Opportunities for Individual Animal Management of Sheep in Western Australia

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1 ACHIEVE AG SOLUTIONS – ABOUT US

Achieve Ag Solutions specialises in the delivery of practical agricultural solutions based on the latest science and technology. While science and technology are vital to the continued improvement of the agricultural sector, both are of little use unless they can be successfully implemented by producers. Achieve Ag Solutions works tirelessly to develop practical and successful methods of delivering information to the industry in a manner that can be easily understood and just as easily implemented.


2 DISCLAIMER

This report contains opinions and recommendations from Achieve Ag Solutions based upon their extensive experience and expert knowledge in the area of Electronic Identification. Any views expressed are solely those of the authors, and are in no way representative of any other commercial or government organisation.

3 EXECUTIVE SUMMARY

Radio Frequency Identification (RFID) is not a new technology. It was first patented in 1973 by Mario Cardullo, and has been adopted and adapted throughout the world in logistics, banking and hundreds of other applications. Its adaptation for use, as a form of Electronic Identification (EID) for sheep & cattle was first truly initiated by Allflex in 1992, with the release of their first commercialised EID tag. Twenty-five years later, the uptake of this technology has been far from extensive in the sheep industry, despite the wide range of equipment, data management tools, industry support and market incentive now available. The State of Victoria has invested in increasing the voluntary uptake of the technology over a decade, prior to the recent announcement that the state would move to a mandatory tagging system for traceability.

The Australian sheep industry has a history of poor uptake of new technologies and concepts, and EID is another prime example. EID is no longer a new or underdeveloped technology, with rapid increases in equipment capability and reduced costs for purchase and implementation over the past five years. With these reducing costs, together with greater awareness of the role that EID can play in on-farm management, there is growing national interest from sheep producers in all sectors of the industry.
While interest is one thing, achieving adoption is another. There are specific approaches that the industry can take to allow producers to make more confident and informed decisions around investment in the technology. Much of this will be driven through individual producers setting and assessing their own business and breeding objectives, and understanding the role that EID can play in helping to achieve them.

Electronic ID is simply a technology that facilitates the concept of individual animal management and monitoring, in a way which is more accurate, easier, faster and ultimately more likely to happen than using visual or manual systems of data capture. Traditionally, commercial sheep production has been undertaken with an almost wholly mob based approach, relying only on averages to inform management, and with little ability to apply selection pressure based upon objective measurement of any sort.

It has been demonstrated through research trials over many decades that the variation that exists between animals in terms of the assorted production traits can be used to great effect, in achieving more rapid genetic gain through applying selection pressure. Simply knowing who the passengers are within the flock, and who the superior performers are, can be achieved through the ability to record information against the individual.

This tool also provides opportunities to make gains achieved through adoption and application of the technology throughout the industry leveraged by an improved level of general understanding and knowledge of individual performance within sheep enterprises.

The application of this tool is not limited by geography, industry sector, nor enterprise type. Whether it is monitoring or measuring wool traits in merinos, growth rates in prime lambs, or individual scanning records in either (just to name a few), there is a range of information that can influence the way a sheep enterprise is managed.

Other than an increase in labour efficiency for tasks already undertaken prior to implementing EID, there is little return that can be attributed directly to the investment in the tag or technology itself. The technology does not make money, decisions do. While attempts have been made in the past to determine a cost benefit derived from EID, ultimately any return is a reflection upon the quality of decision making from an individual producer, as opposed to the technology itself. By way of comparison, it would be like associating a cost benefit return to a pasture ruler. The ruler itself is vital in the process, however the decisions made, produce the end results. EID is a very effective tool in informing management, and allowing the application of selection pressure more easily, however it is simply that. A tool. A tool which if adopted across the industry would see a modest, but more rapid increase in the rates of improvement achieved by livestock managers, through improved decision making.

The first step in the process of assessing the potential of EID for a livestock enterprise, is to understand the business and or breeding objectives of that operation. For many producers, this may be something that they have established in their mind, but never formally documented. It is a simple process, but one which is vital in setting direction and providing a more objective view of the role that a new technology or concept may play in achieving those goals. This is a key component missing from our industry psyche and an essential framework to support informed decision making for investment in technologies such as EID and the supporting infrastructure.
4 **OVERVIEW OF RELEVANCE TO SHEEP INDUSTRY**

4.1 **WESTERN AUSTRALIAN CURRENT POSITION**

The Western Australian sheep flock is currently estimated to be approximately 14 million sheep, including, 7.5 million breeding ewes. The following map illustrates the approximate distribution of sheep numbers throughout the state, with the colour indicating the percentage change in numbers between 2012/2013 and 2015/2016.

*Figure 1 - Western Australian Sheep Numbers - Source* [www.mla.com.au](http://www.mla.com.au)

With much of the state demonstrating a decline in sheep numbers, this is a continuance of the long-term trend of the past 25 years. The decline in sheep numbers, while dramatic, is in line with national trends (see below).
A survey of Western Australian producers in 2014 found that 4% of respondents were currently using EID in some form, with a further 16% indicating that they were considering the use of EID (Jones and Curnow, 2015).

4.2 VICTORIAN EXPERIENCE

Victoria has lead the way in EID adoption in Australia following a number of Victorian State Government investments aimed at increasing the voluntary adoption of the technology. Their investments have included funding research, demonstrations, extension activities, subsidising tag prices and offering producer grants for equipment purchases.

On these initiatives, the following are the express opinions of Achieve Ag Solutions only.

Tag subsidies have been offered over a number of years in Victoria and have played a key role in achieving ever increasing uptake of the technology. The recent announcement of mandatory EID for traceability purposes has resulted in a major spike in interest in the on-farm use of EID. It is the authors estimate, that Victorian EID tag sales were in the low to mid hundreds of thousands prior to the announcement, while approximately 9 million tags are to be applied in Victoria in 2018 under the mandatory tag system. Based on recent producer consultation, it appears as though the decision to apply EID tags has existed as an initial barrier to adoption, and now that decision has been removed from the equation, many more producers are looking to invest in equipment and utilise the tags that sheep and lambs will carry now and into the future. Based upon this, both tag...
subsidy and mandatory tagging have resulted in increased uptake of the technology in their own right.

Initial investments in demonstration properties and producer grants, inadvertently skewed interest and perception towards the need for auto-drafters to undertake EID activities. Some of this may have been due to a lack of lower cost alternatives (e.g. these were prior to the more recently released stick readers etc.), for easily collecting and using data and therefore implementing decisions. Some however was due to a desire to demonstrate the highest level of technology available. While demonstrating what is possible, seemed an obvious drawcard for attracting the attention of early adopters, the unforeseen result was a perception that a high level of investment was required to utilise EID.

This perception has taken some time and a significant number of awareness activities to help overcome. The Achieve Ag Solutions team alone have been involved in more than 50 EID activities in the past 7 years, interacting with an estimated 1500 Victorian producers (plus in excess of 1200 interstate producers over the same period). As more and more equipment options have been released, with increased capability and at lower price points, it has become much easier to demonstrate that using EID does not have to be expensive. Despite efforts to demonstrate low cost options for investment in EID, it is worth noting that the initial excitement that auto drafters and sheep handlers invoke, remains the number one drawcard for attracting producer attention, even if only as a conversation starter.

There are two clearly defined activities that need to be undertaken in the process of introducing a new technology or concept to producers. The first is promotional and the Victorian experience has demonstrated the value of high quality presenting, delivering a view of EID and the sheep industry in general as an exciting place to be. These activities are not about detail and in-depth analysis, but simply introducing the technology in a way that captures the attention and interest of producers. Historically, agricultural extension has focused on communicating the detail and profit propositions for a concept. While these are important, they are not what generate the initial interest, and can in fact achieve the opposite. Once producers are engaged in a concept or the prospect of investing in a technology, the delivery of information should become more detail focused and designed to support the producers through this process. The delivery of information in Victoria has demonstrated the need for both approaches to be undertaken sequentially.

Producer grants for equipment purchases have been offered on multiple occasions in Victoria, with the most recent being in conjunction with the announcement of mandatory EID use for traceability. Under this most recent grant scheme, a total of $750,000 was fully subscribed in less than twelve months, and delivered funding to over 480 farmers. As the funding was offered under a dollar for dollar system, in excess of 1.5m of EID equipment has been purchased, with the actual total level of investment in equipment believed to be more than $2.4m (www.sheepcentral.com.au).

It is the view of the authors, that while producer grants increase the amount of EID equipment purchased, this can, in some cases, result in inefficient and ineffective investment. As discussed further in this report, understanding the outcomes desired by a producer, prior to investment is a critical component of effective EID uptake. When producer grants are offered, without any true qualifying criteria, the risk of poor investment decisions increases, and has been witnessed firsthand by the authors through consultation with grant recipients from previous funding schemes.

While initial uptake of EID in Victoria was dominated by early adopters, this has now transitioned to include more of what would be regarded as the early majority.
The change has coincided with, if not been driven by, improving equipment capability, a growing service sector, more general awareness of the potential uses of EID and most recently the introduction of mandatory EID for traceability. All four have contributed to ever increasing uptake, however the announcement of mandatory EID tag use for traceability, appears the most significant single factor.

Since the announcement of mandatory EID use, Achieve Ag Solutions have been involved in a large number of EID extension activities in Victoria throughout this transition, including full day workshops and producer presentations at industry events. The reach of these has been more than 700 producers to date.

The following are identified as the most significant contributors to successful delivery for the range in producer standpoints. Activities should -

- Illustrate the limited amount of on-farm technological advancement within the sheep industry and inspire a desire for more rapid change.
- Make producers at least partly uncomfortable with their current level of performance recording and monitoring. This has proven to be very easily achieved, given the lack of monitoring undertaken by even the most progressive producers.
- Focus upon the outcomes producers are looking to achieve, prior to presenting the equipment options.
- Demonstrate what is possible with both the highest and lowest levels of producer investment.
- Demonstrate very simple, through to quite complex, data collection strategies
- Talk about problems that can be experienced, such as metal interference with panel readers or failing batteries, to demonstrate that there can be challenges in implementing an EID system.

Victoria’s investment in on-farm use of EID throughout a decade, has seen steady uptake of the technology with ever increasing numbers of EID sheep tags sold across this period. The recent announcement of mandatory EID for traceability purposes has seen a rapid spike in interest from producers. While all of the various activities undertaken have had some influence, recent producer feedback indicates that removing the decision to apply EID tags has been the single largest catalyst for increasing their uptake of the technology for on-farm use.

4.3 BROADER BIOSECURITY APPLICATIONS OF EID
The concept of biosecurity is poorly engaged by livestock producers, although many are already applying basic principles daily to their businesses. Based on structured questioning applied to sheep producers in a series of workshops throughout Victoria in early 2017, Achieve personnel challenged the traditional concept that food safety and market access are the role of government and industry organisations, and advocated that they are an integral part of the role of a livestock producer or land-owner. The general concepts and importance of farm-gate biosecurity were poorly understood, or were poorly defined. Producers understood their responsibility to protect their livestock on farm but in general, perceived market access and national or global biosecurity issues associated with trade to be the responsibility of government or industry institutions (85-95% of producers questioned).
As the livestock commodity markets continue to experience price rises and hold a stable and important role in the Australian agricultural economy, the importance of demonstrating a robust and repeatable system of traceability to our trading partners will become ever more important.

