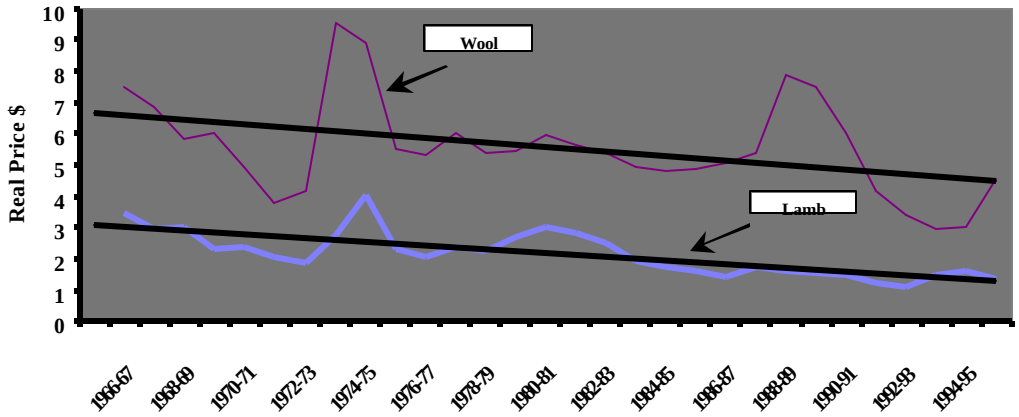
## ASGS 1.2 Changing circumstances for sheep businesses

Implementation of genetics R&D into a marketplace of diverse experience, tradition and independence, presents a complex challenge. The changing circumstances for sheep businesses is essential context. Key directions of change include:

- **Competition:** Commercial sheep products (wool, meat) need to improve their quality –for-price to compete against alternatives, with production being viable and sustainable.

- **Lower real prices for sheep enterprise products.** Wool and lamb prices have been declining steadily since the 1960s in real terms, emphasising cost reduction and productivity growth.

**Real Prices for Wool and Lamb (ABARE)**



➢ **Sheep sub-industries:** Export wool and lamb marketplaces are driving the development of three or so sub-industries with distinct market and production characteristics –

- Fine clean Merino wool, especially under 18 microns, from high-medium rainfall zones attracting high and increasing prices but with associated production issues.
- Broader wools from pastoral areas with limited options (dual purpose sheep, goats).
- Prime meat producers, often supplying through alliances, along with broader wools.

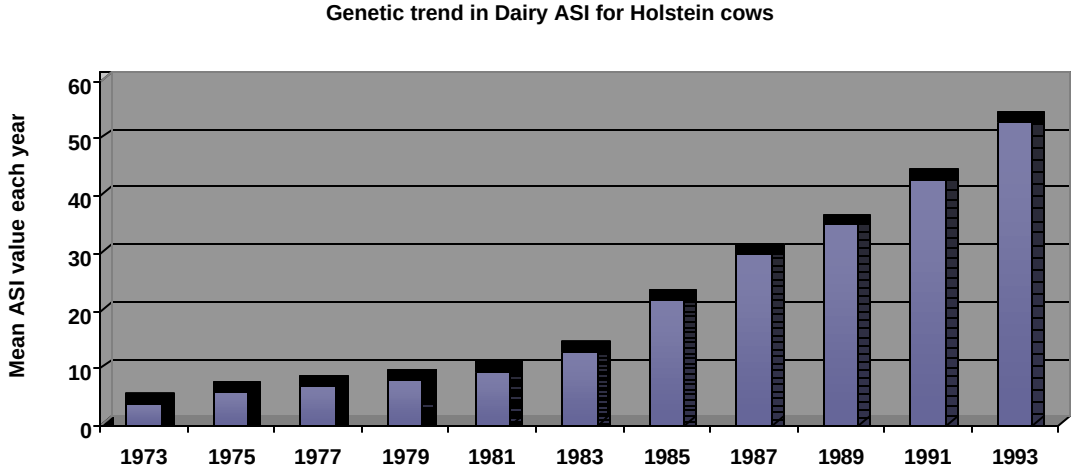
➢ **Farm business as a product mix:** Fewer producers will be wool or lamb specialists. Wool, sheepmeat, other products *plus* off-farm work income will be part of the product mix of increasingly professional agricultural businesses in most regions. Hard-headed business decision -making will lead producers to place priority on genetic gain at some times, but not all the time.

## ASGS 1.3 Genetic advance in animal industries

**Commercial sheep producers face a range of problems that limit or erode enterprise returns.** Dramatic productivity gains could be made through new ways to attack fly strike, or, say, pasture systems for much higher stocking rates, for example. Both MLA and WM have supported a range of such R&D projects, as well as genetics research and implementation.

**Genetic gains offer slower but enduring productivity benefits that accumulate within a flock and an industry.** These include disease and parasite resistance, plus the potential to modify wool and meat products to meet changing marketplace requirements. Genetic advance can be critical to cost reduction and productivity.

**There have been impressive results in intensive animal production.** In Australia, over 20 years, dairy cattle breeding has developed from State bull-testing with focus on milk volume, to a single national evaluation system with ties to world-wide Interbull. Australian dairy industry genetic gain increased dramatically from 1981 when the Australian National Dairy Herd Improvement Scheme (ADHIS) introduced BLUP calculation of Australian Breeding Values (ABVs). Genetic gain of many percent points a year has been achieved in Holstein cows.




Australian Selection Index = (3 X Protein ABV) + Fat ABV – (0.03 X Milk ABV)

Genetic progress has been assisted by artificial insemination (AI) and closed production facilities for dairy and pigs, but the achievements in intensive industries have not been without side effects and costs. Take-up of quantitative genetics has also been associated with forms of industry rationalisation alongside productivity advances.

**Results in these industries provide a guide to the potential for gain, and to points of caution, but are not fully applicable to paddock mating systems in the extensive sheep industry.**

Quantitative genetics (QG) techniques are explained in the full ASGS Report, including an outline of the principles of breeding objectives (where does the breeder want to go?), different animal traits of economic value, their measurement, breeding values (BVs) and selection indexes, selecting superior animals and use of reproductive technologies.

**Industry acceptance and adoption of QG is a vital question.** It became clear during this Study that the dynamics of the current and future Australian sheep genetics marketplaces would be a key to evaluation of current arrangements, and to identifying ways likely to be successful. Separate marketplaces should be recognised. Differences of opinion about genetic gain, important selection traits and about techniques need to be well understood.

**Use of Quantitative Genetics techniques in Australian sheep breeding**

? In 1998-99, of the 150,000-160,000 Merino rams sold to Merino breeders and to commercial woolgrowers, it is estimated from research for this Study, that:

- Perhaps 25% of rams were selected using Quantitative Genetics, though a QG system used by less than 10% of registered Merino studs and other ram sellers.
- Of these rams, a portion may have been sold using Breeding Values or Indexes.

? And in 1998-99, for meatsheep breeds :

- About 70 % of terminal sires (Dorset, Texel, Suffolk) were selected on BVs by about 50% of registered studs. Some 30% of Border Leicesters were BV selected.
- About 40% of these selected animals were sold on the basis of BVs or Indexes.

**A sizeable section of, but not all, breeders of prime lamb sires have adopted quantitative methods** through the Lambplan system. Results have been spectacular for some, less so for others, and this has sparked controversy at times. MLA sees uptake as sub-optimal among maternal sire breeders and commercial producers.

**Quantitative genetics tools are not widely used in wool Merino breeding, far less than hoped, and there are fervent differences of opinion about sheep selection methods.** Objective measurement of some traits (average fibre diameter and associated tests) is now used by over 90% of Merino breeders as a guide, but not in QG systems. Discussions and research indicate that many Merino and some other sheep breeders consider science does not cover all key considerations nor add-value to their skills or breeding aims (which relate to client ram-buyer needs).

**There are also differing views about which sheep and wool traits are most important, both technically and commercially.** The Merino ram-buying marketplace appears, through sales, to place value on some features that differ from an ideal of intensive selection for those traits that are calculated to increase profit for commercial wool producers.

