# final report

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Prepared by: Hamish Dickson
AgriPartner Consulting Pty Ltd

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Meat and Livestock Australia Limited
Locked Bag 1961
NORTH SYDNEY NSW 2059

# Maximising the value of existing technology for sheep producers

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# Executive summary

The adoption of electronic tags (eID) and associated technologies by commercial sheep producers has been low, despite this technology being readily available for over 10 years. Common feedback from producers and industry professionals has identified that resistance to adoption is based on limited information relating to the long-term effects on flock structure and profitability of alternative management decisions guided by the information collected using eID. The benefits have not been clearly defined for each sector and as such producers tend “to focus on the cost rather than the profit” (Pattinson, 2011).

This project undertook a desktop study to model a range of common breeding management systems (scenarios) used by commercial sheepmeat enterprises. It modelled the long-term gain, as measured over five years, that can be achieved through changing management decisions based on the data generated using eID and associated technologies (e.g. pregnancy scanning, fleece weighing).

Each scenario modelled in this project progressively increased the level of eID implementation to compare different and practical decisions that can be made by commercial sheep producers. Scenarios were modelled for both self-replacing Merino and crossbred/composite type operations and with each increase in the level of use of eID additional costs were incurred and additional income was generated as a result of the expected productivity gains.

The results of this project have clearly shown that there are economic gains available to sheep producers through utilising eID to make more informed breeding and selection decisions. The range of scenarios investigated demonstrated there are a variety of levels to which producers can increasingly adopt electronic identification, with corresponding levels of economic gain to be realised in the business.

Some of the most significant gains achieved in the Merino enterprise was through pregnancy scanning ewes and culling twice dry animals. This was the highest cost/benefit per dollar invested of any of the scenarios investigated for Merino operations, returning $5.81 for every dollar invested in this strategy. The average cost benefit of utilising eID to improve breeding and selection decisions across both Merino and crossbred/composite type enterprises was $4.12 return for every dollar invested.

Improving the ability of producers to identify and remove poor performing animals within the flock will increase producer and financial resilience to difficult seasons and market conditions, as costly non-productive animals are removed from the flock. Equally, selection of more productive animals will lead to reduced mortality and reproductive wastage in sheep, resulting in improved economic social outcomes for the industry.

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# 1 Background

The adoption of electronic tags (eID) and associated technologies by commercial sheep producers has been low, despite this technology being available for over 10 years. Common feedback from producers and industry professionals has clearly identified that resistance to adoption is based on limited information relating to the long-term effects on flock structure and profitability of alternative management decisions guided by the information collected using eID. The benefits have not been clearly defined for each sector and as such producers tend "to focus on the cost rather than the profit" (Pattinson, 2011).

Whilst stud producers have observed the benefits eID can provide through more easily and accurately managing individual animal data collection; commercial producers are largely unconvinced about the long-term gains that can be achieved. Commercial sheep producers have a different focus for the use of eID compared to stud producers and require clear information demonstrating the long-term gains that can be achieved by implementing eID to make improved practical decisions relating to flock management and selection.

This project aims to deliver clear guidance to all commercial sheepmeat producers regarding practical strategies for implementing electronic identification technology within their flock and importantly, the long-term cost benefit of such decisions.

Existing publications such as Precision Pays (Sheep CRC, 2007) and iSheep - Data Driving Management (Dickson, 2016), detail various case studies where different farming business have utilised eID technology to measure the wide range in individual animal productivity and improve selection decisions. Whilst these case studies have demonstrated a net benefit for that year, they do not clearly show the long-term effects and improvement that may be achieved through these decisions. Many of these case studies have been conducted on stud enterprises where the outcomes and benefits are not as relevant for commercial sheep producers. A similar case study by Gardner (2016) assessed the return on investment and breakeven point of utilising electronic tags, fleece weighing equipment and software to improve selection of replacement Merino ewes in the flock. The cost benefit was assessed by conducting a theoretical comparison of the value of replacement hoggets where individual fleece data had been captured compared to only utilising visual selection. It showed the higher value of those ewes retained through individual selection provided a 35% return on investment. Whilst this example provides a good study of the effect of using eID in selecting replacements, it only assesses a single year of data collection, not long term affects and is predominately based on wool production.

Making gains from precision production in sheep (Atkins & Richards, 2007) is the only larger scale analysis which assessed the influence of both utilising improved genetics (via ASBVs) and the use of "precision sheep production" principles which involved "using additional measurement and management processes within the flock to extract additional value through breeding and selection of replacement ewes (and wethers), optimising flock structure and obtaining market advantage through better meeting specifications." This previous work assessed the long-term gain of a wide range of changes to management factors that largely influenced wool production and did not directly assess the effect on reproductive traits. It included factors such as changing the percentage of wethers in a flock, differential wool clip preparation and changes to flock age structure. Whilst this work was a comprehensive study at the time, many of the practices investigated then are no longer commonplace and the financial figures used are not directly comparable to current market conditions.

With growing interest in the use of eID by commercial producers and the recent change to the compulsory use of electronic tags in Victoria, producers are searching for information demonstrating the cost benefit of implementing electronic tags. Importantly this information needs to provide the outcomes to common practical selection decisions commercial producers can make on-farm. Providing a range of potential management options would assist producers to fully understand how eID can fit within their operation and the benefits that can be achieved at varying levels of implementation. This will contribute to countering the perception that implementing eID is difficult to trial (Pattinson, 2011) and demonstrate there may be opportunities to gradually increase the level of implementation if desired by the producer.