The decision to make the use of EID tags mandatory and therefore create a more robust system of traceability has been met with a mixed response from producers and livestock industry personnel with respect to its importance in national biosecurity. However, the 2017 experience with the Sheepcatcher II program, clearly demonstrates the need for a significant improvement to this process nationally. With increasing sheep movements in all states, with ready access to interstate trade options via on-line selling, the ability to rapidly and accurately trace livestock movements is a genuine challenge. While it has generally been assumed that saleyard to saleyard movements were uncommon in Australia, recent tracing work undertaken in Victoria showed this to a relatively common practice. While this is most likely to actually resell the animals, saleyards are often used as a holding area for stock prior to transport to a final destination. This introduces a significant risk, and complexity in tracing cohorts of animals, should some form of disease outbreak occur.

The level of inaccuracy the visual system for recording and transfer of data generates has also been captured in Victoria, returning evidence that 44% consignments had ear tags where PIC was not recorded on the NVD, 41% of consignments had PIC recorded and no corresponding ear tag observed, 15% had incorrectly transcribed PIC on NVD. When this information was presented to producers (workshop participants), they were not surprised by the poor quality and capture rate of information and acknowledged inherent and chronic issues with the visual system. Given the physical nature of the visual tag, plus the environment in which it performs, it is not surprising that a read rate of >5% inaccuracy could be expected (SHEEP CRC 2006), coupled with omissions and transcription errors this produces a high level of inaccuracy in this system.

Where the use of transaction tags has been adopted (such as in Western Australia), the ability to trace backwards is enhanced, however the ability to track forwards is still limited. This means that while it is possible to collect information relating to where an animal has been, the are issues with the speed with which it can be discovered where that animal has since travelled, and determine and trace the cohorts of animals with which it has had contact.

In any major exotic disease outbreak, the time taken to identify those animals affected, and any potentially infected cohorts which have been within close proximity is vital. This will not only limit the spread of disease, but also allows more rapid proof of eradication.

Due to the impacts of export restrictions, the time taken between discovery of a disease incursion and final proof of eradication, may be the most significant cost to economy resulting from a disease event (Matthews 2011). The most likely delay in identifying, tracking, and eradicating an exotic disease outbreak will come from human error in recording information for traceability. An electronic recording system using EID tags will significantly reduce the reliance upon human input into the system, as has been demonstrated with the cattle NLIS system.
5 INTRODUCTION/OVERVIEW — WHERE THE TECHNOLOGY IS UP TO

EID technology has been available to the livestock industries in Australia for twenty-five years. However, despite the increasing availability of this equipment, the uptake of this technology has been far from extensive in the sheep industry.

There has been significant improvement in the capability of EID equipment in recent years, while prices have also decreased. With the technology now being fully matured and commercialised, there are significant opportunities for improvements across the supply chain. The user support mechanisms offered by equipment and software providers have also increased significantly, with producers well supported in their implementation of the technology.

Also developing considerably in recent years, is the service sector offering EID activities to producers. There are now a range of contractor services available in Victoria (including, but not limited to fleece weighing, live weight recording from lamb marking, data management), allowing producers to utilise the technology without investing in equipment, or any need to learn the intricacies of using specific equipment.

For stud operations, where large amounts of data are already being collected, the decision to move to an electronic system is a relatively easy one, as it will make data collection faster, easier and more accurate. For commercial sheep enterprises, the ability to collect data faster and more easily will make it more likely to happen at all. While there will always be a higher level of sophistication in the stud operations, EID introduces the opportunity for commercial operations to access more of the genetic gain potential experienced by studs through applying accurate selection pressure.

Accurate reliable data opens opportunities for improvement across the supply chain. Greater integration with existing technologies such as Australian Sheep Breeding Values (ASBV) can be leveraged through the use of EID in the future. The only way to be better, is to change. The only way to change in the right direction, is to monitor, measure and manage that change.

6 SETTING OBJECTIVES

As an industry, we focus too readily on a broad, industry based process of benchmarking and not on assessing and leveraging individual business aims towards progress and success, or benchmarking within an enterprise. The author’s experience reflects this, in that 95% of producers (workshop participants), asked to assess their capacity to engage with EID technology against their business aims, do not have a clear business aim in place.

That is, when faced with this proposition, a producer will relay a generic or tenuous objective such as “mark more lambs”. While the intention is good, the statement as an objective is unconvincing and ineffective. An objective should follow the SMART principal of Specific, Measurable, Achievable, Realistic, Time-bound.
An example of this is:

“I want to mark 145% lambs, turning off 21kg carcasses by 6 months of age, maintaining moderate mature ewe weights under an average of 70kg, and running a stocking rate of 14 DSE/ha, all by 2022”.

Once a producer has their objective clearly stated, it is much easier for them, the facilitator, service provider or equipment manufacturer to assist them in identifying areas of focus, opportunities for more rapid improvement and in this particular case, the specific role that EID and individual animal management may play. For some producers, this process will highlight that there is no immediate role for EID. This is a good outcome. While for others, the role may be obvious and significant. This is also a good outcome. It should be noted that this process, while discussed in this case specifically with reference to EID, will often result in identifying more general areas for development and focus, and assist in pushing producers to look for more answers and improvement.

Without undertaking this process, producers will often be unnecessarily drawn to the more exciting and expensive equipment options, or to where the best sales pitch is being delivered. All investments should be treated as exactly that; an investment, not just in money, but also in time.

Every piece of data captured within a livestock business, costs money. This is either in equipment purchased, contractor fees, or time collecting, collating, or analysing data, or implementing decisions. With that in mind, it must be evident that every piece of data has the potential to deliver value (section 7).

Value may not always be money either. It can be through greater efficiency, leading to more time with the family, or more time to play golf. Value means different things to different people, and may not always be profit.

Included in this report, is a copy of a simple decision tool (appendix one), developed to assist producers through the task of objective setting and assessing their needs. To complete it fully, a producer must understand their objective, understand the data capture opportunities relevant to them and the equipment options available to meet their needs. This will be a congruent process of increasing knowledge and understanding.

7 INDIVIDUAL ANIMAL MANAGEMENT

The Australian sheep industry has traditionally operated on a “mob basis”, where almost all decisions and analysis of performance, has been based upon averages for the group of animals, rather than the individuals themselves. The assumptions made, the known variation in individual performance traits and the nature of averages, have the potential to unfairly disadvantage some animals, while overstate the performance of others.

A concept known as population dynamics, occurs within any group of animals. This is where a bell-shaped curve exists in relation to their level of performance for a given trait.

The population is made up of poor performers, average performers, and superior performers.
Dependent upon the given trait, it is possible for some animals to be costing the enterprise money rather than making money. These are passengers within the operation, which can remain for a number of years without ever being identified within a traditional mob based management system.

The Sheep CRC (Sheep CRC, 2007), found that the range in fleece value within a group of commercial merino ewes, on a property could be as much as $50 per head. Achieve Ag Solutions, have identified differences in lamb production of as much as $300 per ewe within a single year (see 7.1.4.7 “Kilograms of Lamb Weaned” Section of this report). Both examples demonstrate the large amount of variation that exists within a group of commercial animals and also the opportunities for improved selection, culling, and decision making.

Individual animal management, is not all about applying selection pressure however, and can be as much about better informing decision making. Take the example of the recording an individual ewe’s scanning results each year. While selection pressure could be applied to make better use of those ewes scanning with twins in multiple years, or to remove some ewes that are regularly scanning as singles, often the greatest benefit is derived from simply understanding what individuals are achieving within your operation. If for instance there is a large percentage of twins returning the following year to only provide singles, then the questions must be asked; “is it her fault or yours?”
While heritability is low for fertility traits, the repeatability is more reliable if the animal is given the chance to express its potential. The inability to allow an animal to express its real genetic potential, is one of the greatest constraints upon sheep production in Australia, and monitoring individual animal performance can assist greatly in informing management decisions to improve this.

Often when looking at the role of EID and Individual animal management or recording, there is an attempt to associate a cost benefit to the use of the technology/concept. While this is an obvious question to ask, the answer is not as simple.

If looking simply at the labour saving achieved for a single task, the following illustrates the differences in labour cost associated with recording individual live weights using visual tags, as opposed to EID tags.

![Figure 3 - Costs comparison of using visual and EID tags for recording live weights of individual animals (The Sheep CRC 2006)](image)

While labour saving is easily calculated for efficiency gains in a given task, placing a value upon other gains is not as simple. Decisions make money, not an EID tag. The quality of decision making has an enormous impact upon the value garnered from the use of EID. This is a point that will be discussed further throughout this report.

### 7.1 APPLICATIONS OF INDIVIDUAL ANIMAL MANAGEMENT, MONITORING & FEEDBACK

#### 7.1.1 Definitions
The following are some definitions for clarifying the concepts often applied when using EID. While it is expected that the vast majority of industry members reading this report are already well informed in this area, it is vital that these definitions and concepts are communicated effectively to producers. Allowing producers to make poorly informed decisions based on a limited level of understanding of these concepts, has the potential to have a detrimental effect upon productivity despite best intentions.
7.1.1.1 **Heritability vs Repeatability**
Heritability is defined as the estimate of how much of the parent’s genetic merit for a trait, will on average, be passed on to their progeny.

Repeatability is defined as the likelihood of an animal to retain their relative ranking in terms of performance for a given trait over time. For traits that are repeatable, an early measure of performance for that trait in comparison with that animal’s peers, can predict relative lifetime performance.

7.1.1.2 **Genotype vs Phenotype**
The genotype of an animal is the full hereditary information relating to that animal. It is possible that some of this genetic potential is not expressed due to environmental influences. Phenotype is the physical attributes of the animal, as it stands before you, and can include some factors influenced by environment, rather than just the genetics of the animal.

7.1.1.3 **Generational vs Genetic Gain**
It is important to also distinguish between genetic gain and generational gain. Genetic gain is the most commonly discussed, where selection pressure is applied, in order to improve the future genetic performance of offspring bred from a group of animals. Generational gain however, is achieved when culling of animals is implemented based on current performance compared to that animal’s peers of the same age (can include phenotypic expression rather than just genetic).

Even low heritability traits will still achieve some cumulative genetic gain if selection pressure is applied.

Applying selection pressure to more highly repeatable traits, can result in a sudden jump in average performance in a group of animals if the poorer performers are culled from the mob. The simple nature of averages, tells us that if we remove animals below the average, then the average performance will move to a higher level.

7.1.2 **Use for Selection vs Informing Management**
While most often the focus upon EID use is squarely upon the selection pressure that can be applied, perhaps equally or more significant is the contribution to decision making. Understanding a greater level of detail around the performance being achieved by individuals within the production system can influence future management of similar situations. EID has the potential to focus attention onto the factors influencing performance, and produce much greater returns to the enterprise than those directly contributed by the technology itself.

7.1.3 **Constraints Upon Application of Selection Pressure**
One of the greatest constraints to the effective use of EID, is the inability to actually apply selection pressure. For many enterprises, the only role that EID can play is to better inform management decisions, because they are in a rebuilding phase where all ewes are retained, or where the reproductive rate of the flock is insufficient to allow opportunities to apply effectual culling practices.

Where an enterprise is in a growth phase and retaining all available animals, the “banking” of information can be very important to allow selection pressure to be applied once flock numbers stabilize. It should be noted however, that the information “banked” for future use needs to

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be very low cost, and low input, as there are no guarantees that this information will be used in the future.

Where reproductive rate is constraining an enterprise, EID may play a role in informing some decision making, however it must be realized that EID is not a silver bullet, and there will be other areas that a business in that situation should focus their attention initially.

7.1.4 Individual Animal Data Recording

The following is a summary of the most common uses of EID for identifying the performance of individuals.