However, long term research shows that visual appearance can conceal positive and negative factors in an animal's breeding value. Quantitative tools enable mathematical correction for twinning, order of birth in a flock, and pedigree history. Measurements can address poor correlations between some assessed traits and those that add value for commercial producers. Across-flock comparisons of the merits of rams also greatly increases selection power.

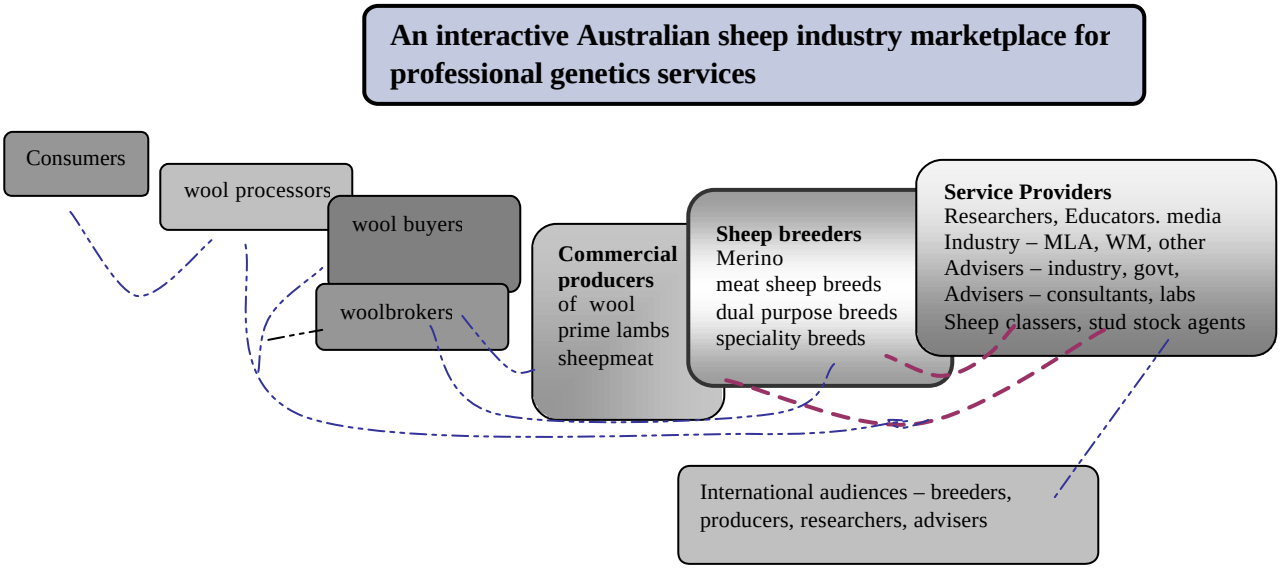
Researchers have expressed sincere frustration with 'highly conservative resistance to change' in the wool industry, and the emergence of new non-measured methods for selecting sheep. The disconnect between Merino ram prices and the theory of fibre diameter and fleece weight selection has been a longstanding puzzle to advocates of QG.

## ASGS Chp 2 Australia's sheep genetics marketplace

**Markets, mainly, determine rate of reward, and so the adoption of, a new approach** such as quantitative genetics, or a new index, or a database system. Marketing, explanation and extension can influence decisions, but actual 'reward', in terms of money and values such as status, confidence and involvement, is the key driver.

The success of almost any venture in a market economy such as Australia will reflect its fit with marketplace needs, particularly into medium and longer terms. In active marketplaces, buyers shape suppliers through custom, prices and feedback. Product providers can explain, lead and educate. Their success will relate to known or hidden needs of buyers, plus the skills of marketers and educators.

**Multiple markets. Different objectives.** A number of product marketplaces operate within the Australian sheep industry and they need to be understood as separate although linked. The largest is made up of the numerous commercial producers selling *meat* and *wool* to Australian and international buyers. Australian breeders sell *rams* to other breeders and to commercial producers – this is a smaller market arena with different driving features.




**An understanding of the interactive marketplaces is needed to assess the potential for any single Australian genetics system to be useful, and to operate in a commercial manner.** The ASGS study concentrates on sheep breeders (Merino, major meatsheep breeds), commercial producers, and the range of genetics service providers.

## ASGS 2.1 The markets – ram breeders and commercial producers

In theory, genetic improvement could be focussed on lead studs, with gains flowing down the pyramid structure from nucleus studs to commercial industry. In concentrated industries, with few lead breeding businesses, this can be very effective. However, the Australian sheep industry is as diverse as the many environments in which sheep are found. There are hundreds of Merino bloodlines, and numerous meatsheep breeds.

**Breeders, commercial producers and genetics service providers all exist within an active, free enterprise, and competitive marketplace.** Breeders are conscious that their position as a superior animal provider depends on market patronage and meeting customer needs.

Genetics technologies and breeding systems have widened the choice for ram buyers. Most ram sellers assess the marketplace and develop a reasonable-cost breeding and marketing program they consider will retain and build custom. Their marketing points-of-difference could emphasise technology, tradition, a speciality approach, or a mix of these.

> "The overriding objective of most Merino breeders, regardless of their views about means, is to achieve genetic progress in a way that will improve the economic viability of their enterprise." *J Litchfield 1987*

**To identify potential target markets, the ASGS study considered which breeders, in theory, should be interested in scientific genetics services in various forms** to assist them achieve breeding goals and develop their stud businesses. Also, what part of the breeding sector would industry leaders and geneticists see advancing genetic gain?

A promising target market of sheep breeders who could be interested in science-based genetic evaluation system is identified in the ASGS study, ie.

- 1,600 breeders / studs and some 500,000 new animals for analysis each year
- being 800 Merino (320,000 new animals), & 800 meatsheep / other (180,000).

**Target ram breeder market for genetics services**

**Merino breeders**: Membership information from Association of Merino Stud Breeders and elsewhere (refer ASGS report) identified an estimated 1,800 studs and ram sellers. Of these, the entities selling over 50 rams a year (about 45%) and studs started after 1980 (also 45% with some overlap) would form a desirable Target Merino Breeder market for quantitative genetics.

So, **about 800 Merino breeding enterprises**, producing an average say 800 assessable lambs a year, of which half are targeted for testing, so **about 320,000 new animals a year**.

- An 800 Merino breeder target market would be promising both in terms of facilitating industry genetic advance and as a solid client base for an Australian sheep genetics system.
- It would be realistic to expect a diversity of views on breeding aims and approaches among 800 Merino breeding businesses. Many will be competing directly with each other.
- Perhaps 130 Merino breeders (less than 10%, but of varying sizes but selling up to 25% of rams) are using Quantitative Genetics techniques (see ASGS report). Most others use measurements and receive advice from consultants and sheep classers. An estimated 200 enterprises supplied 50% of the 150,000-160,000 rams sold in 1998 (latest available figures). Some 900,000 Merino rams are mated in commercial flocks to around 100 million ewes annually.

**Meatsheep breeders**: Of an estimated 1,800 studs breeding meatsheep and exotic types, over 50% appear to have flocks of less than 100 ewes. Poll Dorset, White Suffolk, Border Leicester, Texel and Corriedale breeds are assumed to dominate for the next decade, but there is no basis for excluding any type of sheep from the scope of this Study. Some may build to important breed lines as rural industries change. eg. East Friesian dairy sheep for multiple lamb rearing, or the no-wool Dorper for arid and other areas.

A realistic target market among meatsheep breeds (refer ASGS report), would be **800 studs averaging 180 ewes and 270 new lambs a year**, of which 80-85% or 180,000 new animals would be evaluated each year. This excludes 55% of current numbers as very small studs.

- Currently, some 580 meat sheep studs are clients of Lambplan. Others use a personal selection system, some scanned measurements and / or advice of sheep classers.
- There appears to be a stronger accord among meatsheep breeders on commercial breeding objectives and important traits, but there is still debate among these breeders on subjective and objective assessment, sheep type, primary breeding objectives, markets and selection.

In principle, if these 1,600 studs (of some 3,600 sheep breeding enterprises in all) were using QG to select for traits *agreed* as important, average industry genetic gain should accelerate rapidly (benefits primarily measured as returns to commercial producers).

**Clues on marketplace activity and priorities can be obtained from rural newspapers, industry newsletters and debates in the media.** A sampling of rural newspapers shows a range of market signals as well as active opinions about breeding systems.