# 2 Project objectives

The objectives of this project are to:

- determine the long term (5 year) cost benefit of implementing eID and associated technologies to drive improved selection and management decisions in commercial sheepmeat breeding enterprises for a range of different breeding objectives
- increase producer knowledge and understanding of how eID and associated technologies can be utilised to improve enterprise profitability
- increase producer confidence and accuracy in flock selection and management decisions
- increase the level of production monitoring and animal selection leading to improved productivity of animals, market advantage through better meeting target market requirements, reduced ewe and lamb mortality rates and reduced reproductive wastage
- increase adoption of existing eID technology to improve sheepmeat enterprise productivity and profitability

# 3 Methodology

## 3.1 Modelling approach

This project undertook a desktop study to model a range of common breeding management systems (scenarios) available to commercial sheepmeat enterprises. It has modelled the long-term gain, as measured over five years, that can be achieved through changing management decisions based on the data generated using eID and associated technologies (e.g. pregnancy scanning, fleece weighing).

Each scenario modelled in this project progressively increased the level of eID implementation to compare different and practical decisions that can be made by commercial sheep producers (see Table 1). Scenarios were modelled for both self replacing Merino and crossbred/composite type operations. With each increase in the level of use of eID, additional costs were incurred and additional revenue was generated as a result of the expected productivity gains.

*Table 1 - Merino and crossbred/composite enterprise scenarios investigated for assessing the implementation of eID.*

| Scenario | Ewe breed | eID | Key selection decisions |
|---|---|---|---|
| 1 | Merino | No | Ewes only culled based on age group. |
| 2 | Merino | No | **Visual classing of replacement ewes**. All other ewes culled based on age group. |

| | | | |
|---|---|---|---|
| 3 | Merino | Yes | Visual classing of replacement ewes. All animals **pregnancy scanned and twice dry ewes culled**. All other ewes culled based on visual classing and age group. |
| 4 | Merino | Yes | Visual classing of replacement ewes, in combination with **individual fleece data**. All other ewes culled based on age group. |
| 5 | Merino | Yes | Visual classing of replacement ewes, in combination with **individual fleece data**. All animals **pregnancy scanned and twice dry ewes culled**. All other ewes culled based on age group. |
| 6 | Merino | Yes | Visual classing of replacement ewes, in combination with individual fleece data. All animals pregnancy scanned and twice dry ewes culled. All other ewes culled based on age group. Replacements preferentially **selected from twin mobs**. |
| 7 | Merino | Yes | Visual classing of replacement ewes, in combination with individual fleece data. All animals pregnancy scanned and twice dry ewes culled. All other ewes culled based on age group. Preferential selection applied to ewe hoggets with **higher total kg lamb weaned**. |
| 8 | Crossbred / composite | No | Ewes only culled based on age group. |
| 9 | Crossbred / composite | No | Visual classing of replacement ewes. All animals **pregnancy scanned and twice dry ewes culled**. All other ewes culled based on age group. |
| 10 | Crossbred / composite | Yes | Visual classing of replacement ewes. All animals pregnancy scanned and twice dry ewes culled. All other ewes culled based on age group. Replacements preferentially **selected from twin lamb mobs**. |
| 11 | Crossbred / composite | Yes | Visual classing for replacement ewe lambs. All animals pregnancy scanned and twice dry ewes culled. All other ewes culled based on age group. Preferential selection applied to replacement ewes with **higher total kg lamb weaned**. |

## 3.2 Determination of scenario parameters

A base data set was sourced from industry average figures for both Merino and crossbred/composite type flocks and was used to define the productivity of each flock (reproductive rates, wool cut, growth rates etc.) for the analysis. The average figures used for the model were sourced from a range of industry data and benchmarking services such as MLA, ABARES, Holmes Sackett and the Livestock Farm Monitor Project. The operational parameters of each base scenario represented a 'typical' sheep enterprise for each breed as closely as possible, however given the wide range in productivity and types of sheep within Merino and crossbred/composite breeds it is impossible to represent all flocks perfectly. The Merino enterprise has been modelled as a medium wool Merino flock with both a focus on meat and wool production, whilst the crossbred flock is representative of a crossbred or composite type flock with a focus on meat production only. Base parameters of each flock are shown in Table 2. The relative increase in productivity as a result of changes to selection and management through the use of eID was determined from a range of known genetic responses to selection and management decisions.

*Table 2 - Base Merino and crossbred/composite enterprise parameters.*

| Parameter | Merino | Crossbred / composite |
|---|---|---|
| **Standard animal reference weight** | 60kg | 70kg |
| **Adult fleece micron** | 20.5 | 28.5 |
| **Adult fleece weight** | 5.8kg greasy | 3.5kg greasy |
| **Reproductive rate** | 90% | 120% |
| **Breeding info** | 5 lambings per ewe, first joining at 1.5yr old. Self replacing system, all excess lambs sold as lambs. | 5 lambings per ewe, first joining at 1.5yr old. Self replacing system, all excess lambs sold as lambs. |
| **Sale lambs** | Sold at 11 months of age, 52kg lwt, using 5 yr average Merino carcase price (plus $10 skin). | Sold at 7 months of age, 56kg lwt, using 5 yr average crossbred carcase price (plus $10 skin). |

## 3.3 Modelling process

The genetic and phenotypic responses of each scenario were modelled over a five-year time frame using a module of the SmartMerino decision support software for the Merino scenarios and to provide some input data for the crossbred/composite scenarios. For the crossbred/composite scenarios, SmartMerino was used to provide the base flock structure information such as age group numbers and comparative wool production between age groups. This information was used to supplement the base flock details shown in Table 2 and a separate customised sheep enterprise gross margin spreadsheet was used to calculate the equivalent financial outputs as those generated by SmartMerino.