7.1.4.1 Birth Type & Mob Details

One of the simplest pieces of data to capture within an EID system, doesn't actually require the electronic reading of tags at all. Electronic tags are printed with a serial or visual ID number on the outside of the tag. Simply tracking the sequence of tags applied to each mob of lambs at lamb marking can provide valuable information for the lifetime of that animal. An example of this would be the use of tags 0001 to 0385 in twins bred by XXXX rams. Because the visual ID is matched to the electronic tag number in the “bucket file” provided when purchasing the tags, it is possible to assign the birth type or mob information against the electronic tag number for that animal. At any point in the lifetime of that animal, it will be possible to read its electronic tag and display information recorded at lamb marking. It may be that you are looking for a reason to cull some additional animals, and you no longer wish to retain ewes bred by a particular sire group, or that you only want to retain those born as twins. In any case, you can easily retrieve valuable information that was simply recorded by writing down that sequence of tags at lamb marking.

7.1.4.2 Fleece Weighing & Fleece Testing

Both tasks be undertaken at shearing, or side sampling prior to shearing can be used for obtaining fleece test results. Neither is a new concept, nor does it rely solely upon then use of electronic identification, however the use of EID within the process results in a reduction in errors encountered in capturing the data. EID simply makes it easier, faster, and more accurate (refer to Sheep CRC labour saving data in the introduction of Section 7).

The benefits that can be achieved from applying selection pressure to merino ewes based on fleece weight, micron, or fleece value are well documented (New South Wales Department of Primary Industries, 2007). Many in the industry have attempted recording fleece data in the past using visual ID, however moved away from the practice due to the difficulties and inaccuracy. EID provides an opportunity to reinvigorate this method of improving both generational, and genetic gain.
7.1.4.3 Individual Live Weight Recording
One of the simplest pieces of data to capture using EID is individual live weights. Collecting live weight can be done as part of existing weighing operations with the addition of EID recording equipment. The information can provide useful insights into the varying performance of a group of animals. Examples include identifying poor performing lambs (pasture based or feedlot lambs), or for tracking live weight changes in ewes over joining. While the information can be useful, the ease of data capture can also see producers collecting significant amounts of data which will never actually be utilised. As discussed throughout this report, understanding the need for the data is critical.

7.1.4.4 Individual Ewe Scanning Results
Recording multiple years’ pregnancy scanning data can be very easily achieved using EID. Pregnancy scanning contractors have an opportunity to collect this data automatically with some compatibility between ultrasound and EID equipment. Where scanning contractors can collect this data automatically against individual animals, the gathering of this information is incredibly easy. Where contractors are not equipped to undertake this task, producers can record this information for themselves using either a handheld wand, through a race reader, or through a handler as part of another task. This can be as simple as recording all the tag numbers of animals of a particular pregnancy status, and naming the file as that pregnancy status. Data management at a later date can ensure that all animals in that file are assigned that pregnancy status. The use of this data may be in applying some form of selection pressure (remembering that heritability of fertility traits is low, while repeatability may be a consideration), or to provide feedback upon management and nutrition. Where there is a clear trend of ewes interchanging between singles and twins from one year to the next, it may be the result of insufficient nutrition and management of twins through lactation, weaning, and leading back up to joining. As mentioned earlier, “is it her fault or yours”?

7.1.4.5 Pedigree Match Maker (PMM)
Pedigree Match Maker (PMM) is a walk-by system that uses EID tags to estimate associations between ewes and their lambs, and provide the ability to trace individual animal pedigree. All ewes and lambs in the mob are tagged with EID tags and a single file entrance is set up using an attractant such as water or supplementary feed to entice animals to walk through. An EID panel reader is placed on the single file entrance to record the tag numbers of each animal as it passes. The data captured is processed through software developed by the Sheep CRC (Pedigree Matrix), to establish the predictions for which lambs belong to which ewes. While PMM was originally developed with the intention that it be used within
the stud environment, commercial lamb producers also have an opportunity to make use of the technology to determine productivity of each ewe (see section 7.1.4.7- Kilograms of lamb weaned).

While the recording of PMM data is relatively simple, particularly with the recent developments of the Sapien Technology “PedigreeScan” reader designed specifically for the task, achieving sufficient sheep flow through the system is the greatest challenge. The importance of training sheep onto the system cannot be understated. Training should involve introduction of the single file entrance and then over time, instalment of the remaining fence panels to enclose the attractant (water or feed). This will allow ewes to investigate the components over time and leaves them with an initial choice to enter through the single file entrance, or go around it. As a general rule, 10 days is a good length of time to introduce the full set up, but should be based upon monitoring ewe activity around and through the set up.

Once trained and accustomed to the process of PMM, ewes adapt quickly when re-entering a data capture situation. It has also been reported by producers using PMM, to have a significant impact upon the handling of lambs at weaning. Lambs who have been exposed to a PMM situation are reported to be easier to handle in yards and more inclined to enter a weigh crate or auto drafter without pressure.

There are a number of new technologies on the horizon such as proximity tags, or GPS tags which will, at some point in the future, replace the need for PMM. Currently these are not truly commercialised and likely to be cost prohibitive to commercial producers in the early stages of release.

7.1.4.6 EID Enabled Walk Over Weighing (WOW)

Walk over weighing is a process where weights are recorded against individual animals, as they walk across a platform in a single file entrance, similar to that of Pedigree Matchmaker. An attractant such as water or feed is used to entice the animal over the platform. As the animal passes over the platform, its EID tag is read and an average weight is recorded, using an algorithm to account for weight transitioning on and off the platform. There are a number of constraints and challenges associated with walk over weighing. The most significant of these are –

- The specific training of animals to walk through the system
- The need for large amounts of data to provide a level of confidence in results
- Data must be filtered and analysed, using software to remove the “noise” in the data and provide some level of accuracy for individual animals.
- Power requirements are high due to the various components involved, particularly the panel reader for recording EID tags. This will require either solar panels, or very regular swapping and charging of batteries.
- The risk of equipment theft in the paddock. With $5000-$10,000 worth of equipment in an unsupervised location, this is a very real risk.

While the technology is exciting and has some potential, particularly for pastoral zones, it has struggled for uptake in Victoria due to the issues associated with implementation. For the majority of intensively run sheep operations, weighing through the standard yard system, remains the most cost effective and accurate option. For pastoral areas, where yarding sheep is a significant task,
there is a greater appeal, however, the uptake and use of the technology is currently limited by a lack of practical commercial interfaces, which can present useful information to the user in real time.

7.1.4.7 Kilograms of Lamb Weaned Per Ewe

Through the use of Pedigree MatchMaker and also recording individual weaning weights of each lamb, a flock can be ranked based on the kilograms of lamb produced by each ewe. This allows the producer to rank the flock based on kilograms weaned, culling the worst performers and capitalising on the most profitable sheep. Once again, the recording of kilograms of lamb weaned per ewe is not a new concept (Snowder & Fogarty, 2009), however, the development of Pedigree MatchMaker has made it more achievable for a commercial flock. The opportunity this creates may be to apply selection pressure, or simply provide more feedback to management strategies. The following graph shows an example of the variation that exists within a group of commercial ewes.

It is also possible to assign a value to the lamb weaned by each ewe. This is best achieved by applying pricing based on live weight ranges, to better reflect the value of a finished lamb as opposed to a store lamb (in most years, although there is a trend towards higher store lamb prices in Victoria recent years). In this example, a graph has been generated using the following price grid (right).

<table>
<thead>
<tr>
<th>Weight Range</th>
<th>Price $/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 39</td>
<td>$5.00</td>
</tr>
<tr>
<td>40 - 49</td>
<td>$5.50</td>
</tr>
<tr>
<td>49 - 100</td>
<td>$5.20</td>
</tr>
</tbody>
</table>
If the prices on offer, recently in the Victorian lamb market are applied to the situation, then the highest ranked ewe would be weaning $362 worth of lamb (at $7.00/kg Carcass Weight).

It has also been possible, with an Achieve Ag Solutions client, to collect multiple years’ data against individual ewes, to provide even more insight into the total productivity of a ewe over two years. The following graph has been generated using the same pricing scale as the previous example.

In a further example, of the levels of complexity that can be achieved in data collection, the following is an example of combing ewe live weight, condition score and the kilograms of lamb weaned by each ewe.
The graph above, highlights some of the issues presented when producers are selecting ewes based upon visual appearance only. Those animals presenting best visually at weaning, will be those in the bottom right quadrant of the graph (heaviest, highest condition score and lowest level of productivity). In the case of this particular property, this information changed their mindset in relation to managing ewes, allowing them to express their potential, not being unfairly critical of the best performers and not being drawn visually to the passengers of the system.

Witnessing this information relating to their own ewes, provided significant impetus to better understand the factors affecting the performance of individuals and led to more targeted nutritional management of lighter condition score ewes post weaning, allowing them to better recover from the impacts of lactation.

Collection of information such as kilograms of lamb weaned per ewe, can present some challenges because of the reliance on PMM to provide the critical link between ewes and lambs. In the examples above, however, this information has informed management for the properties in question and also presents some opportunities for applying selection pressure.

Simply presenting this type data to producers, as part of EID workshop delivery to outline the vast variation in individual performance, has provided significant moments of realisation for many producers.

**7.1.4.8 Treatment Recording**

With ever increasing demands and consumer expectations around safe use of chemical treatments, EID introduces an ability to further refine the process to individual animals. Recording this information can be complex and focused on the individual at the time of treatment, or more
practical where treatments are recorded against all the animals present in the yards at the time. The simplest method in this instance, is where all EID tags of animals are recorded at some point during their visit to the yard, with the file name capturing the treatments undertaken. For example, “Yellow tag ewes – Cydectin LA, 5in1”. Batch numbers and expiry information can also be recorded against the file, providing a robust record of treatments applied. Dependent upon the EID equipment being used on a property, it is possible to alert the producer to an animal still within a withholding period, if it presents at a weighing event, or any other event where EID tags are being read.

7.1.4.9 Simple Stocktake
For many sheep enterprises, keeping accurate records of animal numbers has proven difficult. This becomes increasingly evident, when there is believed to have been stock theft occurring. Having the ability to accurately identify the last known time that the stock in question, were present on the property, can be difficult or even impossible without EID. For many producers, just simply recording the ID of each animal as they pass through yards for other handling events, provides an information trail which facilitates more accurate record keeping and trace-back if required. This process also facilitates the collection of mortality data, which is often poorly captured otherwise and could indicate an issue early, compared to after a few years; once per year (e.g. shearing) data collection. This process can also identify class, age or mob variations, producing more sophisticated and useful inventory data, compared to a traditional once or twice yearly manual collection. An easy cost benefit of employing this equipment (through purchase or hire), could be conducted on a business by business basis, using estimated mortality data against stock class value.

7.1.4.10 Record Anything
With an EID system, you can record anything that can be measured objectively or subjectively. This is particularly beneficial in a stud situation, where the number of traits to be recorded can be many and varied. A move to an EID system does not, in any way have to mean to move completely away from traditional visual assessments. Particularly in the case of merino breeding, a classifiers comments can be recorded against the individual, using EID and can be vital information at some point in the future of that animal.

7.2 The Investment Decision Process
Investment in EID equipment should be undertaken based upon a needs assessment, in relation to the enterprise or breeding objective of each particular business. Taken into consideration in each assessment should be the regularity of use, technological capability required, efficiency desired, user capability/confidence and ultimately whether a contractor could be used to undertake any of the tasks.

The technology itself is just a tool, and investments should always be made with the final objective in mind. Critical in this area, is equipping producers with the tools and knowledge required to make informed decisions, prior to talking to equipment manufacturers.
7.2.1 EID Contractors & Equipment Hire

Often EID tasks are sporadic in nature and therefore, do not require ownership of all of the equipment required. Given that there can be up to 12 months between recording events for tasks such as fleece weighing, equipment can sit idle for long periods of time, and the user’s knowledge of how to use it, can diminish over time between events. Both provide incentive to investigate the option of utilising the services of a contractor, reducing the upfront investment in equipment and outsourcing the stress of operating the equipment (particularly relevant when recording fleece data in the high stress environment of shearing).