? Wether trials and field days are regularly covered.
? Ewe Competitions organised by show societies, sheep classers and regional Merino breeder or grower groups also receive publicity.
? Show ring results are widely covered. Reports describe how a stud animal looks and some measurements, but not breeding values.
? Stories about stud or commercial breeding are frequent, and cover a mix of selection systems.
? Reports on genetics and science do occur on occasion, and the messages are mixed.

Ram seller advertisements also provide insights into marketplace priorities. These demonstrate a highly competitive market arena and limited use of quantitative genetics.

**Target commercial wool and sheepmeat producer market for genetics services**

**The commercial sheep producer market for rams, ewes or genetics or services is not captive.** Many commercial farmers can switch among production businesses, influenced by prices and other market signals, costs, new ventures, plus environmental and other concerns. In Australia in 1998, there were near 44,000 sheep farms (over 200 sheep). During the 1990s, the number of sheep farms and specialist wool producers fell. Over 75% of wool producers are mixed enterprises. Of wool sold at auction in 1998, 33% was 20 micron or finer, a large increase from 22% in 1993.

To many producers, the big breeding decision will be whether to change from cattle to sheep, or to Merino or Lamb sire or the reverse, and then where to source rams. Traditional allegiance to ram suppliers is reducing, but where off-farm work and other businesses demand more time, local convenience will still be a key factor.

Some commercial producers are very interested in genetics. A market for professional genetic evaluation services could be developed among specialised commercial sheep producers breeding rams for their flocks – **say 1% of 44,000 producers, or about 400 potential users**.

## ASGS 2.2 Issues at the interface of markets, science and technology

Research for this study indicates that about 710 studs use some quantitative genetics services, 600 in Lambplan (580 of these meatsheep). Usage is 16% of the Merino target, 73% of the meatsheep target.

| | Number of registered studs and ram sellers approx. | TARGET market as estimated above | Number studs using quantitative genetics services | Use of services by whole market % of studs | Use services by TARGET market (% of studs) |
|---|---|---|---|---|---|
| **Merino breeders** | 1,800 | 800 | ~ 130 | 7% | 16% |
| **Meatsheep** | 1,800 | 800 | ~ 580 LP | 32% | 73 % |
| **All sheep breeders** | 3,600 | 1,600 | ~ 710 | 20% | 44% |
| **Wool/meat producers** | 44,000 | 400 | | | |

**Factors likely to influence the interest, or non-interest, of the target market of 1,600 breeders and 400 producers in a genetics selection system (QG, SRS, traditional) include:**

- Feedback and price signals from ram buyer customers (commercial breeders, other studs). Some producers put priority on QG by paying more for superior animals. Lambplan meat rams attract a clear but varying premium. QG has much less influence on Merino ram buyers.
- Time and money costs of joining a selection system (such as Lambplan, ABS, SRS, Elite)
- Need to develop a visible competitive edge and market niche (eg. at shows and sales)
- The alternative genetics methods available and what gives 'winners' and 'losers', and
- Approaches and attitudes taken by genetics services providers.

**Identifying realistic target markets sets a positive vision, but is a first step only in achieving the customers needed for a successful genetics service system.** To secure the interest of most this target group (1,600 studs, 400 producers), any new system would need to cater for differing views on breeding objectives best suited to an enterprise.

Quantitative genetics research reaches back to the 1950s and QG services have been available since 1988 (Lambplan) and 1990 (ABS). The former WoolPlan began about 1987. Use of objective measurement of key traits (eg. diameter and muscle) has increased, but by 2000 most Merino breeders and numerous meat sheep breeders were *not* using quantitative genetics tools.

**Many attribute this a strained interface between sheep breeders and the scientists who developed QG tools, to approaches taken by the scientific community** in explaining, advising and 'selling', and to the need for evidence to support QG in practical and commercial as well as scientific terms. An innovation needs to improve the competitive viability of breeding businesses.

> "Unfortunately, in the past there has been a view by some that geneticists and the stud Merino breeders had different 'bottles' of Merino genes. … This was a view from the 1970's and 80's when there was enough fat in the Merino industry to allow all of the participants to have their stand-offs on points of custom and ideology. Those days, of excess fat at least, have definitely gone. … I believe the various methods of breeding have come closer together because most successful breeding programs now depend as much on measurement as they may still do on visual classing." *Peter Ralston, Pres. Stud Merino Breeders WA 1999*

**Professional genetics services providers are a crucial part of the Australian sheep genetics marketplace.** Expert sheep classers, for instance, have been offering selection approaches to Merino and other stud breeders for over a century.

**Media advertisements can provide insights into real market priorities.** Advertising reflects how stud breeders 'read' their clients' needs, and so the genetics services they seek. Some studs promote the expert approach they use for selection in their advertising. The table below presents a NSW picture. NSW is the base of many current genetics services providers.

**'How the sellers sell' – Market signals from 330 stud sale advertisements in newspapers**

| Number of advertisements mentioning - | Merino studs NSW | Meat sheep studs NSW | Beef Cattle NSW |
|---|---|---|---|
| ? Only stud name, bloodline, animal or wool features described | 65 | 17 | 71 |
| ? Any measurements or testing | 72 | | 9 |
| ? Performance recording – generally | 7 | | 5 |
| ? Systems or services for ram selection | 3 | | 1 |
| Lambplan | | 10 | |
| Scanning method | | 4 | |
| Merino Benchmark/ABS | 3 | | |
| Select Breeding Services | | | |
| SRS/Elite/Watts/Swan | 28 | | |
| Centrally Tested / EPVs | 4 | | |
| Breedplan/Group BP/EBVs | | | 31 |
| Total advertisements | 182 | 31 | 117 |

The Advertisements tabulated are a reasonable sample. The indications are that :

- In beef cattle, while the majority rely on stud name and basic description in advertising, Breedplan and EBVs are established as a selling basis and marketing tool.
- In meat sheep, Lambplan use and rankings are known and used, but some do identify scanning by others methods in their advertisements.
- For Merinos, that rams are measured (micron and other fibre tests) is now as important as stud name alone. Traditional-with-measurements is the most used approach, then 'elite wool' and 'advanced Merinos' (Soft Rolling Skins, Elite systems). QG receives a few mentions.

**Marketplaces set the same challenges for service providers as they do for all businesses.** No matter how logical a technology or innovation is, buyer understanding, practicalities, full costs, real results vis-a-vis other approaches, marketing and fashion, will steer adoption and success. There is a need to focus on service and persuade customers.

**Tailored products, marketing, extension, favourable prices, extra services and regulation can influence uptake of new ways.** These are all tools in the 'selling' armoury, but they can be costly in time and money. It is easier to state that 'more, personalised, advice' is needed, than it is to recover the true costs of such advice in a widespread industry. In a competitive breeder marketplace, arguably, such costs should be directly charged.

### ASGS 2.2.1 Debate: Which traits are important? What methods?

In a competitive industry, each breeder will and should decide what product mix to develop for their clients. Genetics services providers need to assist this decision-making.

It is generally agreed that defining a set of breeding goals focuses and should advance, breeding results. Goals set a start point for collecting information on traits, then calculating breeding values (using research into traits), and ranking animals on genetic merit. BVs can be calculated for any trait that varies among animals and can be reliably graded [ASGS Part 2]. In QG systems, breeding goals are usually a weighted combination of 'economic traits'. The past has seen some rigid central views on what these are.

**In reality, somewhat different 'important economic traits' are likely for different markets and for sub-markets.** Ram selling is a distinct market from wool or meat selling. Within the ram industry, many Merino and meatsheep breeders have developed their market position by providing animals with special combinations of features (such as to suit a regional climate).

**For meat sheep, ram and product value traits are reasonably well defined** (growth rate, muscle, reproduction), but there is some contention about 'across-flock' BVs and selection indexes, and fit of QG results with visual appearance of rams and progeny.

**In 2000, opinion on important wool value-traits and Merino breeding goals is still many-sided** – except that finer fibre diameter is the key for the three main selection systems (traditional, quantitative genetics, and SGS/elite wool).