The SmartMerino production model examined flock changes over time in response to selection and management decisions. Base flock production parameters were entered into the model with wool traits and the effects of age, reproduction, flock structure and selection strategies varied to determine the overall flock productivity after five years. The model selected Merino rams using the MP+ (Merino Production Plus) Index from Sheep Genetics (with predicted responses of 7.3% clean fleece weight (CFW), a reduction of 0.4µm in fibre diameter (FD) and +2.2kg gain in body weight (WT) over 10 years if making 65% of the potential gain). The ewes were selected using a 7%MP index which focuses equally on reducing fibre diameter and increasing fleece weight.

An increase of 5% lambs weaned to ewes joined was used for both Merino and crossbred scenarios to account for culling twice dry ewes. This was the resulting increase in reproduction rate found for culling twice dry ewes in an empirical study completed by Hatcher et al., 2018. Culling based on once dry was not modelled because data from 3 research flocks showed that culling on once dry was not sustainable due the much higher number of animals to be culled creating insufficient replacements.

To model the effect of either preferentially selecting replacement animals from twin lambing mobs or utilising total kg of lamb weaned data (as measured from maiden ewes only), the models incorporated the resulting change in average total kilograms lamb weaned per ewe. Limited data is available to accurately model these two scenarios, however as they are an important progression into the further use of eID, these were assessed as an initial investigation. Data from the Minnipa

Agricultural Centre was used for these two scenarios as this site has the necessary flock data showing total kilograms of lamb weaned per ewe over successive years and importantly, they have not culled ewes based on their previous performance. This allows a more accurate assessment as the other selection strategies outside of this investigation will not affect the results. To estimate the resultant increase in total kilograms of lamb weaned where replacement ewes were preferentially selected from twin lambing mobs, the average kilograms of lamb weaned per ewe over three successive lambing's was compared between groups of ewes that had been born as a single versus those born as a twin. This scenario aimed to represent a common selection decision that many producers could make on farm, where when presented with two comparable replacement ewes, one has been born as a single versus one born as a twin, should the twin be chosen in all circumstances? Data from Minnipa Agricultural Centre showed a 1.9% increase in average kilograms of lamb weaned per ewe of those born as twins compared to singles. However, in many commercial operations there will be an insufficient number of twin-born lambs available to solely select these animals as replacements considering that other breeding objectives would typically need to be met as well. Given this situation, it has been assumed that 60% of replacements were selected from twin lambing mobs, therefore an increase of 1.14% to the weaning weight per ewe was applied where replacements were preferentially selected from twin lambing mobs. No change in fleece production (as a result of reduced lifetime productivity of twin-born ewes) was assumed in this scenario.

To model the effect of utilising total kg of lamb weaned per ewe data, results from Minnipa Agricultural Centre were analysed to compare the average total kg of lamb weaned in three successive lambing's from the top 80% of ewes compared to the overall average of the group. The top 80% were identified as the ewes that reared the highest kilograms of lamb at weaning in their first joining (i.e. maidens). This data showed that the top 80% of ewes reared 1.3% more kilograms of lamb per ewe than compared to the overall average of the group. For these models an increase in total kilograms of lamb weaned per ewe of 1.3% was applied where replacement ewes were preferentially selected from those with a higher total kilograms of lamb weaned.

The model accounted for all major components of the sheep enterprise to generate a gross margin for each scenario. The gross margin accounted for variable costs such as health, management, wool harvesting and selling, livestock selling and breeding costs. These costs were derived from the NSW DPI Farm Enterprise Budget Series and equated to $40 per ewe (including their progeny). Income for the gross margin was generated from the sale of young and mature stock, as well as wool. The wool values were calculated based on the average diameter and fleece weight of the adult ewes, hogget ewes and wethers, less a 9% allowance to adjust to clip prices (removing bellies, locks and an allowance for expected reduced prices of these fleece components) as well as a 4% selling cost.

Income generated by the sale of animals and wool was valued using the recent 5 year average price for each commodity (January 2013 to December 2017).

Comparative economic returns were calculated for each scenario and the net benefit/loss was calculated from the changes in productivity and the costs associated with collecting additional information (e.g. level of technology input) for each scenario. The costs associated with each selection activity assessed in these models are shown in Table 3. It is important to note that these costs are per breeding ewe so that they can be aligned to the gross margin per ewe results. They have been calculated by amortising the total cost for the data collection process over the total breeding ewes in the flock. For example, the cost of item 'RFID tag - wool testing' has been calculated as the cost to tag 650 replacement ewe lambs each year for collection of fleece data. With each RFID tag costing $1.30, the total tag cost each year was $845, which equates to a cost of $0.42 per breeding ewe (2,000 animals).