Equipment hire is another option for producers, where sporadic or annual data capture is required. It does however require the operator to possess the skill level required to use the equipment effectively.

Both equipment hire and contractor use, should be considered in the EID investment planning process of all sheep producers.

7.2.2 Software & Data Management

There are a number of software options available for producers to use in the management of data captured on farm. While simple tasks can be undertaken using common software options such as Microsoft Excel, software developed specifically for managing livestock data will provide a more complete and reliable data management option.

Like all software however, there is a need for producers to learn how to use the software and for many this may be one more task that they don’t need to be taking on, in an already busy management role. Data management is another area where producers should consider the use of a contractor/consultant. Outsourcing the data management can considerably simplify the data handling process, and ensure that the producer can actually make effective use of information collected.

Much of the complexity in data management comes from one of the following –

- Collecting too much data
- Collecting the wrong types of data (i.e. Not in line with objectives)
- Poor data quality (missing records etc.)
- Insufficient time dedicated to managing data
- Lack of interest in managing data
- Lack of skill in managing data.

A data management plan should be established to determine which information needs to be collated against an individual animal for its entire life (i.e. Pregnancy statuses) and which is just useful information to inform management, which can be collected as an isolated record. An example of the latter is the weighing of lambs at marking and then again at weaning. While it will vary between enterprises, generally this information is most useful for informing management around the performance of lambs, as they transition onto pastures in the latter half of lactation. If this is the case and the information is not to be used in any way for applying selection pressure, then simply analysing this data as a standalone task will assist in simplifying the data management system as a whole.

Microsoft Excel is the first option that most producers utilise when looking to manage data. It is capable of achieving almost anything when operated by an experienced user. Simple tasks like
combining two pieces of data for an animal, such as two separate weighing sessions, or two years consecutive pregnancy status, can be undertaken using the VLOOKUP function.

As more and more information, treatments or events are recorded against an individual animal, the difficulty of data management increases, and the need for specialist software is greater.

The downsides or risks of using Excel include:

- Data safety – with no safeguards in place, any unintentional changes to data can occur without your knowledge, rendering the dataset useless if the error isn’t identified
- While functionality can be exceptional, the complexity of some formulas is well beyond the capability of many producers
- Issues with automated data manipulation. The most common example of this is where a producer is using four-digit visual numbers such as 0001 through to 3000 for example. Unless specific effort is put into formatting cells, Excel will automatically remove the leading zeros from all numbers. This is not the only case where Excel will make changes (often with the user completely unaware of them), in an effort to “help” you.

Every business should assess the data collection being undertaken and plan a data management system, that will best suit their business needs, their own capability and desires.

7.3 FUTURE EQUIPMENT DEVELOPMENTS

With worldwide investment in EID increasing each year, there is greater incentive for equipment manufacturers to continue to innovate. All equipment purchases should be undertaken with a view to it being quickly superseded, as this will indicate that the industry is achieving rapid product development and improvement.

It is the authors belief that the recent wave of new product releases, will see a period of consolidation from equipment companies over the next 12 months to two years. There may be some improvements in the user experience (user friendliness) with some products, however there are no significant product developments expected in the short term.

Of most significance, may be the ongoing development and use of phone applications in conjunction with EID technology. To date the use of phone Apps with EID has been limited, and there is still significant opportunity for growth and development. This is likely to be an area where rapid improvement can occur in the short term.

Looking further to the future, and there is the potential for new technologies to become more commercialised in the next 10 to 15 years. Technologies such as proximity tags, and GPS tags are all in development and moving towards commercialisation, however cost will be prohibitive in the early stages, and will not greatly affect EID use. If anything, it is the belief of the authors of this report that those technologies will enhance the use of EID, where pedigree can be more easily obtained. This is likely to be done using a temporary application of the technologies such as proximity tags, while costs are still prohibitive, allowing them to be used on multiple animals in a given year. If this proves to be the case, then the pedigree identified using either proximity tags, or GPS will still need to be permanently recorded against that individual using existing EID tags.
8 EQUIPMENT

Electronic Identification equipment options have developed significantly in recent years with increasing capability and reducing prices. It is expected that this trend will continue, with rapid product development driven by increasing worldwide demand as EID is implemented within sheep and beef operations around the globe. The following is a brief overview of the various equipment options available to producers and the various levels of investment, that a producer may wish to undertake.

8.1 HANDHELD WANDS OR “STICK” READERS
The area of handheld readers has expanded significantly in recent years, with more than four commonly used brands, and multiple models and price points within each brand. As at the time of writing this report, recommended retail prices for handheld readers range from approximately $500 through to $2500, based upon capability.

All can be used for recording tag numbers, while some have the ability to input additional data against an animal in real time using either a combination of button pushes, or a touchpad. The greatest single change in reader capability in recent years, however is the ability to upload data to most readers. This is important, as it allows a producer to view previous data on an animal as it stands in front of them. Simple examples may be fleece value for that animal, the classer’s comments, sire team, or birth status of the animal. It may be multiple years’ pregnancy status, or the decision may have already been made based upon a combination of data previously collected and the reader simply displays the culmination of that work, with a simple “keep” or “cull”, or “maternal flock” or “terminal flock”.

These readers introduce very cost effective and efficient use of previously collected data.

8.2 PANEL READERS
Panel readers are designed to be mounted on the side of a weigh crate, auto drafter, or sheep handler. They are not designed to read sheep as they run past. While they can achieve a reasonable level of accuracy in this task (up to 95% under ideal conditions), it is not what they are designed to do. They are designed to automatically capture the tag number of an animal, confined in a relatively stationary position. Their use in a weighing situation, allows EID tags to be read automatically without any intervention required by the operator, introducing a significant improvement in efficiency.

Metal is a major source of interference in the operation of a panel reader and for this reason, it is critical the producers are aware of the
correct way to mount a reader. For optimum performance, readers should not be mounted on metal, of any type.

8.3 **Race Readers**

Race readers are designed specifically to read the tags of sheep, as they run through single file down a race. These are most commonly used for recording bulk pieces of information against a group of animals, such as treatments applied to the entire group, or simply for recording which animals were present on a particular day.

8.4 **Weigh Scale Indicators**

A critical component in capturing weights, it is important that a producer’s scale indicator (the box that displays the weight on a set of weigh scales), is capable of capturing EID data. There is a growing range of options available to producers when it comes to indicators, however some of the models already in use on farms for the past 10 years, are compatible with EID. For this reason, it is important to assess the capability of existing infrastructure on farm, before leaping into unnecessary investment. There have been significant improvements in user friendliness of indicators in recent years, which is proving to be an effective incentive for some producers to upgrade their equipment, even if their existing indicator was compatible with EID.

8.5 **Manual Weigh Crates, Auto Drafters & Sheep Handlers**

While not technically EID equipment, weigh crates, auto drafters and handlers are often referred to in the same conversation. They can all play an integral part in capturing information, however their justification should, in most cases, come through their general use, and not EID specifically. It is with Auto Drafters and Sheep Handlers where significant cost can be added to the investment in data capture and this is often unfairly allocated against EID, given that much of the investment is designed to improve labour efficiency for tasks more generally.

One of the great advantages offered by an auto drafter is the ability of a single operator to weigh large numbers of animals quickly, without assistance. This presents a significant labour or time saving.
8.6 **LAMBING MARKING WEIGHING SYSTEMS**
A new addition to the EID equipment range, are weighing options for capturing weights of lambs, automatically at lamb marking. As the lamb is ejected from the lamb marking cradle, it drops into a weighing crate, which reads the ear tag, captures the weight, and then ejects the lamb. Product development is ongoing and there is believed to be a number of companies developing similar products.

8.7 **VARIABLE RATE APPLICATORS**
A more recent development in the industry, these applicators allow producers to apply a dose rate specific to the live weight of the individual animal. To achieve that, the animal must be handled through a set of scales or handler equipped for weighing in order to calculate and implement the correct dose rate. This is likely to be an area of increased development and interest from producers as consumer demands and expectations around chemical use become more evident.

8.8 **EFFICIENCY VS COST EFFECTIVENESS**
There is often a misconception around the level of investment required for a producer to make use of EID in their sheep enterprise. Much of this has developed due to the wide publicity around Auto Drafters, and their use with EID. As discussed, an Auto Drafter can introduce great efficiency into many EID tasks being undertaken, particularly in implementing drafting decisions based upon data, however they are not a necessity.

With the increased capability of handheld readers, the ability to display information on the screen in real time allows a producer to implement decisions based upon previously collected data. While an auto drifter can implement these drafting decisions automatically, this is simply a case of increased efficiency, and not an increase in capability in real terms.

9 **BARRIERS TO ADOPTION**

9.1 **ADOPTION THEORY**
Barriers to adoption of technology in agriculture worldwide are well recognised and similarly, present a considerable challenge for the uptake of EID. As discussed, RFID technology is a well-recognised and widely adopted technology in many industries and as part of everyday life, hence the knowledge base and support systems that now exist, the rate of development, and new applications of this technology are numerous. The clear identification of barriers to adoption of a particular piece of information or technology is critical to be able to incorporate this in the development of the most appropriate communication strategies for effective extension of the information. Ensuring this is framed in context for the audience, with a demonstrated understanding of the value proposal to the recipient is also critical. Human nature and then
individual capacity, or mind-set, determines our readiness for change, not only in use of technology, but in terms of practice change. A proven and evidenced successful approach for marketing and engagement with new technologies or products is to first understand and then pitch to the need or desire for the product, simply making a monetary proposition or one of functionality will not drive or foster engagement. As part of this process a desire or need cannot be created if it doesn’t exist, but a desire can be directed towards the product on offer. For EID technology and data, the need and desire is to be able to run a better business or more successfully meet a specific business aim – mastery of farming. Unless producers and broader industry personnel are able to see the relevance to their business and aims, are challenged to clearly define these, and that an achievable and tangible outcome is proposed, adoption of any new or novel approach or tool, including EID is likely to remain low for the majority of producers.

If there are identifiable individual barriers to adoption, or consideration of change, and these are removed from the equation, then the rate of adoption and number of adoptees will change accordingly. This has been demonstrated in Victoria with mandatory tagging, removing the decision making around tag choice (EID vs traditional visual tags). The increased interest in carcass feedback also reflects a shift in mind-set around utilisation of opportunity, rather than being stuck at the decision-making nexus. This is also supported by the acceleration of equipment purchase and uptake of producer incentive grants in Victoria.

The general theory of adoption and practice change is well developed. Rogers’ “Diffusion of innovation theory” identifies a natural distribution for adoption and engagement with new information and technologies.

![Diffusion of Innovation Diagram](image)

*Figure 13 - Everett Rogers “Diffusion of innovation theory” (2003)*

The timeframe over which this occurs will differ for different technologies, as will the position that
any one person sits against the standard curve, hence this is not a theory that may be applied as a blanket rule and often is used in too broad terms. However, understanding that there will be a natural progression of adoption is important, as is leveraging an accelerated left shift towards adoption and on-going implementation. As previously discussed the timeframe for adoption or change against the use of EID technologies in the Australian sheep industry has been extremely protracted. Reasons for this may lie with an understanding of the process of progression through the various stages of adoption as described below compared to the more traditional process of extension that has supported this process.