> "… the real opportunity cost to the industry is the embedded FAQ mentality as regards genetics … the key to innovation, particularly the genetics of the skin. … 'Fine' can't be the only thing to select for – the other attributes involving major gene pathways must be included. There must be a multi-dimensional view of fibre quality…". *Charles Massey, 2000*

**Price signals from wool processors and buyers**

These are not clear beyond fibre diameter. "If you went back 40 years investigating how the wool industry related to its processor customers, you would find the demand factors almost as clouded as they still are today": *Peter Ralston 1999*.

Traits emphasised by processors over 1999-2000 include: Average Fibre diameter, Style (can include good tip, evenness of crimp, deep well defined crimp, whiteness, low fibre curvature, low diameter variation, high strength and good position of break), low crimp frequency, acceptable length, strength, good colour, fibres with 'desirable processing and comfort characteristics', contamination free, and chemical residue levels which meet increasingly stringent environmental requirements.

**GH Michells, Australian wool processor, on desirable wool characteristics 1999**

1. Contamination is the single most problematic issue for the wool industry. 2. Fibre diameter is the most important parameter, accounting for most of price paid. 3. *Some types of wool will process better at the same micron. Wool of the future will have a clearly defined broad crimp, fibres are well aligned and strong, few fibres more than 30 microns.* 4. Test certificates stating mean staple length and strength (processors pay more for the test). 5. Colour of greasy wool not important so long as the colour washes out.

**For this study, it is assumed QG can offer more potential return to Merino breeders and commercial producers than methods using fleece measurements plus forms of sheep classing.** How much more, in practice, will appreciably influence the actual adoption of QG selection.

It has been estimated that modern QG techniques should be able to increase Merino productivity 1.3% to 1.7% a year, ie. over 10 years a gain of 8% to 12% fleece weight with fall in fibre diameter of 0.8 to 1.5 microns. Over time, markets should pay for such value-adding traits and conceivably give dollar returns for investment in QG.

> "[In] analyses of profitability from commercial merino flocks… fleece weight, average fibre diameter, live weight … account for about 80% of the variation in income. With about 44% of selection emphasis placed on these characteristics by the surveyed Merino studs [125 leading breeders said they placed weight on: fibre diameter 17.4%, fleece weight 16.9%, conformation 12.1%, colour / character / handle 10.2%, size-liveweight 12.1%], it could be argued that these influential stud breeders were under-emphasising these commercially important characteristics in their selection programs." *Ian Rogan, Rampower Co-ordinator 1999*

Impediments to adoption of QG tools by Merino studs were seen by Rogan to include:

- Lack of confidence in accuracy of fleece measurements particularly on young rams.
- Lack of formal breeding objective development by stud breeders to set targets for increasing wool cuts and / or improving wool quality, size, resistance to parasites, lambing rates.
- Failure to clearly analyse and communicate the relative commercial importance of different potential selection characteristics.
- The lack of pedigree and birth status information for most rams born in Merino studs (part due to the expense of obtaining this data at mating and lambing times, and of DNA fingerprint tests) so limiting genetic calculations within and across flock.
- Absence of the great stimulus to genetic improvement in other domestic livestock species – across flock comparisons and ready access to superior sires through AI.

**Debate about key traits and genetic methods, is ongoing**. Differences about breeding goals and weighting contributes to disagreement about whether 'genetic gain' is, or is not, being achieved by the industry. **This provides important context to assessment of genetic services needs, current arrangements and options for development.**

For instance, it is a marketplace reality that 'style sells' – be it in wool, lambs, rams, stud-masters, advisers or geneticists. This needs recognition in any system.

**Controversial Merino breeding criteria – SRS, Elite**

Merino ram and wool markets reward breeding and commercial decisions through custom and prices. Use of SRS (Soft Rolling Skins) and the similar Elite systems has grown during the 1990s. They are part of the genetics marketplace. A number of leading modern and historical studs are clients of scientists Dr Paul Swan (Elite) and Dr Jim Watts (SRS).

> "[The SRS] selection package is directed towards a highly productive, balanced animal with highly aligned, well nourished, soft handling, very stylish, lustrous pearly white wool. The fleece surface, which has a mop like structure is quite resistant to dust penetration, water damage and ultraviolet degradation. … our [selection] aim is to improve wool quality and handle, reduce mean fibre diameter and co-efficient of variation while maintaining fleece and body weight and reproductive performance." SA Selection Demonstration Trial 2000

The Elite system places considerable focus on measured wool characteristics and animal fit with the environment, and is expanding its client base. Measured results for diameter, CV, fibre curvature, fibres over 30 microns, plus fleece and animal weights and pedigree, are used to calculate selection ratios which relate to skin features. The features of progeny and products are generally reported in terms of fibre diameter, CV, fleece weight and style of wool [ASGS report Parts 1& 2].

Elite and SGS systems are considered further in the discussion of genetics services providers.

## ASGS 2.3 The range of genetics service providers

**Australian sheep breeders are currently obtaining breeding and selection expertise from many sources,** including (likely as a mix):

- considerable family experience plus reading and short courses / workshops
- university degrees with genetics, animal production, marketing / business subjects
- feedback from ram and ewe customers, stock selling agents, wool and lamb buyers
- interaction with, and specifications set by, Breed Societies and at Shows
- advice and selection services from consultant sheep classers
- advice from agricultural consultants and local agricultural departmental officers
- a range of services from specialised breeding consultants using various systems
- involvement in industry-supported selection systems and trials using QG

**An array of professional genetics and advice services is on offer.** Sheep classers and laboratories (for fleece tests) are widely used. Altogether, the other services are patronised by a minority of Merino breeders, and a larger proportion of meatsheep breeders. Features of the following services are outlined in ASGS Report Part 2.

Quantitative Genetics Service Providers

- Lambplan – Meat and Livestock Australia
- Advanced Breeding Services (ABS) – NSW Agriculture
- Select Breeding Services – CSIRO
- Central Test Sire Evaluation (CTSE)
- Agriculture Western Australia
- Natural Resources & Environment, Victoria
- Mackinnon Project – University of Melbourne
- SARDI – South Australian Research and Development Institute
- Independent consultants

Others

- Soft Rolling Skins and Elite Wool systems
- Professional sheep classers and stud advisors
- Practical advisers and service providers (laboratories, scanners)

**Through R&D programs plus government and commercial services a number of sheep genetics data collections have accumulated.**

**In considering the wider usefulness of these accumulations, such as for across flock comparisons, questions of compatibility and conflict arise.** The operation of these services, their associated data collections and analysis systems, including questions of compatibility are considered in the ASGS Report Part 2, under the following headings.

- Scope of sheep genetics data collections [also below]
- Enterprises, pedigree, accuracy and links
- Traits recorded, measurement and data integrity
- Data collection, delivery, processing
- Preparing BVs, indexes, comparisons, reports

**Sheep genetics data collections:** The following table summarises some key features of most sheep data accumulations in Australia. These were obtained from service providers where possible but most would not state exact client numbers. Estimates (~) are likely to be high rather than low. The value of various aggregations is described. Those more useful for across-flock comparisons are shaded [refer ASGS report Part 2 for details].