*Table 3 - Cost per breeding ewe of each selection activity modelled.*

| Activity | Cost per breeding ewe |
|---|---|
| Visual classing | $0.23 |
| RFID tag - wool testing | $0.42 |
| RFID tag - preg scanning | $0.28 |
| Wool testing cost | $1.16 |
| Pregnancy scanning | $0.80 |
| Pedigree Matchmaker | $0.45 |

The economic modelling results have delivered the cost benefit of each scenario through providing the enterprise gross margin ($/ewe) to assess whether different strategies for implementation of eID were beneficial to the enterprise. Additional measures of the cost benefit such as net return per 1000 breeding ewes and return on investment were also calculated to compare scenarios and put the results in context for a range of producers.

# 4 Results

## 4.1 Cost benefit of eID in Merino flocks

The gross margin per ewe for Merino flocks is shown in Table 4. It illustrates the changing gross margin with each different level of implementation of eID to assist in making selection decisions within the flock. It demonstrates that within a Merino enterprise, whilst wool income is still a significant proportion of total income, over a 5 year period a greater return can be generated through increasing reproductive rates compared to fleece value (scenario 3 versus scenario 4).

*Table 4 - Gross margin per ewe for each Merino scenario.*

| Scenario | Key selection decisions | Gross margin ($/hd) |
|---|---|---|
| 1 | Ewes only culled based on age group. | $138.09 |
| 2 | **Visual classing of replacement ewes**. All other ewes culled based on age group. | $139.18 |
| 3 | Visual classing of replacement ewes. All animals **pregnancy scanned and twice dry ewes culled**. All other ewes culled based on age group. | $145.68 |
| 4 | Visual classing of replacement ewes, in combination with **individual fleece data**. All other ewes culled based on age group. | $140.17 |
| 5 | Visual classing of replacement ewes, in combination with **individual fleece data**. All animals **pregnancy scanned and twice dry ewes culled**. All other ewes culled based on age group. | $147.15 |
| 6 | Visual classing of replacement ewes, in combination with individual fleece data. All animals pregnancy scanned and twice dry ewes culled. | $148.88 |

| | | |
|---|---|---|
| | All other ewes culled based on age group. Replacements preferentially **selected from twin mobs**. | |
| 7 | Visual classing of replacement ewes, in combination with individual fleece data. All animals pregnancy scanned and twice dry ewes culled. All other ewes culled based on age group. Preferential selection applied to ewe hoggets with **higher total kg lamb weaned**. | $148.68 |

The net return per 1000 ewes is shown in **Error! Reference source not found.**. It shows that the greatest return generated in this analysis was achieved through scenario 6 which involved visual classing of replacement ewes, in combination with individual fleece data. All animals were pregnancy scanned with twice dry ewes culled from the flock and all other ewes culled based on age group. In addition, replacements were preferentially selected from twin mobs.

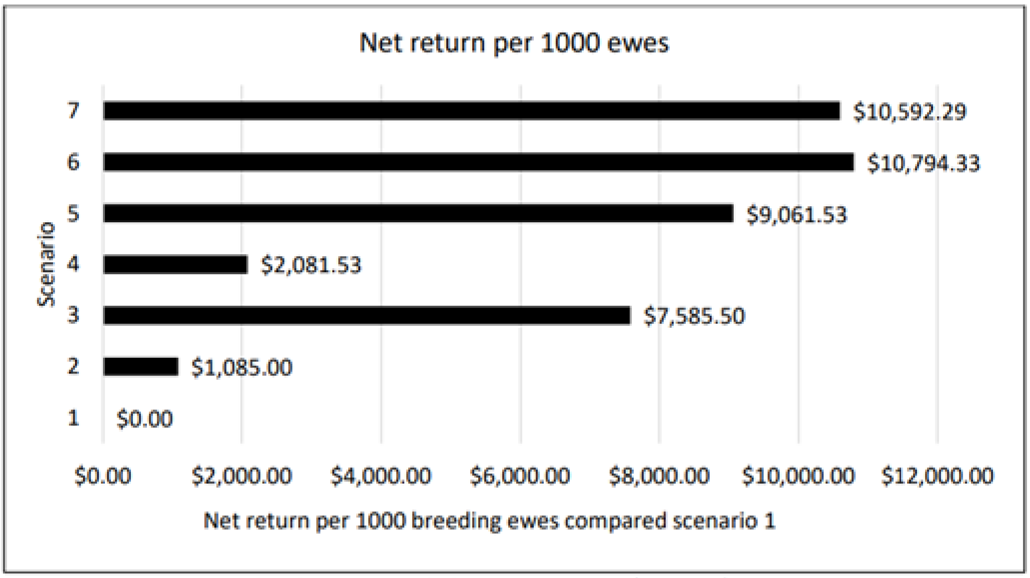


*Figure 1 - Net return per 1000 breeding ewes over the base Merino scenario (scenario 1) .*

Figure 1 shows the net return per dollar invested in each scenario modelled for Merino enterprises. It can be seen that the greatest return on investment is achieved through scenario 3 which involves visual classing of replacements and pregnancy scanning all ewes with twice dry ewes culled from the flock. The relative increase in return of scenario 3 over scenario 1 represents a 5.5% increase in gross margin.