This lack of engagement is likely to have been extended by a lack of inertia in the industry for practice change towards an individual business approach and away from the use of industry average data to benchmark productivity or profitability in an individual business. The collection of accurate, repeatable, objective data has been lacking in the sheep meat industry, with the greater majority of producers unaware of missed potential in their system. Lack of access to support and mentoring, and clearly defined advantages against business aims is also likely to have impacted this progression. Given the overlying immaturity of the sheep meat value chain, the lack of leadership in livestock agriculture, and until recently, no clear catalyst for decision making, the movement of individuals through the stages listed below has been limited to those with an individual interest and drive for this opportunity.

The stages of the adoption process for any given individual or group are summarised below. These also apply to the uptake of EID technologies in Victoria and Nationally

- Awareness of emerging or new innovation; here a person simply knows the new technology exists but lacks critical information
- Persuasion; with access to more information and from experiences of the “early adopters group” a person may become interested in the new idea and therefore is keen to have access to further information
- Decision or evaluation; this is a critical stage for application and assimilation, where a business aims template can be used to facilitate projected outcomes from the use of the technology – this is a critical decision-making stage.
- Implementation or trial stage; here a person has fully adopted the technology and is in the throes of implementation
- Confirmation or adoption stage; continued use of technology or innovation occurs

Ensuring the role out of information and producer support services is considerate of this process is essential in terms of creating an empowered and engaged community. This in turn produces and facilitates peer group interaction, questioning and exploration of possible uses and adaptations of the technology, value adding to the broader industry and individual producer experience and leading to a more stable adoption process, not dependant long term on financial incentives, grants or subsidies.

9.2 **ACHIEVE AG SOLUTIONS VICTORIAN EXPERIENCE**

It is the experience of Achieve Ag Solutions that the Agricultural Industry is far too focused upon profit propositions as the basis for achieving adoption of new ideas, concepts or technology. The members of the Achieve Ag Solutions team have received extremely positive feedback, and witnessed high levels of resulting adoption, as a consequence of their approach to producer communication and engagement for use of EID technologies throughout the past seven years.
The basis of much of this has been the approach taken to the delivery of information. Broadly speaking this is based upon –

- Challenging the norm. Developing a level of discomfort in the ways things are currently done. Establishing the fact that participants want to be better tomorrow than they are today.
- Highlighting to producers the external/consumer and societal perceptions of slow progress in the sheep industry
- Developing excitement. Showing producers that there is progress in our industry, and real opportunities to adopt, implement, and improve
- Building the knowledge of how the technology applies to each individual producer and their own situation
- Demonstrating the variation that exists within individual animals
- Demonstrating the vast range of equipment available, and the costs involved.
- Developing a plan for implementation for the individual with the individual fully involved

Given the vagaries around cost benefit directly attributed to EID tags, and our inherent belief that profit is a poor motivator (debt is a good one!) for change, it is rarely talked about as a specific point during Achieve Ag presentations. This approach is at odds with almost all of sheep industry’s traditional approach in areas such as technology, and yet the success rate has been impressive. While it is the experience of the authors that producers undertake a very brief and informal assessment of the costs involved and potential for return on investment, this process is very much second or third to the more emotional decision-making processes around desire to be the best, and achieving an increased level of personal satisfaction.

If we have producers doing the equivalent of driving a brand-new BMW off a cliff, just in school fees each year, and reasonably comfortable doing it, then why would they be highly motivated to change based on making a bit more profit? A value proposition must appeal more broadly to what producers are looking to achieve. Being the best, they can be (mastery) and a part of something bigger than themselves (purpose) are two components that are far too often overlooked in motivating sheep producers to change. A true value proposition is always more effective than just talking about profit. The value proposition should tap into what they want and direct that energy towards the technology and information of product being discussed, not try to “create” a desire or need based solely on profit proposition.

It is the authors strong belief that if you only go to producers with a profit proposition, you will achieve little adoption. If you first motivate and inspire them to change, and present a real value proposition (not just profit) then you will achieve real change. This is not just in reference to EID, but to every single concept or technology presented to the wider industry.

### 9.3 Other Barriers to Adoption

Keeping in mind the factors discussed above, there are two other critical factors which are commonly discussed as barriers to adoption. These are cost of tags and cost of equipment.

#### 9.3.1 Cost of Tags

As discussed previously (section 9.1), although only early in the transition phase, the move to mandatory EID tagging in Victoria has undoubtedly acted as a catalyst for adoption. In terms of barriers, while the cost of the tags themselves will have presented a barrier to adoption, there is
also the risk of decision apathy. This is where cost isn’t necessarily the hurdle it is perceived to be, but actually it is the decision itself which delays adoption. A large number of Achieve Ag Solutions clients and connections have been “considering the use of EID” for a number of years (similar results found in WA survey - Jones and Curnow, 2015) leading up to the announcement of mandatory tagging. Anecdotally every single producer contacted who was previously in the undecided position has now moved to purchase equipment and undertake some form of data capture. Discussions with a group of these producers has indicated that while cost was stated as a factor, the major reason was “they just hadn’t got around to it yet”.

9.3.2 Cost of Equipment
This area will be discussed in more depth in Section 14 - Benefits and Costs of Opportunities Identified. It is worth noting here however, that it is the experience of the Achieve Ag team, that in most instances producers are thinking more about ease of use and efficiency, than they are about cost. In fact, a great deal of effort has been put into all presentations delivered by the Achieve Ag Solutions team to pull producers back to focusing on the least cost options. While this experience has occurred predominantly with the early adopters and early majority (and is clearly a trait of that demographic), it is the view (and experience) of the authors that uptake will be more constrained by a perceived lack of relevance to the individual’s business, or a lack of motivation to make any change at all, and not the cost of equipment. Experience from early adopters has also demonstrated that “future proofing” purchases against business aims and strategies, and against the business plan for the following 2, 5 or 10 years is essential to avoid poor equipment choices.

10 CARCASS/PROCESSING FEEDBACK

The Australian sheep meat sector has an immature supply chain, including a history of mistrust and poor communication, and self-segregation of farming, support services and processing sectors. The future industry is dependent upon a maturing of this chain, and engagement across sectors to a common goal. The provision of carcass feedback facilitates the development of clear market signals that reflect consumer demand and expectation. The integration of a combination of technology to provide accurate assessment of carcass traits and quality with a system to allocate this to the individual carcass, provides an unmissable opportunity for producers to close the gap with respect to transparency in carcass information. From the processor perspective, it provides an opportunity to request and enforce a strong and clear market signal based on consumer demand and preference. Both perspectives are important for improving supply chain function and maturity.

A number of Victorian processors are currently installing the required infrastructure to capture individual carcass data, including animal health data. There are also installations of Dual Energy X-ray Absorptiometry (DEXA) planned for a number of processing chains throughout Australia. The systems of hook tracking, DEXA and other technologies such as hyperspectral cameras, will provide more accurate and in-depth carcass data with respect to meat eating quality, physical carcass traits (e.g. weight and fat depth) and provide an opportunity to correlate this with on farm practices and live animal data. This installation of hook tracking in Victoria has not been without challenges, with the physical environment on the chain providing a significant test site for the chip technology and EID equipment. Lessons learnt to date will provide a solid baseline for adaptation to most processing lines or other similar environments where the logistics of extremes of temperature and metallic interference on RFID equipment functionality need to be overcome.
Victorian producers interested in the data generated in these systems and on farm using RFID technology have also expressed a higher than average preference to sell “over the hooks”. This also supports closing the gap in the supply chain and facilitates a direct feedback loop between producer and processor (whether or not a stock agent is involved in the transaction). The development of data platforms such as MLA’s Livestock Data Link also provide additional tools and resources for producers engaging with this framework.

There are currently a number of data types proposed to be available through carcass feedback and all will contribute to the decision-making framework available to producers using EID. An interesting outcome from Achieve Ag Solutions surveying of producers to date is the assumption that they are already receiving complete animal health feedback. That is that they would always receive notification if there were animal health findings in a consignment. The fact that historically this feedback loop has been predominantly a negative one, is also something that requires acknowledgement and adjustment in terms of ensuring producers are not only receiving comprehensive and meaningful feedback, but that there are also support systems in place to assist with interpretation and assimilation, in the context of their enterprise. It is only when these support systems exist and are trusted by the producers, that considerable practice change will be generated routinely as a flow on effect from the generation of processor data.

Another interesting finding from surveying of producers is that they do not currently have a strong and clear understanding of the terminology associated with carcass assessment. This is most likely due to their lack of exposure to this information, but must be addressed to ensure that data generated is not misinterpreted through the process of application to the live animal or farm environment. A clear and repeated example of this was for the collection of accurate and meaningful on farm data, and in particular for application of curfew processes to ensure that processor data can be consistently interpreted for the live animal. Producers required considerable support to assimilate how different curfew procedures and decisions would affect the carcass product and associated data.

In general, and despite the current lack of knowledge in this area, producers are keen for any feedback on which to begin to build more resilient systems to produce a more consistent and high quality product.

11 MARKETING AND CONSUMER EXPECTATIONS

11.1 LIVESTOCK MARKETING

The ability to provide accurate data against a livestock sale will only enhance this process and long term has the capacity to generate a paradigm shift in the livestock selling sector. The industry continues to move towards a model which relies on a high level of integrity from the purchaser, in terms of actively seeking the information they need to ensure the transaction meets their requirements and expectations. The ability to provide accurate animal health information and objective performance data with a mob, and at an individual level, could remarkably change purchaser experience, particularly for selling platforms such as Auctions Plus.

There is already evidence of successful negotiation and contractual arrangements between producers selling store stock into feedlots with specific requirements or preferences for both production data and animal health history (including abattoir data). This may leverage more robust
selling opportunities for producers selling store stock, either by formation of a direct relationship with a purchaser or via an on-line or other forum.

Discussion continues regarding the access to carcass data for producers who sell store stock. That is, if systems such as LDL will support a process, where a producer can access carcass data, to be able to apply that to their decision-making framework for store sheep production. Currently the greatest limiting factor is not the data, nor the systems, but privacy of information, and regarding who has access to the data, and at what point in the supply chain. Once these process based limitations are overcome, producers can expect access to carcass data regardless of the point at which they interact with the supply chain through sale of stock.

11.2 CONSUMER EXPECTATION
The lack of market signals in the sheep meat industry also speaks to consumer experience of the product. Where consumers pay a high price for a product, there an associated expectation for what is essentially a boutique or luxury product. The current supply chain has little opportunity to deliver on that promise, resulting in a variable consumer eating experience. As consumers move themselves strategically closer to the sources and process involved in food production, the sheep meat industry should expect to be able to provide a fulsome and transparent consumer experience. The application of a more robust system of data collection, identifying source and progress of animals, and therefore product, through the supply chain supports this possibility. A mature sophisticated production and supply chain with a feedback loop designed to support sheep meat growers’ on-farm decision making will better meet consumer expectation, and will see a fruitful future for the domestic and export sheep meat industries.

12 BENCHMARKING
The process of benchmarking for monitoring potential in production, is currently a flawed approach in our livestock sectors and in fact better represents a process of comparative analysis. The true value of benchmarking is in the production of accurate and objective enterprise specific data, understanding the potential in the enterprise systems, and benchmarking current performance against what is possible/optimal. The generation of individual animal data should move the industry away from a broad benchmarking process based on comparisons to average or top performance, and inspire individual enterprises to understand where they have the most potential for improvement in their own system, producing a stepwise approach to achieve that. EID provides the tools to not only form a reliable and accurate baseline for current performance, but to also provide a system to clearly and repeatedly monitor progression towards what is identified as possible for that system of production. Once again, this forms part of the measure to monitor to manage approach to livestock production, which cannot be achieved as consistently and accurately with a mob based system.