New Zealand's Sheep Improvement Limited (SIL) also holds a sizeable collection of genetics data for a range of sheep breeds, some with links to Australian sires. SIL is interested in Australian developments and the potential for across-Tasman evaluations.

| | **BREEDER CLIENTS mid 2000** – Merino – other | **MERINO animal records** – in total (new 99-00) | **NON-MERINO records** – in total (new 99-00) | **DATABASE Full size** in animal records mid 2000 | **Comments** |
|---|---|---|---|---|---|
| **Lambplan** | 13 Mo 600 XB | 87,000 (5,000) | 830,000 (107,000) | 917,000 | structured database , many cross-links in meat sheep, some in Merinos, many full pedigrees |
| **ABS client database** | 44 Mo (plus 26 Mo B'mk) | 200,000 to 250,000 (~20,000) | | 200,000 to 250,000 | data collection with EPVs, not structured as a database, within flock use, limited pedigrees |
| **NSW Ag Bloodlines wether trials** | | | | lge quantity of data over 10 years | usefulness limited. wethers with little pedigree. Many measurements and trait scores. |
| **ABS Merino Benchmark** | 26 Mo | 105,000 (~20,000) | | ~ 105,000 | 31% pedigree for sires, 15% for dams, good links to CTSE sires |
| **Central Test Sire Evaluation** | | 21,000 ( ~ 2,000)? | | 21,000 500+ sires | Across-flock evaluation by trials, part pedigrees, link sires |
| **Meatsheep CT Maternal Sires** | | | 9,000 | 9,000 91 sires | sire and dam pedigree on most, limited links, unusual traits, so not in LPlan |
| **Select Brding Services CSIRO** | ~20 Mo | | | ~ 3,000 | each breeder's data stored for within flock, not a database |
| **CSIRO Fine wool project** | | 10,000 (closed) | | 10,000 | with pedigree and some ~ 7% links to CTSE rams |
| **South Aust. brdng trials** | | 2,400 Mo (600) | | 2400 | full pedigree, links to CTSE and various studs |
| **Trangie Q Plus trials** | | | | | Closed selection flocks since 1992, full recording, few links |
| **Mackinnon project** | ~10 Mo | ~20,000 (10,000) | | ~ 20,000 | mostly ewe data, limited links to sire databases |
| **WA AgServices** | ~20-25 Mo | 65,000 | | 65,000 | Merino data by flock, pedigree & links improve post 1998 |
| **Independents** | ~ 1-3 | | | | limited, within flock |
| **Laboratories, breeders, sheep classers** | large numbers | | | | many measurement records for sheep most without sire / dam, AI records a stronger resource. |
| **Elite/SRS clients** | ~ 100 Mo together | | | | Pedigrees on most? Could be interesting. Limited links. |

## ASGS 2.3.2 Sheep genetics services – key points and issues

See ASGS Part 2 for discussion behind these conclusions.

- **The overall adoption of quantitative genetics is not impressive, nor are the industry's QG service arrangements,** considering the Australian sheep industry as a whole, and its size and importance, and assuming that quantitative genetics systems have as much to offer sheep producers as other animal industries.

- Investment over decades has achieved an established QG service in Lambplan, which has piloted significant genetic gain in key meat sheep traits. LP services some 600 studs and likely reaches 55-60% of meat-sheep rams sold, though less than half of registered meatsheep studs use Lambplan and membership growth has flattened. Members pay near 60% of costs. Experience gained from Lambplan's development should be considered in any new sheep genetics system. There are messages for products, marketing, and balancing of costs and pricing.

- **In Merino breeding, adoption of QG is low (less than 10% of ram breeders, perhaps 25% of rams sold). Genetic gain is seen as slow in key traits** (diameter, fleece weight), notwithstanding investment in QG genetics R&D and in developing some service providers.

- Industry and scientific efforts during the 1990s to fine the flock have achieved results but over 90% of Merino ram breeders do not use QG systems. A significant number follow 'elite wool' approaches, but the majority are using objective measurements for diameter and fibre characteristics on each ram alongside traditional sheep classing for wool quality and sheep features.

- Wool industry QG services are provided by a small number of consultancies. Current services are modest in scale (ABS the largest with up to 70 clients) and mostly staffed by public sector officers involved in various other work.

- **There are no apparent far-seeing plans to lead, market and provide QG services on a wide scale to the Merino breeding industry.** There is enthusiasm but the plans of service units are limited compared to the industry size.

- Genetics is a 'high-tech' field and clients expect explanation and advice as part of services whether provided by Lambplan or ABS or another. Advisers are generally high cost employees with solid overheads, and advising takes time. Travel adds to costs.

- **No government or industry service is charging prices that routinely cover full costs. Clients are partly or wholly subsidised.** Lambplan recovers above half. ABS feels it covers its added costs. Low cost recovery reflects cost structures, what services think breeders will pay, breeder views on value of services, breeder-grower expectations of low prices because of levies and taxes.

- Independent QG service providers, existing or new, must compete on an uneven field (although they do tend to have lower costs). Notably, the 'elite wool' consultants appear to charge business rates for services and they secure and retain breeder clients.

- NSW Agriculture has developed much of the key QG software, genetic parameters and reporting systems. Lambplan has expanded and developed on these as it has grown. NSW Ag distributes software without Intellectual Property restrictions.

- **Even so, almost all the other genetics services groups (including Lambplan) choose to use a slightly different approach to parameters, system and reporting** because of assessed client preferences and also to competitively differentiate from, the base system. The different systems are confusing to industry participants.

- **Sheep data is accumulating rapidly but on different bases and into different systems** [table above] through Central Test Sire Evaluation, Merino Benchmark, SA Demonstration flocks, wether trials, and the various consultancies, plus Lambplan.

- Differences and compatibility issues include: Enterprises, pedigree, accuracy, links; traits recorded, measurement and data integrity; data collection, delivery, processing, preparing BVs, indexes, comparisons, reports.

- There is apparent scientific agreement on the potential genetic power of a large, national, linked database providing across-flock analysis.

- **The marketplace for quantitative genetics and 'elite wool' systems appears to be merging at some points.** There is a lot of common ground and cross-interests, indicating market opportunities for a stronger genetics services entity.

- **Any new system should aim to engage and offer services to the 'elite wool' sector for both industry genetics and commercial reasons.** It now appears that scientists rather than the marketplace are keeping the approaches apart.

## ASGS 2.4 Opinions on genetics services and leadership

**Sheep breeding in Australia is a controversial, competitive arena, with big money involved and many different assessments on what the market wants and will pay for**. A diversity of views is to be expected on what type of genetics services are needed in that active marketplace, and whether industry organisations should lead changes.

Forthright comments obtained from discussions and documents have added depth to this review of the Australian genetics marketplace and of the need and likely support (in use and fees) for changed genetics service arrangements. Comments are recorded in the full ASGS report. These were analysed for the main messages, as summarised below.

**From sheep breeders and industry leaders**

- *Sheep and wool type-style are important* in selection and selling, and how this is approached could be pivotal to a successful genetics system.
- *The immediate issues for breeders using QG* are:
  - the confusion created by different genetics analysis and reporting, and
  - that strong across-flock analysis is not accessible for much Merino data.
- *Inconsistencies among Merino trials and services, and between Merino and Lambplan systems are concerns*. Most feel neutral on which calculating and reporting system.
- *Vision, leadership and progress are sought, but not instruction.* There is support for a higher level genetics system bringing together data and providing services more consistently and powerfully, and, some insist, under true commercial conditions.
- *If a new system is to be judged as a success it needs to be used*, and recognised through its use and results. Industry organisations should lead considered change, achieving patronage by addressing both the big picture and the detail.
- *Any new system should start in a way that welcomes as many groups as possible,* offering products and services to suit different needs alongside any leadership and guidance role it might be given or develop.

**From, and about, genetics service providers**

- *There are few sheep genetics scientists in Australia.* A number of scientists have contributed very substantially over many years and this is acknowledged.
- *However, there is a stand-off among individuals at senior level,* coupled with significant personality differences and project arrangements which let researchers set much of the delivery framework (even where there are consultative committees). Strained interfaces also add to the complexity of QG systems both in reality and as seen by breeders (whether clients or not – most are not).
- Of concern is the frustration felt by the next level of younger scientists and agricultural technology advisers with the 'goings on' among their seniors, and how this influences the vision and interest of the younger practitioners.
- *Competition in the absence of marketplace dynamics is not always productive.* It can be an inefficient use of industry levy resources, and not conducive to 'taking a helicopter view'. Proprietorial interests seem to prompt some stances on not changing.
- *These people issues will come to the fore, and should not be avoided by the wool and meat industries* when considering options for any new sheep genetics system. Overall, it does seem that many professionals in the sheep genetics arena see that the time has come for key decisions by the industry on future service arrangements.