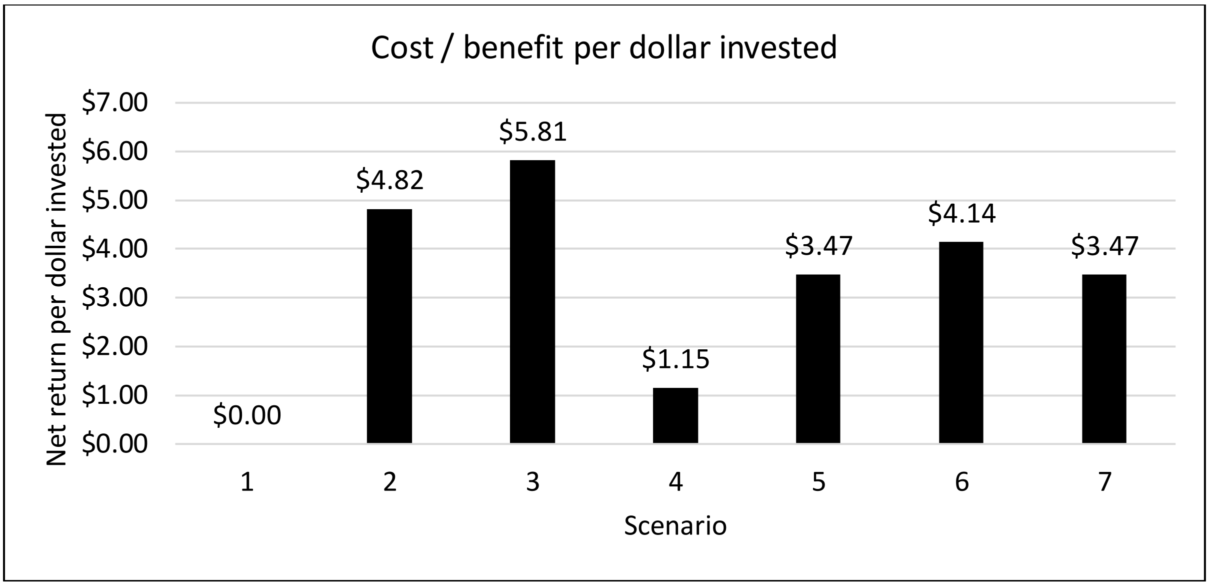


*Figure 1 - Cost/benefit of utilising eID under each different scenario for Merino enterprises, showing the net return per dollar invested in collecting data.*

## 4.2 Cost benefit of eID in crossbred/composite flocks

The gross margin per ewe for crossbred/composite type flocks is shown in Table 5. It illustrates the changing gross margin with each different level of implementation of eID to assist in making selection decisions within the flock. It demonstrates that within a crossbred enterprise the greatest gain can be achieved from both removing dry animals from the flock whilst also preferentially selecting replacements from twin born animals (scenario 10).

*Table 5 - Gross margin per ewe for each crossbred/composite scenario.*

| Scenario | Key selection decisions | Gross margin ($/hd) |
|---|---|---|
| 8 | Ewes only culled based on age group. | $148.54 |
| 9 | Visual classing of replacement ewes. All animals **pregnancy scanned and twice dry ewes culled**. All other ewes culled based on age group. | $154.39 |
| 10 | Visual classing of replacement ewes. All animals pregnancy scanned and twice dry ewes culled. All other ewes culled based on age group. Replacements preferentially **selected from twin lamb mobs**. | $156.42 |
| 11 | Visual classing for replacement ewe lambs. All animals pregnancy scanned and twice dry ewes culled. All other ewes culled based on age group. Preferential selection applied to replacement ewes with **higher total kg lamb weaned**. | $156.26 |

The net return per 1000 ewes is shown in Figure 2. It shows that a significant increase in returns from the base system can even be achieved through simply removing ewes that have been pregnancy scanned twice dry (scenario 9).