The main role that EID plays in benchmarking is the time/cost savings applied to a data collection scenario, and increased accuracy of the data generated when comparing EID and visual tags. The fact that the process is quicker and more easily generates the desired outcome, also makes it more likely to happen. That is, producers who experience the difference in using EID versus a visual system, are more likely to then continue to engage with data collection and use compared to a producer who sees the data collection as inaccurate and time consuming.
The Sheep CRC data produced in 2006 (see section 7, figure 3) demonstrated that for weight recording there was a significant cost benefit in use of EID tags. This resulted from increased accuracy from over 5% error with visual tags compared to 0.05% error with EID, plus a 50% saving in labour inputs. If the cost is offset against an entry level purchase of equipment cost of $5000, this represents an equivalent of 125 hours labour (at $40 per hour, plus cost of tags). Given person hours and labour units are a limiting factor on many livestock enterprises, this represents a significant increase in efficiency, and is more likely to lead to this activity being repeated. Given the high level of error in manually collected data sets (>5%), if data cleaning is also applied to the scenario, this offers a 6.5 times saving in cost per unit of accurate data collected, with a 10-fold cost associated with data cleaning for visual recording vs EID.

For producers with a desire to fulfil the potential already existing in their enterprise, the use of EID presents a great opportunity to recoup the cost of the exercise, by producing the information needed to make sound and progressive decisions. (section 14).

13 PRODUCER PERSPECTIVES

The following producer insights offer examples of a number of ways in which the technologies are currently being used in the Achieve AG client base, and Victorian industry more generally. The early adoption of this technology by progressive producers in all industries sees them well positioned to take full and immediate advantage as further aspects of data production are generated throughout the whole value chain.

The purpose of these producer insights is to provide more background around producer perspectives in relation to individual animal management and carcass feedback. Information will continue to be collected as the EID system rolls out in Victoria, and further interest is generated interstate. The producer insights deliver both positive and negative perceptions of EID and carcass feedback by producers operating across a variety of systems, and will help shape the future approaches to promoting and challenging the opportunities presented in this space.

For the producer perspective participants, property size ranged between 130 and 1800 hectares. Enterprise mix was varied with merino, first cross and prime lamb and mixed cropping and sheep enterprises represented.

The production data collected by producers surveyed was also varied, and represented the main aims or emphasis of the enterprise. The data types included pregnancy status, kilograms of lamb weaned, retention or culling decision making, genetic selection, sheep feeding practices (carcass feedback on fat score).

Feedback ranged from a high level of investment and engagement with EID, through to identifying that it currently presented no advantage over existing systems. All opinions were based on a clear and careful assessment of the systems currently used, and where appropriate, discussion of whether the use of EID would deliver more consistent and efficient decision making.

A range of quotes from producers surveyed are below, identifying differences in opinion against both use and value of EID in their system, but all supporting an informed considered approach.
“The carcass feedback that we receive is unlikely to singularly result in any extraordinary increase in profit, however all of the management and selection processes that are linked to the information will all improve. Making more informed decisions in both management and ewe selection is always our priority, and that is where the real value is in carcass feedback for us.”

“If EID was mandatory and tags were required to be put into terminal animals then I can see that we would look at other ways to benefit from the technology. Analysis of weight gain, drafting into weight categories and allocating feed smarter, auto drafting, selling poor doers as stores are all possibilities.”

“Yes, we do believe carcass feedback would be useful and if given feedback we would make changes to management, especially with regard to producing the right end product. However, at this stage there are no plans to introduce EID to the enterprise as we are satisfied with our current approach.”

“Our decision to invest in EID was actually based mainly upon being uncomfortable with our reliance on our stock agent. We relied on him knowing everything about our stock and how and when to best market them. In hindsight, it was a ridiculous expectation, and left our business vulnerable because we simply didn’t know enough about our own stock. Now we control more of the decision making. In one year a bad decision cost us more than $20 per lamb because our lambs were achieving higher growth rates than we expected, and went over weight on the grid. That stuff up cost more than our EID equipment, and was a major reason for us going into EID in the first place. Simply avoiding stuff ups like that in the future allows us to justify the costs.”

“We were always going to go into EID at some stage. Now that tags are mandatory we might as well use them. We know what we want to record, we just hadn’t got around to doing it yet.”

“Our decision to invest in EID was based simply on looking at the costs, working out what that was per ewe and deciding that it didn’t take much improvement across the enterprise to make a good return.”

“We were just doing too much guessing. We needed something to back up our decision making”

“We looked at EID initially, but without it being mandatory we couldn’t justify it. We buy our ewes in, so the cost of tagging everything was making it hard for me to get my head around when we weren’t going to get any genetic gain. Now that everything we buy from here on will be tagged, and we have to tag our lambs as well, the decision became easy. Why wouldn’t we?”

“The data collection side of things is easy for us. I just don’t have time to manage it. I started out in Excel, but it was just too much data. We have since bought software, but I am struggling to spend enough time learning the software. We may look at getting someone to manage our data for us, and then I can focus on analysing it and actually using it to make decisions”.

“Our pregnancy scanner didn’t have equipment this year to record automatically. This was frustrating. He was supposed to have it. Just adds another job for us, as we will have to capture that information ourselves. Fortunately, the neighbours and I bought a Shearwell Race Reader together, and I can just set that up and record each mob as we do our pre-lambing treatments.”

“I am looking to set up a commercial lamb feedlot, and the best thing that could have happened for me is the mandatory tagging. Now every lamb that arrives will have EID in it. If I had to put a tag
in everything as it came through I don’t know if I would have done it. I probably would, but it is a
tougher decision, especially if our feedlot is performing well and turning lambs out quickly.”

“Luckily this year we had recorded pregnancy status against our ewes because our scanner
doesn’t mark who are twins and who are singles (just drafts them). A stuff up saw the dry ewes
boxed with a mob of singles. All I had to do was grab the data, and set it up so that I could load it
onto our stick reader. While we were doing pre-lambing treatments I just read the tag of each ewe
in the race first, and marked the dry ones. They didn’t get treated, and they then got drafted out. It
was simple, and solved a fair stuff up”.

“Our pregnancy scanner somehow wiped the data that he collected for us at scanning. This is so
frustrating, but we will just read the tags when doing our drenching and vaccinating pre-lambing.
It’s funny that we are frustrated, because we never would have had it at all in the past.”

“We started with EID about 5 or more years ago. It didn’t go well. I couldn’t get the equipment to
work properly, and I was too busy so I put it back in the box. Now we know a lot more about it,
and it actually didn’t take much for me to get it going again. A bit of help from the rep and we were
away. I could have had data for the last 5 years if I hadn’t chucked the towel in so easily.”

“When we bought our equipment, there wasn’t all of the options that there are now. But that is
technology. There will always be something better. I suppose that’s a good thing.”

“We have done pretty well integrating our data collection into our existing jobs. We try not to add
labour, but just capture data while we already have the sheep there.”

“We are even weighing lambs at lamb marking now. I just built myself a box that they drop into
and then we read the tag, and it gives us a weight. Initially it was just to weigh a few to give us
some averages but it was so easy that we have started doing every lamb now.”

“I would like to see carcass feedback uploaded to the cloud. Initially I just thought a file emailed
would be good, but I want my consultant to be able to log in and see it, or our data manager to be
able to just download the files and match it to our other data. If it is left up to me doing anything
with a file it won’t happen.”

“We didn’t do much cost analysis when making our decision. We are a stud, and the decision
became pretty obvious. We were spending too much time, and making too many mistakes. I had
seen a number of presentations about EID and it still took me a while to do it. I have no idea why.
It is the best thing we have done.”

“We were involved in a project that allowed us to get feedback on individual lambs. We found that
our maternals were producing just as a good a carcass as our terminals, and our on-farm data
showed us that they weren’t far behind on the growth rates at all. It gave us a lot more confidence
to join more ewes to maternal sires, which is good because we need to grow our numbers. We
now know that the wether lambs are still a good product, and not a by-product.”

“My son is the one that makes it all work. I can see why we want it, and I can see what it will do,
but he is the one that makes it work.”

“Our fist lot of EID equipment was difficult for me to use. In the end I didn’t, I just waited for our
consultant to turn up and help me each time we wanted data. We decided to upgrade when we
had the chance, and sell our old equipment. The changeover didn’t cost us much, but I can now
“Achieve Ag Solutions Pty Ltd
done everything, including download files onto my phone and email them while standing in the yards.”

“We can’t wait for carcass feedback. At the moment, we know little about whether we are producing a good product or not. Just knowing that would be great for us.”

“It’s just another tool in the toolbox for us. We will use it where we need to, but it isn’t going to have a massive impact on our day to day operations. Hopefully just allow us to manage better.”

“I had no idea there was so much variation in the performance of our sheep. We only ever saw the average results. EID has opened our eyes.”

A quote from a consultant –

“Most of our clients are moving to some level of EID use since it became mandatory. I think they inherently realise that they just don’t know enough about the performance of their sheep, and that if they want to be better, and make better decisions, then they need more information. EID can help provide that.”

The empowerment of producers to make informed decisions for themselves and to better their enterprise must be a key extension approach. If a producer actively, consciously and cognitively chooses EID is not the right technology or tool for their enterprise, then that is an equally valid decision as one who opts to engage fully with the technology. The process in which these decisions are made provides the building blocks for resilient and flexible farming systems, whether EID forms a component tool in those systems or not.

Where an uniformed, or dismissive approach is taken by a producer in assessing the technology, a vastly different message is communicated.

“I have no idea why they are making us do this (mandatory tagging). It is just another cost that us farmers have to wear”.

“It wouldn’t do anything for us. I’m not interested in fancy gadgets.”

“It’s hard enough to make money out of sheep as it is half the time, this will just add more cost that we can’t afford”.

“Those (insert profanity here) are just forcing more stuff onto us. It won’t change anything, and we didn’t need it. We certainly won’t be using it”.

While a negative view point may be a producer’s initial stance, it is important that at some point in time they are engaged in a constructive and informed discussion with someone capable of demonstrating the relevance of EID to them (whether that is from traceability or on-farm use). Without that informed discussion, the same points of view will be communicated throughout their network, aggravating and exacerbating the issue. That producer’s final decision may well be that there is nothing in it for them on their farm, which is a good outcome if based upon solid information, and not something their equally pessimistic neighbour told them.
13 LESSONS LEARNT FROM EXPERIENCE TO DATE

13.1 LIMITATIONS & CHALLENGES ON-FARM

There are a number of factors which have the potential to limit performance or implementation of EID equipment, or data capture on farm. The following are the most common issues experienced by producers:

13.1.1 Data Capture Process

Few producers have ever properly considered the use of a standard protocol for weighing or data capture. Many are weighing animals straight out of the paddock or feedlot, without allowing them a chance to empty out. While some producers are then applying an arbitrary discount to weights to adjust them for gut-fill, the reality is that the data is unreliable. From data collected to assist an Achieve Ag client to refine this process demonstrated a variation in 5-95% confidence in the data generated for live weight recording lambs through a feedlot system.

While it may be useful for crude drafting into categories for sale, when looking at the data of an individual animal, there is significant inaccuracy introduced through weighing animals that are not properly curfewed. It is the experience of the authors that animals should be curfewed for a minimum of 4 hours prior to weighing if a greater level of accuracy is desired.

Similarly, it is important that a producer has some protocol around other data capture events such as fleece weighing. Some producers are weighing fleeces un-skirted, while others are using a skirted fleece. Some including bellies, while others are not. Skirted fleeces have the potential to disadvantage an individual based upon the amount of skirt removed, and is open to variation resulting from different people skirting. Consistency in data capture, is the ultimate aim so that any comparisons being drawn are fair and equitable. Decisions based on poor data can be worse than those based on no data at all.