## ASGS Chapter 3 One sheep genetics system? options, issues

### ASGS 3.1 Moving ahead and defining a Vision

From balancing the points above, it is concluded that the time is right for sheep industry leadership to work toward a single Sheep Genetics System based on quantitative genetics principles and which:-

- **is marketplace oriented, noting a range of market segments**
- offers return on monies invested to many in the industry – so it is used
- **is genetically powerful, but flexible to service needs**
- obtains strength by urging current systems together, then building, and by supporting a diversity of genetics advice providers
- **includes a broadly and neutrally available service centre**
- promulgates a common language for industry wide products through informative and professional communications
- **builds a broad and varied, indirect and direct, client base**, including breeders, producers, a range of advisers, businesses, researchers
- is able to aim for commercialised operation by spreading costs
- **leads in a considered way, building wider market interest in quantitative genetics**
- learns from the past in terms of market needs, science and management

**This is a Vision for a sheep genetics service system that would be used by clients in support of industry businesses, as part of their quest for profitable genetic advance**.

**The key targets for such a system are usage and usefulness. Notably, this Vision does not set out to secure genetic gain in itself.** Genetic gain should be achieved, with prompts from market price signals and wider industry activities, but methods may be diverse.

Many factors need to be reviewed in assessing the likely optimum form for such a system – and, importantly, to avoid an industry 'white elephant'**.** The following are considered.

- Current arrangements and compatibility [refer ASGS report 3.2 and Part 2]
- Key elements of a potentially successful system, as identified through the report [3.3]
- Options with regard to achieving the Vision and key elements [3.4].

### ASGS 3.2. Current services – methods and compatibility

Compatibility, or lack of it, among Lambplan, ABS, and other schemes, can look like a significant obstacle to change (or equally, a major reason for moving fast to bring processes and information together). This is a complex area, and was closely examined.

**As this Study's investigations advanced, the scale of compatibility issues contracted.**

The more detailed workings of main QG services, their associated data collections and evaluation approaches, including questions of compatibility are examined in PART 2, section 4.2, including:

Enterprises, pedigree, accuracy and links;
Traits recorded, measurement and data integrity;
Data collection, delivery, processing;
Preparing BVs, indexes, comparisons, reports.

**Overall, it is assessed that, with investment, energy and good faith, a single, national database for sheep genetics information could be constructed.** Should the owners be convinced, several of the current data collections brought together would provide a strong start to the database.
An Integration Project would be needed as part of the planned development.

## ASGS 3.3. Key elements of a potentially successful system

Working from the Vision (which reflects the research findings and discussions for this study), the critical elements of possible national sheep genetics system could be determined.

These would be need to be refined with closer examination of markets, costs and returns, and policy / management questions.

**Key element 1 : An overall system, oriented toward markets and targets**

**1A Scale** - able to provide its services, directly or through advisers, to an estimated:

a 1,600 breeders / studs and some 500,000 new animals for analysis each year
– being 800 Merino studs (320,000 new animals a year), 800 meatsheep / other studs (180,000)
b 400 specialised commercial sheep producers, spread widely
c Plus, services for a range of genetic advice providers, industry businesses, researchers

**1B Market flexibility** - to support market segments and various needs, including:

a General reports for wide audiences, plus specific reports for those seeking them
b Support to public or private consultant advice services of varying expertise
c Catering for diversity of opinion on breeding methods, while providing industry guidance
d Engaging and offering services to 'elite wool' and traditional breeding sectors

**1C Service innovation** – useful products at viable prices, with explanation and advice to encourage usage among target markets and to build custom, through

a A viable common language for use and for animal comparisons by many participants
b Client services that can recognise levels of contribution to the data system
c Seriously addressing the question of selection for Type or Style
d Ongoing streamlining of data processes for clients from paddock to selection decisions.

**Key element 2 : A strong genetics base sufficiently powerful in capability and capacity, and responsive, and cost effective**

**2A Technology power** – to enable use of quantitative genetics to the scale in 1A, and to encourage both client interest and rapid genetic advance, through

a A high-capacity BLUP system able to cater mechanically for various adjustments, groups, different parameter sets, growing quantities of linked data, various reports
b Mechanisms for bringing together accumulating data in differing systems
c Considered approaches to privacy, intellectual property and contracted services.

**2B Technology flexibility** – to encourage much higher usage of the QG system

a Capacity to run small within-flock and large Across-Flock analyses
b Capacity to positively deal with varying levels of animal pedigree data
c System support to front-line genetics and new research, with an eye to costs.

**Key element 3 : Management of the system to achieve stakeholder objectives, via**

a Optimal use of technologies, different expertise, co-operative arrangements
b Management and service delivery to meet performance targets and contracts
c Business thinking and planning, to achieve income-cost balances set by stakeholders
d Taking a genetics leadership role to the level sought by the sheep industry

## ASGS 3.4 Four options – degrees of change and leadership

**Four options are examined in the ASGS report, involving a gradient of change and industry leadership.** The options identified during the study are:

1. Continue current arrangements.
2. Develop a common language for current arrangements.
3. A consolidated service database.
4. A pro-active system genetics agency and system.

### Option 1. Continue current arrangements

**Features:** Eight QG public/industry groups and 2 private providers loosely linked by BLUP software, key parameters and some communication. Not sufficient strength to be a 'system'. Service power resides with data holdings, research funds and status, and having some clients – with competition for all three. Most QG groups recover little of the true costs of services. Some commercial enterprises receive high service at low cost.

Services to Merinos are moderate in scale, mostly run by public sector officers involved in various other activities. Results have been achieved, but less than 10% of total studs and less than 20% of the target market has adopted QG. Perhaps 25% of rams sold have QG selection behind them, with some flow on effects. Within this set, across-flock evaluations are growing.

Lambplan reaches near 50% of terminal sire studs and 70% of rams sold. All analysis and reports are across-flock. Genetic gain from QG selection is evident. Adoption is much lower in maternal sire breeds. Lambplan recovers over half of costs and has a strong set of QG tools and processing resources.

**Potential:** The concerns identified in Parts 2 and 3 all relate to the current arrangements – which involve sizeable funding by MLA, Woolmark and State governments.

- Continuing with present arrangements would not address these concerns and issues, and the problems would get worse.
- There is low potential for attaining a target sheep industry marketplace for QG services of 2,000 users (or even 1,500) and no far-seeing vision to achieve this.
- The wider marketplace is not very interested in current offerings and what is involved. The 130 or so Merino breeders now using QG might double in five years with strong marketing by service groups and individuals. Lambplan use is flattening at about 600 members but could grow with marketing.
- OVIS technology could readily service a system with 2,000 clients (500,000 new animals a year). Logistics for data collection and reporting need development.

**Issues:** On the surface, to not change is the simplest option, as there is much involved in achieving developments under the other Options. However, concerns about inefficiency and ineffectiveness of current arrangements can be expected to become more serious. Most in the genetics service sector are now expecting change.

Any new developments would require co-operation among a range of industry and government entities, at both policy levels and genetics services levels. It is anticipated that wool and meat industry R&D entities would support change directions with funding decisions.

## Option 2. Current set-up, common language

**Changes - Outline**

? Collaborative effort to introduce a common identification system for sheep of all breeds used in industry trials and QG breeding programs.
? Collaborative development of a common language covering sheep breeding values, reporting units, and report styles for all future reports.

**Aims**

? One animal being identified the same way in as many trials, analysis schemes and data collections as a possible, for current and future use.
? Results for the same animal in different reports to be identical or similar with reasons for differences centred around the animal and its progeny, not scientific format. Common approach to explaining differences.

**Further work:** Align sheep identification, and across-flock comparison baselines used in different data collections. This would start to involve adjusting the historical data in collections (which is a larger exercise) [refer ASGS Part 2].

**Potential:** A standardised sheep ID for new animals entering trials and analysis should not be difficult to introduce, with co-operation, and would start a positive foundation for future use of data in across-flock evaluations.

Developing a common language could bring the eight QG service groups and other private providers closer together and should reduce confusion in the quantitative genetics marketplace, – if and for as long as the standardised language were followed.

**Issues: Standardising language and ID among existing and some anticipated service providers is at best an interim measure.**

- **A common language would deteriorate in short time without a centre of focus.** As has been seen, the propensity of service providers is to 'add-difference' rather than follow set forms of presentation. Some breeders also add their own twists. A common language needs an originating focal point.
- **Potential for achieving a target market for sheep QG services of 2,000 users is only a little higher.** Less conflict and better understandability could persuade some to try a QG system. Many will continue breeding without the assistance of QG techniques.
- The small-scale, within flock, consulting focus of most services would continue. Common sheep ID will assist future across-flock analysis but will not achieve it.
- The resources across sheep industry services are used no more efficiently, without any possible reduction of service delivery costs through economies of scale.