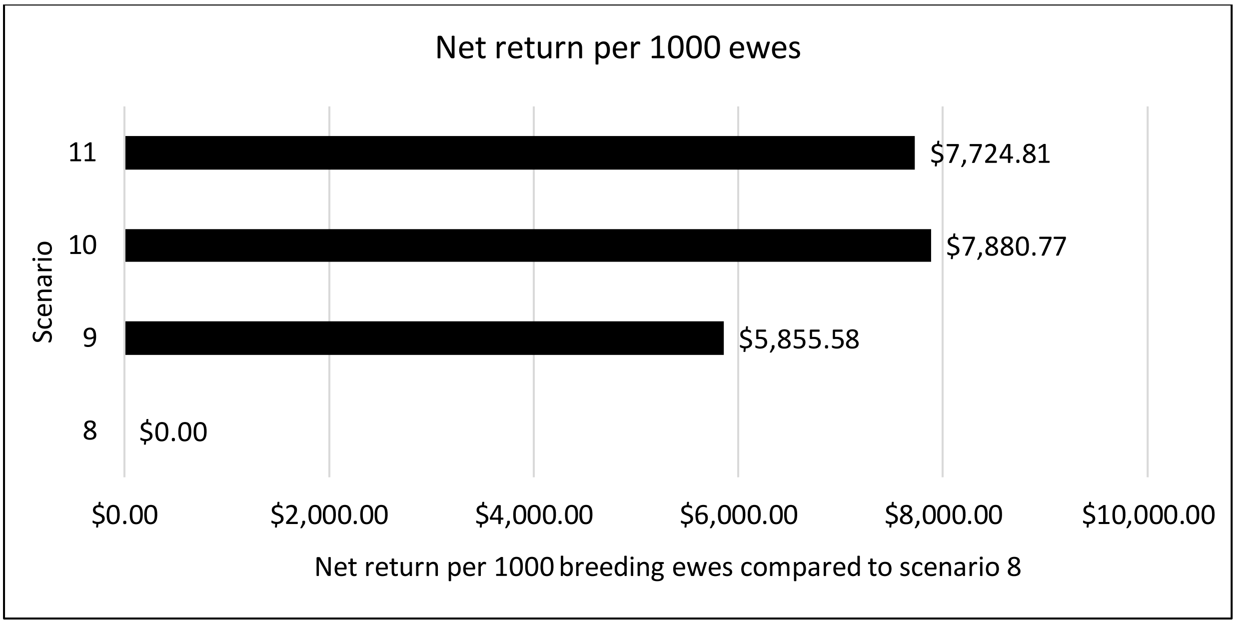


*Figure 2 - Net return per 1000 breeding ewes over the base crossbred/composite scenario (scenario 8).*

Figure 3 shows the net return per dollar invested in each scenario modelled for crossbred enterprises. It can be seen that the greatest return on investment is achieved through scenario 10 which provides a return of $6.04 per dollar invested in this strategy. Scenario 10 represents a 5.3% increase in gross margin over the base crossbred scenario (scenario 8).

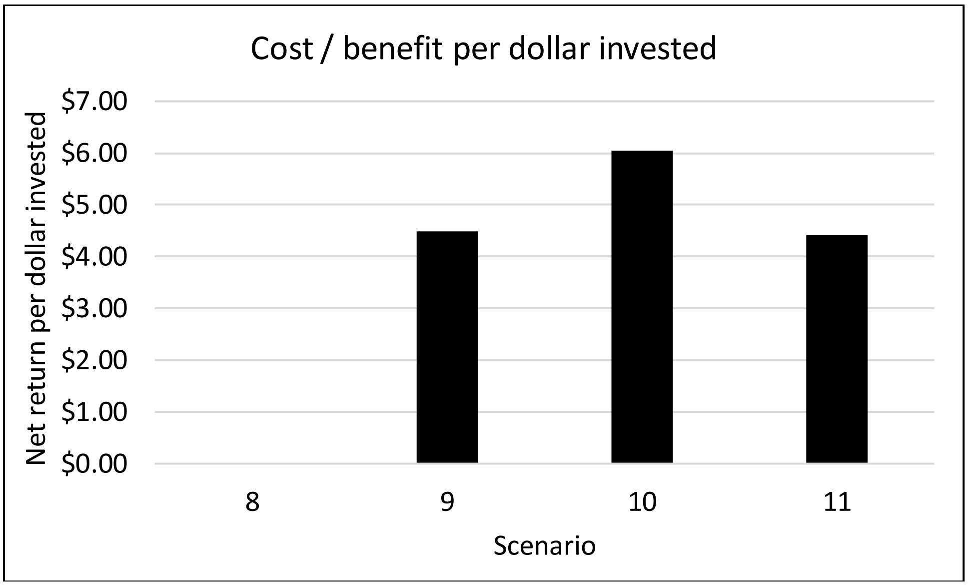


*Figure 3 - Cost/benefit of utilising eID under each scenario for crossbred/composite enterprises, showing net return per dollar invested in collecting data.*

# 5 Discussion

## 5.1 Findings

The results of this analysis have clearly shown that there are economic gains available to sheep producers through utilising eID to make more informed breeding and selection decisions. The range of scenarios investigated demonstrated there are a variety of levels to which producers can increasingly adopt electronic identification, with corresponding levels of economic gain to be realised in the business. Whilst the relative gains vary between scenario's it is relevant to note that under all scenarios a positive outcome was achieved.

Some of the most significant gains achieved in the Merino enterprise was through pregnancy scanning ewes and culling twice dry animals. This result was demonstrated by this scenario achieving the highest cost/benefit per dollar invested of any of the scenario investigated for Merino systems. The cost benefit of this strategy included the cost of using electronic tags. However, for this particular strategy, whilst electronic tags would typically make the data recording process easier, the same outcome could be achieved through the use of some type of visual indicator on the animal such as a separate visual tag or ear notch, for any animals that have scanned dry.

It is important to note that the results of this analysis show the comparative performance on a per head rather than per DSE basis. This approach was selected as the majority of commercial sheep operations in Australia do not operate at 100% of carrying capacity year-round. This means that where a selection decision resulted in an increase in overall stocking rate, breeding ewe numbers were not reduced by the equivalent amount. For example, identifying and removing ewes that have been pregnancy scanned as twice dry, results in an overall increase in lambing rate of 5%. These analyses have assumed that this increase in lambing rate and subsequent change to overall stocking rate, can be absorbed in the system as it is not already running at 100% of carrying capacity.

The five-year duration of the modelling provides a good assessment of the benefits that can be achieved in a realistic time frame from an investment perspective for commercial sheep flocks. However, it is worth noting that for wool traits in particular, additional gain is likely to be achieved beyond this time frame due to the increasing influence of selection decisions achieved across the entire flock in subsequent years and the increasing rate of genetic gain.