13.1.2 Bluetooth Connection Issues

In the past Bluetooth connections have created major headaches within the previous generation of equipment. With the release of a raft of new products into the EID market, has come a new generation of Bluetooth technology. It is more user friendly, provides greater range, easier searching and connecting, and generally is more reliable. Like any other Bluetooth device in your life, there is potential for error, and the vast majority of this is human error. The most common issue faced is turning on the devices and connecting them in the correct order.

For example, a Tru-test xr5000, and Tru-test Bluetooth panel reader must be turned on in the right sequence. This is because in any Bluetooth connection there is a master and a slave. In this case, the XR5000 must be switched on first, followed by the EID reader. Failing to do this can result in the EID reader reading tags, but not sending them anywhere. This is a good example of why it is important after the first couple of sheep have been handled, to check that data recording is happening as expected. Once again this is in no way a failing of the equipment, but a human failing which can be easily avoided if producers are aware of way in which Bluetooth operates.

The other common issue faced by producers is when using built in Bluetooth on devices such as laptops. While the systems are fine for office applications, they are often unreliable out in the field.
If looking to record data straight into a laptop, tablet or phone always check the quality of the Bluetooth that comes standard. Particularly in the case of a laptop, if you have any doubts at all, opt for an aftermarket Bluetooth device designed for the role.

### 13.1.3 Battery Failure

When it comes to equipment operation, the number one issue identified in troubleshooting efforts is a flat or underperforming battery. This is particularly relevant for panel readers, where an external battery is used. Rarely is a new battery purchased to do the job, and often the battery is capable of producing tag reading capability, but with a reduced (or reducing) read range. The result will be frustrating inconsistency in tag reading, and eventually no reading at all. Checking the level of charge, and quality of battery should always be the first point of call in troubleshooting reading issues, particularly where the equipment has functioned correctly in that location in the past.

The other occasion where batteries are often to blame, is actually human error. Failing to charge batteries of handheld readers prior to a data capture event is a common mistake. Battery life has improved remarkably in recent equipment releases, however this can never rectify human error. Worth noting is that some readers have a fixed battery, while others have removable batteries. Those with removable batteries, can have a spare battery purchased and on standby to overcome the issue. For one brand in particular, this is a simple problem to overcome as the reader operates using rechargeable AA batteries which can be replaced temporarily with any AA batteries. For those with a fixed battery, there is no alternative other than to plug the reader into a power source, and allow it to recharge. This will result in no data capture being possible in most cases.

### 13.1.4 Metal Interference

Metal interference is an unfortunate reality of all RFID technology. RFID works by readers creating a magnetic field which powers the chip inside the tag. Metal entering that magnetic field will alter the way in which that reader can operate. In some instances, this will be minor, while in others it will render the reader useless. This is not a failing of the technology, just an unfortunate reality. The simple rule of thumb for producers to achieve optimum performance of a panel reader is to remove metal from the entire read area. This may not be possible, and so read range expectations may need to be reduced. In many instances, such as when mounted on a weigh crate, the sub-optimal reading conditions can be facilitated because the animal is at least momentarily stationary, and moving its head around, increasing the chances of reading the tag.

As a general rule, all recommendations should be to remove metal from the area in which a panel or race reader is to be installed. Any decision to attempt to mount a reader where metal is present is done under the expectation that suboptimal performance is highly likely. The impact of this reduction in performance may or may not impact upon the effectiveness of data capture.

### 13.1.5 Electrical Noise Interference

Electrical noise interference occurs where other electrical devices are also creating their own magnetic field. This can occur where two RFID readers are operating within close proximity, or where electrical transformers such as those used in laptop and phone chargers are operating in the immediate vicinity. In some rare cases, it can occur where other electrical motors, or even powerline transformers are operating within relatively close proximity. The result will most often
be intermittent reading of tags. When holding a tag in front of the reader, you will hear that it is not the regular beep expected, but a stuttering inconsistent beep.

Where the interference is coming from another RFID reader, it is possible with some readers to synchronize their reading patterns to that they do not compete with each other. This will require specific technical advice and assistance.

Where it is some other form of electrical device creating the problem, removal of the competing object is really the only option for overcoming this issue.

13.1.6 Multiple Tags within Read Range
An EID reader can only read one tag at a time. Where two tags are within the read range at one time, either no tag will be read, only one tag will be read, or there will be interchanging of the tag reads. In any case, two tags in the read range will result in accurate data capture, or in the case of race readers where sheep are running through, can result in missed tags (it should be noted that the more expensive and sophisticated saleyard style readers are designed to overcome this issue).

The most common cause of two tags being within the read range at one time is either animals presenting two abreast, or where metal interference is causing the read range shape to change and capture an animal behind the one intended. The classic example of this is where a panel reader is mounted upon a weigh crate with a metal frame. Due to the nature of the magnetic field interference, the entire side of the weigh crate will become the antenna, and can result in reading the tag of the animal waiting to enter next. This again highlights the importance of understanding the impact that metal interference can have.

13.1.7 Inappropriate Selection or use of Equipment
The most common example of inappropriate equipment selection is where a producer purchases a panel reader with the expectation that they will be able to run sheep passed it and achieve a 100% read rate. While read rates can be quite high (95%+), this is not what a panel reader is designed for, and it is an unrealistic expectation.

Also common is the selection of equipment based solely upon the recommendation of a sales representative. While the companies selling EID, equipment are generally very good at assisting producers with product selection, it is often based off very limited information, and they are left to demonstrating the most impressive features of their equipment. While these features may be impressive, they may also have no relevance whatsoever to an individual producer’s objectives. Having independent advice available to producers is highly valuable in this decision-making process.

14 Benefits and Costs of Opportunities Identified
As an industry, Agriculture is heavily reliant on the capacity of a value proposition through dollar return to drive practice change. Electronic ID presents as a catalyst for a different approach to decision making. It is this change in decision making that can derive a direct cost benefit, and not
the technology itself. The change may be delivered through accessibility to more accurate, consistent, and meaningful data, but there cannot be a direct benefit associated with EID in achieving this practice change. Cost benefit analyses has been proposed and attempted on multiple occasions and have all have been found lacking.

With some determination in this space, a cost benefit may be demonstrated as a comparison of achieving the same improvement in results, however comparing a visual tag method of data capture, and an EID based system. As has been the case in precious attempts, this approach will only provide a cost benefit analysis of the labour saving provided by EID. What this approach will not capture, is whether the equivalent information would ever have been captured within the enterprise without the catalyst that is EID. In any case, discussion of an EID tag generating a cost benefit proposition, should be carefully communicated within the appropriate framework of decision making towards a clearly defined business aim.

To shed more light on the decision-making process in this area, the authors consulted a number of producers who have very recently invested in EID. While some admitted that there wasn’t a lot of analysis undertaken, and that they “knew it would make them better” the majority had taken an informal approach to assessing the investment. Their approach to the financial decision was remarkably consistent. That is, they simply looked at the cost, spread it over the number of years they expected the equipment to last, and distributed the annual cost across the number of animals they were managing.

As a result, the Achieve Team have set about formalising and simplifying this process for producers, and have developed the following concept.

The assumptions implemented include a 10-year lifespan of equipment with no residual value. This is currently open to debate, however the authors experience suggests that 10 years is not unreasonable, and that there would most likely be some residual value. Therefore it could be regarded as a conservative approach. It also assumes that a 3:1 return on the cost of the equipment should be obtained to justify the investment in equipment. It does not factor in opportunity cost or finance cost, as it is designed to provide a quick simple analysis for producers who have indicated that they would otherwise be using the back of an envelope, or simply a quick mental calculation.

Step one is to use the following table to calculate the return required per ewe per year to produce a 3:1 return on equipment cost. Across the top is the number of ewes, and down the side is the amount of money invested in EID. It should be noted here that a producer must make the decision as to whether or not to include items like an auto drafter in this process, as it, strictly speaking is a labour saving device and not a piece of EID equipment.
If for example a producer running 2000 ewes was to invest in $6000 worth of EID equipment, then the extra productivity that would need to be achieved per ewe to produce a 3:1 return on investment in equipment would be $0.90 per ewe.

If that same producer is running a prime lamb operation, then the additional performance required can be calculated using the following table. Additional income required is found across the top of the table, while lamb price is found down the left-hand side. With lamb prices at $4.50, the producer would need to increase productivity per ewe by 0.2kg of carcass weight.

Even if the effective life of the Equipment was halved to four years, the total increase in lamb production would only equate to 0.44kg of carcass weight. Similarly, if lamb prices dropped to $3.75 throughout the 10 year period the increase required would only be 0.27kg of carcass weight.

If the same concept is applied to a wool production enterprise with the same number of ewes, and same level of investment in EID equipment, the increases in productivity required are minimal to produce the 3:1 return. Assuming a wool price of $12/kg clean, the producer would need to increase wool production by 0.07kg clean or approximately 0.11 kg of greasy fleece per ewe.

And all of this is just looking at influencing a single production factor. The likely result is a small to moderate impact across a number of traits. When exposing producers to this logic, the resounding response from producers has been –

“Wow that’s not much”.

Figure 14 - Calculation table for establishing the amount of extra productivity ($) required per ewe to produce a 3:1 return on equipment cost.
“That’s even lower than I thought”

“I hadn’t worked it out exactly like that, but it isn’t much”

“Just having more information in our decision making should make that easily”.

“I would be staggered if we can’t produce that return. It should probably end up much more than that in the end”.

It should be noted that the above approach does not take into account a differential in the cost of an EID tag as opposed to a visual tag (in States where that is still allowed). In states where mandatory EID tag use is not in place, the cost differential between EID and visual tags would need to be added to the per head equipment cost calculated in the first table. This again highlights the influence of mandatory EID tagging in decision making process around implementation of an EID system on-farm.

While it is difficult to directly attribute a true cost benefit to an investment in EID, it is possible to more accurately assign the cost of equipment, and desired return, to the number of animals that will be influenced by the investment. Making better decisions using all of the tools and information available within the management system is what will actually produce the final outcome.

15 SPECIFIC OPPORTUNITIES FOR WESTERN AUSTRALIA

While the sheep industry in Western Australia is different to that of Victoria, the opportunities and challenges remain much the same. Mob based animal management and monitoring creates a risk of underperformance of an enterprise where decision making is based only on averages, and the depth of understanding of the factors influencing individual performance is limited. Whether looking at extensive or intensively run sheep operations (Victoria or WA) the approach should not alter. Any investment of time, and or money, in a new concept or technology should be based upon a specific need to address a previously unresolved issue. It should also be based upon achieving that outcome with the least amount of investment and effort.

The risk for the national sheep industry in assessing the opportunities presented by EID is to assume that it will require a considerable jump in data recording activities, and will significantly alter existing day to day tasks. That doesn’t, and in most cases actually shouldn’t, be the case. EID is a tool designed to better inform decision making, not add labour and frustration. Better decisions lead to better outcomes, increased satisfaction, and ultimately a higher level of productivity and profitability.

Understanding that the use of EID is best integrated into existing animal husbandry activities is a critical part of assessing the role that EID can play within the WA sheep industry. It should also be considered in conjunction with assessing the uptake of other developments such as pregnancy scanning, condition scoring, and general concepts around improving lamb survival for example. Where low adoption of pregnancy scanning exists, the likelihood of achieving adoption of EID is limited. It is difficult to talk to a producer about the opportunities for recording individual scanning results using EID if that same producer is yet to adopt pregnancy scanning.
As mentioned previously, it is not possible to associate a cost benefit to EID as a standalone investment, as it is the decision making that produces the ultimate return. It is however, the view of the authors of this report that EID stands as one of the most effective catalysts for initiating a much greater depth of understanding of one’s livestock enterprise, leading to significant improvement.