## Option 3. Consolidated service database: calculation power

**Changes - Outline**

- A joint industry Database Exercise to define and implement all arrangements for a powerful, cost-efficient single sheep genetics database with input from distributed points, and access by many users under reasonably open terms and conditions. Identify arrangements and conditions to attract the industry target markets.
- Agreement on processes and responsibilities for maintenance, development and ownership of the database, reporting, data collection and input, roles.
- Collaborative development of a common language covering sheep EPV reporting by those utilising the database, plus common sheep ID.
- An Integration Project to align (in terms of sheep ID, baselines, EPVs, report units, links, etc) as many useful records as possible from data collections willing to contribute records to a national industry database.

**Aims**

- To address issues identified in this Study as much as possible.
- To achieve a workable, powerful, useful, single national database service, with distributed access to all interested (including service providers and researchers outside current groups).
- To make best use of resources groups can contribute and of new ideas
- Common ID and language for input, calculations and reports (as for Option 2).
- Defined roles / contracts for the parties, with the Database operation being an 'engine room' for breeder and industry service activities developed by various genetics service providers under their plans and programs.

**Potential:** Bringing present and future data collections into a single database with a robust common language should increase capacity of genetics service providers to deliver within and across flock reports to clients, more cost efficiently (costs being spread across more users). This, plus a well-designed database operation, should attract clients with input data, plus researchers.

**Issues: As an 'engine room' the Database Operation would be limited in its wider contribution to sheep industry genetics and development.**

- **Potential for developing a larger sheep industry market for QG services is better but not high**. Powerful QG services would be more available, however marketing and explaining of QG and promotion to involve more possible users (elite wool, other scanners) would rest with current arrangements (industry entities, 8-12 genetics advisers, most in smaller scale consultancy style). Few new advisers are likely. Government centres, which are now expected to charge a full cost recovery price for advice to individual commercial enterprises, will face issues with 'seeling' their prices.
- How the single database evolves will depend much on the person(s) appointed to develop and run it. A front-room manager and / or geneticist will, over time, drive a higher profile operation.
- A range of policy and legal issues would likely arise if access to the database were restricted to 'genetics service providers'. Some breeders or breeder groups may seek direct processing of their data – bringing the need for advice and a higher profile operation.

## Option 4 A proactive system – services for an advancing industry

**Changes - Outline**

- **A joint industry Sheep Genetics Agency Project** to define and implement all arrangements for a authoritative, cost-efficient sheep genetics bureau, taking a genetics development leadership role, mainly by providing industry-wide database and QG reporting services to genetics advisers and a range of users
- Agreement on processes and responsibilities for maintenance, development and ownership of the database, access, reporting, data collection and input, roles in industry genetic development, advisory committees, accountabilities
- **A Market Needs sub-project**: Identify arrangements and conditions to attract industry target markets and build usage, including animal / wool type and style, elite wool, QG demands, data collection and reporting, support to advisers
- **A Language sub-project**: Collaborative development of a common language covering sheep EPV reporting by the database to users, plus common sheep ID
- **An Integration sub-project** to align (in terms of sheep ID, baselines, EPVs, report units, links, etc) as many useful records as possible from data collections willing to contribute records to an industry database.

**Aims**

- To address issues identified in this Study as much as possible, including the need for industry leadership and pro-activity to develop use of quantitative genetics services without prescribing breeding decisions.
- To achieve a workable, powerful, useful, single national database service, with distributed access to many users (encouraging service providers and researchers).
- To make best use of resources and ideas current or new groups can contribute.
- Common ID and language for input, calculations & reports, communicated widely.
- Defined roles / contracts among the Agency and various stakeholders and clients, including recognition of various contributions by stakeholders (data, expertise, funding). Defined Agency responsibilities in genetics leadership and marketing.
- A commercialised basis to operation. Making industry investment widely available, and services as price-attractive as possible, by spreading costs.

**Potential: This option offers the chance of achieving a major increase in use of Quantitative Genetics across the Australian sheep breeding industry** (up to 2,000 users), through market-focussed development of a leading service agency that builds on experience and existing scientific and technical resources. Given that adoption of QG principles is considered to be crucial for more rapid genetic gain, this option offers a pathway to this goal.

**Issues: This would be a higher profile activity, and potentially controversial.**

- **A range of policy and priority questions on investment of resources arise for the wool and meat industries,** plus broader questions such as competition policy.
- How the Agency evolves will depend much on the person(s) appointed to develop and run it, and on Industry advising or decision committees. The Agency would need to perform well in many senses. Parts of the sheep industry will depend on it.
- Positive competition among genetics advisers and service providers is important, and the Agency should not reduce this. Mechanisms to introduce competitive accountability into the Agency's operations should be considered.

## 3.5 Apparent best option – look to the marketplace

**In determining a direction of change, it is critical that industry organisations 'look to the marketplace'.** Not just to current market interest and activity, but to the probable marketplace and sub-markets for sheep genetics services into the future.

**On balance, from the analysis in this Study, it is recommended that in-principle support be given to the development of a joint-industry Australian Sheep Genetics Agency to be a pro-active focal point for an integrated genetics service system.** Option 3 should remain under active consideration during the preparation and planning stages.

It is assessed that introducing a common language and ID alone (Option 2) would not be worth the costs in terms of expenditure and disruption to current arrangements.

**Options 3 or 4 should bring advances.** Under 3, Merino breeders seriously using QG services would obtain stronger selection information in a common language, with probable higher rates of gain (as for meatsheep). Option 3 would rely on current advisers and newcomers, if any, to promote use of QG services. Marketplace expansion would be moderate or slow.

**Option 4, additionally offers industry leadership in developing and promoting market-oriented, flexible, quantitative genetics services.** Option 4 should provide most of the Key Elements [below]. Only Option 4 could reach the targets of 1,600 studs and 400 producers as users of QG. Option 4 could also reduce scientific and organisational barriers to wider industry access of genetics tools arising from ongoing R&D investment.

| For services as a whole (wool and meatsheep)<br>5 = arrangements well meet this Key Element<br>3 = moderately, reasonably 1 = inadequately | **Option 1**<br>**As at present** | **Option 2**<br>**Common language** | **Option 3**<br>**Database operation** | **Option 4**<br>**Proactive Agency** |
|---|---|---|---|---|
| | Current | Potential | Potential | Potential |
| **Key element 1: An overall system oriented toward markets and targets** | | | | |
| **1A**: | | | | |
| a target 1,600 breeders, 500,000 new animals pa | 1 | 1 | 2-3 | 5 |
| b 400 commercial producer breeders | 1 | 1 | 3 | 4 |
| c wide range of service providers | 2 | 2 | 4 | 5 |
| **1B**: ***Market flexibility*** | | | | |
| a general wide-use reports & specific reports | 3 | 3 | 3 | 5 |
| b support a variety of consultants and advisers | 2 | 2 | 4 | 5 |
| c work with diversity of opinion giving guidance | 1 | 1 | 2 | 5 |
| d engaging elite wool and traditional sectors | 1 | 1 | 1 | 3 |
| **1C**: ***Service innovation*** | | | | |
| a viable common language | 1 | 3 | 5 | 5 |
| b recognising levels of data contribution | 3 | 3 | 4 | 4 |
| c addressing type and style needs | 1 | 1 | 1 | 4 |
| d streamlining processes paddock to selection | 3 | 3 | 4 | 5 |
| **Key element 2: A strong genetics base sufficiently powerful capacity, responsive, cost effective** | | | | |
| **2A: *Technology power*** | | | | |
| a high capacity BLUP system | 4 | 4 | 5 | 5 |
| b solid mechanism for bringing data together | 2 | 2 | 4 | 5 |
| c approaches to privacy, IP, contracted services | 3 | 3 | 4 | 5 |
| **2B**: ***Technology flexibility*** | | | | |
| a within flock and wide across-flock | 2 | 2 | 5 | 5 |
| b positively addressing animal pedigree issues | 3 | 3 | 4 | 4 |
| c system support to front-line research | 3 | 3 | 4 | 5 |
| **Key element 3: Management to achieve stakeholder objectives** | | | | |
| a optimal use of technologies, expertise | 1 | 1 | 3 | 4 |
| b manage to performance targets /contracts | 3 | 3 | 5 | 5 |
| c business planning, cost/income balances | 2 | 2 | 4 | 5 |
| d a sheep industry genetics leadership role | 2 | 2 | 2 | 4 |