Whilst both scenarios for the Merino and crossbred systems that investigated preferencing replacement ewes from those either born as twins, or that have reared higher kilograms of lamb, generated the highest returns overall, the lower relative accuracy of these results should be acknowledged. These results are based on the data collected from the Minnipa Research Centre Merino flock and whilst the data is considered robust, consideration must be given to the limited extent of this information. Further understanding of the long-term implications and impacts on other production traits of selecting replacements in this manner is required from a broader range of genotypes and environments to confidently extend these particular results. Unfortunately, at this stage there are very limited datasets available to industry that record the level of information required to fully model these more complex strategies over the long term. Fortunately, a number of projects within the industry are underway that may assist these analyses in years ahead. For the moment, the results of these particular scenarios should be treated with caution and recognise that whilst the expected responses were relatively conservative, the models do not fully account for the complex relationship between traits such as reproductive performance and wool value.

Given the above considerations, this modelling work has shown that for Merino enterprises many producers could clearly justify targeting the use of eID in a similar nature to scenario 5, that is utilising eID to select animals for improved wool cut, decreased micron and via pregnancy scanning ensuring that twice dry animals are culled from the flock. This strategy provided a net benefit of approximately $9,000 per 1000 breeding ewes. For crossbred/composite type flocks, this modelling work would suggest that at a minimum producers should be at least utilising pregnancy scanning to remove dry animals and possibly given the stronger focus on meat production, consider targeting replacement animals from twin born mobs where possible given the high return on investment.

## 5.2 Strategies for implementing eID on-farm

A key consideration of how to best implement eID within a breeding flock is having a clear breeding objective. This breeding objective, which details the productivity targets of the flock, is critical to understanding what areas of the livestock operation require most attention, what data is necessary to record and subsequently what equipment or services may be necessary to employ. It should be noted that eID of itself, does not result in production gains, it is a way of collecting information that may be too hard or not economical to gather without the technology. The technology is an enabler for implementing strategies for achieving desired objectives.

The modelling in this project specifically aimed to investigate a range of scenarios that represented both commonly practiced selection decisions and represented an increasing level of eID implementation. Merino flocks typically have a focus on maximising both meat and wool income and the results of this work suggest that for producers who are currently only visually classing replacement ewes, there is significant gain to be made. In addition the steps necessary to make a significant gain would not be considered to be particularly onerous by many producers. At a minimum, implementing pregnancy scanning to cull dry ewes would be beneficial and where possible, also utilising eID to measure the wool value of replacements as a selection decision would provide a 5.7% net increase in gross margin. Similarly, for crossbred/composite type enterprises, given the focus on lamb production, pregnancy scanning ewes to remove dry animals, in combination with preferentially selecting twins as replacements where possible can represent a significant increase in returns.

In both of these scenarios, the necessary equipment and skills required can vary to suit the particular producer and their desire to learn the skills associated with managing this technology. Producers typically have three broad options available in terms of how they collect and manage various pieces of data:

1. Purchase own equipment
2. Hire necessary equipment
3. Engage service provider

For many producers who are not fully confident in using the technology associated with collecting data such as fleece value or using eID tags to track lambs born from twin mobs, the use of a service provider can be a valuable resource to help manage the data collection and analysis process, as well as minimising the initial capital outlay of buying equipment. For some producers who are comfortable using the equipment but do not want to purchase all or any of the required equipment, there is a growing number of businesses offering equipment hire options for this type of technology. For some producers who are interested in beginning to collect more individual animal data, the option of hiring equipment for one to two years before committing to purchase their own equipment can be a way of ensuring they are comfortable with the strategy whilst minimising the initial capital expenditure.

In many areas of agriculture, scale of operation can influence the returns achieved; however, given the individual animal nature of the activities investigated in this project (i.e. measuring individual animal wool data, reproductive performance etc), the size of the flock has little influence on the cost of data collection. The costs incurred for data collection have been calculated using contract data collection rates, not own labour and equipment. Typically these costs are on a per head basis and as such there is little room for movement in these assumed prices with varying flock size. Minor variances may be achieved through the amortisation of travel expenses that a contractor may charge, or negotiation of the per head rate on an individual farm basis.

Having the skills and equipment necessary to collect data is only the first part of implementing eID to improve selection decisions. Another key skill required is the ability to manage and analyse the data generated by these technologies to be able to make and implement selection decisions across the flock. This typically requires a reasonable working knowledge of computers and data management. As with eID related equipment, there is a growing network of service providers who can assist with data management, analysis and selection decisions for those producers who require it.

## 5.3 Success in achieving project objectives

*Determine the long term (5 year) cost benefit of implementing eID and associated technologies to drive improved selection and management decisions in commercial sheepmeat breeding enterprises for a range of different breeding objectives*

- Achieved through the modelling scenarios detailed in the results section of this report.

*Increase producer knowledge and understanding of how eID and associated technologies can be utilised to improve enterprise profitability*

- Achieved through the results and information in this report, extension article in Feedback Magazine and webinar scheduled for May 2019.

*Increase producer confidence and accuracy in flock selection and management decisions*

- Achieved through the results and information in this report, extension article in Feedback Magazine and webinar scheduled for May 2019.

*Increase the level of production monitoring and animal selection leading to improved productivity of animals, market advantage through better meeting target market requirements, reduced ewe and lamb mortality rates and reduced reproductive wastage*

- To be achieved through project extension activities resulting in an increase in producer adoption of eID technologies and improved enterprise management.