The introduction of objective measurement to the processing sector in the areas of lean meat yield, fat, and meat eating quality have the potential, in conjunction with on farm measurement, to transform the sheep meat supply chain and align closely with consumer expectations. With Victoria already positioning itself well to uptake the opportunities presented by hook tracking and DEXA, there is potential for eastern state lamb producers to achieve competitive advantage on both a domestic and world stage.

While much of the discussion around mandatory tagging has focused upon the ability to trace and contain an exotic disease outbreak, there are potential opportunities for competitive advantage through better meeting consumer expectations. While some argue the virtues of one traceability system over another, it is possible that other EID opportunities for the industry are slipping by.

Rather than focusing on one aspect of EID in isolation, it is the recommendation of the authors of this report that the West Australian sheep industry consider the sum of all parts; biosecurity, product integrity, product quality, animal welfare, and attracting the next generation of farmers. Electronic ID can play some role in improving every one of them, once again illustrating the difficulty faced when looking to quantify the cost benefit.

Perhaps the industry should ask the consumer what they want. The answer will invariably be, consistency, product integrity, quality, food safety, animal welfare, and a connection with the production system. Can the Western Australian industry afford not to use EID to help deliver these things?

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17 Appendices

17.1 EID & Carcass Feedback Planning Tools

17.2 Extension Summary Notes
# Sheep Electronic Identification Planning Tool

Breeding/Enterprise Objective:

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<th>Already Collected?</th>
<th>EID equipment Required</th>
<th>Estimated Equipment Cost</th>
<th>Could a contractor do this task?</th>
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Total Investment $  

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Objective should be Specific, Measurable, Achievable, Realistic, Time-bound
## Data Collection Plan

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<thead>
<tr>
<th>Month</th>
<th>Event</th>
<th>Data to be collected &amp; how</th>
<th>Equipment Required</th>
<th>Should a contractor do this task?</th>
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For more assistance call Nathan Scott – 0409 493 346
<table>
<thead>
<tr>
<th>Individual Carcass Feedback Trait</th>
<th>Measurements collected on farm to monitor/relate to making improvements in this trait</th>
<th>How will this data be collected?</th>
<th>When is/will this data be collected? Time/frequency</th>
<th>Rank traits in order of preference for meeting your main enterprise breeding objective</th>
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<tr>
<td>Carcass weight</td>
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<td>Dressing percentage</td>
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Individual Animal Management & Monitoring

**Individual Animal Management**
The Australian sheep industry has traditionally operated on a “mob basis” where almost all decisions and analysis of performance has been based upon averages for the group of animals, rather than the individuals themselves. When assessing animal performance for a given trait, the group of individuals will always be made up of poor performers, average performers, and superior performers.

Dependent upon the given trait, it is possible for some animals (poor performers) to actually be costing the enterprise money rather than making money.

These are passengers within the system which can remain for a number of years without ever being identified within a traditional mob based management system.

Identifying the passengers and removing them, while capitalising on the best performers for longer are fundamentals that underpin the individual animal management concepts.

Individual animal management is not only about applying selection pressure however, and can be as much about better informing decision making.

Are you allowing your animals to express their real potential? If they aren’t performing at their optimum the questions needs to be asked; “is it their fault or yours?”

The following are some examples of the variation in performance that exists within a group of commercial animals. Where there is variation, there is great opportunity for improvement.

Information compiled by
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EID Equipment Options

Electronic Identification equipment options have developed significantly in recent years with increasing capability, and reducing prices. The following is a brief overview of the various equipment options available to producers, and the various levels of investment available.

**Handheld Wands or “Stick” Readers**
All available types can be used for recording tag numbers, while some have the ability to input additional data against an animal in real time using either a combination of button pushes, or a touchpad.

The greatest single development in reader capability in recent years is the ability to upload data to the reader. This is important as it allows you to view previous data on an animal as it stands in front of you. Simple examples may be fleece value for that animal, the classer’s comments, sire team, or birth status of the animal. It may be multiple years’ pregnancy status, or the decision may have already been made based upon a combination of data previously collected, and the reader simply displays the culmination of that work with a simple “keep” or “cull”, or “maternal flock” or “terminal flock”. These readers introduce very cost effective and efficient use of previously collected data.

**Panel Readers**
Panel readers are designed to be mounted on the side of a weigh crate, auto drafter, or sheep handler. They are not designed to read sheep as they run past. They are designed to automatically capture the tag number of an animal confined in a relatively stationary position. This greatly increases the efficiency of weighing operations where the EID tag reading occurs automatically with no intervention required from the operator.

For optimum performance, readers should not be mounted on metal of any type.

**Race Readers**
Race readers are designed specifically to read the tags of sheep as they run through single file down a race. These are most commonly used for recording bulk pieces of information against a group of animals such as treatments applied to the entire group, or simply for recording which animals were present at a particular husbandry event and facilitate more accurate and frequent inventory data recording.
**EID Equipment Options**

**Weigh Scale Indicators**
A critical component in capturing weights, it is important your scale indicator (the box that displays the weight on a set of weigh scales) is capable of capturing EID data. Some of the models already in use on farms for the past 10 years are compatible with EID, so it is important to assess the capability of your existing infrastructure on farm before leaping into unnecessary investment. There have been significant improvements in user friendliness of indicators in recent years, which is proving to be an effective incentive for some to upgrade equipment even if their existing indicator was compatible with EID.

**Manual Weigh Crates, Auto Drafters & Sheep Handlers**
While not technically EID equipment, weigh crates, auto drafters and sheep handlers are often referred to in the same conversation. They can all play an integral part in capturing information, however their justification should in most cases come through their general use, and not EID specifically. It is with Auto Drafters and Sheep Handlers where significant cost can be added to the investment in data capture. Assessing this extra cost should be based upon the increased efficiency they introduce.

**Variable Rate Applicators**
A more recent development in the industry are variable rate treatment applicators. These applicators allow producers to apply a dose rate specific to the live weight of the individual animal. To achieve that, the animal must be handled through a set of scales or handler equipped for weighing in order to calculate and implement the correct dose rate.

**Efficiency vs Cost Effectiveness**
There is often a misconception around the level of investment required for you to make use of EID in your sheep enterprise. Careful selection of equipment allows you to implement decisions based upon previously collected data. While an auto drafter can implement these drafting decisions automatically, this is simply a case of increased efficiency, and not an increase in capability in real terms.

Plan your investments -
(See “EID planning tool” to assist you with your decision making).

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Electronic ID (EID) can be used to capture a huge range of information against individual animals. It is critical to understand your objectives, and then identify the data that will help you achieve that outcome. Data recording should be designed to produce the greatest outcome, from the least amount of expense and effort. To help plan your data collection, see the attached EID planning tool. The following are some of the options most commonly recorded using EID.

 Birth Type & Mob Details
This is one of the simplest pieces of data to capture within an EID system and doesn’t rely on electronic reading of tags. EID tags all have a serial or visual ID on the outside of the tag. Tracking the sequence of tags applied to each mob of lambs at lamb marking provides valuable information for the life of that animal.
Example; use a specific sequence of tags (eg. 0001 to 0385) to identify twins bred by team A rams. Because the visual ID is matched to the electronic tag number in the “bucket file” provided when purchasing your tags, it is possible to assign the birth type or mob information against the electronic tag number for that animal. At any point in the lifetime of that animal, it will be possible to read its electronic tag and display information recorded at lamb marking. It may help in decision making for selecting culls (eg single born lambs, particular sire line etc).

 Fleece Weighing & Fleece Testing
As for birth type and mob, fleece weighing and fleece testing do not require electronic data collection, however EID makes it easier, faster, and more accurate. There are significant benefits that can be achieved from applying selection pressure to merino ewes based on fleece weight, micron, or fleece value. This is supported by evidence demonstrating the wide range of fleece data in any group of animals.

 Individual Live Weight Recording
One of the simplest pieces of data to capture using EID is individual live weights. Collecting live weight can be done as part of existing weighing operations with the addition of EID recording equipment. The information can provide useful insights into the varying performance of a group of animals. Examples include identifying poor performing lambs (pasture based or feedlot lambs), or for tracking live weight changes in ewes over joining. However, make sure you only collect useful information and be selective about the information you collect, including the number of weight recordings over time.
**Individual Ewe Scanning Results**

Recording multiple years’ pregnancy scanning data can be very easily achieved using EID. Pregnancy scanning contractors have can collect this data automatically with compatibility between ultrasound and EID equipment. Where contractors are not equipped to undertake this task, producers can record this information for themselves using either a handheld wand, through a race reader, or through a handler as part of another task. This can be as simple as recording all the tag numbers of a group based on their pregnancy status, and naming the file as that pregnancy status. When assessing trends or making drafting or culling decisions based on pregnancy status, one of the key questions to ask yourself; “is it her fault or yours”?

**Pedigree Match Maker (PMM)**

Pedigree MatchMaker (PMM) is a walk-by system that uses EID tags to estimate associations between ewes and their lambs, and provide the ability to trace individual animal pedigree. All ewes and lambs in mob are tagged with EID tags, and a single-file entrance is set up using an attractant such as water or supplementary feed to entice animals to walk through.

An EID panel reader is placed on the single file entrance to record the tag numbers of each animal as it passes. The data captured is processed through software developed by the Sheep CRC (Pedigree Matrix) to establish the predictions for which lambs belong to which ewes. While PMM was originally developed with the intention that it be used within the stud environment, commercial lamb producers also have an opportunity to make use of the technology to determine productivity of each ewe (see “Kilograms of lamb weaned”).

**Example of kilograms of lamb weaned per ewe within a commercial ewe flock**

**Kilograms of Lamb Weaned Per Ewe**

Through the use of Pedigree MatchMaker and also recording individual weaning weights of each lamb, a flock can be ranked based on the kilograms of lamb produced by each ewe.

This allows you to rank the flock based on kilograms weaned, culling the worst performers, and capitalising on the most profitable sheep, or it may simply provide more feedback to your management strategies to ensure ewes are being given every opportunity to express their potential.
EID Data Recording Options

**Treatment Recording**
With increasing demands and consumer expectations around safe use of chemical treatments, EID introduces an ability to refine the recording of this information down to the individual animal. The simplest method in this instance is where all EID tags of animals are recorded at some point during their visit to the yard, with the file name capturing the treatments undertaken. For example “Yellow tag ewes – Cydectin LA, 5in1”. Batch numbers and expiry information can also be recorded against the file providing a robust record of treatments applied. It is then possible to alert the producer to an animal that is still within a withholding period if it presents at a weighing event, or other event where EID tags are being read.

**Simple Stocktake**
For many sheep enterprises, keeping accurate records of animal numbers has proven difficult. This becomes increasingly evident when there is believed to have been some degree of stock theft occurring or high mortalities in one age or class or sheep. Having the ability to accurately identify the last known time that the stock in question were present on the property can be difficult or even impossible without EID. For many producers, just simply recording the ID of each animal as they pass through yards for other handling events provides an information trail for more accurate record keeping, and trace-back if required.

**Record Anything**
With an EID system you can record anything that can be measured objectively or subjectively. This is particularly beneficial in a stud situation where the number of traits to be recorded can be many and varied. A move to an EID system does not in any way have to mean a move completely away from traditional visual assessments. Particularly in the case of merino breeding, a classers comments can be recorded against the individual using EID, and can be vital information in the future of that animal.

**Plan Your System**
Planning your data capture is critical. You should only be recording data that will add value to your business, and never collecting data unless you will actually use it.

Start by developing your overall business or breeding objective, and then identify the data that would assist you in achieving your goals.

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