## ASGS 3.6 Towards an Australian Sheep Genetics Agency (ASGA)

Other considerations, wider than the genetics marketplace, would also likely influence support for a Consolidated Database, or a proactive Sheep Genetics Agency, including :

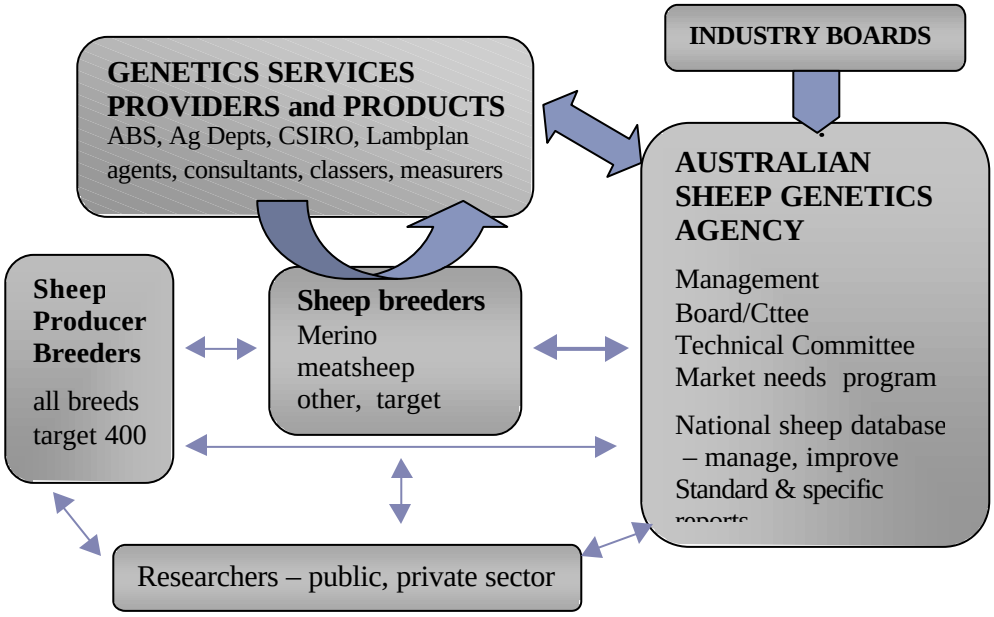
- Does the potential for sheep (especially wool) industry benefit from Quantitative Genetics justify current or higher R&D investment vis-à-vis other priorities?
- Should an Agency or Database be required to operate on a commercial basis, giving priority to business development and viable financial operation?
- If not, in recognition of 'industry-good', what proportion of grant funding might be anticipated, and how much income will need to be earned from users of a Database or an Agency? (Pricing would affect usage, number of clients would affect costs and prices).
- What degree of subsidised assistance to individual commercial enterprises is reasonable and under what circumstances?

These policy questions would need to be addressed in defining a useful, and so, potentially successful new Australian sheep genetics system.

### Development steps and an Agency framework

**Within an emerging new system, the proposed Australian Sheep Genetics Agency (ASGA) would take a pivotal service function –** anticipating and meeting the needs of many sheep industry participants including specialised service providers. ASGA would also take a lead role in sheep genetics evolution **–** to attract and service various clients, to build the database, and to build breeding industry use of QG.

**An Australian Sheep Genetics System – probable interfaces**




**There is no suggestion of meat or wool industry organisations looking to run all parts of such a system, although R&D funding could reinforce priorities.** A challenge would be to encourage current and additional genetics marketplace participants to join into a new genetics system.

**A decision to proceed with an Australian Sheep Genetics Agency would place substantial responsibility on the industry owners, and on the management team, to achieve an Agency that would be seen by industry members as successful.** Development steps and a timetable plus a Framework for a commercially supported agency in five years – are set out in the ASGS report.

## Abbreviations and Glossary

| | | | |
|---|---|---|---|
| AAMSB | Australian Association of Merino Stud Breeders | EW | Elite Wool method of sheep selection |
| ABS | Advanced breeding Services (NSW Agriculture) | FD | Fibre diameter (average) |
| AI | Artificial Insemination | MLA | Meat & Livestock Australia |
| BLUP | Best Linear Unbiased Prediction procedure | QG | Quantitative genetics |
| BV | Breeding value (estimated as an EBV or EPV) | QGS | Quantitative genetics system |
| CTSE | Central Test Sire Evaluation | SBS | Select breeding Services (CSIRO) |
| CV | Coefficient of variation of fibre diameter | SI | Selection Index |
| EBV | Estimated breeding value | SRS | Soft Rolling Skins method of selection |
| EPV | Expected progeny value | WM | The Woolmark Company Pty Ltd |

Glossary key source: *Animal Breeding - Use of new technologies*, 2000, eds. B Kinghorn, J van der Werf, M Ryan (with permission); Also: Agriculture WA Farmnote – Genetics for sheep breeders, *David Windsor*, Ms Sue Jarvis.

***Across-flock:*** A comparison of animals from two of more different breeding flocks, generally from different studs or properties. Within-flock refers to comparisons of a set of animals from a single breeding flock usually in 1 year.

***BLUP :*** Best Linear Unbiased Prediction (of breeding values) is a powerful statistical method. BLUP combines information on an animal's performance, the performance of its relatives and any known environmental differences to produce an Estimated Breeding Value. Can be used to separate the genetic and environmental factors influencing animal performance.

***Breeding objectives*** relate to the goals of the breeding program - the traits to be improved. An economic approach calculated economic weights to be assigned to each important trait. A 'desired gains' approach involves defining the relative amount of genetic change desired for each trait.

***Correlation:*** the extent to which genes that determine one trait also influence other traits.

***Estimated breeding value (EBV):*** An EBV is the estimate of an animal's breeding value – the estimated genetic difference between an animal and the average of a group. An animal's estimated superiority after adjustments.

***EPV (Expected Progeny Value)*:** The amount by which an animal's progeny are expected to be superior to the progeny of the whole group. This is generally half the value of the animal's EBV for the same trait.

***Genotype:*** The genotype make-up of an animal. Used loosely in animal breeding to describe genetic grouping such as a breed or a trait-based classification (such as 'a fat genotype').

***Heritability:*** The proportion of parental superiority which is expected to be transmitted to the next generation. Fibre diameter heritability is about 50%.

***Index selection*** involves the construction of a multiple score system, based on a number of component criteria, to give an overall selection criterion (an index) which can be used to rank animals for selection purposes. The criteria can be phenotypes of animals and their relatives (as in a classical selection index, weighted by selection index weights), or estimates of breeding values (typically from BLUP analysis, weighted by economic weights).

***Individual selection***, or mass selection, is selection on animals own phenotypes alone, without use of information from relatives, or correction for environmental effects. ***Phenotype*** is the observable merit for a given trait, as measured or recorded for an animal.

***Progeny test*:** A comparison between lambs born to a group of rams which were mated to randomly selected ewes at the same time. Pregnant ewes and progeny for all sire groups are run under identical conditions.

***Quantitative Genetics*** (QG) is the science of exploiting natural genetic variation to give genetic improvement of quantitative or metric traits. It can be used for any multiple-gene inherited trait.

***Selection*** is the choice of animals to be used as parents. by ranking animals on selection criteria.

***Selection criterion:*** The information used to rank animals in order to select the best for breeding. The selection criterion is generally an estimate of breeding value, or a selection index using information (either phenotypes or BLUP EBVs) from a number of traits.

***Selection Index:*** A multiple score system, based on a number of component criteria, to give an overall selection criterion (an index) which can be used to rank animals for selection purposes. Criteria can be phenotypes of animals (as in a classical selection index, weighted by index weights), or estimates of breeding values (from a BLUP analysis, weighted by economic weights)