*Increase adoption of existing eID technology to improve sheepmeat enterprise productivity and profitability*

- Achieved through the results and information in this report, extension article in Feedback Magazine and webinar scheduled for May 2019.

# 6 Conclusions/recommendations

## 6.1 Key findings

The results of this project have clearly shown that there are economic gains available to sheep producers through utilising eID to make more informed breeding and selection decisions. The range of scenarios investigated demonstrated there are a variety of levels to which producers can increasingly adopt electronic identification, with corresponding levels of economic gain to be realised in the business.

Some of the most significant gains achieved in the Merino enterprise was through pregnancy scanning ewes and culling twice dry animals. This result was demonstrated by this scenario achieving the highest cost/benefit per dollar invested of any of the scenarios investigated for Merino operations, returning $5.81 for every dollar invested in this strategy.

Given the strong focus on meat production for crossbred/composite type enterprises, the greatest benefit was achieved through culling dry animals via pregnancy scanning as this effectively assisted to increase the overall reproductive rates of the flock. Whilst there is more data required to validate the findings regarding the effects of preferentially selecting twins as replacements, particularly in a meat focussed operation this additional layer of selection may have merit as an additional selection activity.

## 6.2 Future R&D

To ensure that these results are adopted as widely as possible by the industry, future R&D in this area should consider expanding the range of flock types analysed in this project, to assist in making the results as directly applicable as possible to a wide range of sheep genotypes and production environments.

Long term, individual animal data relating to reproductive performance of ewes over their lifetime is required to more accurately model the effects of such strategies as selecting replacements based on kilograms of lamb weaned per ewe. These types of measures of efficiency have been investigated to some degree in isolation, however when used within a broad breeding objective, the resulting effects of these decisions on other traits requires further knowledge to be able to accurately model long term profitability.

## 6.3 Acknowledgements

The author of this report would like to acknowledge the following people:

- Jessica Richards (NSW Department of Primary Industries), for her significant contribution to the project findings and assistance with modelling via the SmartMerino decision support software.

- Jessica Gunn (Minnipa Agricultural Centre), for the use of the flock research data to model the effects of selection decisions based on reproductive performance.

# 7 Key messages

## 7.1 Project findings

- Utilising data captured through electronic identification technology has the ability to increase producer gross margins via identifying superior animals to act as replacements, as well as removing those animals that underperform.
- Through modelling a range of management options it was found that the average cost benefit of utilising eID to improve breeding and selection decisions was approximately $4.12 return for every dollar invested.
- Improving the ability of producers to identify and remove poor performing animals within the flock will increase producer and financial resilience to difficult seasons and market conditions as costly non-productive animals are removed from the flock.
- Selection of more productive animals will lead to reduced mortality and reproductive wastage in sheep, resulting in improved social outcomes.

## 7.2 Extension materials

See appendix:

- Media release
- Webinar overview

# 8 Bibliography


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# 9 Appendix

## 9.1 Extension materials – media release

*Title:*
Electronic tags prove long term gain for sheep producers

*Content:*
For every dollar invested in capturing data via electronic tags, there is $4 in return. This was a key finding from a recent study funded by Meat and Livestock Australia.

The project modelled the long-term benefit of a range of common management options for commercial sheep producers to utilise electronic tags for improved breeding and selection decisions.

Hamish Dickson, the author of the study said, "the voluntary adoption of electronic tags by commercial sheep producers has historically been fairly low, despite the technology being readily available for over 10 years".

One of the causes of that low adoption rate has been a lack of information surrounding the long-term effects on flock structure and profitability of using eID to make different breeding and selection decisions. The project modelled the five-year gain that can be achieved through the use of eID and associated technologies (e.g. pregnancy scanning, fleece weighing) to record individual animal data. Scenarios were modelled for both self-replacing Merino and crossbred/composite type operations and a range of levels of eID implementation and breeding decisions were investigated.

"We took a self-replacing flock simply culling ewes based on age group as the base scenario, then progressively increased the selection decisions with typical breeding decisions such as visual selection, pregnancy scanning, wool quality measurements and more, to see what effect it had on gross margin," Hamish said.

"The results of the project clearly showed there are economic gains available through utilising eID to make more informed breeding and selection decisions. For example, in a self-replacing Merino flock undertaking pregnancy scanning to cull ewes that scan twice dry and using fleece measurements to assist hogget selection, increased the overall gross margin per ewe by over $9 per head, after paying for the costs associated with the data collection," Hamish said.

The project report is available on the MLA website and details many more scenarios implementing eID, the benefits and tips for getting started with electronic identification. A webinar discussing the project results and how many producers have implemented eID on their own farms is also available from the Meat and Livestock Australia YouTube channel.

For more details, contact:
Hamish Dickson
hamish@agripartner.com.au

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Word count: 364 words

## 9.2 Extension materials – webinar content

Webinar overview

Purpose;

- Present and discuss the project findings
- Increase participant knowledge of strategies to implement eID in commercial sheepmeat enterprises

Duration; 30mins, plus 10 mins questions.

Delivery; webinar, either standalone or delivered in combination with a complimentary topic for improved exposure. Delivered through MLA approved webinar series.

Slides; see attached powerpoint file.